Planning for the First Mile & Last Mile in the Greater Toronto and Hamilton Area

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Abstract

This paper brings together topics surrounding transportation planning issues and opportunities in the Greater Toronto and Hamilton Area. Using the concept of transit urban design around major transit station areas, I examine how to retrofit the existing urban form across multiple typologies to solve first-mile/last-mile transportation mobility challenges in suburban communities across the region. By undertaking a holistic and interdisciplinary approach towards retrofitting suburban communities, simple changes can make all the difference across a multitude of basic typologies.

The paper begins with review of the scholarly literature surrounding the themes connected to this topic. Beginning with a historical dive back two centuries, I examine the factors that led to the desire to create the first suburban environments away from cities. From here we explore the history of the automobile and suburban sprawl in Europe and America. Focusing on Toronto in the mid 20th century, I look at when planning changed course and abandoned the American model of city building in favour a new Toronto style, one which would save most of the downtown core. Following this, I unpack barriers to the built environment, the first-mile/last-mile dilemma in transportation planning, and what it means to retrofit suburbia and what that entails. Finally, we examine current land use issues around regional transit stations in the GTHA and identify the conditions requiring retrofits.

I then turn to policy and break down the expectations from the Province of Ontario's *Growth Plan for the Greater Golden Horseshoe*, identifying Urban Growth Centres and major transit station areas within various typologies, as per the plan. Continuing the dive into policy, I uncover what the *Provincial Policy Statement, Planning Act, and Greenbelt Plan* all have to provide with regards to transportation planning and transportation infrastructure development. I then examine local policy in the City of Toronto's Official Plan and the Toronto Complete Street Design Guidelines. Following this I look at how cities and people take policy into action, examining the role and form of public consultation and its impacts. Then looking at the two Regional Transportation Plans, I examine what has been done, what is in progress and what is proposed in the region to help close transit gaps and create a well-connected network for the GTHA.

Using the Growth Plan's urban growth centres as key nodes, the retrofit of suburban environments across the region is broken down into three typologies: (1) greenfields, (2) auto-centric superblocks, and (3) developed communities. The typologies are distinct as they interact with the urban environment in different ways, and require unique retrofit strategies in order to implement better transit urban design strategies. First, we look at "creating the blocks," then "changing the blocks" and finally "laying the blocks" of the urban environment.

Various themes related to transportation planning, urban design and mobility are connected to numerous challenges and benefits identified within the retrofit process for each typology. I examine issues around land ownership, costs, equity in decision making, safety, politics and public opinion. I also present opportunities in the form of transit-oriented development, redeveloping blocks, and alternative modes available through transportation demand management, in order to mitigate first-mile/last-mile issues and increase local to regional mobility across the region and between its nodes. I conclude that a holistic, interdisciplinary approach, considering numerous angles at once is required regardless of the context in question.

Foreword

This paper is closely connected to my plan of study which was developed at the start of my M.E.S. journey. My original area of concentration was "regional transportation planning for connected communities" with special consideration towards the "first-mile/last-mile" dilemma in transportation planning. This major research paper aligns well with this goal, as the focus of this paper examines how local improvements in urban design can mitigate first-mile/last-mile challenges. This is achieved by improving mobility to connect local systems with the larger regional transportation network, which will ultimately connect urban growth centres across the Greater Toronto and Hamilton Area.

Part of the objectives within my plan of study was to complete a review of regional plans created by the Province of Ontario for the Greater Golden Horseshoe region. This was proposed in order to identify what type of growth is forecasted, what policies are in place to manage this change, and what solutions have already been proposed to foster the transportation connectivity required to support this growth. Within this paper, I present a comprehensive review of the *Growth Plan for the Greater Golden Horseshoe*, as it pertains to regional transportation planning and the strategies applicable towards effectively supporting the projected growth in the region.

Acknowledgements

First, I would like to offer thanks to my Guru, Sathya Sai Baba, for being my source of inspiration, motivation, wisdom and for guiding me every step of the way. I hope to put your core teaching of "Love All, Serve All" into practice as an urban planner, as I strive to provide equitable access to opportunities to all by transforming communities and how we connect.

Thank you to my family: to my parents, brother, aunts, uncles and cousins. Thank you all for keeping me energized, in a positive state of mind, and most importantly, full of good food!

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Introduction

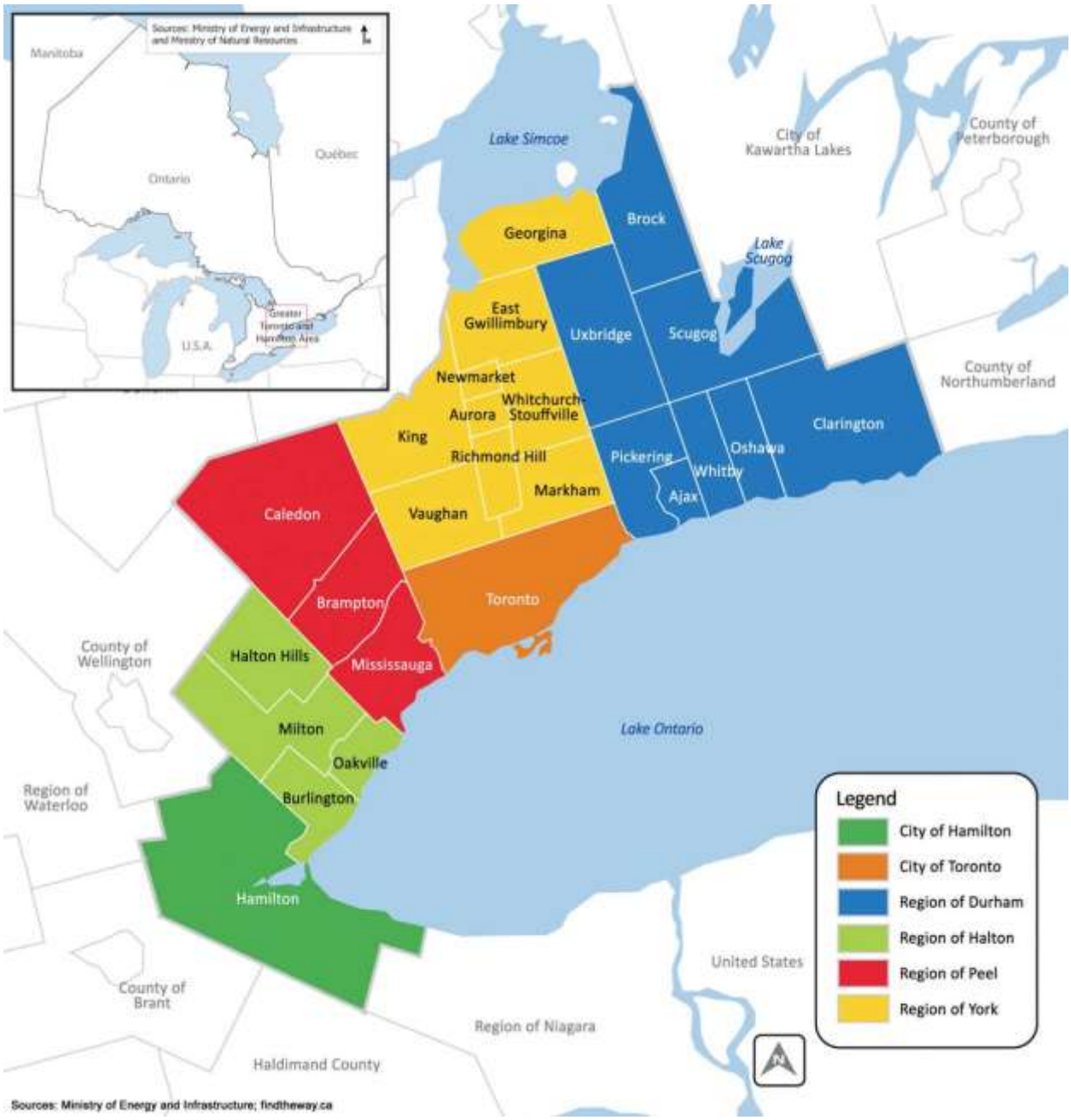
The Greater Toronto and Hamilton Area (GTHA) has no shortage of transportation planning issues and challenges, whether it is the implementation of road tolls or cycling infrastructure, the King Street Pilot Project, the integration of services like Uber and Lyft, the infamous Scarborough one-stop subway versus LRT debate, or most recently the expansion of the Toronto Transit Commission subway system into Toronto's surrounding suburban municipalities. An overarching theme that I have found connecting many of these topics is the notion of planning for an individual's entire commute through the region, and more specifically for the "first mile and last mile" of the trip. However this "first-mile/last-mile" challenge is not only surprisingly missing from the debates themselves, but also largely absent from current planning academic discourse. This paper explores and bridges that gap and provides an understanding of the issue and provides suggestions on how these challenges can be addressed across the region.

Looking across the Greater Toronto and Hamilton Area's urban region (Figure 1), these "first-mile/last-mile" challenges are most pronounced in the suburbs surrounding Toronto, and largely limit an individual's mobility options when travelling across municipalities. For example, transit stops are located on the outer edges of looping residential streets and disconnected cul-de-sacs, which may be a short distance away on a map, but require riders to navigate through a maze of streets before emerging onto a main road. These detours considerably increase an individual's commute time and effort. As a result, commuters are often discouraged from using transit and other modes of transportation in favour of automobiles, which in turn have clogged up our roads with endless congestion.

Land use and transportation planning issues are top priorities for politicians and policy-makers, and attempts have been made to directly address them both provincially and locally in planning policy. An overview of these strategies will be provided in this paper, with a particular focus on the Province of Ontario's *Growth Plan for the Greater Golden Horseshoe* and the *Regional Transportation Plan* prepared by Metrolinx, the Province's transportation agency. These plans provide guidance and initiate action to help build more complete communities surrounding Toronto, while connecting everyone on a regional transportation network. The provincial focus on Toronto's surrounding municipalities connects back to the fact that for decades the focus has been on moving people from the suburbs into the city for work, and back. Shifting commuter trends have signaled the need for investments in a network that crosses and connects the regions, and which would help mitigate 'first-mile/last-mile' issues and provide improved access and mobility. When asking why these challenges are largely found in the suburbs in particular, the process of inquiry leads us to urban design. Urban design shapes the way cities form and function, and the scale can vary from entire city blocks to an intersection or placement of a bus stop. The neighbourhood form we often see in suburbs hinders access to transit and active transportation, which in turn magnifies first-mile/last-mile issues. The reasons behind this urban versus suburban disparity will be discussed in the opening sections, however it is also important to point out that the built form is not

consistent in the city or in the surrounding suburbs. We can find examples of suburban sprawl in Toronto's inner suburbs, as well as dense communities in pockets around the region.

Figure 1: Greater Toronto and Hamilton Area



Source: Metrolinx, The Big Move, 2008

Regardless of the decisions made which led to the current reality in the GTHA and many other urban regions, it is clear that a form of retrofitting must take place in suburbia in order to meet current and future needs in land use and transportation. The current form does not provide cities the ability to provide higher order transit and accessible transportation alternatives to serve growing communities, which is needed as the region prepares to add millions more people and jobs in the coming decades. Accordingly, I have identified three types of physical typologies for consideration in this study of first-mile/last-mile issues, based on the locations of major transit station areas (MTSAs) and urban growth centres (UGCs) which are identified in the *Growth Plan*. The typologies are: greenfields, auto-centric superblocks, and densely developed communities, all of which would benefit from improved transportation connections.

From an urban design perspective, we can consider the three typologies as 'creating the blocks', 'changing the blocks', and 'layering the blocks' of the urban fabric. When discussing greenfield typologies, I refer to urban growth centres in undeveloped areas around downtown Milton or Newmarket, as well as areas like hydro corridors in suburban areas which are existing greenfield spaces, marked for the development of transit stations, or already being developed as such. In each of these locations, we are creating the blocks for a transit-oriented node from an existing blank slate. With regards to typology #2, I am referring both to urban growth centres with big malls such as Mississauga City Centre or Scarborough Centre, and to commercial strips along auto-centric streets. Essentially, this typology is inclusive of all spaces which are surrounded by parking lots and based around infrastructure designed primarily for cars. Here, we aim to break the larger blocks and change them to create more accessible, safe and appropriately scaled communities, while maintaining their commercial and economic value. Finally, typology #3's "developed communities" refers to areas of the city which are already densely developed with little room available to change block sizes or the size of the street's right of way for more transit/cyclist/driver lanes. Places like Downtown Toronto, North York Centre or Yonge-Eglinton Centre would each benefit from a retrofitting process in order to improve transportation access and mobility options, however limited they are by the defined urban space. Therefore for this typology, I will examine how to "layer the blocks" of the urban fabric to balance land use planning with various modes of transportation and inclusive of emerging technologies.

All of these topics connect together to form a complex web of theories and strategies which intersect in the specific question this paper addresses, as follows: given that the *Growth Plan* requires municipalities to create major transit station areas (MTSAs) across the region, how do we then retrofit hypothetical typical conditions found in greenfields, auto-centric superblocks, and developed communities, using urban design best practices, to help solve 'first-mile/last-mile' challenges in suburban communities?

Before we dive into this study, let’s pause and reflect to ask why the first-mile/last-mile issue is important, and why is addressing it necessary? What benefit would it provide to the city and also to an individual person? Would projects that support first-mile/last-mile

strategies help people and individual commuters get from their home or workplace to their nearest transit stop by car, bicycle, foot, rideshare, or another mode in a more sustainable and efficient manner? Does it matter? In fact, I think it does matter. As we will see, improved access and the provision of choice supports social equity. By addressing first-mile/last-mile issues, we can expand access to all kinds of opportunities across the region, create potential for new opportunities, and support a better functioning environment for everyone.

Methodology

The methodology used for this paper is qualitative in nature. I began with a review to categorize the urban growth centres (UGCs) and major transit station areas (MTSAs) identified in *The Growth Plan for the Greater Golden Horseshoe* (Ontario, 2017) based on their existing and projected future conditions in terms of form, and potential urban design challenges. I further studied planning policy documents in order to determine what has already been considered and implemented in strategies to expand transportation infrastructure in the GTHA. Building upon this, I conduct extensive research into existing scholarly literature, popular media, and professional reports, all on suburban development, planning in Toronto, urban design and existing barriers, the first-mile/last-mile dilemma, retrofitting suburbs, current land-use issues in Toronto and transit-oriented-development (TOD). I faced a significant challenge in the literature due to the lack of discussion about the historical development of Toronto and its local context. The vast majority of sources solely focus on American cities and an American lifestyle. This context does not truly represent Canadian history and development, nor does it accurately portray Toronto's culture and the laws which limited extreme low-density sprawl in the GTHA, versus in suburban America. In contrast, literature about the Toronto region often specifically focused on a particular street or community, and was extremely technical, which did not favour this analysis. Despite these challenges, the literature forms an intricate web of theories and strategies which help provide a detailed context for this study.

Throughout this paper, I have incorporated much of my lived experience as a commuter and frequent driver and transit rider in the GTHA into my understanding and perspective of the challenges individuals face when trying to connect to that first mile or last mile of their journey. In addition, the analysis and presentation of transportation demand management strategies, transit-oriented development, and public consultation practices were developed based on my professional experience working as a transportation planner at WSP Canada Inc, during an internship from September 2017 to April 2018. In this time I was heavily involved in numerous Transportation Demand Management (TDM) studies and transportation analyses for development proposals. My involvement in the City of Toronto's Re-Imagining Yonge Street project for North York Centre provided me first-hand experience in public consultation while presenting proposals on how to retrofit a major artery of the city to meet evolving demand. This experience directly influenced my understanding of how to retrofit communities which fall under typology #3. At WSP, I

was instrumental in leading the transportation and traffic impact analysis for four proposed transit stations, as part of Metrolinx's Regional Express Rail / City of Toronto SmartTrack project. This immersive project developed my perspectives and understanding of how to practically integrate transit into typologies across the GTHA, including greenfields, auto-centric superblocks, and into developed communities. My experiences at WSP gave me the opportunity to directly address first-mile/last-mile challenges in various projects and have played a large part in shaping this paper. Finally, short case studies are incorporated into the later sections, based on first-hand primary experience I obtained traveling through the United Kingdom, Prague, Barcelona, Copenhagen, and Vienna, while backpacking across Europe in May 2018 to study the unique transportation strategies and urban environments in major cities across the continent.

Section 1 | Framing the Debate: A Literary Context

In order to understand many of these debates around regional transportation planning, one must first understand the idea and concept of the suburb. Bourne (1996) defines this term in the article *Reinventing the suburbs: Old myths and new realities* in the journal *Progress in Planning* as the decentralized urban form. Bourne (1996) argues that the separation of the city, suburbs, and the rural-urban periphery is not only overly simple and outdated, but it impedes current efforts to anticipate future urban forms. Therefore when we categorize something as "suburb" it inhibits us from progressing forward in developing and bringing forth future urban forms, as our vision of the area is almost stuck to one type of form from one point in time. Older communities in suburbs like Mississauga were built specifically for commuters who wanted to escape the city, live farther away and drive into Toronto for work. Growth in the decades since has led to the transformation of those communities into more diverse urban centres and nodes for future growth. However the rejection of this evolution, with the mindset that Mississauga is still a commuter suburb, can impede planning processes aimed at redeveloping the suburban form to match current realities. My case studies and later discussions on the Mississauga Transitway, Dundas Connects and Square One demonstrate how different types of this suburban form have already and could react to this growth through various strategies. In order to re-inhabit, re-develop, and essentially retrofit suburbia, we need to examine the unintended consequences of suburbanization including traffic and auto-dependency, affordability, social capital and public health, and work to address those issues at the source (Dunham-Jones, 2017). This examination is best understood once we look back to see how suburbia took its shape in the first place.

A Brief Suburban History

To understand where our present auto-dependency came from and why we have suburbs in the first place, we take a quick jump back to the 19th century. Following the industrial revolution and the mass influx of people into cities in Europe, New York and other major cities, the slum city was formed. New York City and other American urban cities were seen as "pestilential to the morals, the health and the liberties of men" and a cancer on

the social and political body of society (Hall, 2014, p. 47). In other words, cities of the time were not seen favourably due to their horrible living conditions, exacerbated by the New York tenement crisis. In London in 1885, the housing problem was compounded by high densities, land rents, transportation problems, and competition for space with 5.6 million people in London's urban area alone (Hall, 2014). Town planning began in the early 1900s, and at the same time London's tube system began expanding, bringing about the first instances of suburban sprawl and building communities around avenues of access to the city centre (Hall, 2014). As suburbs grew around the stations, department stores and tourist attractions opened along the rail lines to maintain and grow ridership (Wolmar, 2018).

Many models of city and town planning grew in the early part of the 20th century, with many famous architects each creating their own grand master plans of the perfect utopian city. One of the most famous and successfully implemented models was Ebenezer Howard's *Garden City* model from 1898 which envisioned urban pockets surrounded by greenbelts, connected by rail and aimed to be largely self-sufficient (Greenberg, 2011; Hall, 2014; Kelbaugh, 1989). The Garden City movement was a direct response to the overcrowded, unhealthy industrial city; a reaction to the failure of the widespread industrial city of the nineteenth century (Miller, 2010). Later in 1925, architect Le Corbusier presented his radical vision for Paris, named *Plan Voisin de Paris*, which saw the entire city leveled to the ground (a far more brutal destruction than that of Haussman centuries earlier) and replaced with "towers in the sky" surrounded by green space and linked by super highways (Hall, 2014; Miller, 2010). In 1932, American architect Frank Lloyd Wright in his plan for *Broadacre City* embraced automobile use and separated land uses. All three architects solved the city's problems by fleeing it entirely (Greenberg, 2011). The summation of this movement was presented by CIAM, the Congress International d'Architecture Moderne, in the Athen's Charter of 1933 which established a formula for the "Functional City" which refashioned cities into independent zones, each dedicated to one of four primary functions: dwelling, work, recreation, and transportation (Greenberg, 2011). This led to a trend of urban renewal in North America and the eventual rise of New Urbanism. This process of American suburbanisation was semi-structured and largely organic, as developments followed the expansion of serviced land, which was not the case in parts of Europe or in Southeast Asian cities (Kusno, 2017).

After World War 2, the flight to the suburbs was partially stimulated by American military mobilization and the massive deployment of resources, fueled by the rapid expansion of the American interstate network, as a response to threats to urban centres during the Cold War (Greenberg, 2011). As Sewell (2009) comments in the book *The Shape of the Suburbs: Understanding Toronto's Sprawl,* Toronto's sprawl was primarily shaped in the post-war era through the creation of highways and investments in transportation planning alongside advancements in new technologies. The consumer revolution of the 1940s and 50s saw a demand for new in place of the old, with the focus entirely on home ownership with a car in the garage. This shift in lifestyle and mobility in turn developed into an auto-dependant culture present to date (Paikin, 2018). The new

suburban-style neighbourhoods which formed usually required a car to get out of them. At first neighbourhoods were hybrids still within the city fabric, but progressively turned inwards, with connections between neighbourhoods disappearing, and their edges growing sterile, creating "superblocks" (Greenberg, 2011). As Ken Greenberg so eloquently writes, imagine walking up any major street in a North American city and "as you move from the downtown to the suburbs, the roads get wider, shopping plazas sit farther from the sidewalk, across parking lots with no pedestrian route to shop doors…The intersections become larger…the physical environment is meant to be driven in. The street is no longer seen as a shared public space; its singular purpose is a traffic artery" (Greenberg, 2011, p. 6-8).

Planning in Toronto: Diverging from the American Model of City Building

After a short period of following the American precedent, post-war Toronto in the 1960s had a reaction to the city that was emerging, growing and expanding into the suburbs (Paikin, 2018). While the "American model of city building" provided great opportunity and security to certain members of society able to escape the city, the process of urban renewal to "clear slums and build new" risked hollowing out the downtown core (Paikin, 2018). This hollowing out was rampant in American cities, with expressways in particular decimating neighbourhoods. The American model pushed for expressways into the core and promoted a separation of uses, with living, working and recreation all separate and connected by a car. Toronto put a halt to the American model, halting projects such as the Scarborough Expressway, Crosstown Expressway, and the infamous Spadina Expressway (Hiller, 2010; Paikin, 2018). Instead, Toronto identified a need for primary mixed uses, small blocks, a concentration for city diversity, and no expressways to the core (Jacobs, 1961). This became known as the Reform movement, as it was neither American nor British, but uniquely Torontonian, with the city building the way it wanted for its own context (Paikin, 2018).

As such, the growth patterns of Canadian cities differ from those of American cities, exhibiting fewer characteristics of leapfrog development and less ultra low-density sprawl (Bourne et al. 2011; Newman and Kenworthy 1999; Sorensen and Hess 2007). This difference is mainly attributed to local and regional planning policies that shape growth patterns. Originally, provincial subsidies for newly-formed municipalities possibly allowed suburban sprawl to grow as expensive services were provided to low-density communities which otherwise could not sustain them on taxes alone (Sewell, 2009). Following that growth, major transformations took place in Canadian cities, resulting from economic dynamics, environmental impacts, and evolving urban lifestyles (Filion et. al., 2015). As the cultural transformation of Canadian inner cities began to re-imagine the urban, changing demographics, labour markets, economic innovation and a focus towards urban sustainability all led to changing parameters of urban form, structure and policy (Dunham-Jones, 2017; Filion et. a., 2015). In recent years, like their American counterparts, planners in Canada's fastest-growing cities have promoted smart growth principles, as evidenced in the most recent plans (Filion and Kramer 2012). Politicians have begun to support plans that call for redirecting growth to existing urban areas, given

the high cost of building infrastructure to service new urban areas (Taylor, Burchfield, and Kramer 2014). In general, an acceptance of regulatory land use policies has historically influenced the shape of Canadian cities (Bourne et al. 2011; Taylor and Burchfield 2010). As a result, the current push to retrofit locations around the GTHA in order to develop major transit station areas is not markedly new, but is rather the latest instance of planners responding to the evolving needs in Canadian cities. However instead of addressing the effects of sprawl with land use or transportation policies alone, we are now looking to bring the two together with urban design for a holistic approach.

Barriers in the Built Environment

The built environment which resulted from a century of rapid growth, suburbanization, and evolving lifestyles, and which was once seen as a sign of progress and economic promise, is now one of the region's greatest challenges. The "suburb" is now one of the most abused terms in planning and architecture, surrounded by externally-imposed images, entrenched social meanings and inherited cultural baggage (Bourne, 1996), making dialogue around its future a challenge to unpack. The urban form we have created now acts as a barrier to growth, not only by limiting access to economic opportunities, but also through engrained social exclusion. Urban policy ideas around combating social exclusion through urban design quality started in France in the 1980s (Roberts, 2000). In French cities, the "Banlieues 89" initiative was multidisciplinary, challenging perceptions and professional practice with regard to inner and outer suburban areas of cities and working to connect the culture of the suburbs to the center of the city (Roberts, 2000). As global flows changed the economic makeup of the city, and increased multiculturalism through immigration led to changing demographics, divisions within cities began to grow and inequality, neighbourhood poverty and homelessness were amplified (Filion et al, 2015). Planners worked to make marginal neighbourhoods "real" pieces of the town by improving the quality of life and dealing with social exclusion for citizens often excluded from civil society. It was important to first break these social barriers in cities and in urban culture in order to then change policy and finally impact the built environment. Overall, the Banlieues 89 movement challenged attitudes and successfully challenged urban policy in France, and this eventually spread to the United Kingdom and quickly beyond to Toronto and other North American cities (Roberts, 2000). Once the social barriers were overcome, the process to retrofit communities in the Toronto area became a political one as planning guidelines were established to aid the physical construction and development of the region. The resulting sprawl led to new, physical barriers to the built environment and planning's attempt to fix cities.

As we fast forward to present day and moving from the social to the physical impacts of the built environment we find in the Greater Toronto and Hamilton Area, one significant barrier to growth which developed as a result of auto-centric policy and growth is the overwhelming vehicle congestion in the region. This traffic congestion in the suburbs signals a strong change in the structure of our culture—the decentralization of the work place, causing new traffic patterns and "suburban gridlock" (Kelbaugh, 1989). Gridlock is a result of the suburbs being built with an auto-centric design, meaning everyday

destinations are in single use zones placed far apart, requiring residents to own and operate personal vehicles in order to move from place to place. The built environment is not pedestrian- or cycling-friendly, and with transit infrastructure ignored for decades, people are left with just one option: drive. Despite transit and cycling infrastructure now appearing in the suburbs, decades of driving habits have become engrained into the culture of living in the suburbs. Based on personal experience from growing up in Mississauga, I know that it was always expected and anticipated that as you turn 16 you get your driver's license and begin driving from place to place, which is exactly what I did. Despite the daily drive from high school to my family business being only 10-minutes long, taking transit was hardly an option due to infrequent service and multiple bus changes. In addition, the superblocks of the suburbs made it impractical to walk, due to large distances and building setbacks between blocks and wide road widths, and the lack of bike lanes made cycling along main arteries uncomfortable, if not dangerous. As a result, driving became a habit for me out of necessity, and partly out of choice due to the driving-is-cool culture at the time. Driving is dominant in suburbs due to this built environment and decades of mobility decisions which placed individuals with a car at the top of social hierarchies, idolizing the freedom the vehicle provides.

This trend has been broken in recent years by a millennial generation which has been defying its sheltered, suburban upbringing by delaying the acquisition of a driver's license and choosing transit instead (Schwartz, 2016). Millennials are not buying cars or fleeing to the suburbs as their parents did at the same age. They are, in fact, driving less than previous generations. However this is partly a result of the growing shared economy and freedom offered by technology (Schwartz, 2016). In 1970, freedom was calculated based on the ability to own a car, but in 2016 this freedom is achieved through a smart phone, using apps and services like Uber, Car2Go, City Mapper and others which provide mobility options previously unavailable (Schwartz, 2016). The next technological boom, expected with the emergence of autonomous vehicles, will radically change transportation again within a generation. The impacts of these technological trends on the first-mile/last-mile challenge are still being discovered, and will continue to evolve and change as technology leaps forward and revolutionizes the transportation landscape.

Despite millennials defying the norm and turning away from single-occupancy-vehicles, traffic congestion is still a significant problem across a region scrambling to build the transit infrastructure to catch up to where it should have been a decade ago, let alone for current demand. However as Kevin Lynch (1960) says, "a city is a multi-purpose, shifting organization, a tent for many functions, raised by many hands. The form must be somewhat noncommittal, plastic to the purposes and perceptions of its citizens" (Lynch, 1960, p. 91). In other words, the city needs to actively work to change and evolve in order to meet the needs of its citizens. Therefore, for immediate relief, we need to change our existing urban form into enhanced travel environments, using urban design best practices. These changes would need to take place in the fundamental and expressive functions of the city including its circulation, major land-uses, and key focal points, in order to prevent the built environment from holding the city back from future

opportunities (Lynch, 1960). Boarnet and Crane (2001) recommend that cities wanting to become less auto-centric should follow the design concepts known collectively as *New Urbanism* in architecture and planning. New Urbanism ideals recommend the re-thinking of the relationships between form, scale, and movement in modern urban environments, with a shared emphasis on mixing land uses and getting people out of their cars (Boarnet & Crane, 2001). This is because cars tend to entirely take over the public space of the street, where the street has always been a key element of a city's social fabric. Therefore in order to overcome urban design barriers in the built environment, cities should aim to reduce car use and increase the quality of neighbourhood life generally using new urbanist principles. By improving the built, pedestrian and transit environments, with improved and more welcoming streetscapes, people would be more inclined to use and provide life to the street (Jacobs, 1961). In essence, fundamental changes in land-use and urban design patterns have been seen as potentially promising tools, with new urbanist ideas finding their way into public planning and policy documents aimed at reducing congestion by means of land-use and transportation linkages (Boarnet & Crane, 2001), which will be detailed in later sections.

Unpacking the 'First-Mile/Last-Mile' Dilemma

"First-mile/last-mile" is a dilemma in transportation planning which refers to the challenge in access to the first leg and last leg of a commuter's journey and is a critical barrier to public transit accessibility (Locquiao, 2016). For many commuters, the inconvenience of travelling the short distance to or from a transit station is enough to keep them driving to work. Planning for the first-mile/last-mile is a term transportation planners use specifically to refer to strategies implemented to help the individual commuter get from their home or workplace to the nearest transit stop, whether by car, foot, bicycle, or another transit connection (Ryerson University, 2016). As will be evident in this paper, first-mile/last-mile investments tend to focus on active transportation (modes that rely on user energy and power) improvements as these changes are usually cheaper and easier to incorporate into a community.

Oftentimes, the first-mile/last-mile dilemma is addressed in popular media as a side note in articles focussing on other, perhaps more substantial topics related to transportation planning. First-mile/last-mile has been quantified in papers looking at exact travel times and route options, and critiqued appropriately (see Mangan, 2013). Other papers define the problem extremely well but stop short of recommending approaches to mitigate issues associated with it (Locquiao, 2016). The first-mile/last-mile problem is always linked to street network designs and transit performance (Mangan, 2013). However first-mile/last-mile concerns for pedestrians and cyclists are often overlooked, as are the numerous other transportation demand management strategies available to planners. The first-mile/last-mile dilemma is often blamed on one singular issue, from poor local transit to a lack of adequate infrastructure and investment. These singular analyses make the problem seem like a simple fix; if you do this one thing, such as expanding local transit, ridership will improve. However, we know that is not the case. First-mile/last-mile is a complex and dynamic issue, varied by context, policies, and most importantly, people.

Strategies described in the literature that have been successful in Europe or Asia do not necessarily work in the Canadian context due to differences in acceptable walking distances, commute times, and car cultures (Spurr, 2016).

King's 2016 article *"What do we know about the "First Mile/Last Mile" Problem for Transit?"* provides an interesting history of where the term itself came from. King (2016) states that the first-mile/last-mile problem was originally drawn from telecommunications in the 1970s when cable TV companies had to deploy tremendous amounts of wire to individual housing units from their high capacity units at a very high economic cost. Then logistics companies such as FedEx encountered the problem surrounding their supply chain management where delivery trips were complex arrangements requiring optimization to lower the costs as much as possible (King, 2016). In recent years the term has been used to describe passenger travel in the context of getting to/from bus and rail stops, however, despite similarities to telecommunication and goods movement, first-mile/last-mile for transit has very few peer-reviewed studies published on the topic, while more attention has been provided in popular media after being addressed in recent professional reports.

In today's context, Locquiao (2016) stated that the first-mile/last-mile problem presents a challenge in terms of access to the first leg and last leg of a commuter's journey and is a critical barrier to public transit accessibility. The Ryerson City Building Institute (2016) has found that for many commuters, the inconvenience of travelling the short distance to or from a transit station is enough to keep them driving to work. This inconvenience can come in the form of infrequent or unreliable bus service to and from their neighbourhood, the need to make stops along the way, or the frustration of looking for parking in a crowded GO Transit or TTC station parking lot (Ryerson City Building Institute, 2016). For cyclists and pedestrians, this problem is compounded by inaccessible locations, a lack of safe bike lanes and bike storage, and unfriendly conditions in the winter. Metrolinx's efforts to promote transit use and get people out of their cars has resulted in GO Transit becoming the largest parking provider in North America with over 70,000 spots across its network (Spurr, 2016). 60% of GO Transit passengers drive to their station and another 14.7% are either dropped off or picked up in a private vehicle (Spurr, 2016). Therefore while GO is not entirely delivering on the major promise of transit: taking cars off the road, as local roads remain congested in the suburbs, it has significantly redirected vehicles off regional roads and highways and towards local GO station parking lots instead.

A significant challenge that suburban communities need to overcome to help address the first-mile/last-mile dilemma is not related to cars, but to individual pedestrians. According to several studies, the most reasonable walking distance to transit is 400m from home to the stop, and also from the final stop to a person's destination (Gibson, 2016). This 400m radius may seem ample in dense urban cores, but in the suburbs this distance from a stop often does not reach many households or businesses. As MacKechnie's 2016 article *"Get me to the train on time!"* points out, while stations may appear to be within close walking distance of a large cluster of residential blocks, the non-

contiguous streets and cul-de-sacs of the suburbs actually cause an increase in walking distance, despite their physical proximity to the transit station. Mangan builds upon this idea in the 2013 article *"Integrating first and last mile access measures in the estimation of light rail transit ridership"* by stating that even with suitable walking distances, transit stations need pedestrian-friendly access points. Large parking lots are deterrents for pedestrians trying to reach the station building quickly. While it is important to consider vehicular traffic to and from the station, pedestrians should not be overlooked in station designs (Mangan, 2013). Since mobility shapes people and their way of life, each transit station should be seen as an opportunity to engage riders whether they are starting their journey or connecting to the next leg of their trip (Mangan, 2013). This efficiency starts at the local station, however, some stations are deficient in providing opportunities for equal access for people walking, biking, or driving between the station and their origin/destination (Mangan, 2013).

While reducing car use in favour of effective and efficient alternate modes of travel is an important factor in addressing the first-mile/last-mile dilemma, it should also be noted that cars do not need to be entirely eliminated in the Greater Toronto and Hamilton Area. A tweet by Jennifer Keesmaat, former Chief Planner of the City of Toronto, helps provoke the thought process when she says "j*ust because cars are inefficient in cities doesn't mean they are always inefficient."* (Keesmaat, February 11 2018). Based on personal experience living in the suburbs, sometimes driving that first mile to a transit stop *is* the most efficient form of transportation, particular in off-peak hours. However, this is largely dependent upon local contexts and the built environment, as will be examined in the various typologies identified. In general, the problem as we will see is not necessarily transit design, but suburban design, with the response from transportation planning requiring the utilization of urban design. Depending upon the urban design and how a transit station is designed, walking or cycling may be a more effective mode to close the first mile gap. However, suburban design to mitigate the first-mile/last-mile should not end at the station fence but be a comprehensive community plan.

Retrofitting Suburbia

Considering the challenges we face in the built environment around the Greater Toronto and Hamilton Area, and the intersections between this urban form and the first-mile/last-mile dilemma, one can determine the need to retrofit suburbia in order to implement the solutions needed. In this context, retrofitting extends beyond the notions of rehabilitation or adaptive reuse, to encompass the idea of systematic, long-lasting, transformative change (Dunham-Jones & Williamson, 2011). Suburban retrofits can quite easily become entire redevelopments of sites, introducing the components of urbanism that were either illegal, undesired, or ideas missing from suburbia of their time. According to Dunham-Jones and Williamson (2011), suburban retrofitting is in essence "a process of entirely revamping, and in many cases completely replacing, the conventional zoning that has dominated land-use decision making and development for decades" (p. xii). Even though decades earlier the rationale was strong to separate uses and separate people and buildings from automobiles, the results we see across suburban regions have

led to unsustainable auto-dependency and the repeated development practices which do not align with present day workplace and living patterns in society (Dunham-Jones & Williamson, 2011). Therefore the changing identity of the suburbs, along with ageing and out-of-date properties in need of renewal, provides the perfect climate for large scale re-imaginations of suburban environments.

When retrofitting a built environment in order to improve its first-mile/last-mile connections, the use of urban design elements is useful as they are tools for creating healthier, stronger communities. Urban design elements such as walkability, imageability, enclosure and the human scale are all instruments in a planner's toolkit to create world class cities that will thrive in the 21st century (Ewing & Bartholomew, 2013). Walkability is the key to smart growth and has been a trend in Canada to value places where you can walk to a corner store or to other conveniences. Shifting demographics now reveal that baby boomers now prefer neighbourhoods where walking and taking transit are safe and convenient options, as these provide the freedom people crave after their ability to drive is gone with age (Ewing & Bartholomew, 2013). People now prefer places that are human scaled and have a sense of enclosure, and this knowledge should inform the way we plan and design streets and buildings. Urban design features such as building setback, block lengths and street and sidewalk widths all impact walkability and as a result it is indeed possible to make streets safe for people to walk, bike and drive, while meeting the needs of local businesses and residents while improving safety for all users (Ewing & Bartholomew, 2013). Additional features to consider include a sense of comfort, sense of safety, traffic volumes, the number of people, a tree canopy, and the local weather patterns (Ewing & Bartholomew, 2013).

Urban design differs from urban planning in terms of scale, orientation and treatment of a space. With urban design, the scale is primarily that of a street, sidewalk, park or transit stop, rather than a larger region or community. The orientation is aesthetic as well as functional and the treatment of space is 3-dimensional with vertical elements as important as horizontal ones in the design of the space (Ewing & Bartholomew, 2013). These two worlds collide when considering the implications of Smart Growth. If urban design is done right, first-mile/last-mile challenges can largely be addressed through smart growth principles. Pierre Filion's 2003 article on Smart Growth, entitled *Towards Smart Growth? The difficult implementation of alternatives to urban dispersion* offers strategies to curb the negative consequences of urbanization by pulling lessons from a history of failed attempts at altering urban development. Filion (2003) suggests that smart growth represents a reaction to increasing resentment towards the unintended consequences of urban life, including high development costs and deteriorating quality of life. He suggests the creation of high density corridors for transit and pedestrian use, however I do not think that this is enough to combat urban sprawl. Here, Peter Calthorpe's (2001) design concept for "transit-oriented development (TOD)" comes to mind, where he calls for a re-orienting of the urban region around a system of light-rail lines extending from a central hub.

In general, the key tenets of smart growth are increased density, transit-oriented and mixed-use developments, and re-urbanization (Glendening 1997; Maryland 1997). These tenets come out of the concept of the "smart city", which is one of the most prominent of the "smart" concepts to dominate public imagination in the past decade (Morozov & Bria, 2018). The concept is also one of the most consequential and politically significant of the lot, informing and shaping the work of urban planners, architects, infrastructure operators and real-estate developers, transportation officials, as well as mayors and entire industries. Smart City has no single meaning; to some it means the ecologically-friendly use of resources, while to others it signifies the deployment of real-time devices, such as the smart traffic lights installed in Rotterdam which privilege cyclists in rainy weather (Morozov & Bria, 2018). Specifically, Smart Growth is designed to favour alternative modes of transportation to the automobile, such as walking, cycling, and transit, in order to reduce traffic congestion (International City-County Management Association-Smart Growth Network, 1998).

These are all key alternatives and travel modes necessary to mitigate first-mile/last-mile challenges in the GTHA. At first, the ideas of smart growth were more popular with planners than with land developers. However, in the years following the 2008 recession, researchers have documented a shift in the U.S. housing market whereby in fast-growing city-regions, development is occurring in core areas and not just the suburbs (Frey 2014). All things considered, smart growth is still seen as a generational trend, representing the preferences of millennials today (Flint, 2014).

Current Land Use Issues in the GTHA

Building on this historical and theoretical understanding of suburban and regional transportation planning, barriers to the built environment, the first-mile/last-mile dilemma, and methods of retrofitting communities, we can now examine the Greater Toronto and Hamilton Area with a more specific lens. In particular, how do we define urban sprawl, how does the GTHA compare with other regions, and what underlying issues does the region face which impact its equal transit investment into communities? By understanding these themes, I hope to identify gaps in investment which could be closed to create a more equitable and transit-accessible city. Understanding these gaps will then impact the best practices considered as we retrofit various suburban typologies in the region and ensure they connect.

To understand the urban region it is necessary to understand how we measure our urban sprawl and growth to inform our future planning practices. One definition of urban sprawl is that the increase in urban expansion is greater than the increase in population (Fulton et al. 2001). Between 1991 and 2001, the urban area of the Greater Toronto and Hamilton Area grew by 26%. From 2001 to 2010 it grew by only 10%. By this measure, with the rate of expansion slowing, the GTHA is no longer sprawling. With this known, it is important to consider how the region will continue to grow to meet the expected population increases over the coming decades, and where will this growth take place?

Looking for inspiration to answer these questions, we look abroad. Since the 1950s, Sydney has adopted a medium-density strategy sustained by public-sector incentives and regulations. In Toronto, in contrast, the focus has been on high-density developments driven mostly by market trends. Digging deeper, we find that the following intensification policies have helped urban regions like that of Sydney and elsewhere. First, the ubiquity of NIMBY reactions and the importance of senior government involvement is essential because they are less sensitive to anti-density NIMBY reactions (Filion et al, 2011). In addition, the possibility of framing intensification strategies in ways that avoid political party confrontation, and the role of major environmental movements in raising public opinion have worked to support intensification in urban regions (Filion et al, 2011).

One development preference in the region has been the application of new urbanist planning principles into regional and local community planning. However, while new urbanism principles are increasingly integrated into planning principles across Canada, full-fledged new urbanism developments prove surprisingly rare in the market (Grant & Bohdanow, 2008). New urbanism communities have been successful in achieving a mix of housing types, high design standards, attractive open space systems, and a walkable environment. They have had less success in establishing viable commercial districts, increasing urban densities, providing affordable housing, or reducing reliance on automobiles.

Unfortunately, Toronto is becoming increasingly unaffordable and these costs are pushing people out of the city, further and further out into a region which is not intensifying as it should ideally be. Between frequent transit networks, housing costs, urban form, and socioeconomic variables, the city is becoming increasingly polarized and in stark contrast to come nearby municipalities (Kramer, 2018). The results show apparent contradictions: while there is great variance in transit access and housing cost between and across cities, transitscapes are consistently more racially diverse, higher density, and poorer than surrounding autoscapes; but, once income and racialization are held constant, there is a decreasing chance of access to transit as housing prices become more affordable (Kramer, 2018). In other words, for many people, there is no affordable access. This reality can be explained due to patterns of racial and economic geographies of land use and mobility, the dominance of postwar automobility, the suburbanization of poverty, and wealth inequality in North American cities (Kramer, 2018; Hulchanski, 2007). David Hulchanski's famous "The Three Cities within Toronto" study helps provide insight into how Toronto's land became so polarized by income around rapid transit over time. The income polarization follows social and demographic changes of neighbourhoods over time, which is visually linked to access to rapid transit in those communities (Hulchanski, 2007). Low income "City #3" residents have to travel farther to find employment and have the poorest access to TTC subway stations. Only 16/68 TTC stations are within or near City #3, which in stark contrast to the richer "City #1" (Hulchanski, 2007). Hulchanski explains that there are three city destroying trends in Toronto. First the economic inequality which creates a growing gap between rich and poor with respect to income and wealth. Second, the socio-spatial polarization and

exclusion, seen by the decline of the middle and movement towards the poles in income and wealth distribution. Finally, spatial segregation and disadvantage, with respect to the relative residential separation of population categories from each other; the creation of 3 Cities (Hulchanski, 2013). A clear takeaway from these studies is that poorer neighbourhoods lacking rapid transit would benefit in income, wealth, opportunity and mobility through the investment of more transit infrastructure into those communities. This investment would further close first-mile/last-mile gaps in the network and create a more even and equitable Toronto, and GTHA region.

Identifying Typical Conditions

Based on this information regarding the reduction of sprawl in the Greater Toronto and Hamilton Area, the requirement for intensification, and the polarization around transit lines, it is clear that action needs to be taken in the region's suburbs in order to transform the region enough to accommodate the expected growth in population and the growing demand for transit access to solve first-mile/last-mile challenges. This transformation will need to be focused in economic and transit nodes around the region, specifically urban growth centres, as per *The Growth Plan*. These centres would encompass major transit station areas to help meet the transportation demands of the growing population. In this paper, I have sorted and classified these urban growth centres into three typologies: greenfields, auto-centric superblocks, and developed communities.

In order to contain sprawl and effectively use the land still available for development, we need to retrofit greenfield areas using urban design best practices around future rural transit stations in order to help integrate those communities into the region through local and regional transit access. Second, we need to re-develop and retrofit low density, auto-centric areas of the suburbs, where economic and commercial centers exist in massive 'superblocks' with buildings surrounded by parking lots. Finally, existing built up neighbourhoods with little possibility of large scale redevelopments need to be retrofitted in such a way as to layer improved transit access on top of existing uses, in order to provide better mobility and regional connections. Retrofitting major transit station areas around all three typologies would help transform the region and solve the first-mile/last-mile challenges across the network by developing local access to regional transit networks, and connecting urban growth centres together for improved opportunities.

Section 2 | From Policy to Action

In this section, I will be presenting a concise review of provincial and local planning legislation and policy, as it pertains to the Greater Toronto and Hamilton Area, transportation planning, and urban design. Looking first at when the concept of planning for the region as a whole first developed, I then undertake a brief review of *The Growth Plan*, identifying the urban growth centres which will be the contexts for the discussions to follow. After reviewing additional legislation, policy and guidelines, I present a discussion on how to bring these ideas from written policy to action, with public consultation at the center. Finally, I dive into strategies and transportation projects

already underway across the region to expand the rapid transit network, and connect the communities and urban growth centres, forming the major transit station areas central to the discussion which follows. This information is valuable as it is important for planners to have a good understanding of the direction policy is leading planning and development towards, and it provides a strong foundation for the typology analysis which follow.

Planning for a Region

For most of the 1900s, we determined cities were obsolete and as such we abused and devalued them, while fleeing them to the suburbs (Greenberg, 2011). Two profound shifts in urban planning led to this situation: (1) cities and planners started to give highest priority to automobiles, which was accepted as progress at the time, and (2) the very concept of the city street as a shared social space was killed (Greenberg, 2011; Hall, 2014). Uncontrolled suburban growth created new urban forms which Bourne (1996) referred to and it was deemed that a new approach was required to understand suburbanization, and that this should be done through the establishment of a regional plan (Sewell, 2009). Building on these fundamental ideas, Calthorpe and Fulton (2001) argue that sprawling growth has transformed twentieth century industrial cities into today's "metropolitan regions" which can extend enormous distances beyond the central city itself. In their book, *The Regional City: Planning for the end of sprawl*, Calthorpe and Fulton (2001) raise issues surrounding the relationship of a technologically advanced society and the natural world, as well as the equally important issue of social equity in planning cities. Since urban regions which effectively promote and manage growth, educate their populations, and maintain services for a standard quality of life will inevitably succeed, it makes sense that the regional scale is required to solve society's economic, ecological, and social problems. The cooperation of municipalities across the region is a big reason why the whole region is economically successful. We are currently planning during a time of unprecedented interconnections between municipalities and as a result, we are in some ways already putting the regional city theory into practice.

As will be shown in the policy below, transit is currently front and centre in the region's discourse today, with politicians, planners and citizens discussing ways to build and finance transit infrastructure. Toronto has had numerous unsuccessful attempts to expand a rapid transit network, with no shortage of creative transit plans to create the integrated network Toronto needs (Levy, 2013). A history of missed opportunities can be summed up in Levy (2013)'s thoughts: "Many of these plans contained the concept of a U-shaped subway line extending east and west of the city core, the long sought “network builder” that would have allowed Toronto’s skeletal subway system to become a true network offering several well distributed and integrated interchanges, built-in redundancies in the case of train breakdown, area-wide connectivity and operating flexibility for the benefit of the majority of riders across the city and region." Looking forward, Levy argued that the rebirth of regionalism with the creation of Metrolinx and the Province of Ontario’s “Places to Grow” plan for south/central Ontario provides the backdrop to what should be our next grand in-city subway building exercise. “In doing so the Greater Toronto Region must learn from its history and do it right” (Levy, 2013).

Analyzing the following policies, we will see that the region is in fact on the right track.

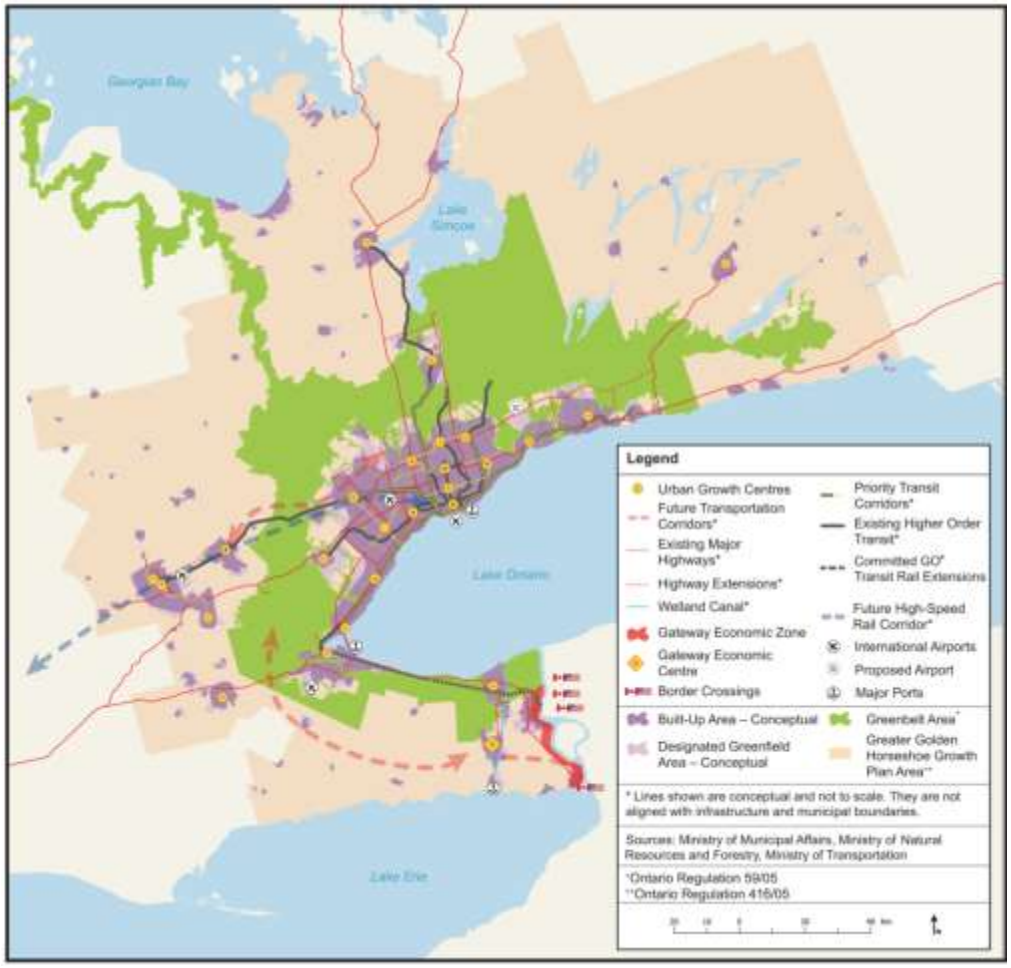
The Growth Plan

Recognizing environmental limits to unchecked growth, suburban governments are now planning for the future by implementing new legislation and policies that rethink zoning, anticipate the arrival of mass transit, and encourage the construction of affordable housing (Dunham-Jones & Williamson, 2011). The Province of Ontario's *Places to Grow Act* of 2005 is one such legislation, shifting the direction of development in the Greater Toronto and Hamilton Area. Under the act, the *Growth Plan for the Greater Golden Horseshoe* was prepared. The plan is a framework for implementing the Government of Ontario's vision for building stronger, prosperous communities by better managing growth in the Greater Golden Horseshoe region (Figure 2). The Greater Golden Horseshoe region is one of the fastest growing in North America and is the destination of choice for many people and business relocating from other parts of Canada and around the world due to the high quality of life and economic opportunities. The plan recognises the realities facing municipalities and works to guide decisions on a wide range of issues - transportation, infrastructure planning, land-use planning, urban form, housing, natural heritage and resource protection (Ontario, 2006). The plan does not replace municipal official plans, but works within the existing planning framework to provide growth management policy direction for the region. *The Growth Plan* aims to connect the region by bringing together land use and transportation planning across municipal boundaries (Figure 3).

Figure 2: Greater Golden Horseshoe Growth Plan Area

Source: Ontario, Places to Grow Act: Growth Plan for the Greater Golden Horseshoe, 2017

Figure 3: Places to Grow Concept of a Connected Region



Source: Ontario, Places to Grow Act: Growth Plan for the Greater Golden Horseshoe, 2017

According to the plan, while the Greater Golden Horseshoe can remain competitive with other city-regions, urban sprawl can affect its competitiveness. Increasing numbers of automobiles are travelling longer distances resulting in clogged transportation corridors, including those providing access to Canada's critical border crossings. Traffic congestion and the delay in movement of goods and services costs Ontario over $5 billion in lost GDP every year (Ontario, 2006). Another challenge is that efficient public transit is difficult to introduce into sprawling communities, which limits the Province's ability to respond effectively to growing traffic congestion issues. This plan works to address these challenges, identifying Urban Growth Centres and Major Transit Station Areas along intensification corridors, in order to guide and direct growth in a method which would result in improved transportation network efficiency.

The guiding principles of the Growth Plan include building compact, vibrant and complete communities; plan and manage growth to support a strong and competitive economy; optimize the use of existing and new infrastructure to support growth in a

compact efficient form; and promote collaboration between all sectors of the government and residents to achieve the vision (Ontario, 2006).

Urban Growth Centres

Urban Growth Centres (UGCs) are determined in coordination with municipalities, which specify the areas in their official plans. UGCs are focal areas for investment in institutional and region-wide public services, as well as commercial, residential, cultural and entertainment uses. Urban Growth Centres are meant to accommodate and support major transit infrastructure and serve as high density major employment centres to accommodate a significant share of population and employment growth in the region (Ontario, 2006).

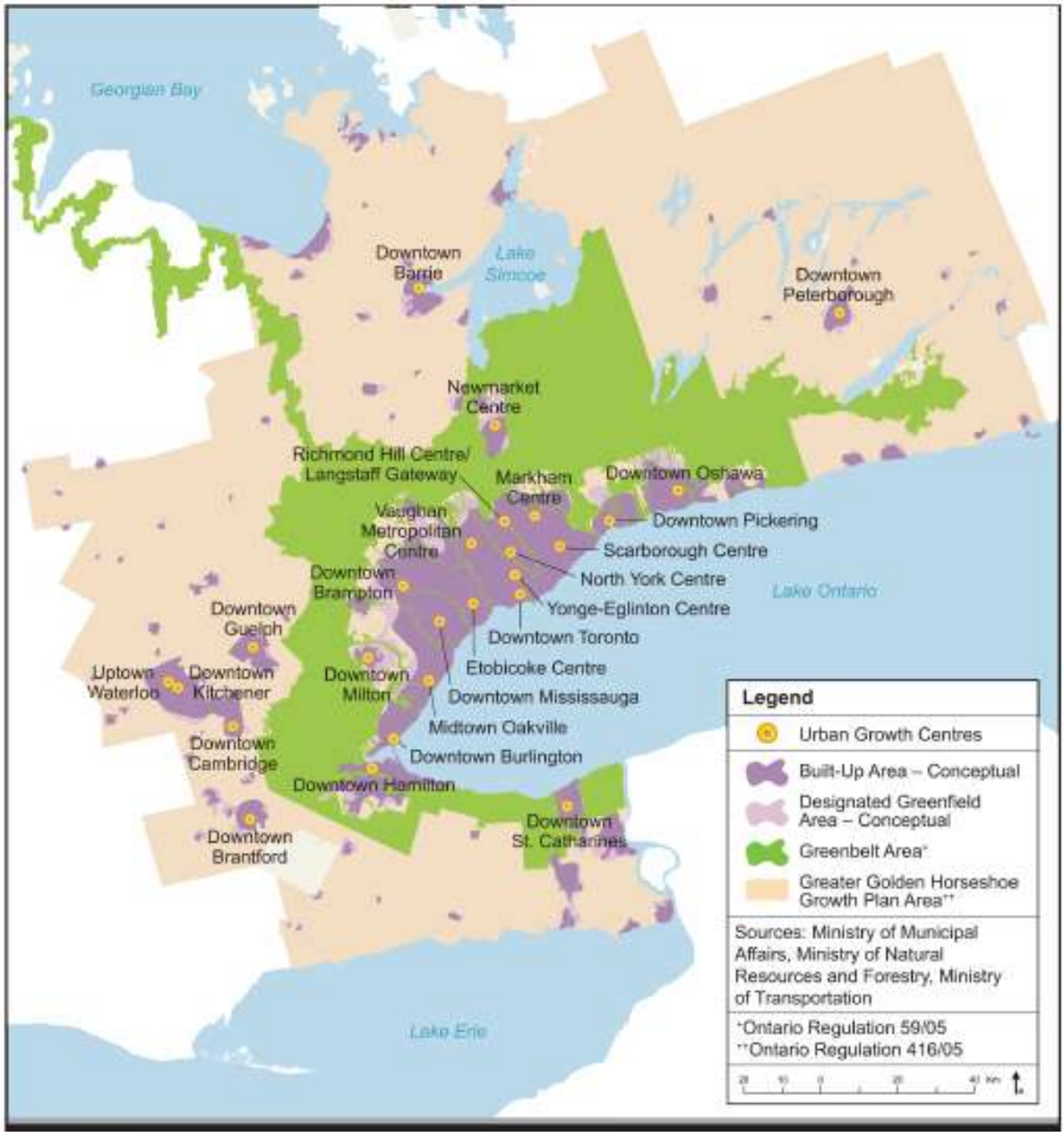
While *The Growth* Plan is not radically shaping the urban landscape just yet, a shift has begun to occur, as compared to other Canadian urban regions such as Metro Vancouver. Between 2001 and 2011 , GTHA Urban Growth Centres accounted for just 13% of region's net growth in population (vs. 28% in Metro Vancouver). This was possibly because Ontario's Growth Plan has a more generalized requirement of 40% of all housing development to occur in the form of intensification; a policy which does not direct intensification to areas which it would have the greatest benefit (Burchfield & Kramer, 2015). The Growth Plan assumes any intensification will contribute to reduced congestion, efficient use of infrastructure, and more sustainable communities. However research shows this may not be the case in the context of declining household sizes (Burchfield & Kramer, 2015). By 2031 or earlier, urban growth centres plan to achieve a minimum gross density target of 400 residents and jobs per hectare for each of the urban growth centres in the City of Toronto, and 200 residents and jobs in the downtown cores of surrounding municipalities (Ontario, 2006).

There are 25 Urban Growth Centres spread out through municipalities across the region, as seen in Schedule 4 of The Growth Plan (Figure 4; Ontario, 2006). I have classified each urban growth centre under one of the three typologies prescribed earlier in this paper: greenfields, auto-centric superblocks, and developed communities. An urban growth centre in a presently low density, largely undeveloped area like Downtown Milton or Newmarket Centre would fall under Typology #1. Typology #2 would encompass the majority of locations, including the nodes at Mississauga City Centre, Vaughan Corporate Centre, and Scarborough Centre. Finally, urban growth centres in Downtown Toronto, North York Centre, or Yonge-Eglinton Centre would classify under Typology #3.

Major Transit Station Areas

Major transit station areas (MTSAs) and intensification corridors are designed in official plans and aim to achieve an increase in residential and employment densities that support and ensure the viability of existing and planned transit service levels. Major transit station areas are planned and designed to provide access and mobility from various transportation nodes to the major transit facility, including the consideration of pedestrians, bicycle parking and commuter pick-up/drop-off areas.

Figure 4: Urban Growth Centres in the Greater Golden Horseshoe



Source: Ontario, Places to Grow Act: Growth Plan for the Greater Golden Horseshoe, 2017

Each of the aforementioned urban growth centres has an major transit station area incorporated within its boundaries, which will be considered in this analysis. As stated, the goal of the analysis which follows is to determine and discuss how to create these major transit station areas, using urban design best practices, in such a way as to mitigate first-mile/last-mile challenges in their respective communities. By retrofitting the existing and future conditions found across their various typologies, the ideal scenario would produce nodes which provide improved access to local and regional transit, effectively connecting the urban growth centres across the Greater Toronto and Hamilton Area.

Connections to Planning Policy

The following planning policies work in coordination with The Growth Plan, and provide support and guidance on transportation planning objectives.

Provincial Policy Statement

Section 1.6.7 Transportation Systems, and Section 1.6.8 Transportation and Infrastructure Corridors (Ontario, 2014) both provide support for transit and transportation planning, in line with supporting strategies which would mitigate first-mile/last-mile issues in the region.

1.6.7 Transportation Systems

- 1.6.7.1 *Transportation systems* should be provided which are safe, energy efficient, facilitate the movement of people and goods, and are appropriate to address projected needs.
- 1.6.7.2 Efficient use shall be made of existing and planned *infrastructure*, including through the use of *transportation demand management* strategies, where feasible.
- 1.6.7.3 As part of a *multimodal transportation system*, connectivity within and among *transportation systems* and modes should be maintained and, where possible, improved including connections which cross jurisdictional boundaries.
- 1.6.7.4 A land use pattern, density and mix of uses should be promoted that minimize the length and number of vehicle trips and support current and future use of transit and *active transportation*.
- 1.6.7.5 Transportation and land use considerations shall be integrated at all stages of the planning process.

1.6.8 Transportation and Infrastructure Corridors

- 1.6.8.1 Planning authorities shall plan for and protect corridors and rights-of-way for *infrastructure*, including transportation, transit and electricity generation facilities and transmission systems to meet current and projected needs.
- 1.6.8.2 *Major goods movement facilities and corridors* shall be protected for the long term.

Despite this policy being in place and a clear route presented by multiple levels of government, the province is still missing a major piece, how to translate this policy into action in local community development practices. In the discussion to follow, I will examine and present such best practices to implement these policies, using urban design and merging land use and transportation planning together in suburban communities.

Planning Act

The Province of Ontario's Planning Act also supports transportation expansion and protection. One section in particular, 24(1), is uniquely relevant in this case as it states

that one cannot do any work that does not apply to the Official Plan of a municipality or with the Planning Act (Ontario, 2018).

> **Public works and by-laws to conform with plan**
> **24** (1) Despite any other general or special Act, where an official plan is in effect, no public work shall be undertaken and, except as provided in subsections (2) and (4), no by-law shall be passed for any purpose that does not conform therewith. R.S.O. 1990, c. P.13, s. 24 (1); 1999, c. 12, Sched. M, s. 24.

Therefore, considering that every municipality has urban growth centres and major transit station areas identified within its official plans, as per The Growth Plan, those plans and locations are safe from other forms of development which would otherwise not conform with the plan.

Greenbelt Plan

The Growth Plan for the Great Golden Horseshoe, as well as the Regional Transportation Plans for the GTHA, all work in coordination with the other major piece of provincial planning legislation, the Greenbelt Plan (Ontario, 2017). The Greenbelt Plan was prepared and approved under the Greenbelt Act, 2005, and it includes lands within and builds upon the ecological protections provided by the Niagara Escarpment Plan (NEP) and the Oak Ridges Moraine Conservation Plan (ORMCP). Growth and development allocated in the Growth Plan must stay within the boundaries identified by this plan, as seen in Figure 5, and development may not encroach upon the protected lands.

Figure 5: The Greenbelt Plan

Source: Ontario, Greenbelt Plan, 2017

City of Toronto Official Plan

The City of Toronto's first Official Plan in 1999 aimed to replace the 7 Official Plans of the different municipalities pre-amalgamation, to create a new city plan. The overarching goal was to change planning so that planning could help change Toronto to be a more competitive urban region globally (Boudreau et al, 2009).

Section 2.2 Structuring Growth in the City: Integrating Land Use and Transportation states that " In keeping with the vision for a more liveable Greater Toronto Area, future growth within Toronto will be steered to areas which are well served by transit, the existing road network and which have a number of properties with redevelopment potential. Generally, the growth areas are locations where good transit access can be provided along bus and streetcar routes and at rapid transit stations" (City of Toronto, 2017).

In addition, "the growth areas are knitted together by the City's transportation network, the viability of which is crucial to supporting the growing travel needs of residents and workers over the next 30-years. The key elements of the City's transportation network are: subway, LRT, streetcar and bus lines; the GO Transit rail network; expressways and major streets; railway corridors and railway yards; the city-wide bikeway network; a system of sidewalks, pathways and trails; and potential use of hydro corridors for transit facilities, bikeways and walkways" (City of Toronto, 2017). All of these elements are critical investments required to close first-mile/last-mile gaps in the network and improve connectivity, mobility and accessibility across the city.

The official plan of any municipality is so important to consider when discussing solutions to the first-mile/last-mile dilemma. This is because the impact of local investments in individual communities is crucial to further regional goals of connectivity and accessibility. Urban design and suburban retrofitting takes place at the community level, which is most impacted by policies in the official plan.

Toronto Complete Street Design Guidelines

A valuable toolkit when utilizing urban design strategies to retrofit a street, the City of Toronto Complete Streets Design Guidelines (2017) help to implement the City's Official Plan vision for complete communities. The guidelines provide details for Area Plans, Secondary Plans, and Transportation Master Plans, as well as instructions for major street projects. The guidelines also detail processes for smaller scale projects including new sidewalks and pedestrian links, new bicycle infrastructure or facilities, streetscape improvements including street furniture or trees, and signal installations and lighting.

The chapters on street design for pedestrians, cycling, and transit each provide an overview of design principles and considerations for a complete street. For pedestrians, the guidelines describe sidewalk zones, pedestrian clearway zones, accessibility features including curb cuts, pedestrian crossings, and place-making in the public realm. For cyclists, the guidelines focus on safety and curbside conditions, as well as guidelines on

what type of cycling infrastructure is most appropriate on a given street based on its size, speed of traffic, and volume. Finally, the transit design principles consider the transit users' experience, ensuring safe, convenient and seamless connections on city streets, and safe and visible transit stops. It states that the key considerations for transit stop design in a community are safety, accessibility, comfort, place-making, and the integration with transit vehicle design. These five elements help improve a commuter's experience and further mitigate first-mile/last-mile challenges.

Public Participation

It is clear that planners and the policies they implement have a long lasting impact on the equitability of spaces created, accessed and enjoyed. Planning decisions impact communities and appropriate processes must be in place in order to ensure fair and equitable decisions are made with regards to transportation planning in the city. Worldwide, activists, development practitioners, radical NGOs, government bodies, and progressive thinkers are calling for great public involvement in making the decisions that matter and are holding governments accountable for following through on their commitments (Cornwall, 2008). Each stakeholder's definition of "participation" varies, with various models, meanings and practices in theory and action. However it is important to pay closer attention to *who* is participating, in what and for whose benefit (Cornwall, 2008).

Policy like the Regional Transportation Plan is studied and drawn up at such a high level, possibly separate from on-the-ground needs, but its results will impact lives so deeply and directly. It is therefore important to connect with local people and specific realities which would likely impact the success of failure of a regional plan. In the words of Cohen and Uphoff, it is now time for "clarity through specificity" (Cohen & Uphoff, 1980).

The real need for planning comes when people in a community, its citizens, realize a desire to improve their community's built and natural environment, to solve present and future problems and address opportunities (Hodge & Gordon, 2014). Community is essential to good planning. Toronto is in need of better planning that is well rounded in order to avoid issues around community alignment (Hodge and Gordon, 2014). People care about their environment and want to see it improved, but they also want to be a part of the process. By coordinating public development efforts and ensuring early and frequent consultation, accessible by all members of the community, the city can avoid cases where massive redesigns are required (Hodge and Gordon, 2014). Externalities are important to consider in planning and design, and so discussion around these can be insightful.

In general, public participation in the planning process is a tricky process to master. Arnstein's (1969) ladder of participation outlines how participation *should* be categorized, but does not offer insights into effectiveness of these methods. This model is largely considered too old and ineffective in today's society. For example, consider Step 3, Informing, in Arnstein's Ladder of Citizen Participation (Arnstein, 1969). Even though

there was no real participation, it still satisfied the requirements of community involvement, as stated in the Planning Act (Ontario, 2011). However, recently, Sarah White (1996) presented new forms of participation which while being fewer, are more realistic to what is experienced today. According to White, public participation can either be nominal (for legitimacy), instrumental (for efficiency), representative (for sustainability), or transformative (for empowerment) in nature (White, 1996).

Kretzmann and McKnight (1993) explain how the perceived 'success' of planning depends on how the community is engaged, and it requires a community's vested interest for a project to really succeed (Kretzmann and McKnight, 1993). However, as Stephen Connolly (2006) explains, public involvement is often ineffective and citizen engagement is low when the motives behind the outreach are viewed with suspicion. While it is not disputed that the effectiveness of transportation planning relies on the willing and insightful participation by the impacted members of the community, it also has to be planned well. Transit infrastructure is increasingly seen as a social good rather than a physical asset, and this issue is examined and criticised regularly by planners (Collens and Hertel, 2016). At the end of the day, a planner's primary responsibility is to the public interest, as per 1.0 of the OPPI Professional Code of Practice: "the planner's responsibility to the public interest is to identify and promote opportunities for meaningful participation in the planning process to all interested parties" (OPPI, 2014).

Regional Transportation Planning in the GTHA

Greater Toronto and Hamilton Area residents face inequalities when it comes to accessing transit, even now with unprecedented infrastructure investments at local, provincial and federal levels which have the potential to dramatically reshape mobility (Collens & Hertel, 2016). As Kramer and Goldstein (2015) explain, social equity is an important consideration for transit network planning, as transit is essential for enabling and improving social equity and metropolitan regions. Transit offers mobility, accessibility to jobs, education, social networks, support services, and commerce for those who don't drive or are transit-dependent due to the cost of driving (Kramer & Goldstein, 20015). The achievement of social equity is a recurring goal within the current regional transportation plans, as evidenced in the Big Move where it says access to frequent, fast and affordable transit is crucial for equity and social cohesion (Province of Ontario, 2008). The adoption of strategies to solve the first-mile/last-mile challenges in the region is linked with the expansion of frequent, fast and affordable transit. This is because as transit expands, local first-mile/last-mile connections also need to be created in each point for the network to function most efficiently as a whole.

Looking at the Greater Toronto and Hamilton Area as a whole, the region's largest transportation challenges relate to the auto-dependency currently engrained in the culture, and the increasing population of the region. Currently, 1 in 4 trips crosses a regional municipal boundary. This signals that individual transit agencies in each municipality won't achieve their goals of increasing ridership until service and fares are integrated and movement across municipal lines is seamless and smooth. With 3.46

million cars owned in the GTHA, it is ludicrous that a whopping 79% of all trips are made by car, yet that is also the present reality (Engel-Yan, 2018). With so many cars on the road, congestion and gridlock are at all time highs, with rush hour seemingly unending on the 400 series highways.

Breaking this auto-dependant culture is something which will require considerable investment in alternative modes, in order to convert drivers to transit and other alternatives. However in this process, the attention to detail is crucial as small gaps lead to access issues to that first mile or last mile, causing people to stick to their cars. A complete connected network is needed. Finally, with 110,000 new residents calling the GTHA home each year (according to the Growth Plan, 2014), capacity on existing routes will need to increase to handle the surge in riders, assuming new developments are in transit-oriented communities. Connected to the increase in population, demographic changes in employment, seniors, diversity, and wealth inequity are all increasing. The region's population is expected to grow from 7.2 million in 2016 to 10.1 million by 2041; employment is projected to increase from 3.6 million to 4.8 million in the same period (Engel-Yan, 2018). Most of this growth is expected outside of Toronto, meaning intensifying the suburbs, which will in turn require a robust and interconnected transportation plan for the region.

In summary, addressing the region's challenges through transportation planning is critical to help the GTHA sustain its growth and economic and social opportunities. The challenges are the alignment of transportation and land use planning; refocusing on moving people, not just vehicles; improving the traveler experience; responding to emerging future mobility options; integrating fares and services across the region; coordinate decision-making regionally; and provide sustainable and long-term funding for transportation infrastructure (Engel-Yan, 2018; Ontario, 2014).

The Big Move (2008)

In order to address the region's transportation challenges, in 2006 the Government of Ontario established the Greater Toronto Transportation Authority (GTTA) under the Greater Toronto Transportation Authority Act. The GTTA, which became known as Metrolinx in December 2007, was given the mandate to develop and implement an integrated multi-modal transportation plan for the GTHA. In 2008, Metrolinx released The Big Move, a regional transportation plan for the Greater Toronto and Hamilton Area (Figure 6). The transportation plan takes into account all modes of transportation; makes use of intelligent transportation systems; promotes the integration of local transit systems with each other and with the GO Transit system; works toward easing congestion and commute times, and reducing transportation-related emissions of smog precursors and greenhouse gases; and promotes transit-supportive development and the viability and optimization of transit infrastructure (Ontario, 2008). The Big Move brought about massive investments into the expansion of capital infrastructure, visibly seen in Figure 6. These capital projects include the Toronto-York Spadina Subway Extension, LRTs along Eglinton, Hurontario and Finch, and the expansion of Bus Rapid Transit, to name a few.

Figure 6: The Big Move, 15-Year Plan for the Regional Rapid Transit and Highway Network

Source: Metrolinx, The Big Move, 2008

With a 25-year outlook to 2031, The Big Move contains 10 Strategies to achieve its vision and objectives. The strategies are as follows:

1. Build a comprehensive regional rapid transit network,
2. Enhance and expand active transportation,
3. Improve the efficiency of the road and highway network,
4. Create an ambitious transportation demand management program,
5. Create a customer-first transportation system,
6. Implement an integrated transit fare system,
7. Build communities that are pedestrian, cycling and transit-supportive,
8. Plan for universal access,
9. Improve goods movement within the GTHA and with adjacent regions, and
10. Commit to continuous improvement.

These 10 strategies provide a high level of direction for transportation and land use planning across the region, which is then adopted into local policy such as official plans. The plan also details specific implementation strategies and transit projects which are of top priority across the region. These include the Mississauga Transitway, Hurontario rapid transit from Port Credit to Brampton, a rail link between Union Station and Pearson Airport, Spadina subway extension, Eglinton rapid transit, and improvements to existing GO rail services. Many of these projects have already been completed as of 2018, in "Phase 1" of The Big Move's implementation plan, with several others under construction or expected to be advanced in the near future.

Looking more closely, these top priority projects specifically work to connect all 17 of the urban growth centres in the GTHA identified in the Growth Plan. The first subway extensions outside of Toronto will connect two additional urban growth centres — the Vaughan Corporate Centre via York University and Richmond Hill/Langstaff Gateway. Toronto's five urban growth centres — Etobicoke Centre, Yonge-Eglinton Centre, North York Centre, Scarborough Centre and Downtown Toronto — will be linked by the expanded and improved rapid transit network. Rapid transit services will also be extended to Mississauga City Centre, Newmarket Centre and Downtown Burlington. The Downtown Markham and Downtown Pickering urban growth centres will be connected via rapid transit on Highway 407 and Brock Road. By the end of the first 15-years of the RTP, every urban growth centre in the GTHA will be linked by the regional rapid transit network (Ontario, 2008).

However, one strong criticism of The Big Move is that it focuses entirely on large capital projects, but forgets smaller local service improvements and equitable investments for accessibility, to help get people *to* the stations and stops of these transit lines (Hertel, Keil and Collens, 2015). The strategies forget the first mile and last mile challenges of riders, and leave riders asking, "if not now, when?"

Regional Transportation Plan (2018)

The Regional Transportation Plan adopted by Metrolinx in 2018 (Figure 7) is an update and expansion of The Big Move plan from 2008. The Big Move focused mainly on large regional capital projects, such as the Toronto-York Spadina Subway Extension, Union-Pearson Express, Eglinton Crosstown and various other light rail transit and bus rapid transit routes. On the other hand, the 2018 Regional Transportation Plan is distinctly different as it builds on the capital investment which is already underway with a greater focus on smaller local investments. These investments are directed towards improving local services, layering levels of service together, and developing a fare integration strategy which would considerably improve local to regional transit connections.

In addition to a broader vision and expansion of policies, the RTP extends the plan until 2041. The 2041 RTP goals are to achieve strong connections, complete travel experiences, and sustainable and healthy communities (Ontario, 2018). The 2041 RTP further states that " The GTHA will have a sustainable transportation system that is aligned with land use, and supports healthy and complete communities. The system will provide safe, convenient and reliable connections, and support a high quality of life, a prosperous and competitive economy, and a protected environment."

A significant change is that the 2041 Regional Transportation Plan builds on The Big Move by directly addressing first-mile/last-mile challenges by putting the traveller's needs and experience at the core of planning and operations. There is a clear growth present from 2008, now that larger investments are taking shape, bringing about the realization of the need for small investments to improve access and mobility at a local level.

The 2041 RTP presents 38 Priority Actions to support its 5 new strategies.

1. Strategy 1: **Complete** delivery of current regional transit projects
2. Strategy 2: **Connect** more of the region with frequent rapid transit
3. Strategy 3: **Optimize** the transportation system
4. Strategy 4: **Integrate** land use and transportation
5. Strategy 5: **Prepare** for an uncertain future

In addition, the Fast Reliable Transit Network (FRTN), a multi-layered rapid transit network, is presented and prioritized in the plan. The FRTN incorporates priority buses, LRT and BRT, subway and transitway, frequent regional express bus, GO 15-minute all-day service, and local transit service. These layers support the FRTN by providing the region with integrated, fast, reliable and frequent transit service which is customer focused and provides greater access, thereby increasing transit equity across the region.

Figure 7: The Regional Transportation Plan

Source: Metrolinx, 2041 Regional Transportation Plan, 2018

Section 3 | Typology 1: Greenfields - "creating the blocks"

This section presents an in-depth analysis of my first typology, greenfields, where I examine urban design best practices when "creating the blocks" of the urban environment from an area which is essentially a blank slate. Beginning with a description of the context and where and how these typologies are developed, I review the ownership, cost and equity challenges faced when developing these types of areas. Upon examining the benefits of transit-oriented development, I dive into a case study of the Mississauga Transitway and its Erin Mills Station, later connecting it to my childhood home in England, in Ashton-under-Lyne. Following this I present the impacts of the first-mile/last-mile dilemma in these suburban environments and together with urban design strategies, examine how to address them. Finally, I examine how bridging land use and transportation planning can help better integrate local communities to regional networks.

Site Contexts

Greenfield sites are found all around the GTHA, but are becoming increasingly rare as suburbanization continues. However these locations found across Milton or Newmarket have the greatest potential to be developed from a "blank slate" in such a way that brings together ideal land use planning with transit-oriented development (TOD) to create complete communities free of first-mile/last-mile mobility challenges.

Long-term efforts to build sustainable city-regions like the GTHA are rooted in attempts to slow down sprawl by building more compact communities that can be served effectively by transit. Currently, the GTHA is focused on transit-oriented development around urban centres to combat sprawl and rein in greenfield development (Burchfield and Kramer, 2015). However the GTHA could learn from Metro Vancouver by introducing a more strategic approach to growth that directs more new residents to areas with frequent transit service than still leaning towards more greenfield development. This strategy would ensure new residents don't face the same first-mile/last-mile mobility issues that currently plague most of the region. According to the 2015 Neptis report "Growing Pains," from 2001 to 2011, the GTHA continued to accommodate the majority of population growth through greenfield development (86% to new subdivisions), despite the condo boom in Toronto, which represented part of just 14% growth into existing urban areas (Burchfield and Kramer, 2015).

It is clear that intensification is needed, with particular focus in greenfield sites, in order to not only keep up with and sustain the population growth the region is experiencing and is forecasted to experience, but also to provide appropriate transportation options throughout the region. Unfortunately, growth in GTHA is going to areas without transit, with only 18% of regions new residents accommodated near frequent transit routes, including GO (Burchfield and Kramer, 2015).

As discussed previously in Sections 1 and 2, several of the GTHA's Urban Growth Centres are located in typologies akin to greenfields or are surrounded by the same. In addition,

several transportation corridors, such as the Mississauga Transitway, are located along a strip of green land which crosses the city. These typologies are prime spaces in which planners can utilize urban design best practices and develop ideal major transit station areas. A great deal of site planning would be required, organizing the external physical environment to accommodate expected human behaviour across the built environment (Lynch & Hack, 1984), however using transit-oriented development, we can integrate these greenfield sites into the larger regional network.

Challenges: Ownership, Costs and Equity

There are a number of challenges when it comes to developing greenfield sites in a holistic manner. These challenges are usually related to ownership of the land, cost to redevelop and provide all the services expected, and challenges around equitable process in the planning process. When owned by a private developer, large areas of land are sometimes difficult for a city to manage to ensure local and regional transit will be fully integrated into the development. This is because the integration of transit infrastructure is a substantial investment developers may not always want to invest in, as this may be seen as the city's burden. Resulting public right-of-ways may not leave municipalities much room to incorporate the infrastructure needed. In addition, as we have seen historically, building sprawling neighbourhoods and selling large lots are quick and easy for a developer, however this approach would not provide the density the city and region requires. Zoning by-laws help to regulate density and other elements, however the locations of transit stops are the most crucial features with respect to expanding mobility.

Cyclists and pedestrians are put off by inaccessible locations, a lack of safe bike lanes and storage, and winter conditions where sidewalks are not cleared (Ryerson City Building Institute, 2016). It is important to consider pedestrian paths and cyclist routes when developing greenfield areas. As "blank slate" greenfield sites are often large open swaths of land, there is a tendency to misjudge distances and use the extra space to create large right-of-ways across a new community. However, while wide roads and spread out buildings may seem appealing for drivers and from an architectural perspective, it is not practical from a transportation planning perspective, and indeed hinders first mile connections.

Equity in decision making is also important and needed when building communities, particularly from blank slates on greenfield land. As repeatedly stated by Sean Hertel (2016), there is a major need to incorporate transit equity into The Big Move because transit investments contribute to social equity and help ensure residents can afford to access transit across all levels of income and circumstance (Hertel et al, 2016). Unfortunately, the benefits of public transit investments are not equally distributed. Like all metropolitan regions in the world, the GTHA has structural inequities created over decades, if not more than a century, of decisions being made and not made: where growth occurs; the type and density of development; where transit and other infrastructures are constructed, and; where public and private capital is invested and extracted. While the region, as a whole, stands to benefit from public transit infrastructure investments, those

benefits are unequally distributed within the region (Hertel et al, 2015). However, the benefits can be shared by expanding access through first-mile/last-mile considerations across the region by increasing the quantity and quality of local nodes which connect to a larger regional transit network. This is because transit investments, however small or local, have consequences beyond capital (rolling stock, terminals) and the operations (routes, headways) they support (Hertel et al, 2015). They also build cities, enable communities, empower individuals to participate in society's opportunities more fully.

In reality, these investments can be as simple as bus shelters and marked cycling lanes in communities, which drastically improve a pedestrian, cyclist, or transit user's experience. While these small investments may not seem like first-mile/last-mile solutions, these small improvements make alternative modes more appealing, and therefore more accessible, which in turn open up the possibility for larger connections. In the GTHA, there really are winners and losers among transit users. They are defined by location and frequency of service, technology, and even pilot projects. For example wealthier communities in Toronto have bus stops with shelters and benches, whereas predominantly black communities in Scarborough or Etobicoke North have considerably fewer or none altogether (Bart, 2018). This is an issue of budget allocation towards local improvements to the commuter and individual experience, regardless of the party responsible for maintaining the bus shelters. Unfortunately right now when travelling in communities outside of the downtown core, the frequency of buses is slower, there are more experiences of people waiting for buses without a bench or bus shelter, and the distance between getting on/off a bus and getting to a subway is markedly farther (Bart, 2018). Knowing this we can work towards closing those gaps, starting in low density greenfield areas which currently experience the largest gaps and distances between stops, and then expanding across the region.

Benefits: Potential for Transit Oriented Development

The transformation of extensive "blank slate" greenfields to an increasingly dense, transit-oriented, urban mixed-use district in a city originally built on a conventional suburban planning and development model can be challenging and time consuming (Macht, 2017). However, through public/private partnerships, greenfield sites can become transit and economic hubs within a municipality. Experts frequently discuss ways to fund transit-oriented developments (TODs), provide affordable housing near public transit options, minimize the amount of parking space near TODs, prepare for the potential widespread adoption of autonomous cars, and otherwise encourage the creation of TODs (Nyren, 2017a). The next step is to transform this dialogue into action, starting with urban growth centres in the GTHA which are located in greenfield environments.

A common debate around greenfield development into a transit-oriented environment is the high costs associated with the transformation, and the questions around the financial return as a result. Particularly with active transportation investments such as cycling infrastructure, developers and investors ask if active transportation creates real estate value, and if "trail-oriented development is the new "TOD" (MacCleery et al, 2016). In

fact, investments in bicycle and pedestrian infrastructure are generating economic development and increased real estate value. Innovative developers and communities are supporting walking and biking because they are seeing bike/pedestrian infrastructure stimulate adjacent development (MacCleery et al, 2016).

Surprisingly, walkability now may outweigh transit access in valuing a location (Brass, 2018). While ride-hailing services and autonomous vehicles are already starting to change the economic formulas for transit-oriented development, creating a place, not just a development next to transit, is growing more critical than mere access to transit (Brass, 2018). The emphasis these days is more on walkability than a direct rail or metro connection. The ability to walk to shops and restaurants can add more value than proximity to a rail link. The "transit premium" for valuation is considered by a Urban Land Institute study to be decreasing, in part due to the recent surge in transit-oriented development and construction (Brass, 2018). Of course, transit can amplify a walkable neighbourhood, but transit is not a prerequisite to making a decent walkable neighbourhood (Price, 2018). Take a small, older European town where you can walk from one side to the other in 10-minutes. You might need a car to visit the town from outside (or you can take a day trip in on a bus), but if you live in town, everything is a 10-minute walk. There is no massive transit investment needed to build this kind of place. Many small, historic towns in Canada are the same. Based on this, I would advise against the false hope that if we just spent more on transit, we would radically change our development pattern, become financially productive, induce suburban retrofit, and everyone would be happier. It may be possible, but it is not going to happen if we keep our land usage stagnant. It makes more sense to change our land usage first, so that if we ever do insert a transit line, it will be popular on day one (Price, 2018).

Case Study 1: Mississauga Transitway

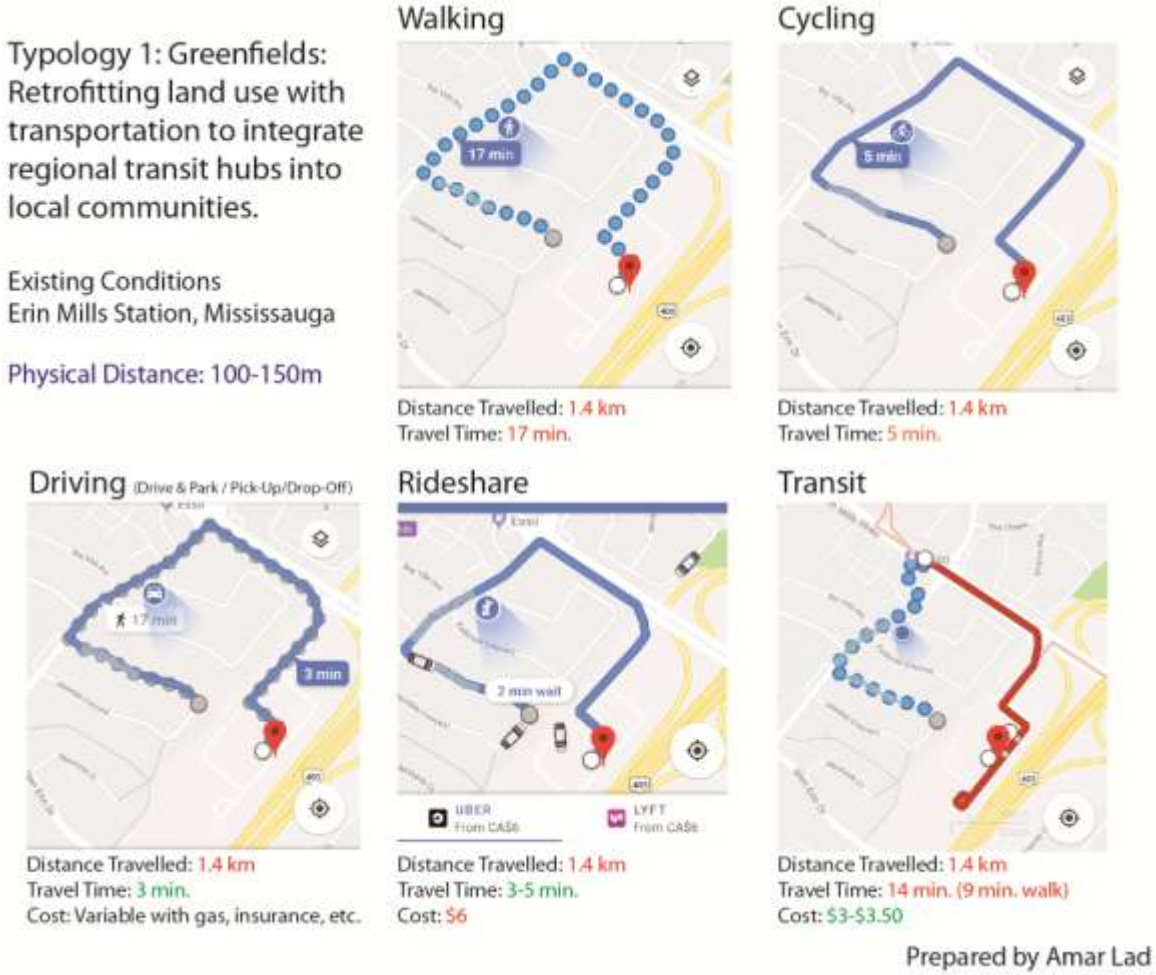
Greenfield sites may be challenges to develop, but those blank slates along transportation corridors, such as the Mississauga Transitway are especially difficult to manage without adequate local first-mile/last-mile connections into and out of the station areas. The Mississauga Transitway is a $259 million, 18 kilometre east-west busway across the City of Mississauga. The first of its 12 stations situated along Highway 403 opened in 2016 and brought with it numerous transportation improvements and options for local residents. These options included expanded local and express bus service on Mi-Way routes servicing the newly opened stations as well as new GO Transit stops for routes coming from Hamilton, through Square One and continuing to transit hubs such as Union Station and York University. This regional connectivity is integral in creating shorter commute times, and providing easier and more frequent access across municipalities. However, this benefit is only experienced once a commuter reaches a station. Unfortunately that first mile or last mile to/from many of the stations pose a significant challenge to overcome.

Upon first inspection, one would question why the transitway stations are right up against highway 403, far from the main local roads and set back a great distance from

residential and commercial lands nearby. Upon investigation, the answer came down to ownership. Simply put, the Province, and through them Metrolinx, did not own any substantial amount of land along main roads through all of Mississauga. Obtaining land along Eglinton Avenue for a BRT route would have been incredibly costly and ineffective. Instead, the province opted to use the land it owned adjacent to the highway 403, along the hydro corridor, to build its transitway.

With stations such as Erin Mills, Winston Churchill, Dixie and Tomken being on greenfield sites, adjacent to a busy highway, and not integrated into a neighbourhood, access is currently the biggest issue limiting ridership. Each of these stations, as well as most of the others, require commuters to drive and park, get picked up and dropped off, or use another mode to access the station. However these additional transfers have an inverse effect on ridership. Riders prefer to avoid transfers when possible, at a maximum of one; transfers have to be easy in time and effort, and minimizing waiting (King, 2016).

Figure 8: Typology 1 Transportation Comparison - Erin Mills Station: Existing Conditions

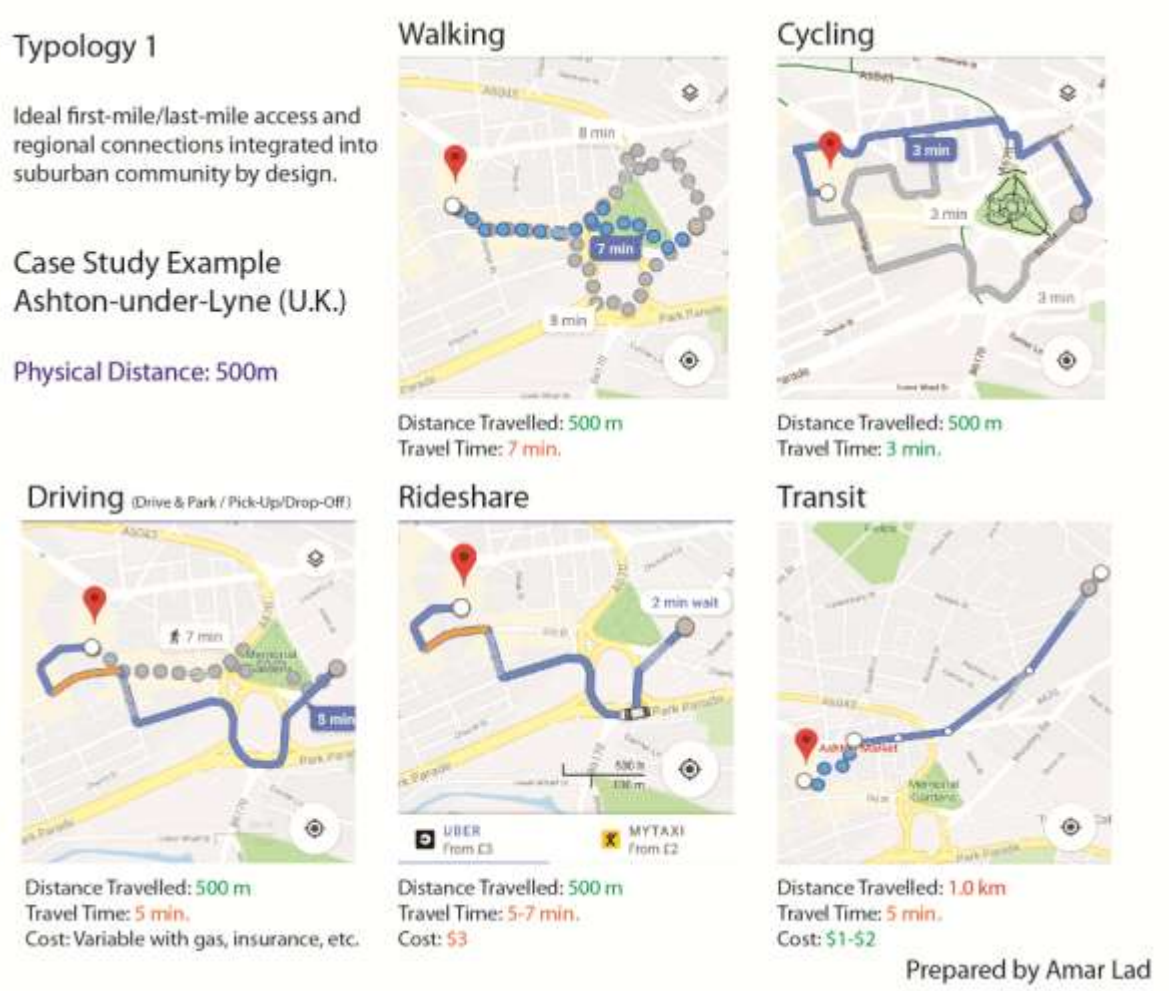


As we can see in Figure 8, pedestrian and cycling connections in particular are poor, inaccessible and uninviting to try. At Erin Mills Station in particular, the station building is set all the way back, far from Erin Mills Parkway, across a 4-lane entrance road, a large parking lot, and a pick-up/drop-off zone. If a rider is going eastbound, which most are, they then need to cross an additional 4 bus lanes to access the side of the station loop to board. That is just the walk through the station. Accessing the station by foot or bike puts you on a narrow sidewalk adjacent to Erin Mills Parkway, where cars frequently exceed 80 km/hr. The 'adjacent' residential streets are seemingly a short 100-150m walk to the station, but on closer inspection you find that they all back out onto the station property, and a 20-foot-tall fence separates the community and the transit station. This leads to long detours, extending travel distances to 1.4km and lengthening a 2-minute walk to 17-minutes. In addition, the winding nature of the streets and lack of connections between them, ensures there are no shortcuts and a pedestrian has to walk around the entire suburban block in order to access the station from Erin Mills Parkway. Poorly connected and infrequent local routes also extend a commuter's transit trip to 14-minutes, including a 9-minute walk, to access the station without a car. Drivers on the other hand currently experience a comfortable 3-minute drive, and this is consistent whether a commuter is driving and parking, being picked up or dropped off, or taking a rideshare service at an additional cost.

With the absence of adequate pedestrian and cycling connections offering so much potential to improve first-mile/last-mile connectivity, I was surprised to learn previously existing paths were closed as this station opened. There was previously a pedestrian alley, connecting Idlewilde Crescent and Marshdale Court together over to Credit Valley Road, and the back end of this trail would have perfectly aligned with the transit station. Unfortunately, 2-years before the station was even open, residents of Idlewilde petitioned the city to shut down the entire pedestrian walkway (which is currently boarded up and access blocked off) due to fears that the station would attract unwanted street parking on their closed crescent. Despite the fact that the station has more than enough parking, which, now that it has been operational for 2-years has shown no signs of reaching capacity during peak periods, the walkway remains closed. I reached out to the local councillor but actions to reverse past council decisions are rarely taken, and with fewer riders using the station that originally anticipated, the benefits are not considered worth the additional investment to reopen the paths.

This whole scenario just demonstrates what a lack of foresight and consideration of all users can do to a potentially incredible investment in infrastructure. By looking at small local connections, unrelated to driving, stations along the transitway have the potential to open up connections for people living along the corridors, but are currently cut off by poor management and political indifference. By providing that "first mile" option, planners could actively work to turn this greenfield retrofit into a successful transportation corridor for the city, as we see in a comparable neighbourhood in Figure 9.

Figure 9: Transportation Comparison - Ashton-Under-Lyne, United Kingdom



In Figure 9 we see the same transportation comparison undertaken for Mississauga's Erin Mills Station, but instead in Ashton-Under-Lyne, a suburban neighbourhood outside of Manchester in the United Kingdom. I picked this seemingly random location on Mossley Road as it happens to be my grandparent's home and where I spent a lot of time growing up. Most recently in May 2018, I spent almost a week here without access to a car, and I was delighted to experience no difficulty in moving around the community! As a result of its similar characteristics with the Erin Mills community, a land use and transportation comparison is most appropriate. In Figure 9 we see the distance travelled and time it would take to travel from 'home' to the center of town where you can find a large market, shopping mall, local bus hub, and even an above-ground rail station which connects Ashton to the rest of the region, and in fact to the rest of the country via a transfer in Manchester.

The key difference between Erin Mills (Figure 8) and Ashton (Figure 9) is that in the latter, any individual can travel considerably farther, access more services, at a lower price and in much less time than in Erin Mills. The 100-150m walk to Erin Mills Station was 1.4

km and 17-minutes long for a standard pedestrian and 5 minutes for cyclists. By comparison, a 500m trip to the Ashton market is exactly 500m for pedestrians and cyclists, and is as long as a 7 minute walk or 3 minute bike ride. Driving or using rideshare is in fact slower in Ashton, due to a road network which prioritizes active transportation and safety, with slower speeds, and narrow, 2-lane streets. Most surprisingly of all, transit in Ashton is not a realistic option until the distance is doubled to 1km, and even then would take no longer than 5 minutes, at half the cost as in Mississauga.

Despite these stark differences, both of these neighbourhoods are in fact comparable. Both are commuter suburbs, situated close to a major shopping center (Erin Mills Town Centre is the same distance to the north of the station), regional transit station, and many local shops, parks and schools. Both have limited bike lanes, local bus service, and many cars on the roads. So what makes them so different in first-mile/last-mile mobility? As I explore in the next two sections, the answer comes down to effective urban design.

Addressing the First-Mile/Last-Mile

As we know, transit can be a way to employment, education, housing and social opportunities. When all of these are found together on a newly developed greenfield site, with ideal transit urban design, mobility is improved. However mobility does not simply equate with accessibility. Accessibility deals with the notion of how to reach people and help them take advantage of opportunities (Collens & Hertel, 2016). Therefore it important that a holistic approach is always considered.

When working on retrofitting greenfield sites, strategies commonly implemented to address first-mile/last-mile issues include a focus on active transportation (modes that rely on user energy and power) improvement; continuous pedestrian sidewalks, direct pedestrian paths to transit stations, and pedestrian amenities at stations; extensive bike networks, secure bike storage areas at stations, and space for bikes on transit vehicles; and safety from traffic calming and pedestrian priority intersection signals (Locquiao, 2016). Additionally, planners should consider land topography and the presence of sidewalks and paths. Pedestrians should not be overlooked in transit oriented development designs (Mangan, 2013).

The establishment of visible infrastructure in greenfield developments is also a valuable investment to help improve the attractiveness of transit and active transportation options. Mangan (2013) explains that an LRT has a greater public image than a bus, but less than a subway. Visible infrastructure adds a feeling of permanence and reliability, and therefore the "better public image" brings in more "choice users" who would otherwise drive. As seen in Figure 8, buses may be limited to serving local communities, but if they can connect residential and employment areas effectively with higher orders of transit, station success will increase (Mangan, 2013).

Ideal Retrofit

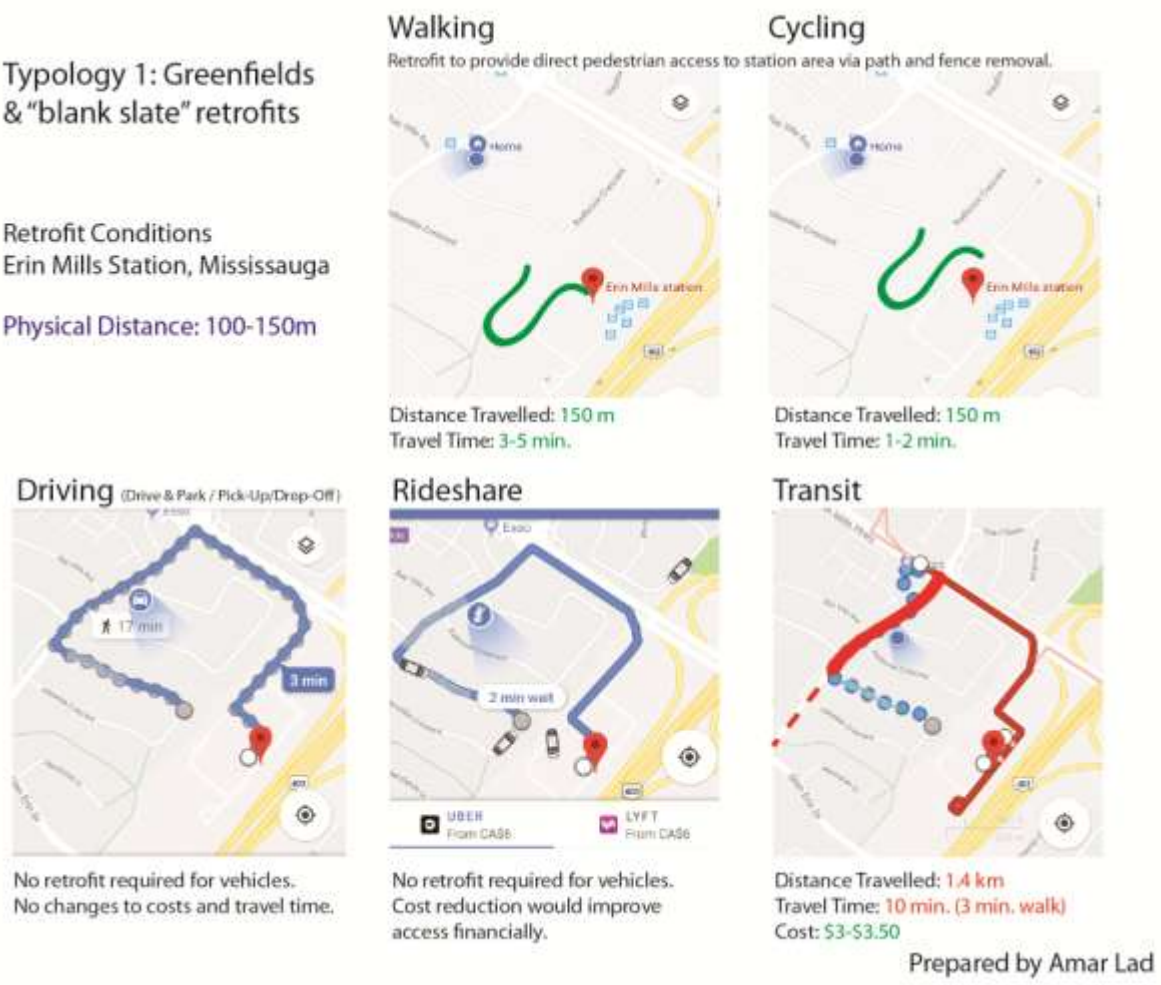
From an urban design perspective, greenfield development and retrofitting can be done in the style defined in Kelbaugh's *Pedestrian Pocketbook* (Kelbaugh, 1989). Smaller than a new town, the Pedestrian Pocket is defined as a balanced, mixed-use area; “a simple cluster of housing, retail space and offices within a quarter-mile walking radius of a transit system” which answers the rapid privatization, depersonalization and fragmentation of suburbia with a model that relies upon mass transit, higher density development and quality public space (Kelbaugh, 1989). The result is a small town that offers its population true pedestrian accessibility and a sense of place. This model has similarities with Ebenezer Howard's Garden City; both the garden city and pedestrian pocket are surrounded by greenbelts of permanent agricultural land. Both are relatively dense, allowing residents to walk to the urban centre in a short period of time, both combine residential, commercial and workplace elements. The garden city is served by railroad, while the pedestrian pocket is served by light rail transit while also accommodating the car (Kelbaugh, 1989).

Additionally, Ewing and Bartholomew (2013) outline a number of important urban design elements to consider when developing an area, particularly from scratch with greenfield conditions. These elements include imageability, enclosure, transparency, complexity, coherence, legibility, linkage, human scale, and conclusion through visual connectedness (Ewing & Bartholomew, 2013). With respect to imageability, urban design makes a place recognizable and memorable, with a distinct impression. The space captures a person's attention as they pass through it, evoking feelings and creating a lasting memory. This is achieved through physical elements such as landmarks. Landmarks are particularly useful as "a landmark lifts a considerable area around itself out of anonymity, giving it identity and visual structure" (Ewing & Bartholomew, 2013). Life in the space, the climate, and the architectural quality support and complement each other to create an unforgettable total impression (Gehl, 1987). Enclosure concerns the degree which streets/spaces are defined by walls, trees and buildings. An outdoor space is positive when it has a distinct and definite shape with unbroken walls and an even height (Ewing & Bartholomew, 2013). Transparency denotes the degree with which people can see human activity beyond the edge of the street. This incorporates physical elements such as walls, windows, doors, fences, landscaping and openings. Display windows are good uses of transparency, while blank walls or reflective office glass are not desirable (Ewing & Bartholomew, 2013). Finally, urban design at a human scale considers the size and articulation of physical elements defines the scale. Moderate size buildings which are 3-6 stories tall, setback on narrow streets and with small spaces are considered to be human scale (Ewing & Bartholomew, 2013). The human scale also extends to the intricacy of paving patterns, amount of street furniture, ornamentation, parked cars, and window spacing.

Putting just a few of these concepts into practice, we can transform greenfield developments, transit corridors like the Mississauga Transitway, and create better access to transit nodes like the Erin Mills Station. In Figure 10 we see how small improvements such as opening up a pedestrian path to link residential streets to the station area, and

improving local transit feeder routes can dramatically increase access to the station. While these changes are small and do not require redesigning the entire block, it demonstrates that a retrofit process does not need to be invasive to be effective. However with these practices in mind, we can aspire to plan better communities from the start, like what we saw above in Ashton-Under-Lyne.

Figure 10: Typology 1 Transportation Comparison - Erin Mills Station: Retrofit Conditions



Bridging Land Use and Transportation Planning

Greenfield typologies provide the greatest opportunities in the GTHA to link land use and transportation strategies together. Particularly with the region's current challenges and today's most-concerning environmental and social problems, including sprawl, congestion, oil dependence and climate change, opportunities to retrofit greenfield sites are prompting municipalities to turn to land use planning and urban design to rein in automobile use (Ewing & Cervero, 2010b).

In general, we need to adjust transit policies with regards to land use and density, in line with the growth plan. "People don't want a neighbourhood tour to the station, which buses do" but commuters want flexible routing in order to stop for groceries and errands

on their way home (Rudin, 2016). Otherwise people are losing freedom and convenience while on transit.

Presently in the GTHA, land use planning and transportation planning appear to be on separate tracks. Municipalities began planning in conformity with the Growth Plan in 2006, two years before the release of *The Big Move*, the first regional transportation plan. As a result, there seemed to be less focus on accommodating growth around corridors and centres with existing or planned frequent transit service (Burchfield & Kramer, 2015). However, subsequent Official Plans have included transit-supportive policies and designs are currently being based on the nodes and corridors strategy.

With all elements considered, there are signs of progress in Toronto, where we are currently seeing a good step forward in Downsview, which is the last blank slate in Toronto. This greenfield has huge potential which may be realized in its key element of mobility and the incorporation of a light rail transit (LRT) line that was used for the purposes of integrating the various uses of residential, commercial, and institutional (Wong, 2018). Downsview represents a unique opportunity to increase density within and/or around the Downsview site. Taking advantage of the transportation links already set up (i.e, new TTC subway stop and GO station) unlocks potential to develop large tracts of land within an urban area that will no longer be constrained by flight path restrictions. Given the site is currently zoned for employment uses, Downsview is considered a prime location for the "live-work-play" culture (Wong, 2018).

Section 4 | Typology 2: Auto-Centric Superblocks - "changing the blocks"

This section presents an analysis of typology #2, auto-centric superblocks. The term superblock is used because the size of a typical suburban neighbourhood block is significantly larger and wider than that of downtown city blocks. With intersections spread father apart, higher speed limits, and wider roads, the term superblock best describes this typology. In this discussion, I present urban design elements and first-mile/last-mile strategies which would be best used to retrofit these communities by breaking apart and changing the blocks of the suburban form. I refer to malls such as Square One, and conduct a case study on the transit project Dundas Connects, which strives to transform all of Dundas Street through Mississauga by re-developing the auto-centric plazas along the street. This section further examines issues around safety, land use, and ownership, while presenting the benefits offered by a large public right-of-way which presents ample space to retrofit for all modes.

Site Contexts

As you travel from the downtown core out into suburbia, the urban transforms from a pedestrian-oriented streetscape to a world built around the car. The basic elements remain (the stores, residences, and the people) but their form and relationship alter block by block until the balance between pedestrians and drivers entirely shifts. Streets expand with wider lanes, intersections include exclusive turn lanes, the blocks get larger, and the

distance between safe street crossings increase (Greenberg, 2011). As buildings are set farther back and give way to parking lots, we enter a world of auto-centric strip plazas, stand-alone big box stores, and giant malls surrounded by seas of parking lots.

The direction of travel west/north/east out of Toronto does not matter, as this scene is depicted everywhere where development has created commercial strips. Commercial strips can be defined as major city streets lined with commercial activities. they usually host a mixture of retail establishments, office buildings, automobile dealerships, car parks, and some occasional residential buildings, and often vacant space (Dunham-Jones & Williamson, 2011). These strips cut across different urban sections, serving as access routes and travel corridors. Prior to the construction of freeways, they were the principal traffic arteries of the city, and still carry a significant share of vehicular traffic (Dunham-Jones & Williamson, 2011; Greenberg, 2011).

By breaking the superblocks and melding transportation and land use planning together, these spaces have boundless potential to become part of a re-imagined land use and develop complete communities around the GTHA. Uniquely, typology #2 encompasses the majority of locations for Urban Growth Centres around the GTHA, as identified in the Growth Plan. These locations include the nodes at Mississauga City Centre, Vaughan Corporate Centre, and Scarborough Centre. Places like Square One in Mississauga, Vaughan Corporate Centre and Scarborough Town Centre are each attempting to evolve in order to stay relevant and part ways from this trend. The task of retrofitting these spaces in order to incorporate better transit, activity, and reduce first-mile/last-mile challenges is becoming increasingly important.

Challenges and Opportunities: Safety and Land Use Planning

One of the driving factors for change is the issue of safety in the suburbs. Concerns with road design leading to a rise in traffic-related fatalities on Toronto's streets, and indeed around the GTHA, have ignited discussions around the huge retrofit required. Currently in auto-centric communities, pedestrians are faced with the choice between a 30-minute walk around a block to find a safe crossing, or stepping off the curb and jaywalk to save time. The latter comes at the risk of not getting home alive, and this dilemma is directly correlated with the rise in pedestrian deaths on city streets, according to Vision Zero (Keesmaat, 2018). Notably, one of the paradoxes of transportation systems is that air, sea and rail sectors are characterized by a safety culture where accidents are rare and exhaustively investigated, and systemic improvements are made to avoid repetition, whereas road networks appear to have an inbuilt but never explicitly stated tolerance for an “acceptable” level of serious injury and death (Firth, 2017). Experts are conclusive that it is the responsibility of cities to be responsive to the needs of its citizens, through urban design, public policy and community engagement (Hirota & Pitman, 2017).

Vision Zero is the city's goal for absolutely zero pedestrian or cyclist deaths on city streets, as even one is too many. It has evolved out of the paradigm shift in the way we think about the function of street; are they for moving cars or moving people? In

addition, there is a rise in equity in safety, as the understanding spreads that safety is our responsibility as planners for people who are transit dependant, with no access to cars, working multiple jobs and want to feel SAFE on city streets (Keesmaat, 2018). Sweden was the first country to refute this paradigm with Vision Zero, whose concept is equally simple and powerful: that death and serious injury in the road system is unacceptable and the transportation system should be designed to prevent it (Firth, 2017). As a result, Sweden now has the safest roads of any country on earth, with Stockholm successful in applying the concepts even in its dense urban context (Firth, 2017). In Toronto, Vision Zero has built a shared interest across political spectrums by focusing on patience and urgency. The urgency comes from the growing need to adapt where people *want* the change, but also where people *don't want* the change for the safety of all citizens. Unfortunately as per the latter, suburban drivers frequently fight against changes to road designs which would result in reducing speed limits, potentially reducing lanes, and increasing stops, in order to protect the safety of non-drivers. I personally witnessed the anger and rejection of change first-hand while participating in public consultations for the City's Re-imagining Yonge Street project in North York Centre. However, leaders like Keesmaat are determined to push through and educate citizens on the benefits in order to save lives, while providing the dual benefit of retrofitting the streets and eliminating first-mile/last-mile accessibility issues for non-drivers.

Beyond addressing issues of safety in these suburban contexts, the challenge with retrofitting developed districts like Square One or Yorkdale Mall is the economic risk to cities of ensuring financial prosperity remains as strong, post-revitalization. It would theoretically be easy to demolish these plazas and treat them like greenfields for redevelopment, however it is important that they remain, as malls are reliable nodes for employment, economic and social activity. Shopping malls are anchors and community nodes, and often major nodes designated for intensification in a city's Official Plan. In response to this concern, the City of Mississauga is developing new land use planning policies for land use, transportation and urban design around five of Mississauga's shopping malls and their surrounding areas (Davidge & Lee, 2018). Through improved policy, we can preserve the best attributes of these typologies - their mixed use, strong community presence, vital local retail - while improving the built environment towards a healthy complete community ideal, mitigating first-mile/last-mile concerns and developing them into urban growth centres, as per the Growth Plan.

Looking at the existing conditions surrounding Mississauga's City Centre in Figure 11, we can see that access to Square One's transit terminal is considerably inconvenient for anyone coming from any of the residential areas surrounding the mall to the east, west and south. In Figure 12 I re-envision the city centre with one seemingly simple change: moving the transit terminal to the south side of the mall area, closer to all of the residential and employment along Burnhamthorpe Road, and adjacent to City Hall and Celebration Square. The average distance pedestrians and cyclists have to travel to reach regional (bus) transit stops would be cut in half to 750m in this example. Pedestrian travel time would drop from a discouraging 20-minutes (longer in winter conditions) to a more

universally appealing 10-minute walk. In addition, by dramatically expanding safe cycling facilities in the entire city centre, cyclists would have a comfortable 3-minute trip, down from 7-minutes while battling vehicular traffic. The road network in the area has wide lanes and significant right-of-ways with adequate space to build separate lanes for cyclists, improving safety for both cyclists and drivers alike. Finally, the provision of more frequent local transit service into this regional hub would be the greatest short-term solution to improve first-mile/last-mile access. As we see in the Regional Transportation Plan, the future Hurontario LRT will dramatically change this and further study would be required to understand what retrofit strategies may be applied to best align this new mode of transportation with the existing network.

Figure 11: Typology 2 Transportation Comparison - Square One Terminal: Existing Conditions

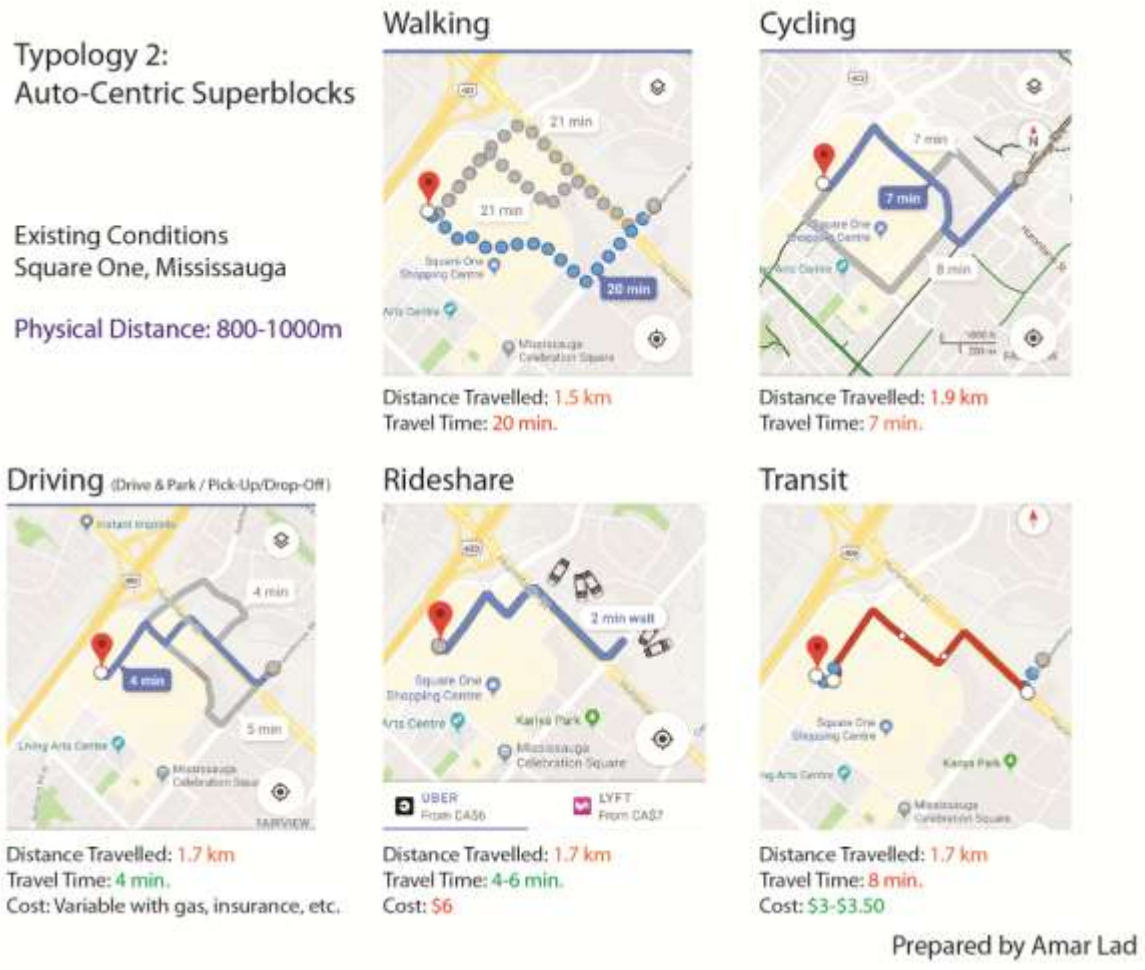
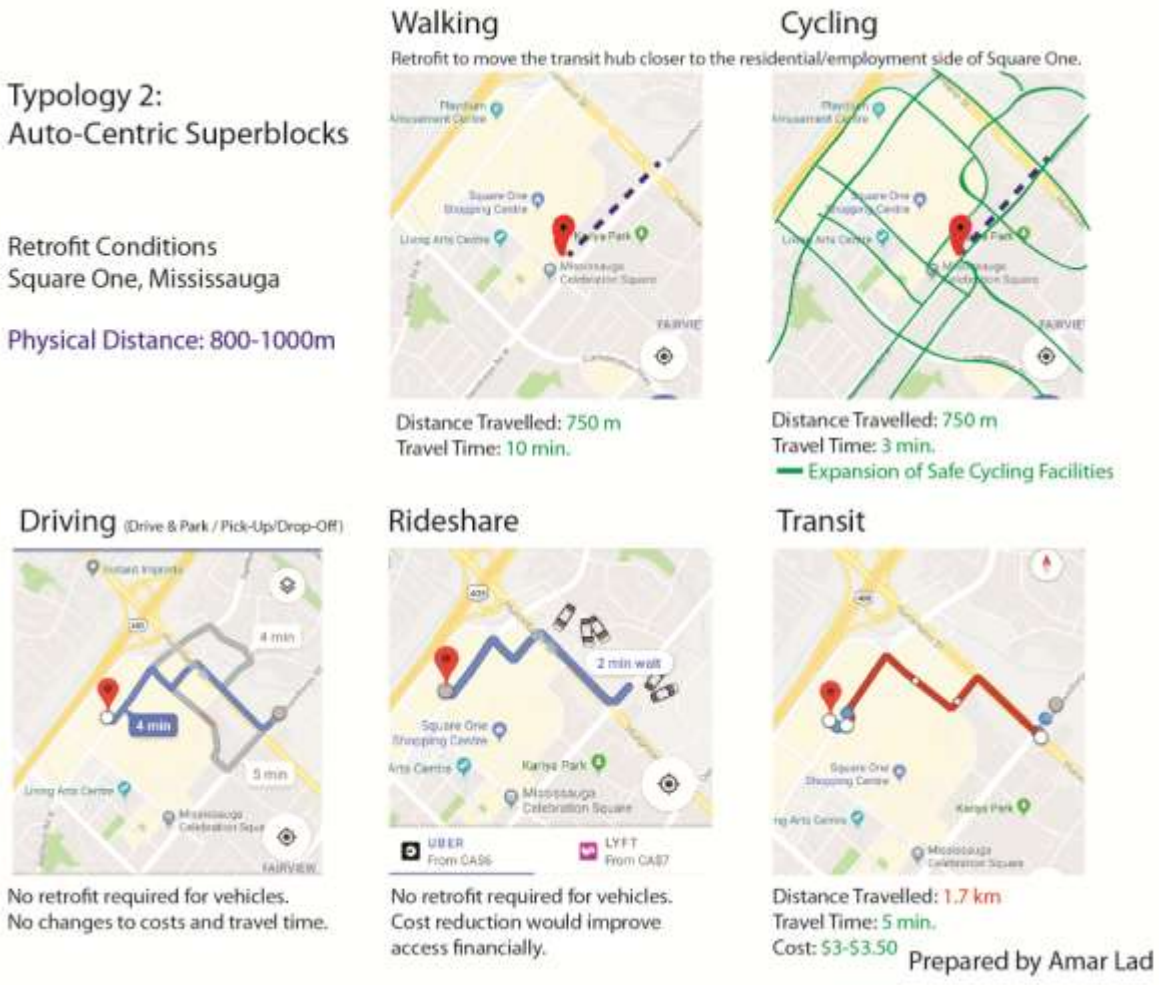


Figure 12: Typology 2 Transportation Comparison - Square One Terminal: Retrofit Conditions



Case Study 2: Dundas Connects

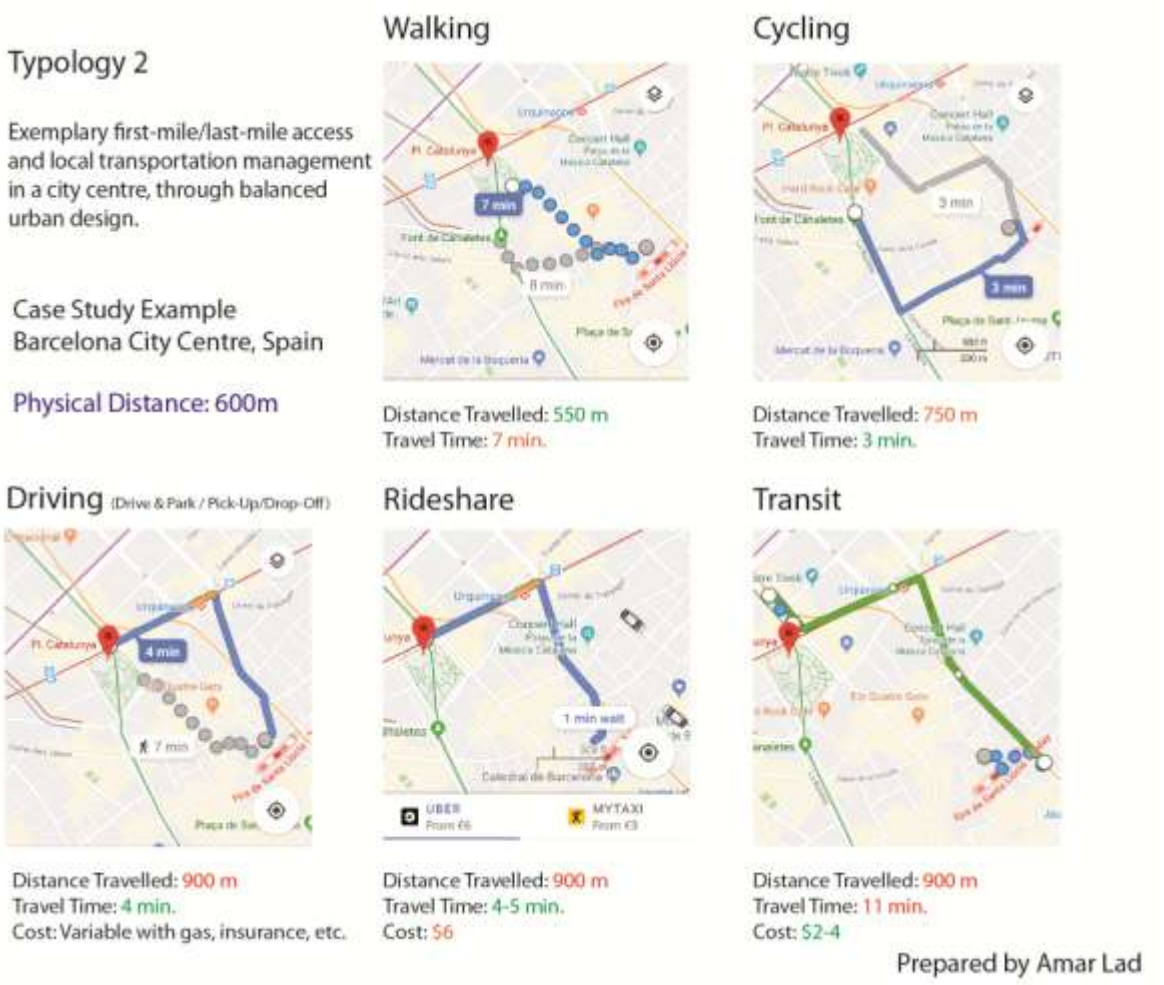
While the obvious case study for a low-density suburban redevelopment project in Mississauga would be Square One City Centre, I would like to switch gears to a lesser known project with far reaching consequences for the city. Dundas Connects is a transportation planning study encompassing Dundas Street from Kipling TTC Subway Station in the east end, all the way to across the width of Mississauga to 10th Line in the west. While public space in the city centre is developed through design and activity (Filion et al, 2015), a key element is how to connect that city centre to those of surrounding municipalities. The Hurontario LRT was originally going to connect Square One to Downtown Brampton's urban growth centre, until Brampton City Council voted against allowing the provincially-funded project to cross into its municipal borders. However the Hurontario LRT would connect Square One south, to Dundas Street (and continuing to Port Credit GO), and Dundas Connects would bridge the gap into the City of Toronto, with direct access to the TTC subway.

The Dundas Connects project looks at redeveloping the entire Dundas Street corridor into a mixed-use strip with rapid transit servicing the entire route with a mix of Light Rail Transit (LRT) and Bus Rapid Transit (BRT), the latter through a historic district where the right-of-way is too small for separated LRT lanes. As Hammerschmidt (2016) discusses, complete corridor redevelopment integrates various planning and design approaches - complete streets, living streets, and livable streets - which aim to redevelop commercial corridors to meet more of their users' needs, including their need for walking and biking rather than driving. A marked difference between a healthy corridors approach and other approaches is that the former looks beyond just the street and considers how the street supports the daily needs of all who live, work, and travel along it (Hammerschmidt, 2016).

Dundas Connects plans to break the superblocks filled with low density strip malls, along the entire length of Dundas Street, and replace these superblocks with smaller connected communities. These communities would be mixed with residential, commercial and institutional land uses, and would above all else, feature complete streets. The 'Complete Streets' concept and movement in urban planning and policy has been hailed by many as a revolution that aims to challenge long-standing auto-centric practices by reversing the broader effects of an urban form shaped by the logic of keeping automobiles moving (Zavestoski & Agyeman, 2015). By enabling safe access for all users, Complete Streets promise to make cities more walkable and livable and at the same time more sustainable. Streets should not be thought of as merely physical spaces, but as symbolic and social spaces. When important social and symbolic narratives are missing from the discourse and practice of Complete Streets, what actually results are incomplete streets (Zavestoski & Agyeman, 2015). In essence, Dundas aims to embrace the complete streets concept, and help retrofit the corridor, enhancing those first-mile/last-mile connections to Toronto via a direct LRT to the subway. This network connection will vastly improve mobility for residents in Mississauga, while connecting urban growth centres in Mississauga and Toronto.

In comparison, downtown Barcelona is a perfect example of what a thriving economic centre can achieve by putting active transportation first. The area seen in Figure 13 has thriving commercial strips, just like we find along Dundas Street in Mississauga. However within a similar distance, residents, tourists and commuters in Barcelona have access to considerably greater commercial and retail options, employment, and other amenities. As with the case of Ashton-Under-Lyne, I picked the city of Barcelona for this comparison after visiting it firsthand in May 2018. As we can see, pedestrian and cycling times are significantly shorter than would be experienced along Dundas Street or around Square One. In addition, a strong transit network and road design ensures efficient and seamless movement for cars, buses and trains, along their own lanes and levels. As a result, first-mile/last-mile connections are made easy, mobility options are accessible, and good urban design helps sustain this transit-oriented economic centre. Therefore, by learning from street design best practices and transportation strategies in a place like Barcelona, planners for Dundas Connects may be able to achieve similar success along a core transportation corridor in Mississauga.

Figure 13: Transportation Comparison - Barcelona City Centre, Spain



In addition to Barcelona, many other European cities are ideals for the creation of mixed-use economic centres, with walkable blocks and equitable access for all modes of transportation. Prague's city centre in particular was largely pedestrian-oriented by design, with wide open streets solely for pedestrian and cyclist circulation. By dedicating entire right-of-ways to active transportation, the city encouraged the use of other modes and limited vehicular traffic and successfully created spaces people want to visit, spend time and their money in. It demonstrates a win-win for the city, its residents and businesses too.

How can we bring these ideals to the Greater Toronto and Hamilton Area? By directly addressing our own first-mile/last-mile challenges and retrofitting our auto-centric superblocks accordingly.

Addressing the First-Mile/Last-Mile

As these auto-centric plazas transform through urban design retrofit exercises into more complete communities, it is important to consider a few additional specifics around

planning for the first-mile/last-mile. With distances so large in the suburbs, there is a need to look at station access features present within 1/2 mile of a future transit station (Mangan, 2013). As we know, availability, location and convenience influences how a person completes their trip. Therefore, elements such as the level of feeder service (local routes which connect to transit hubs), densities, land use, mobility factors, and personal safety all impact the level and impact of the barrier to access the station (Mangan, 2013). Specific strategies including community design, infrastructure availability, infrastructure quality, programming and pricing can influence the degree of walking or cycling for travel (Forsyth & Krizek, 2010). Urban environments with high levels of walking and cycling for travel typically represent a combination of many factors that help promote these modes. The most compelling argument, particularly for cycling, is that only via an integrated range of built environmental features (including infrastructure and facility improvements), pricing policies, or education programmes will substantive changes result (Forsyth & Krizek, 2010). Regardless, infrastructure changes, improved traffic control (speed limits) and street management (wide sidewalks, pedestrian crossings) will create safer streets, and safety should always be our first priority (Appleyard et al, 1981). At the end of the day, more protected neighbourhoods invite more street activity, which increases the potential to draw people towards active transportation options, and therefore act as a solution towards mitigating first-mile/last-mile solutions across a community.

Ideal Retrofit

The process to retrofit first generation suburbs from sprawl to complete communities is a complex process to consider. Sprawl is a pattern of growth characterized by an abundance of congested highways, strip shopping centres, big boxes, office parks, and gated cul-de-sac subdivisions - all separated from each other by land use blocks (Tachieva, 2010, p. 1). Central to our wasteful use of water, energy, land and time spent in traffic, sprawl has also been linked to increased air and water pollution, greenhouse gas emissions, loss of open space and natural habitat, and the exponential increase in infrastructure costs. Complete communities need to be able to address all of these, while transforming failing single-use and car-dominated developments into complete communities that have better social, economic and environmental performance (Tachieva, 2010, p. 5). Complete communities have a mix of uses, are walkable with daily needs (shops, offices, transit, civic and recreational places) easily accessible in a short distance from home, and are compact, less open, and with multiple modes of transportation (Tachieva, 2010, p. 1-3). Considering this, sprawl repair is needed at both a regional scale and at community scale. The community scale is inclusive of subdivisions, shopping centres, commercial strips, business parks, and sprawl-type open space. The repair to throroughfares and parking includes everything from highways to cul-de-sacs. Retrofit required at the block and building scales extend to slab and tower blocks, drive-throughs, parking garages, big box stores and strip malls (Tachieva, 2010, p. 99, 118, 186, 217-218). This can be achieved through the creation of high density corridors for transit and pedestrian use, in the existing low-density, car-dependant areas, as well as the creation of mixed-use, high-density corridors within newly urbanized areas (Filion, 2003).

A common misconception when conceptualizing these retrofits is that the street must remain designed around a car. However as Liu (2016) explains, streets do not need to be designed for cars in order to accommodate cars. Street design at the incorrect scale has the effect of dwarfing pedestrians and cyclists while subconsciously promoting automobiles as the dominant design element (Liu, 2016). By changing perspectives so that cars are not the dominant user group, we can accommodate all users. Ewing and Bartholomew (2013) echo many of the same sentiments when sharing best practices for urban design in these areas. Essential features to consider when retrofitting an auto-centric plaza to a complete community is the inclusion of medium to high densities, fine-grained mix of land uses, short- to medium-length blocks, transit routes every half mile or closer, two- to four-lane streets, continuous sidewalks which are appropriately scaled, safe crossings, appropriate buffering from traffic, street-oriented buildings, and comfortable and safe places to wait (Ewing & Bartholomew, 2013).

Section 5 | Typology 3: Developed Communities - "layering the blocks"

This section delves into typology #3, existing densely developed communities in the region. In this analysis, I review issues around connectivity, politics and public opinion which impact decisions made to improve mobility options through the community. With limited space available, I present travel demand management strategies which can be used to layer transportation and land use planning blocks, creating complete communities. Using a case study, I examine the King Street Pilot Project and its impacts on the first-mile/last-mile, as well as how it relates to best practices in Vienna and Copenhagen. Finally, I review the impact of emerging technologies in urban cores, and discuss how the inclusion of these technologies will help to expand mobility options, mitigating first-mile/last-mile challenges and thereby increase access to local and regional transit connecting the Greater Toronto and Hamilton Area.

Site Contexts

This final typology considers neighbourhoods which are already considerably developed, with little open space available for a major redevelopment, without clearing large swaths of homes, businesses, and the built form which gives that neighbourhood its character.

In the suburbs, retrofit is needed in order to layer transportation options around communities. Usually you can't just draw a 1 mile circle around a transit stop and assume all of the houses are within walking distance, and therefore pedestrians are accounted for. Non-contiguous streets and cul-de-sacs increase the walking distance even if homes are physically close or under a mile in theory (MacKechnie, 2016). With this typology, it is important to specifically work to "debunk the cul-de-sac" (Badger, 2011), and abandon American ideas about how to live and build communities, which have since changed. For decades, families fled the dense urban grid for newer types of neighborhoods that felt safer, more private, even pastoral (Badger, 2011). “It was addressing real problems, but it went overboard,” Badger says of the suburban model. “It took real problems and then

made caricatures for solutions." While in theory, cul-de-sacs may have potential for layering transit, a more immersive process is required to connect individual streets together to form a network which links a community. Using urban design best practices, it is possible to do this, as we will see, without levelling the community which is seen in the previous typologies.

While integration into the existing built form can be applicable to dense neighbourhoods in the suburbs, it is more frequently considered with respect to more populated, dense communities within the city itself which could benefit from improved access to transit. Downtown Toronto, North York Centre, and Yonge-Eglinton Centre are all Urban Growth Centres in the Growth Plan, and would classify under Typology #3. While these communities benefit from subway, streetcar, and future LRT services, a number of changes would still need to be made in order to improve the number of mobility options for commuters.

Challenges: Connectivity, Politics and Public Opinion

The biggest reason there is a need to layer new transportation mobility options in dense areas downtown is because millennials are increasingly multimodal. Millennials choose the best transportation mode (driving, transit, bike, or walk) based on the trip they are planning to take, and are flexible with combining modes to arrive at their destination (Gibson, 2016b). The shared modes like bikeshare, carshare, or rideshare companies complement public transit, enhancing urban mobility. However it is a challenge to ensure all of these options are provided for in the urban space, and new mobility options are often challenged by the non-millennial status quo, as witnessed in Toronto's taxi versus Uber challenge.

Politics is also a major hurdle to overcome when planning changes in cities. While Provincial guidelines are available to build denser, more complete communities around transit stops to allow thousands more to live within a 10-minute walk to a local transit station (Ryerson City Building Institute, 2016), putting this into practice is more challenging. Public consultations often bring out NIMBY individuals who are opposed to change. Considering public opinion, it would be easier to get commuters on board with support for public transportation without the first-mile/last-mile challenges currently plaguing the system. "The enemy is really the car's unequaled convenience; commuters need multiple, equally easy choices before they'll give up the steering wheel" (UTNE, 2009). However through intensive retrofit, these challenges can be overcome.

To multiply the challenges with downtown redevelopment, there is often competition among the various levels of government trying to make the change, each vying for political points. This is best examined in the present debate and threat by the Province's Ford government to upload the Toronto Transit Commission to the Province for control. "While the city is far from perfect in leveraging the city building potential of its TTC stations, they stand in stark contrast to the regional GO stations designed as desolate wastelands with almost no connection to the urban fabric," writes Jennifer Keesmaat

(2017). Current strategies for future GO stations show little improvement, with respect to plans around Regional Express Rail / SmartTrack. Keesmaat (2017) emphasised that while the city has room for improvement, "local sensitivities to social need, public realm, economic vitality, and the broader matrix of walking, cycling evolving “last mile” technologies" are core reasons for keeping local transit governance local (Keesmaat, 2017).

Benefits: Travel Demand Management

The ability to provide and manage a number of transportation options is the biggest benefit to retrofitting dense urban communities in order to incorporate solutions which expand access, and minimize first-mile/last-mile challenges. The Canadian Urban Transit Association defines Integrated Urban Mobility as "*The ability for people to move easily from place to place according to their own needs*" (CUTA, 2017). For CUTA, Integrated Urban Mobility is a people-focused goal that: starts with public transport service connected to all modes of transport including walking, cycling, auto and alternatives to transportation; enables door-to-door and seamless mobility throughout an urban area; and is designed for all segments of population (CUTA, 2017). This form of reimagined integration considers design for movement, demand management, and mobility management. Design for movement integrates planning and land use, complete streets, and intelligent transportation systems. Demand Management considers pricing policies and incentives, smart travel programs, and education on options. Mobility management incorporates carshare service partnerships, transit network companies (TNC) and taxi partnerships, carpool and ridesharing services, bikeshare service partnerships, microtransit services, and mobility-as-a-service models (CUTA, 2017).

When bringing factors for travel demand management into the built environment, ideals to consider include density, diversity, design, and regional accessibility (Ewing & Cervero, 2010a). According to data collected by Ewing & Cervero, vehicle miles travelled (VMT) is most strongly related to measures of accessibility to destinations and secondarily to street network design variables. Walking is most strongly related to measures of land use diversity, intersection density, and the number of destinations within walking distance. Finally, bus and train use are equally related to proximity to transit and street network design variables, including land use diversity (Ewing & Cervero, 2010a). Additionally, Foth, Manaugh and El-Geneidy (2014) studied the determinants of mode share over time. They found that when exploring the influence of job accessibility, transport infrastructure, and social disadvantage on transit mode share for three job categories in Toronto, new transit infrastructure did not necessarily attract more transit commuters but was found to affect commuting to different job categories differently. Also, new highway infrastructure hampered transit mode share, regardless of job type, increases in accessibility by transit were found to augment transit mode share, and people in more socially disadvantaged areas were more likely to commute by transit in any job category (Foth et al, 2014). It is important to consider data when boosting regional transit ridership while maintaining social equity goals. This because urban form, infrastructure, and socio-demographics impact mode choice, and improved transit networks and concentration of desired destinations are found through improved urban form. Therefore benefits to an

urban retrofit extend far beyond the boundaries of that neighbourhood alone, the first-mile/last-mile connections open it up to equitable opportunities across a region.

The following are key transportation demand management (TDM) strategies and the best practices on how to implement them in urban environments.

Auto Management

While many planners have a negative affinity to automobiles, cars are still a useful tool to move from A to B in auto-centric communities, and this cannot be entirely ignored. While a major issue is the environmental impact of driving, with the implementation of proper auto-management strategies, first-mile/last-mile auto trips in these auto-centric communities are found to increase total multimodal transit trip emissions by 2-12 times, still less than everyone driving alone (Hoehne, 2016). In order to mitigate the high amount of air pollutants around rail stations with auto access, we need to better incentivise carpooling and non-auto transit accessibility in order to reduce environmental impacts (Hoehne, 2016). Currently the free parking at GO stations incentivises driving to the station over taking a local bus, or walking. There are numerous things which could be considered to change this including paid parking, road tolls, local transit fare integration, and incentivising other modes through government subsidies or taxes. However a balance needs to be found which does not push people so far that they instead skip the train and drive all the way to their destination to save money on additional transit fares or parking.

Looking abroad for an example, Finland's capital is one of the least dense cities in Europe but has managed to drop traffic into its core by 20% (Jounila, 2017). It boasts a range of exciting transport innovations, including the Crown Bridges—a series of green bridges for walking, cycling and public transport only—and a planned conversion of urban expressways with a 80km/h speed limit into urban boulevards with a 40km/h speed environment. Finland puts paid to the excuse that density is an absolute prerequisite for great transportation and urban innovations (Jounila, 2017).

In Seattle, the region has consistently invested in expanding transit service, with new light rail stations, a revamped bus network, and a voter-approved transportation benefit district sprinkling transit stops within a 10-minute walk to more city residents (Bliss, 2018b). In Washington state, big employers have been pushed by law since 1991 to reduce solo commutes (Bliss, 2018b). The Gates Foundation, for example, has gone from an 88 percent “drive-alone” rate to 34 percent by distributing a suite of transit benefits to employees, including free Monorail punch cars and free monthly Zipcar hours. It also disincentivizes parking: The company lot charges a daily rate instead of a monthly rate (Bliss, 2018b).

In New York City, a fee-based plan may be the only hope for the city’s costly transportation crisis. " Half a century of transportation research shows that there’s only one way to reduce congestion: charging people to drive" (Bliss, 2018a). The plan in New York is to first fix what's broken, then tax Uber, Lyft and other rideshare services adding

to congestion, and then finally price the roads by introducing zone pricing similar to London (Bliss, 2018a).

All of these examples show what could be achieved by regulating auto use and providing incentives to swap car keys for a transit card.

Pedestrian Management

Much has been written about pedestrian management in this paper. To extend the discussion as it relates to a downtown city core, the focus needs to be on sidewalks. Sidewalks are the main public places of a city and its most vital organs (Jacobs, 1961). Pedestrian activity activates a city and it is more than just circulation. Sidewalks also keep people and streets safe. Scale in particular is important and impacts how safe a sidewalk feels relative to the street, and appropriate sidewalks which feel safe are better at enticing people to walk to their destination to/from transit (Jacobs, 1961). Walking distances to rapid transit are closely related to subway mode share, auto ownership, and auto use (Crowley et al, 2009). There are strong associations between convenient walking access, lifestyle, and transit use at peak periods and during the day in North York Centre, as I learned on the Re-imagining Yonge Street project at WSP.

Cycling Management

The provision of good and safe cycling infrastructure is key to expanding mobility across a city like Toronto, which is full of eager cyclists, but also struggling with cycling safety. Good bike infrastructure is in fact an integral part of keeping a city functioning—not only keeping transit fluid, but also reducing the burden on health services and making urban spaces altogether cleaner and more livable (O'Sullivan, 2018). Even Metrolinx is looking beyond increasing parking at its lots at ways to help people get to a station and local transit feeder services are often infrequent and slow compared to driving. Walking has limited range, and sometimes walking across the parking lot itself is a barrier to GO Transit customers (Liu, 2018). Metrolinx mobility management advisor Matt Pinder said "Cycling, in my professional opinion, is the highest-potential, yet least-utilized access mode to GO stations" (Liu, 2018). "Cycling is the most similar access mode to the car. It's available on-demand, provides door-to-door access, and is very time-competitive over distances up to five km." In fact, privatised bikeshare has the capacity to strengthen and diversify Guelph's transportation system by providing first-last mile connections, 24-hour access to transportation, hub-to-door service, and access to areas of Guelph not serviced by other transit options (Liu, 2018). Looking in Toronto, demand for bike sharing services is on the rise in southeast Scarborough, prompting calls to connect to the existing city service now largely concentrated in the downtown core (Mirza, 2018). Most importantly, GO transit is now publically trying to combat the "last mile" - where people who live within a mile of a go train station, instead of taking public transit, drive. They have bike racks at GO stations and Metrolinx think bikeshare programs are a good idea. The Scarborough bikeshare program has gained support from Cycle Toronto, an advocacy group, but officials say the city should first build a connected grid of safe cycling infrastructure. "Physical infrastructure must come first, or we risk people riding bikes -

especially those who are newer to riding on city streets - being put in dangerous environments, like cycling alongside cars travelling upwards of 70km/hour on busy arterials," according to Jared Kolb, Cycle Toronto executive director (Liu, 2018).

While there are debates around the benefits or harm bikeshare could cause in the city, especially dockless bikeshare, it is unquestioned that micro-transit like this could help boost mobility. As seen in Detroit, short term improvements to existing infrastructure to privide more bike options have to be made to increase efficiency, reliability, frequency, availability, safety, and fare payment options (Karitis, 2018). This is crucial investment because "one of the biggest trends in the mobility world right now is the introduction of completely private, dockless bike-share companies" (Karitis, 2018). In Washington , the argument for dockless bikeshare is that it improves racial equity, because dockless bikes reach more people as they are dispersed more widely instead of being tethered to docking stations that tend to be concentrated in whiter, higher-density, better-off neighborhoods west of the Anacostia River (Sturdivant-Sani, 2018). However cities do need to be careful as the dockless nature of this service tends to draw more complaints than praise. Bikeshare users sometimes park their dockless bikes on sidewalks and curb cuts, making them obstacles for people who use motorized chairs or otherwise experience disabilities affecting mobility, among others (Capps, 2018). Dockless bikeshare is a vivid illustration of how residents define nuisances not as issues to be navigated, but irritations that they feel entitled to regulate out of existence (Capps, 2018).

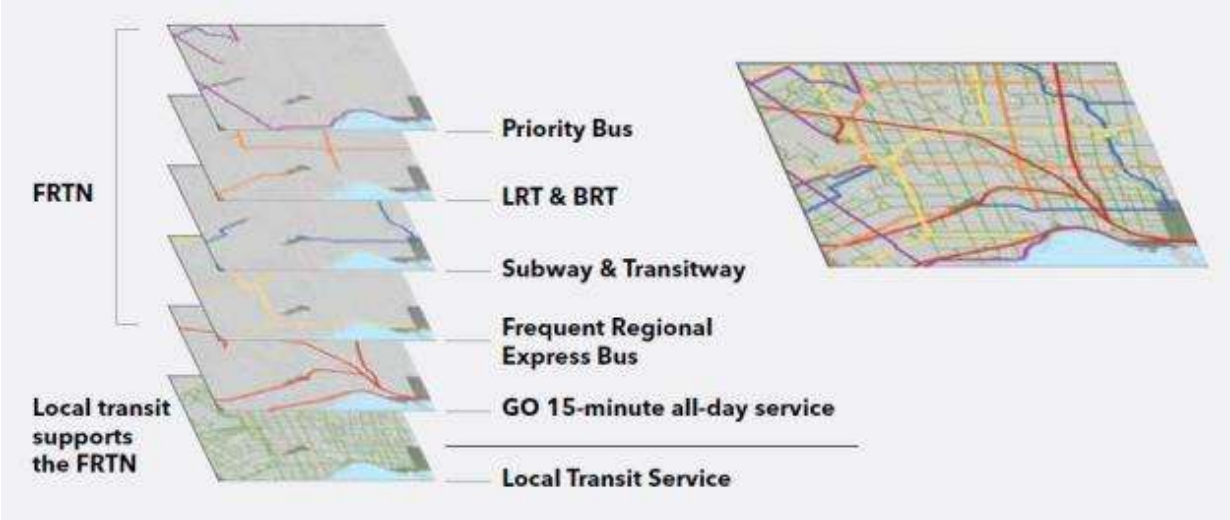
With proper management and policy, cycling infrastructure along with bikeshare services could be big players in the mission to provide more transportation demand management solutions in communities of varying densities.

Transit Management

A key component of transportation demand management is of course transit. Oftentimes when we think about transit management, we divert into discussions around expansion. However, a key strategy which Metrolinx is now promoting in its latest Regional Transportation Plan is the concept of layering various modes of transit together to create an integrated Frequent Rapid Transit Network. As shown in Figure 14, this concept brings together local transit service, regional bus services, transitways, subways, light rail transit, bus rapid transit, and priority bus routes, each supporting the other by connecting and bringing riders together through the network.

This integration would be remarkable for developed communities like Yonge-Eglinton Centre which already has a subway, regional GO bus stops, local bus transit, and is currently undergoing a huge transformation with the construction of the Eglinton Crosstown LRT. Having many options is excellent for commuters, but the best outcome may be achieved once each level of service works together seamlessly. This would demand fare integration, accessible transfer points, safe movement for active transportation users moving to and from this rapid transit network, and of course well timed transit to reduce wait times and move people quickly and efficiently.

Figure 14: Frequent Rapid Transit Network



Source: Metrolinx, 2041 Regional Transportation Plan, 2017

Case Study 3: King Street Pilot Project

"Regional transit also only truly offers a real choice when it 'lands' in cities with density and excellent local transit. Otherwise, you need a car when you arrive" (Keesmaat, 2018). This tweet by Jennifer Keesmaat, former Chief Planner of the City of Toronto, on February 11th, 2018, sums up why local investment in transit infrastructure is so important. While Metrolinx and the Province are investing billions into large-scale capital projects, it is up to individual municipalities to make those smaller investments which would help shift mobilities, improve connections and solve those first-mile/last-mile issues. This local investment is needed because we have a number of transit gaps in the region and these gaps are the responsibility of local municipalities. A transit gap is some kind of difference between transit service and transit need or demand (Walker, 2018). But need and demand are different things. A *need* means that there are people whose lives would be better if they had transit. A *demand* is an indication that transit service, if it were provided, would achieve high ridership (Walker, 2018). These terms correspond to the two opposing goals of transit service. If the goal of service is *ridership*, then it should provide excellent service where there is *demand*. On the other hand, many people who need transit wouldn't be served if transit agencies ran only high-ridership service. So transit agencies run a certain amount of service for the non-ridership goal of *coverage,* which responds to *need* (Walker, 2018). In Toronto, there is excessive need everywhere, with not enough coverage and frequency to cover it all, particularly during peak periods.

The King Street Pilot Project is a perfect, and current, example of an initiative which would dramatically help boost ridership, improve the viability of numerous modes of transportation along the corridor, and create a transportation corridor which increases mobility, supports accessibility, and is efficient. The King Street Pilot prioritizes transit, and blocks cars from driving straight down King. Cars have to turn right after each block, and cannot make left turns. This ensures that streetcars have an uninterrupted corridor

to move more people, faster and more frequently. As a result of this pilot program, which is nearing its 1-year completion, ridership has surged dramatically, and no adverse effects were found on the surrounding street grid with respect to redirected car traffic potentially causing increased congestion on parallel streets. By initial estimates, the pilot appears to have been a huge success, and it is a beautiful example of the effects of prioritizing transit in a city, very similar to places throughout Europe, and particularly in Vienna.

The King Street Pilot also implements a number of highly desirable urban design elements, which if made permanent, could be taken a step further. The inclusion of functional street furniture, public art, outdoor dining and patios is what makes King Street a major destination in the city. These elements draw people because they create an atmosphere worth experiencing (Ewing & Bartholomew, 2013). Other worthwhile additions which could be incorporated into a permanent King Street revitalization include the use of landmarks, consistent street walls, coherent, small-scale signage, water features, underground utilities, and special pavement such as cobblestones or a similar smooth surface, which would provide a pleasant European style atmosphere to the street.

Overall the King Street pilot program is an excellent example of how to bring European style transit priority from Vienna to Toronto. By prioritizing transit, the city is helping close the gaps in the local network, while supporting increased flow through the region. The King Street Pilot helps layer the blocks of the city, integrating transportation with land use, supporting transportation demand management modes, and increasing mobility to help mitigate first-mile/last-mile connectivity issues.

Addressing the First-Mile/Last-Mile

When retrofitting downtown communities with more transportation mobility alternatives, it is important to remember that people often require different orders of transit for different legs of a journey. As a result, cities need smooth integration and transitions, while minimizing the number of modes for a faster journey. For the first-mile/last-mile, efficiency in money, time, reliability and speed are important factors which in turn influence which mode of transportation is used.

The solutions to first-mile/last-mile also surround smart design, active transportation, new technologies, and planning for intensification around transit hubs (Ryerson City Building Institute, 2016). This intensification is connected to the connectivity of the street network a station is a part of. Street network connectivity is influencing service quality of feeder services, with grid street spacing proving to be the most effective (Chandra, 2012). The primary role of the street network is to connect spatially separated places and provide movement from one to another. Connectivity depends on the structure and design of the network; more options increases accessibility which improves liveability (Chandra, 2012). Currently, street network focus is on improved car flow, signal timing, and this focus on cars at intersections reduces liveability for others. Instead, providing improvements to transit feeder service network on the street grid is the best solution to improve first-mile/last-mile access.

Ideal Retrofit

According to the Canadian Urban Transit Association, we are currently facing a critical turning point in personal transportation trends towards different behaviours and modes (CUTA, 2017). Transit is going through a transition phase into new forms of service and ways of delivering existing services - ridership has steadily grown, mobility hubs have become central building blocks of municipal planning, operating costs are rising faster with inflation, accessibility is mainstream, transit is more than a municipal matter, suburbs are stepping up to transit, new mobility manners are emerging, and technology is transformational (CUTA, 2017). All of these factors along with the changing demographics trend towards transit-dependence demonstrates that the individual is increasingly important, and as communities change so must transit (CUTA, 2017).

With transit evolving and numerous other modes of transportation coming to the forefront, it is important that the urban design of downtown cores remains focused on ensuring the best environment is created, supportive of all modes. Specifically, urban design features which are highly desirable when developing an area like a downtown artery are the inclusion of supportive commercial uses, grid-like street networks, traffic calming, closely spaced shade trees, little dead space, nearby parks and other public spaces, small scale buildings (or articulated larger ones), pedestrian-scale lighting, and attractive transit facilities (Ewing & Bartholomew, 2013). This urban condition influences outdoor activities, the presence of which are supportive influences to encourage active transportation, as a solution towards the first-mile/last-mile dilemma (Gehl, 1987). The physical environment is one factor that influences the outdoor activities in public spaces to varying degrees, which can be divided into 3 categories: necessary activities, optional activities, and social activities (Gehl, 1987). In this context we are concerned with necessary activities, such as the inclusion of transportation options in an urban center.

Finally, an important design consideration when retrofitting the built environment, is the artistic design itself. Metrolinx's Design Excellence program brings sensible urban design that supports the community where projects are being built, and this investment in design thinking spurs growth, increases building sustainability, durability, and vital lifespan, increases ridership, improves passenger comfort, safety and pride in transit, and reduces maintenance costs (ULI Toronto, 2018). Examples of this include the Eglinton Crosstown & Davenport Diamond projects, both of which boast architecturally impressive and eye-catching landmarks at their transit hubs. Whether as small as a bus shelter or as large as a major train station, public transit buildings need to have a prominent profile in the streetscape so that riders can find them; ergo, aesthetics matter (Nyren, 2017b). So does circulation: the routes that passengers travel to get to and from the station or platforms—not to mention to and from different modes of transport—have to be quick and simple to navigate, especially during peak travel hours (Nyren, 2017b). I think this idea is best summed up by my personal favourite architect, Frank Gehry. when he says architects need to become partners with planners and developers (Brass, 2017). Architects need to "get into the fray," Gehry said. Too often architects are overprotected and do not accept blame or credit for the cost and efficiency of their buildings. "We need to take

more responsibility and become partners" with developers and planners. Therefore, design matters, it influences the success of a transit station or a city street. Through these conditions, design influences choice of mobility mode, and as a result can impact the success of first-mile/last-mile solutions in urban and suburban transit station area environments across the GTHA.

Emerging Technologies in Urban Cores

Finally, it is imperative to consider the implications of emerging technologies to the urban core, the design and type of retrofit appropriate in urban environments, and the impacts on the first-mile/last-mile dilemma. There is a growing popularity of Uber and Lyft as solutions to providing more coordinated options in areas under-served by transit (Lorinc, 2016). Without a doubt, better integration and coordination by transit agencies like Metrolinx is needed with carshare/rideshare/bikeshare organizations, along with Presto, in order for such collaboration to be successful (Lorinc, 2016). But the effects of Uber, Lyft, and other transportation network companies (TNCs) are proving more complicated on city streets. In New York City, rapid growth in on-demand vehicles roving the roads—with and without passengers—is contributing to considerably slower traffic, as numerous analyses of Taxi and Limousine Commission data by Bruce Schaller, a transportation consultant and former NYC DOT official, have shown (Bliss, 2018c). Of course, many factors are causing this shift. It is important to remember how quickly transportation has changed in urban America. In July 2010, a service called UberCab went live in San Francisco—that's fewer than eight-years ago. Washington, DC's Capital Bikeshare, the country's first major bike-sharing program, really got off the ground in 2010.1 Austin became the first US city to host car-sharing service Car2Go a few months into the same year. Lyft launched in SF in June 2012 (Marshall, 2018). The introduction dates of these services are even newer in Toronto. So, there is still time to figure out strategies, test and implement, before "transit is doomed." For example, in Chicago, a 15-cent fee on Uber, Lyft and other ride-hailing services is helping to pay for track, signal and electrical upgrades to make the city's trains run faster and smoother (Hu, 2018). This provides the best of both worlds as transit improves rather than suffers. Autonomous vehicles are causing the latest jolt in the transportation industry, with some saying that the coming wave of ride-hailing companies and driverless cars will push down levels of vehicle ownership, reduce parking demand, and transform the way that city planners, real estate owners, and consumers interact with urban space (Harper, 2017). In order to fully realize the benefits of autonomous vehicles, passengers will have to subscribe to a network and hail rides as needed, rather than own their own personal autonomous vehicle, many experts speculate (Harper, 2017). Regardless, an electric self-driving traffic jam is still a traffic jam, and we need to start investing in solutions to ensure cars are not the endgame in North American cities, and indeed across the GTHA.

While the combination of ride-hailing services and driverless vehicles represents a transportation revolution with far-reaching implications for the entire city, retrofitting communities across the spectrum of urban form, in order to increase mobility and mitigate first-mile/last-mile challenges, will have immediate benefits. There is no need to

wait any longer for technology to surpass the rate at which we plan. Change is going to come regardless, and it is up to us as planners to look ahead, keep up and start somewhere. As planners we should not limit our approaches based on current technology, but rather create and present strategies which are adaptable to our changing world. Change starts now. If not us, who? If not now, when?

Conclusion

In conclusion, we can ensure major transit station areas are accessible and reliable by implementing smart growth and new urbanist principles, and generally just good urban design, to retrofit suburban communities. Shifting commuter needs have signaled the need for investment into a transportation network which crosses and connects the region. Local accessibility challenges often discourage commuters from using transit and other modes of transportation, thus encouraging the use of automobiles. Providing improved local access and mobility would help mitigate these 'first-mile/last-mile' issues in the network, and ultimately reduce vehicle congestion. Using urban design best practices, precise changes and enhancements to the suburban form can be implemented to address first-mile/last-mile connectivity issues. If left untouched, moving people to and from employment centers and around urban growth centres without the use of a car may be the biggest contemporary land use challenge in the region.

We can accomplish this when joining land use and transportation planning policies to provide solutions to the first-mile/last-mile issue across the GTHA. These solutions will vary from transit node to transit node, depending upon the typology of the urban growth centre within which it is situated. These typologies include greenfields or 'blank slates' which provide the opportunity to create the blocks of the urban fabric and introduce transit-oriented development. Auto-centric superblocks present planners with the challenge of changing the blocks while preserving the economic benefit of commercial and retail centres. Finally, developed communities with little room to physically expand can introduce travel demand management measures and encourage the use of multiple modes, in order to effectively layer transportation options over existing land uses.

In the process of implementing these measures, we can remain mindful of land ownership limitations when identifying corridors for rapid transit expansion. Transportation planning and land use strategies are currently top priorities for politicians and policy-makers, for which decisions having far-reaching influences both positive and negative across the province. As a result we see a surge in attempts to directly address these issues both provincially and locally in planning policy. Decisions around where to invest are polarizing and careful consideration should be applied while navigating politics and governance. While doing so, ensuring equity in consultation and decision making throughout the planning process is key to successful integration into local communities.

The resulting environment would see both local and regional transit jointly connecting the region's economy and social equity together for the benefit of all residents.

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