Solving the 'First Mile Problem'

Opportunities for bike-transit integration in Edmonton, Alberta

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Abstract

In an effort to shift reliance away from single-occupancy vehicles, many cities have been investing in active and public transportation, and promoting multi-modal travel. It has been recognized both academically and professionally that there is a need to address issues regarding access to transit stations and nodes – the 'first mile problem.' Many see bicycles as the answer to the first mile problem; however, scholarly literature has generally neglected exploring how to accommodate bicycles at different stations.

This practicum investigates the first mile problem in Edmonton, Alberta, and identifies existing challenges with bicycle access to Edmonton's Light Rail Transit (LRT) system. The findings suggest three distinct LRT 'station types', each requiring a nuanced suite of infrastructure improvements in order to encourage more bicycle access. Further, these improvements can only be realized through the development and execution of comprehensive policies and regulations that support cycling and bike-transit integration.

[Keywords: *Cycling, first mile problem, transit accessibility, active transportation, Edmonton*]

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1.0 Introduction

The City of Edmonton has invested in both bike infrastructure and urban rail infrastructure in recent years. There are plans to build on these existing networks of infrastructure as the City continues to grow. Combining these two transportation modes has been a goal of the City in order to encourage an urban modal shift away from single-occupant vehicles; however, the connection between cycling and rail transit and how the prior accesses the latter are not yet well understood in the Edmonton context. This practicum aims to clarify the relationship between these two modes and identify how cycling and rail transit can be properly integrated.

1.1 Problem statement and research questions

In an effort to curb reliance on single-occupancy vehicles, cities have invested in alternative modes of transportation in hopes of shifting citizens' travel habits towards more sustainable modes like public transportation and active transportation (i.e., walking and cycling). Cities have been actively promoting multi-modal travel and mixed mobility options as a way to encourage this shift. It has been recognized both academically and professionally that there is a need to address issues regarding access to transit stations and nodes – the 'first mile problem.' As cycling becomes more popular and cities continue to invest in public transportation, many see bicycles as the answer to the first mile problem. However, scholarly literature has generally neglected exploring how to accommodate bicycles at different stations.

This practicum investigates the strengths, weaknesses, and opportunities for the integration of bicycles and the LRT system (henceforth referred to as 'bike-transit integration') in Edmonton, Alberta. Given Edmonton's existing LRT system, its stations operating in different urban contexts, and the city's renewed policy directives for sustainable modes of transportation and bike-transit integration, Edmonton offers a suitable case study. This research project fills a gap in the existing bike-transit integration literature by identifying how transit stations in different urban contexts can best accommodate access by bicycles. The research findings will inform the planning and design of Edmonton's expanding LRT system and comparable systems elsewhere.

This practicum explores the links between bike infrastructure and LRT infrastructure in Edmonton, and how proper policy and investment can help to integrate both. More specifically, I aim to answer the following research questions:

1. **How do cyclists access and egress Edmonton's LRT infrastructure?**
2. **What are the characteristics of neighbourhoods surrounding LRT stations, and how does this relate to bicycle access and egress trends?**
3. **What are the 'station types' for Edmonton's LRT system, and what are their strengths, weaknesses, and opportunities for accommodating bicycle access and egress?**
4. **What can the City of Edmonton do to accommodate and encourage more bike-transit integration?**

The findings of this practicum will be informed by various forms of research, including observations and surveys/structured interviews with cyclists at LRT stations, semi-structured interviews with Edmonton planners and engineers, and analyses of station site conditions including the characteristics of their surrounding neighbourhoods.

1.2 Research objectives and significance

By understanding the different factors that influence how and why people access different LRT stations in different parts of the city by bike, the City of Edmonton will have the information and resources to plan future and existing communities that are more tenable to cycling to LRT stations. As this practicum will reveal, Edmonton is one of many cities in North America with goals to encourage more bike-transit integration. The first mile problem is an issue that is topical and relevant in many jurisdictions. While the findings of this practicum are specific to the Edmonton context, they may also be applicable to other cities with comparable built forms and active and public transportation networks.

Understanding the nuances of the issue of transit accessibility is important as this topic has not been the focus of any academic research in Edmonton. Understanding these issues will facilitate the implementation of a more complete and efficient multi-modal transportation network. This research may, in turn, lead to other opportunities for additional academic research regarding the relationship between active transportation and transit accessibility in Edmonton and elsewhere.

1.3 Document structure

This practicum begins by introducing the reader to the context of the research problem, by discussing the City of Edmonton, its LRT and active transportation networks, and transportation planning documents. Following this is a literature review of sustainable transportation modes and bike-transit integration, and a discussion of the research methods used in this practicum to answer the various research questions.

The research findings will then be discussed. This section first outlines job and population densities of neighbourhoods surrounding LRT stations and these neighbourhoods' access to active transportation infrastructure. The findings of the cyclist surveys/structured interviews will then be summarized, including cyclists' trip purposes, willingness to board trains with bikes, and access routes taken. These findings lead to the development of three LRT 'station types' – core, mature, and suburban. Following this, a discussion of the practitioner (semi-structured) interviews identify the existing challenges of bike-transit integration in Edmonton and relevant precedents that the City could follow to encourage more bike-transit integration.

The analysis of the findings will then explore trends relating to bike access distances and trip purposes. Different infrastructure and policy interventions that could be implemented to encourage more bike-transit integration are also discussed, including the provision for better bike parking and more active transportation infrastructure.

Finally, some conclusions are drawn for the City of Edmonton relating to policy implications for transportation infrastructure and neighbourhood planning and design. The implications for planning practice, including the importance of integrating transportation and land use planning and the need to work collaboratively with other professional disciplines, are also discussed.

2.0 Context

2.1 Edmonton, Alberta

Edmonton is a growing city. In recent decades, the city has become a popular place to do business in the country due to a strong natural resource industry, making it a leading Canadian city in terms of GDP growth (City of Edmonton, 2014b, p. i). As per the 2011 Census, Edmonton's population is 812,201, an increase of 11.2% over the 2006 Census (Statistics Canada, 2015b). Between July 2013 and June 2014, the population within the Edmonton census metropolitan area grew 3.3%, outpaced in Canada only by Calgary (+3.6%), and ahead of other major cities including Saskatoon (+3.2%), Regina (+2.8%), Winnipeg (+1.6%), and Toronto (+1.5%), as well as the Canadian average for all census metropolitan areas (+1.4%) (Statistics Canada, 2015a).

As a result of Edmonton's growth, the city has seen greenfield development, leading to auto-centric sprawled neighbourhoods and commercial districts. The City, however, recognizes that travel solely via single-occupancy vehicles is unsustainable. Recent planning directives are encouraging people to drive less and to take transit and walk and bike more (City of Edmonton, 2009b). The City has also specifically mentioned the integration of transit with active modes of transport to improve the state of public transportation in the city (City of Edmonton, 2009b, p. 52). In fact, Edmonton already has some infrastructure in place to support these alternative modes of transport.

2.2 Edmonton Light Rail Transit

Edmonton's LRT network spans 21 kilometres and connects downtown and the central business district with the city's northeast neighbourhoods, the University of Alberta, and the south side of the city. The current line (Capital Line), operational since 1978 and expanded several times, features fifteen stations either underground (at the university and downtown) or at grade (outside of downtown and the university), separated from vehicular traffic.

The newly opened Metro Line (opened September 2015) branches off the Capital Line at Churchill Station downtown and travels north. Once fully completed, the Metro Line is expected to connect downtown Edmonton with the city's northwest neighbourhoods and potentially the City of St. Albert (Dubois, 2014). Also approved is the Valley Line (to open by the end of 2020), which will connect downtown Edmonton with the city's western and southeastern neighbourhoods (City of Edmonton, 2014d). Construction of the southeast portion of the Valley Line is expected to start summer 2016.

Field research for this project was done in summer 2015, when the Metro Line had not yet opened. This project is mostly applicable to LRT stations on the Capital Line; however, the conclusions and policy and infrastructure implications discussed later may very well be applicable to Metro Line stations and other future stations on the Edmonton LRT network as well.

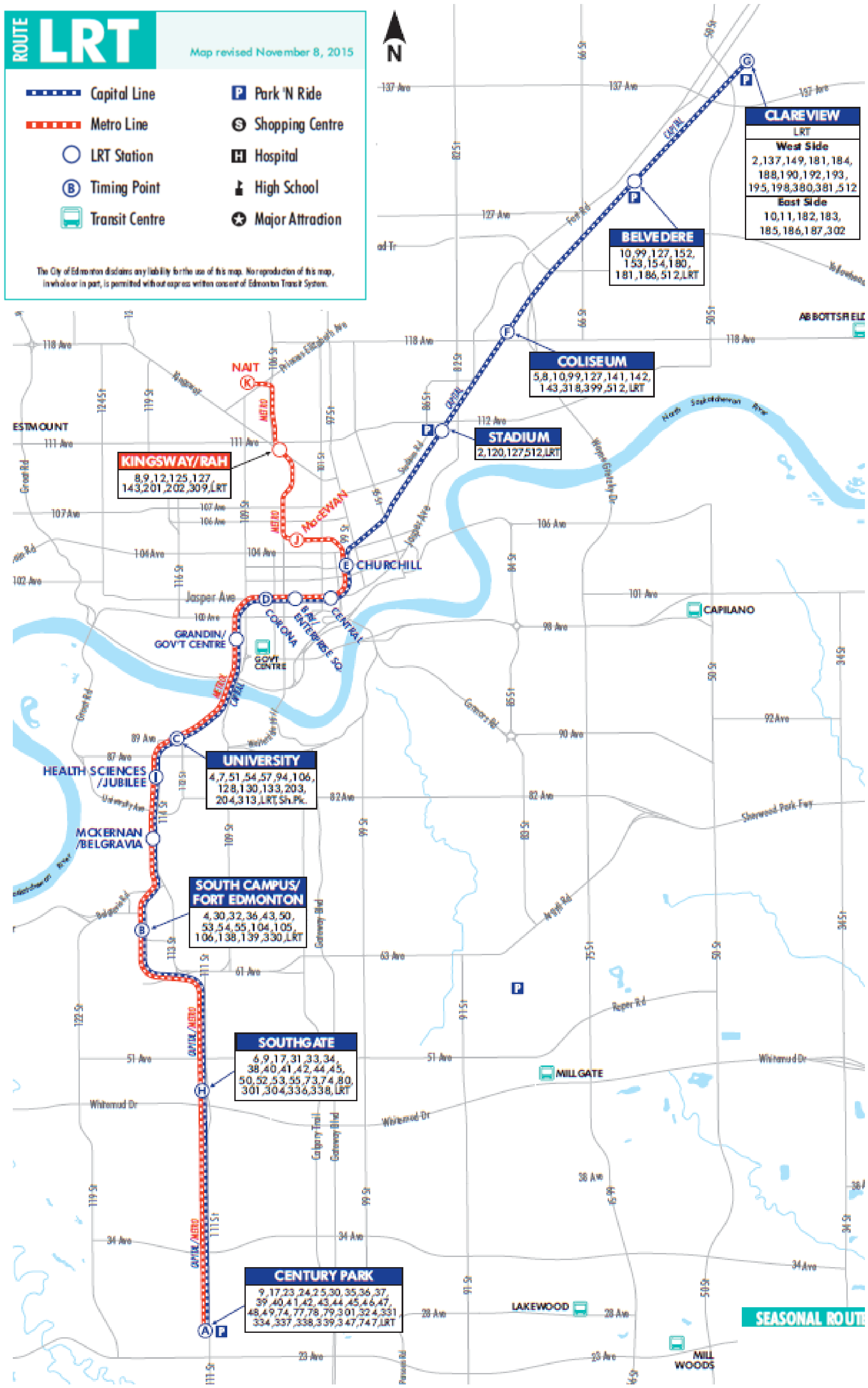


Figure 2.1: Existing Edmonton LRT system map with bus exchange points identified (Edmonton Transit System, 2014, adapted by author).

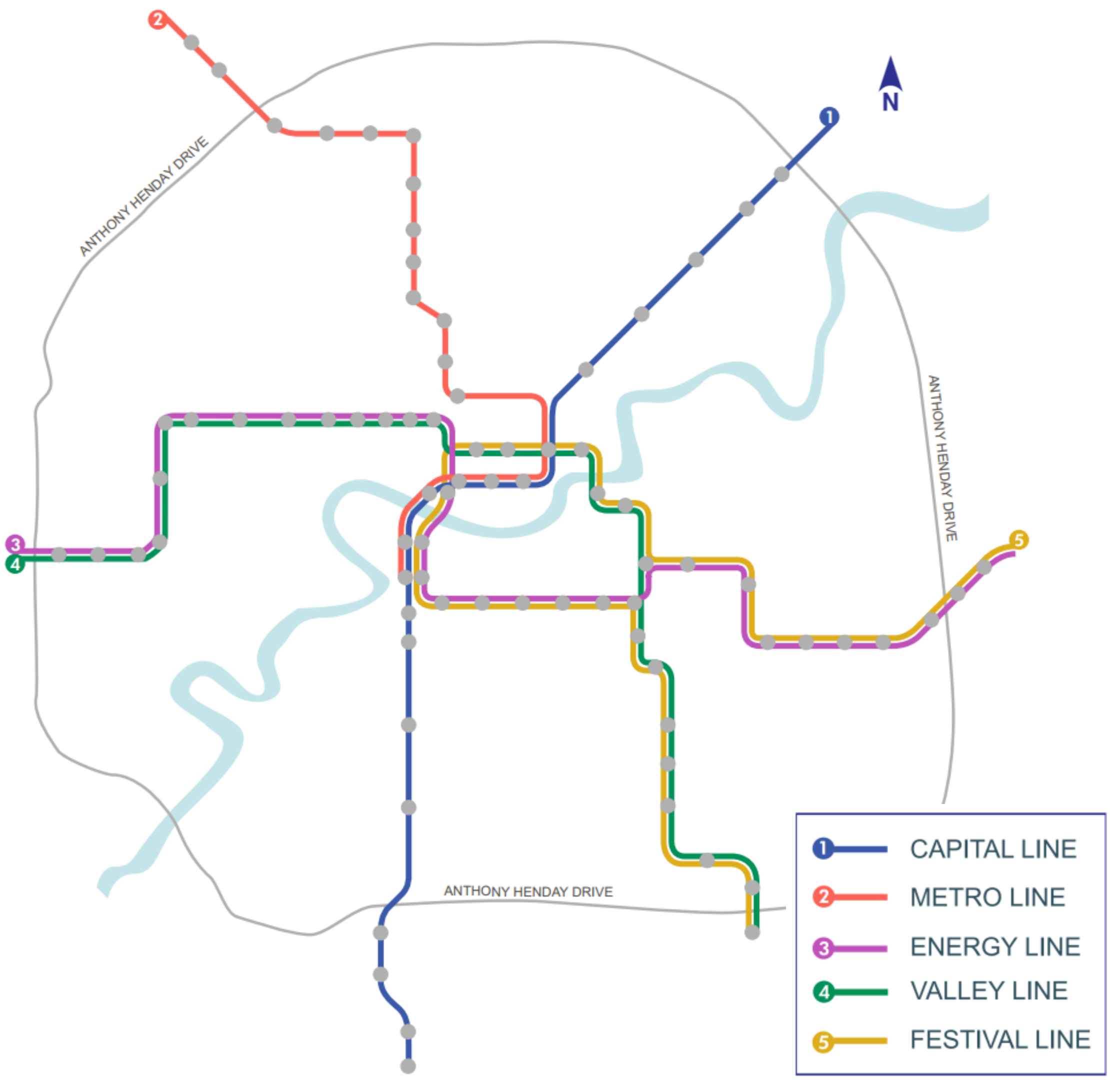


Figure 2.2: Potential build-out of the Edmonton LRT system (City of Edmonton, 2013b, adapted by author).

2.3 Bike infrastructure in Edmonton

The City of Edmonton also has a diverse network of bicycle infrastructure, with signed bike routes, on-street painted bike lanes, bike boulevards, bike counterflow lanes – i.e. painted bike lanes that flow in the opposite direction of vehicular traffic on a one-way street – and shared-use paths. Bicycle infrastructure can be found throughout the city, but is most prevalent in the inner-city areas or mature neighbourhoods. The City is currently undertaking several bicycle infrastructure projects in the downtown and inner-city areas, thanks to recent sizeable investments by City Council in active transportation (Osman, 2014). Of note are the 102 Avenue and 83 Avenue separated bike lane projects set to be constructed in summer 2016. These projects involve the installation of bi-directional bike lanes separated from vehicular traffic by a concrete barrier, installed on 102 Avenue west of the downtown core, and on 83 Avenue east of the University of Alberta.

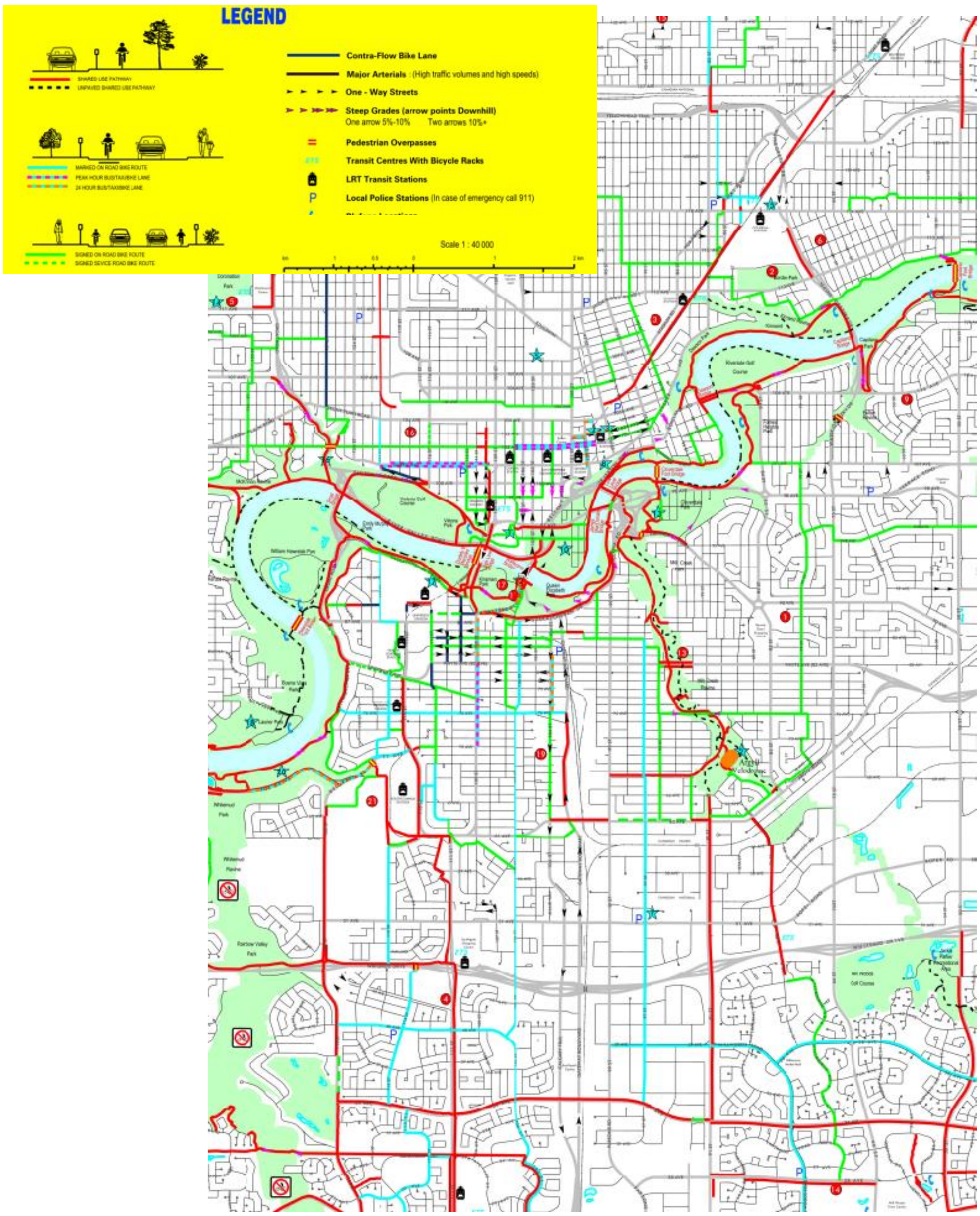


Figure 2.3: Edmonton's bicycle infrastructure with LRT stations shown (City of Edmonton, 2013a, adapted by author).

Some bike infrastructure already exists at LRT stations to support cyclists who access stations by bike, including formal bike racks or bike lockers provided by Edmonton Transit System (ETS). Bike-transit integration policy to support bikes on buses and trains also exists. Table 2.1 summarizes several examples of Edmonton's existing bike-transit integration infrastructure and policy.

Table 2.1: Existing bike-transit integration infrastructure and policy

Infrastructure / policy	Does policy exist?	At no LRT stations	At some LRT stations	At all LRT stations
Formal bike racks provided by ETS	Yes		●	
Informal bike racks not recognized by ETS	No			●
Bike lockers	Yes		●	
Secure bike facilities (e.g. 'bike stations')	No	●		
Bike ramps on stairs at LRT stations	No	●		
Bikes on trains	Yes			
Bike racks on buses	Yes			

2.4 Edmonton's urban context

The physical extent of Edmonton's LRT system is vast and covers a large area. As cycling to LRT stations may be faster than walking or taking public bus transportation, and combining bikes and LRT in one trip may be easier than cycling the entire distance of the journey, researchers note many people already integrate their bike with transit in cities around the world (Fishman et al., 2013; Hochmair, 2014; Martens, 2004; Park et al., 2014; Pucher et al., 2011; Pucher et al., 2010; Rietveld, 2000; Tsenkova & Mahalek, 2014; Wang & Liu, 2013; Yang et al., 2015). Given the differing built forms and urban contexts that the LRT system in Edmonton travels through, Edmonton offers an interesting case study to investigate how different station conditions relate to bicycle access and egress.

Field research in Edmonton has confirmed the different urban contexts and respective station conditions throughout Edmonton's LRT system. A review of Edmonton through online satellite imagery suggests the LRT system travels through three distinct urban contexts:

1. **Core neighbourhood / downtown;**

   "Core" neighbourhoods, as defined by the City of Edmonton (City of Edmonton, 2015c, p. 12) are found in the central areas of the city, including downtown, the central business district, and adjacent neighbourhoods. These neighbourhoods have "the highest average density, more apartment buildings, and less single detached and row housing" (p. 50).

2. **Mature neighbourhood;** and

   "Mature" neighbourhoods are found outside core areas and central Edmonton, and mostly completed prior to 1970 (City of Edmonton, 2015c, p. 12). These neighbourhoods "tend to have lower densities and more single detached homes than other neighbourhoods" (p. 50).

3. **Established neighbourhood / suburban.**

   "Established" neighbourhoods are found outside mature neighbourhoods and "tend to have a lower average density than mature neighbourhoods, with less apartment housing and more row housing than other neighbourhoods" (City of Edmonton, 2015c, p. 12, p. 50). These areas are generally found within the Anthony Henday Transportation Corridor – the circuitous, freeway-like road that encircles the city.

Some parts of the LRT network are adjacent to "developing" neighbourhoods, which are those that are currently developing or planned, though most are almost fully developed (City of Edmonton, 2015c, p. 12, p. 50). Newer neighbourhoods in these areas "may have low dwelling unit density because development is in its early stages and single detached homes tend to be the first areas developed", though the recent development trend is towards higher densities in these areas (p. 50).

Both established and developing neighbourhoods are typically more 'suburban' in nature.

Note that the definition of the stations conditions or 'types' are not confined to population densities and descriptions of the used by the City of Edmonton above, which are based largely on the period of development. There are, in fact, other factors that will affect the 'type' of a station, to be discussed and confirmed later on in this research project through the use of other research methods.

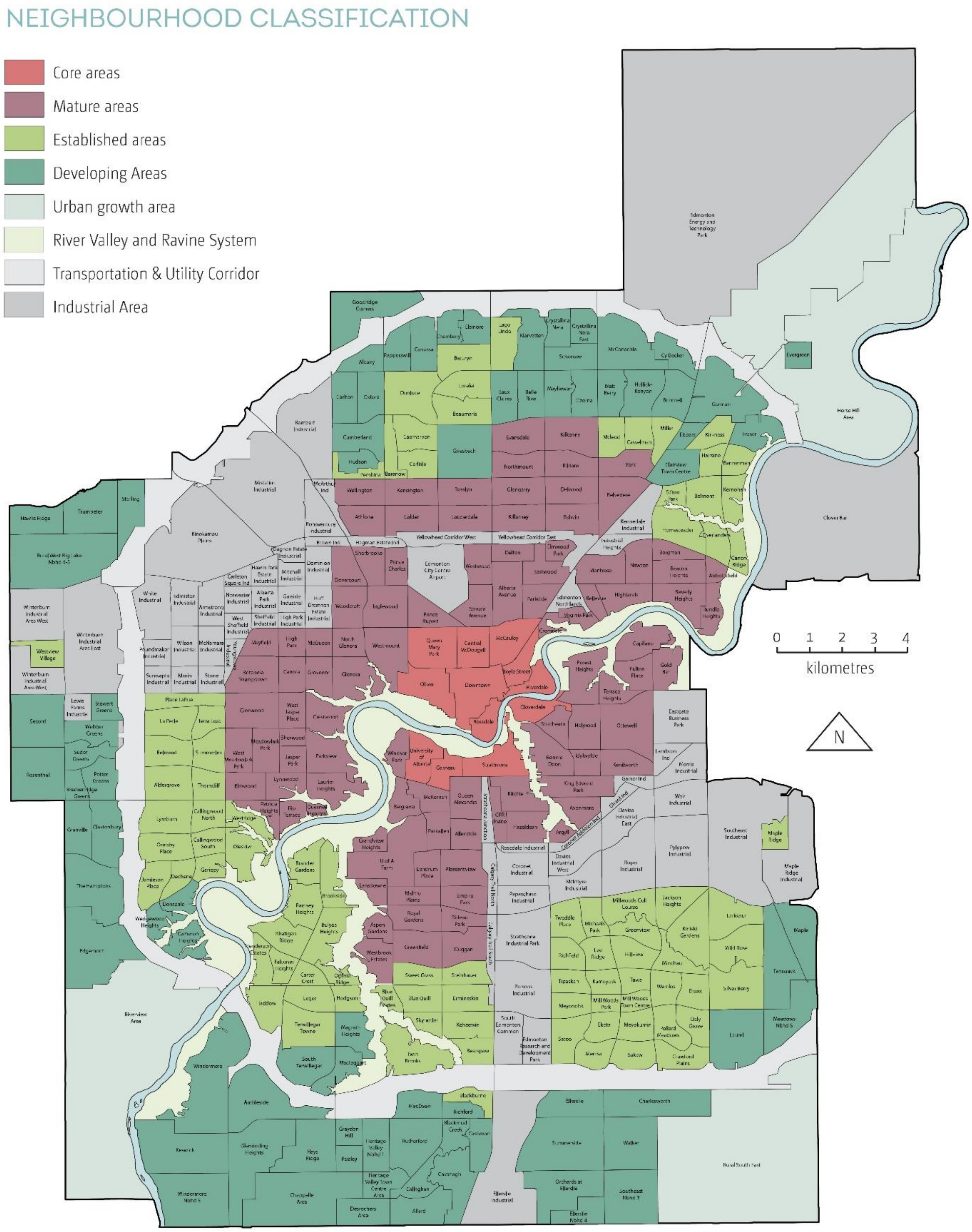


Figure 2.4: Edmonton's neighbourhood classification system (City of Edmonton, 2015c, p. 13).

2.5 Edmonton as a case study

Edmonton's bike-transit integration policy is featured in its Transportation Master Plan, The Way We Move. This plan is one of six strategies outlined in the City of Edmonton's Strategic Plan, The Way Ahead – the Plan and its strategies are collectively referred to as 'The Ways' documents – which identifies the City's vision for Edmonton in 2040 as a sustainable and attractive city. As mentioned prior, the City has officially mandated more investment into bike-transit integration, as per the Transportation Master Plan (City of Edmonton, 2009b, pp. 52-53, p. 57).

Edmonton's policy directives for bike-transit integration include provision for facilities for cycling, including adequate bike parking at transit stations and bike racks on buses (City of Edmonton, 2009b, p. 52, p. 53, p. 57). These policies are comparable to other North American cities whose goals are also to incorporate more bike-transit integration.

Table 2.2 identifies bike-transit integration policy directives for various North American cities with urban rail transportation systems comparable to Edmonton's LRT. A cursory review of bicycle, public transportation, and transportation planning policy documents from Vancouver, Calgary, Minneapolis-St.Paul, and Toronto shows that bike-transit integration policies are being implemented across the continent. The policy documents and directives identified in the table are not comprehensive, but suggest that Edmonton's desire for bike-transit integration is timely, and now is a suitable time to undertake a case study of bike-transit integration in the city.

As Edmonton's LRT system will be seeing expansion for years to come, this research presents a unique opportunity for planners, engineers, and political leaders in Edmonton to ensure future LRT station designs adequately address bicycle access and egress.

Table 2.2: Bike-transit integration policies in select North American cities and regions

City or region	Rail transportation system (comparable to Edmonton LRT)	Governing policy document(s)	Strategies and/or actions for bike-transit integration
Calgary, AB	CTrain (LRT)	***Calgary Transportation Plan*** City of Calgary, 2009	<u>§ Walking and Cycling</u> "Walking and cycling must be integrated with transit services and improve intermodal opportunities at the community, city and regional scales" (p. 3-8). <u>§ Transit</u> "Other modes of transportation, specifically walking, cycling, private vehicles, rail and air, should be integrated with transit services" (p. 3-14).
		RouteAhead Calgary Transit, 2013	<u>§ Accessibility</u> "Engage customers who access stations/stops by bike to identify and implement preferred improvements for bike parking and storage [so that] people who use bikes will have improved facilities at LRT and transitway stops/stations" (p. 51). "Evaluate the benefits, costs and potential customer use of bike racks/hooks inside CTrains and transitway vehicles [so that] customers who bring bikes on board will have a designated location to park them out of the way of other customers" (p. 77). "…Focus future bike racks on buses and bikes on trains on long-haul trips [so that] customers who want their bike at the start and end of their bus trip will not be required to have a folding bike and will have access to more destinations" (p. 77).
Vancouver, BC	SkyTrain (automated LRT)	***Transportation 2040*** City of Vancouver, 2012	<u>§ Multi-Modal Integration</u> "Work with TransLink to plan and implement abundant, secure, weather-protected bicycle parking at transit stations" (p. 29). "Support measures to expand on-board carrying capacity of bicycles on public transit vehicles" (p. 29).
		Cycling for Everyone… TransLink, 2011	<u>§ Bicycle-Transit Integration</u> "Ensure that the public transit fleet is 100% accessible to bicycles and work to increase the bicycle carrying capacity of transit vehicles" (p. 36).

City or region	Rail transportation system (comparable to Edmonton LRT)	Governing policy document(s)	Strategies and/or actions for bike-transit integration
			"Ensure that the [bikeway network] includes safe, convenient and legible connections to, transit stations and exchanges" (p. 36). "Ensure that transit facilities offer sufficient amounts and the right mix of bicycle parking including secure on-demand parking at every rapid transit station and major bus exchange and covered racks at major transit stops" (p. 36).
Toronto, ON	Scarborough RT (automated LRT)	***Toronto Official Plan*** City of Toronto, 2010	<u>§ Shaping the City</u> "Policies, programs and infrastructure will be introduced to create a safe, comfortable and bicycle friendly environment … including provision of adequate and secure bicycle parking at rapid transit stations…" (pp. 2-27).
		Toronto Bike Plan City of Toronto, 2001	<u>§ Cycling and Transit</u> "The City of Toronto [should] undertake a comprehensive review of bicycle access to all transit stations in the City and implement improvements wherever possible" (pp. 8-9). "The City of Toronto, GO Transit and the TTC [should] develop a co-ordinated bike-and-ride promotion strategy and related initiatives" (pp. 8-10). <u>§ Bicycle Parking</u> "The City of Toronto [should] install bicycle parking at all civic centres and work sites, recreation facilities, libraries, transit stations …" (pp. 9-4).
Minneapolis-St. Paul, MN	Metro (LRT)	***Minneapolis Bicycle Master Plan*** City of Minneapolis, 2011	<u>§ Strategies</u> "Make biking to transit a convenient transportation option… [by] ensuring that all major transit hubs in Minneapolis have adequate bike parking" (p. 131).
		Minneapolis Plan for Sustainable Growth: Chapter 2 – Transportation City of Minneapolis, 2009	<u>§ Creating a Bicycle-Friendly City</u> "Continue to integrate bicycling and transit facilities where needed, including racks on transit vehicles and bicycle parking near transit stops" (pp. 2-7).

3.0 Literature Review

3.1 Sustainable and resilient cities

Cities need to be more resilient due to increased environmental and economic concerns brought on by issues like peak oil and climate change (Leichenko, 2011). For cities, resilience refers to "the ability to absorb, adapt, and respond to changes in an urban system", including the shocks of economic crises, population demographic shifts, and environmental catastrophes (Desouze & Flanery, 2013, p. 89). In such an unclear future, cities must plan for this uncertainty, vulnerability, and adaptation, amongst many other things (Jabareen, 2013).

Some researchers suggest the provision for more transportation options ensures cities' resilience. In their study of urban transportation resiliency in light of volatile – and increasing – gas prices, Bronson & Marshall (2014) suggest that "environmentally friendly transportation options" including bicycling and public transportation can contribute to a city's resilience (p.2245). Their study goes on to conclude that provision for modes of transportation other than the automobile "supports the economic, social, and environmental strength of cities and towns" (p. 2257). Similarly, Egger (2006) states in his research that a higher degree of urban transportation choice offered – public transportation, in the case of his research – is a "fundamental component of the sustainability debate" due to their effect on the environment and economy (p. 1245).

Edmonton has focused on becoming more resilient and sustainable in recent years through its policy directives to shift Edmontonians' travel habits from a dependence on automobiles to more sustainable modes like active and public transportation (City of Edmonton, 2009b). Other cities in the world have also done well with such sustainability-focused policy directives (Buehler & Pucher, 2011, p. 45).

3.2 Recent developments in sustainable transportation

There has been a recent push from cities to encourage and provide for more sustainable modes of transportation that do not rely on automobiles and limit the use of fossil fuels, like active modes of transportation – walking and cycling – and rail travel. Many researchers cite the health benefits of active transportation and how these benefits can act as a stimulus for municipal governments to plan more for active modes.

The benefits of active transportation are reaped not only by the individual – in the form of better cardiovascular health, for example – but by entire cities as well – in the form of reduced air pollution and carbon emissions (Pucher & Buehler, 2010, pp. 408-409). Tight & Givoni (2008) agree that active modes of travel like walking and cycling contribute to the creation of healthier and more sustainable cities stating that "sustainable mobility is the new paradigm in transport planning and policy" (p. 385). They are hopeful that active modes of transportation will be given adequate attention in the future as contemporary planning practice is beginning to show evidence that general society understands that planning for motor vehicles is not a viable option if governments want to meet their sustainability goals (p. 390)

Cycling, in particular, has gained more attention in North America in recent years as a low-pollution, low-cost transportation mode that is socially, economically, and environmentally beneficial (Tsenkova & Mahalek, 2014, p. 126). Cycling in Canada has been on the rise as well. On average, Canadian cities saw a 42% increase in daily bicycle commuters from 1996 to 2006, representing a growth in share of work commuters from 1.1% to 1.3% over this same time period (Pucher et al., 2011, p. 452). As a result of increased cycling, cities have recently focused on installing bicycle infrastructure like bike lanes, off-street bike paths, and traffic-calmed residential streets or "bike boulevard" (pp. 465-466).

Boulder, Colorado, for example, has made significant investments to cycling infrastructure for decades through the addition of bike lanes and multi-use paths. Henao et al.'s (2015) study of Boulder's funding of sustainable transportation modes – walking, cycling, and public transportation – over the course of two decades suggests that increased funding and installation of appropriate infrastructure resulted in an increase in bicycle mode share (p. 69). Incidentally, a significant increase in public transportation mode share was also seen (p.69).

Other cities see similar results with investment to active transportation infrastructure. Vancouver has also invested in an array of bicycle infrastructure in recent years as well. Encouraged by a 40% increase in trips by bike from 2008 to 2011 (City of Vancouver, 2016), the City of Vancouver installed their very first bi-directional bike lane separated from vehicle traffic in 2011 in their downtown core (Newcomb, 2011, p. 5). Since then, more separated bike lanes and bike boulevards have been added in and adjacent to downtown Vancouver, which has led to record bike ridership (in the summer) never seen before in the city (City of Vancouver, 2015). Closer to Edmonton, the City of Calgary has also invested in the installation of bike infrastructure – i.e. separated bike lanes or "cycle tracks" – in 2015 in and around their downtown core, resulting in a corresponding increases in bike ridership as well (City of Calgary, 2015; City of Calgary, 2016).

At the same time, many cities have been encouraging rail transit and investing in rail infrastructure and transit-oriented development. Similar to the "new paradigm" that Tight & Givoni (2008) speak of as previously mentioned, Kamga (2015) suggests there has been a "transportation paradigm shift" in many cities (p. 113) towards planning for *trains and transit* instead of cars. Some researchers note the addition of rail transport can enhance cities' sustainability (Cervero, 1995) and offer solutions to their environmental and social problems (Newman & Kenworthy, 1996, p. 7).

Vancouver and Calgary can, again, be used as an example in this case. In recent years, SkyTrain, Vancouver's automated light rail transit system, has seen steady investment from TransLink, the regional public transportation agency. From 2000 to 2010, the SkyTrain network saw the opening of two new lines and subsequent improved integration of bus transit, resulting in a consistently increasing and record-breaking ridership (TransLink, 2011). CTrain, Calgary's light rail transit network comparable to Edmonton's LRT system, received funding from the City in recent years in order to extend the network to serve neighbourhoods in the western part of the city. The western extension opened in 2012 and led to a significant increase in transit ridership. Despite Calgary's transit ridership being relatively lower in comparison to bigger urban centres in the country, increased investment in transit infrastructure did translate to an additional 10.9M riders, or approximately 10% of all transit ridership (Rodgers & Neyra, 2014). A current addition being planned for Calgary's CTrain network is the new Green Line LRT, which is estimated to serve an additional 41M passengers annually (City of Calgary, 2016).

3.3 The 'first mile problem'

Recent research has focused on the problem of transit accessibility faced by transit systems around the world (Chandra et al., 2013; Koh & Wong, 2013; Moniruzzaman & Paez, 2012). Operators are always aiming to increase the ridership of their transit systems, but the accessibility of bus stops and/or transit stations prevent many people from using them (Chandra et al., 2013, p. 48). Additionally, the act of accessing (and egressing) public transit can "lower a commuter's satisfaction level" and "reduce the attractiveness of a [public transportation] system" (Yang, et al., 2015, p.180). As such, it may be in cities' or public transportation agencies' best interest to make the access and egress stages of a public transportation trip as convenient and fast as possible in order to satisfy existing commuters and perhaps attract new ones.

This issue of transit accessibility is often referred to as the "first/last mile problem" (Chandra et al., 2013; Chandra & Quadrifoglio, 2013; Koh & Wong, 2013). In this practicum, this issue is referred to as the '*first* mile problem,' since the research mostly concerns how people access transit stations from their trip origins (i.e., the 'first mile' of travel). However, researchers can refer to the transit accessibility issue as *both* a first *and* last mile problem. Travelers who leave transit stations for their final destinations (i.e., the 'last mile' of travel) will once again need to re-access the same transit station upon their return (i.e., the 'first mile' of travel again, but in the return direction).

In their discussions of the first/last mile problem, many researchers recognize several potential solutions. Some suggest feeder transit services, for example, as a solution to this problem. Chandra & Quadrifoglio (2013) describe feeder transit routes as regularly used types of transit services, usually seen in low density residential areas found in cities across North America (p. 1). They operate on a "demand responsive… shared-ride mode" model that shuttle passengers to major transit nodes. Despite potential scheduling problems brought on by this service, feeder routes may play an integral part in solving the first/last mile problem, and may increase transit ridership in general as well (p. 14). Deng et al.'s (2013) research agrees, stating that feeder transit routes can "promote service level, efficiency, and competitiveness of public transport" (p. 2384). Their research also suggests that improved and coordinated scheduling of bus and urban rail transportation can lead to operational cost savings, and should be prioritized in the planning and improvement of existing public transportation networks (p. 2383).

Other researchers recognize walking often solves first/last mile problems (Koh & Wong, 2013; Moniruzzaman & Paez, 2012, p. 203), simply because it is the easiest and potentially most convenient access mode. Koh & Wong's (2013) study of Singapore, for example, suggests many people choose to walk to subway stations simply because they are close by (p. 47). They also suggest that the coordination of bus and transit service, which increases frequency and convenience of transit accessibility, is integral to increased transit usage (p. 50). Similarly, in their study of Hamilton, Ontario, Moniruzzaman & Paez (2012) found people usually walk from their trip origin to the nearest transit stop (p. 203).

Research also suggests that implementation of transit-oriented development (TOD) may solve first/last mile problems. TOD neighbourhoods typically have a center with a transit station or stop (Moniruzzaman & Paez , 2012, p. 203). A higher density of people in the area in conjunction with TOD's mixed-use nature, supports access to transit (Ratner & Goetz, 2013, p. 31). Ratner & Goetz (2013) mention the municipal policies that promote higher-density TODs in Denver have even gone on to impact the city's land use and urban form (p. 31). Other researchers note, however, complex relationships between successful TOD, population densities, and job densities. Kang (2010) recognizes that the location of rapid transit and job densities depend on one another. Bus rapid transit improvements in Seoul increased employment densities near rapid transit stops and affected job densities along the entire transit corridor (Kang, 2010, p. 140). In a study of 19 metropolitan areas across the United States, Guerra & Cervero's (2010) research suggests cost-effective mass transit and TODs require not only a higher nearby population density, but also a higher job density as well. Similarly, in a study of metropolitan areas around the world, Newman & Kenworthy (2006) conclude that an urban intensity of 35 people *and jobs* per hectare is required to significantly reduce automobile dependence (p. 37). This translates to approximately 10,000 people and jobs within a 10-minute walking radius (p. 43).

Frank & Pivo's (1994) research reviewing single-occupant vehicle use in Washington state echoes the above research. Frank & Pivo found that policy in Washington encouraged mixing land uses and increasing residential and employment densities to reduce the use of single-occupant vehicles (SOV). These strategies also encourage the use of alternatives to SOV as well, like transit and active modes. They conclude that areas with mixed land uses and higher population and employment densities saw less SOV use and more trips taken via public transportation and active modes (i.e. walking) (p. 51). They also found that walking trips "were the most sensitive to increases in population density" and a decrease in SOV use was more dependent on employment density than population density (p. 52).

The aforementioned cities and studies may not necessarily be comparable to the Edmonton context, but they do suggest there are various ways to solve the first/last mile problem. In the absence of increased bus service to transit stations, many people choose active modes like walking to solve their transit accessibility needs; however, walking long distances to access transit stations may not be possible for all people for a variety of reasons. As an alternative to this, it has been recognized in academic literature that cycling can be an effective 'first mile mode' to solve the transit accessibility problem.

3.4 Bike-transit integration

In cases where walking, driving, or taking public bus transportation to transit stations proves to be too inconvenient, or in cases where travelers choose to access transit stations through other active modes, access by bike can be an effective alternative. The resulting combination and integration of cycling and transit can be seen as an alternative mode of transportation competitive with private automobile usage (Cheng & Liu, 2012, p. 1691). The integration of bicycles and transit is beneficial to both modes as it encourages both cycling and transit usage. Using bicycles to access transit stations extends stations' catchment areas. In these cases, cyclists access and use public transportation for longer trips, as trips solely by bike may prove to be too long or strenuous (Pucher et al., 2011, p. 467).

In their study of various North American cities, Pucher et al. (2011) note that many jurisdictions have, in recent years, made improvements to bike-transit integration infrastructure and policy. They note that most cities in their study have installed bike racks on 100% of their buses, and allow bikes onto rail transit outside of peak hours. Many cities also provide an array of bike parking for both short term and long term trips – i.e. bike racks and bike lockers, respectively (p. 467). Some cities offer added security and protection for cyclists at transit stations through "bike stations". Bike stations are often found adjacent to transit station and offer "secure, sheltered bike parking, usually with an attendant, as well as bike rental and repair services" (p. 467). Chicago, San Francisco, Washington DC, and Toronto all have bike stations integrated with their rail transit systems (p. 467). Incidentally, the City of Edmonton has also expressed interest in installing bike stations at strategic locations adjacent to the LRT network as well, which will be discussed later in this practicum.

Other cities have found success with public bike share systems as an effective means to integrate bicycles and rail transit. Pucher et al. (2011) suggest public bike share programs in cities across Europe have both encouraged more cycling and improved its integration with public transportation (p. 468). Other research confirms this and shows the integration of public bike share systems with rail transit is indeed an important aspect of urban transportation systems (Fishman et al., 2013, pp. 157-187). For example, strong relationships between bike share docking station activity and proximity to train stations have been recognized in Melbourne, Australia, while studies of both Melbourne and Washington, DC show bike share users make trips to address transfer inefficiencies within the rail transit network (Fishman et al., 2013, pp. 157-187). Some users of the public bike share system in London report substituting travel on the underground rail network with these bikes, which may contribute to a reduction in overcrowding on public transportation as well (p. 158). This suggests that public bike share systems may not only offer a useful way to address transit station access and egress, but can also be a viable mode of urban transportation by itself.

While many researchers extol the virtues of bike-transit integration (Pucher et al., 2011, p. 467; Cheng & Liu, 2012), other researchers cite gaps in literature and research. Despite their recognition of the benefits of bike-transit trips, they discuss the need for better understanding of how bicycles can access transit hubs (Hochmair, 2012), and how cities can effectively encourage integration of the two modes (Wang & Liu, 2013).

Hochmair's (2012) study of bicycle service areas around transit stations adds to existing bike-transit integration literature by discussing the different characteristics of bike-transit trips and how they result in different bicycle access distances. The study concludes that faster or more direct public transportation makes up for longer bike access distances; and areas with high street intersection density and therefore low effective cycling speed resulted in shorter bike access distances – amongst other conclusions (p. 17, p. 26). However, Hochmair notes the variability in bicycle access distances and service areas in his research and the need to understand geographies of transit stations' bicycle catchment areas (p. 28).

Similarly, Wang & Liu's (2013) study of the characteristics of bicycle-transit integrated trips in American cities also adds to existing bike-transit integration literature by addressing the demographics of those undertaking bike-transit trips, and the various regions and urban areas in which these trips are popular. Their study found that bike-transit trips were popular in high-density urban areas, and those undertaking these trips are generally younger and male (p. 116). However, Wang & Liu cite a gap in existing research and literature, as the connections between mode choice and gender and ethnic background, for example, are not yet fully understood (p. 117). They also suggest additional collection and synthesis of "modally-focused data" and the need for more research regarding how trip characteristics can change depending on trip purpose and origin and destination details (p. 117).

3.4.1 Bicycle access and egress

Numerous studies discussing the nuances of bicycle access and egress to transit stations already exist; however, even these studies cite research gaps and suggest suggests various bike-transit integrations topics that could benefit from more attention and research.

In their study of intermodal commuters in Nanjing, China, Yang et al. (2015) discuss the first mile problem for commuters who combine bicycle use with the local metro system. They conclude more comprehensive study on transit access and egress trips is needed to identify and address barriers commuters face in switching to and from different modes (p. 180). Encouraging bike use for egress trips is more difficult, as some public transportation policies don't allow bicycles to be brought onto transit vehicles at certain times of the day (Calgary Transit, 2015; City of Edmonton, 2015b; TransLink, 2015); there would subsequently be no bicycle available at the end of a transit trip (Martens, 2004, p. 286). In these situations, a case could be made for public bike share to complement the existing public transportation network (Fishman et al., 2013, p. 150). In regions with a low cycling ridership, the lack of bicycle infrastructure may also discourage the use of bikes for egress trips (Martens, 2007, pp. 336-337).

Nonexistent or improperly designed bicycle infrastructure at transit stations is also frequently discussed in the literature. For example, Rietveld (2000) found that many potential cyclists are discouraged by insufficient parking and theft at railway stations (p. 74), so they choose not to cycle. Yang et al. (2015) find similar results in their research, where those who access transit stations by bike are concerned with bike parking safety (i.e., theft), particularly if their commute is long and they will be away from their bikes for a long period of time (p. 191).

Some research suggests correlations between the built form around transit nodes as well, which affects if and when people choose to access them by bicycle. In a pilot study conducted in the

San Francisco area, Park et al. (2014) found that access to transit nodes via active modes is more positively associated with roadway features like intersection density and four-way stops (p. 657). They also found proximity to auto-friendly streets and longer travel distances to access transit nodes deter cycling to transit stations significantly (2014, p. 657). In a similar study of several other large American cities, Hochmair (2014) found street intersection density and vehicular dead-ends also positively correlated with bicycle accessibility to transit stations (p. 28). The same study suggests two-mile buffers from train stations are realistic radii to consider in bicycle infrastructure improvements (p. 28).

The improvement of bicycle infrastructure should not, however, be restricted or confined to target only that which improves transit station accessibility. Many researchers of bicycle planning in cities around the world recognize the role of proper bicycle infrastructure and how it not only encourages bicycle access to transit nodes, but also encourages utilitarian cycling for all purposes (Cervero et al., 2009; Cheng & Liu, 2012; Zhang et al., 2015; Buehler & Pucher, 2011).

3.4.2 Bike-transit integration policy

Policies for bike-transit integration – or what some refer to as "bike-and-ride policy" (Martens, 2007) – are also important. Even in locales like Groningen, The Netherlands where bicycle mode share is high, specific bike-and-ride policies are needed in order to encourage bicycle access to transit stations (Martens, 2007, p. 336). In their research of cycling in various cities across North America, Pucher et al. (2011) suggest cycling has increased in cities that employ a wide range of programs and policies to promote the activity, including comprehensive bike-transit integration policies like bike stations at transit nodes and bike racks on busses (p. 467, p. 470). In Calgary, similar to Edmonton in built form, there is evidence of elements of bike-transit integration in the city's newer neighbourhoods due to better developed "commuter-oriented cycling networks." These have resulted from the implementation of sound bicycle planning policies (Tsenkova & Mahalek, 2014, p. 139).

Increasing levels of bike-transit integration (and cycling, in general) depends on a combination of 'hard' and 'soft' policies. For example, proper policies need to ensure cycling infrastructure is actually planned for and implemented. "Comprehensive, long-range bike plans have been crucial… for guiding overall strategies to increase cycling, coordinating a range of programs, and phasing infrastructure investment over time" in various North American cities (Pucher et al., 2011, p. 469). As a result, cycling has been made safer in these (and other) cities through the provision of better bike infrastructure, including bike lanes, cycle tracks, and off-street bike paths (p. 464). A wider range of bike parking and amenities have also been provided, including secure bike parking at transit stations, which many cyclists strongly prefer. For example, and as discussed previously, "bike stations", often located near transit nodes, are a recent development in bike infrastructure that promotes bike-transit integration (p. 467).

Some researchers also note the success of urban cycling isn't completely reliant on infrastructure policy, as "programmatic interventions" (Pucher et al., 2010, p. S115) – promotional activities, media campaigns, and educational events – play important roles as well. Research conducted by Pucher et al. (2010) indicate that an "integrated package of strategies" usually helps communities increase levels of cycling (p. 122). Such strategies could range from supportive land-use planning and disincentives for car use, to "legal interventions" like helmet law reform and reduced vehicular speed limits, to promotional programs like "travel awareness programs", "Safe Routes to School", and bicycle marketing (pp. 113-114, p. 122). The same policy and program interventions that have made urban cycling more commonplace in recent years could potentially be adapted for bike-transit integration as well, in order to encourage and promote more bike-transit travel.

3.5 Conclusions

This literature review shows that many researchers and scholars suggest the key to bike-transit integration is a combination of bicycle policy (e.g., directives to accommodate and support bicycles), bicycle infrastructure (e.g., separated lanes and paths that make cycling safer and more attractive), and bicycle programming (e.g., educational and support initiatives to promote cycling).

There is, however, a noticeable gap in the literature regarding bikes as the mode of transportation that has the potential to solve the first mile problem. Despite the existing literature regarding bicycle access and egress to transit stations already available, there appears to be a need to even better understand the many factors and nuances that influence the 'bike' portion of bike-transit trips – the distance traveled, the route(s) taken, and the reasons why the bicycle was chosen as a 'first mile mode'.

Additionally, stations in different areas of a city with different urban forms may require different infrastructure and policy needs. For example, a low-density urban areas may need more off-street bike paths leading to LRT stations, particularly for those who seek added personal safety on the road. Secure bike parking may also entice riders wanting added security at the station. Conversely, a high-density, walkable urban area may benefit from public bike share systems or a network of on-street separated bike infrastructure within the vicinity of a LRT station.

This research project intends to fill some of the existing gaps in literature identified above. Based on the research findings discussed later, this research project identifies the exiting state of bike-transit integration in Edmonton, and offers nuanced recommendations regarding policy and infrastructure interventions specific to the Edmonton context.

4.0 Research Methods

A variety of research methods were used to gather and analyze information for the purpose of addressing the various research questions. Edmonton is used as a case study for this practicum, and the main research methods used included observations, site condition analyses, surveys/structured interviews with cyclists, and semi-structured interviews with participants and practitioners in Edmonton's transportation and city-wide planning community (including City engineers, planners, and City Councillors, as well as bicycle advocates). The following sections outline in further detail the research methods used in this practicum and which research question(s) these methods answered.

4.1 Case study research

Yin describes a case study as an "empirical inquiry that investigates a contemporary phenomenon in depth and within its real-world context especially when the boundaries between phenomenon and context may not be clearly evident" (2014, p. 16). With this description, what Yin describes as a "contemporary phenomenon" is the 'case' of the case study – that is, bike-transit integration in Edmonton, in this scenario.

While case studies can use quantitative research methods, many employ qualitative research methods. Qualitative research enables the researcher "to investigate situations where little is known about what is there or what is going on" and "to explore complexities that are beyond the scope of more 'controlled' approaches" (Gillham, 2000, p. 11). Case study research also often employs different "sub-methods" like interviewing, observations, and document analyses in order to get a "true picture" of the case (Gillham, 2000, p. 13). This case study of bike-transit integration on Edmonton's LRT system makes use of these and other research methods, as discussed below.

Edmonton makes for a suitable case study as there is the ability to "intensively investigate one or a small set of cases, focusing on many details within each case and the context" (Neuman, 2011, p. 42). In looking at Edmonton and its LRT system, the research reveals potential differences and nuances in how cyclists access and egress different LRT stations in the city. The case study approach allows the analysis to "[examine] many features of a few cases" of station access and egress by bicycle (Neuman, 2011, p. 42). Localized results for certain stations and station types can be generalized and applied to different parts of the transit system and the city.

4.2 Site analyses

Site condition analyses were conducted to address the second and third research questions posited earlier, which aim to determine the characteristics of neighbourhoods surrounding LRT stations, how this relates to bicycle access trends for the respective LRT stations, and what the resulting LRT 'station type' is.

Site condition analyses gathered information concerning the characteristics of the built form of residential and/or commercial neighbourhoods surrounding LRT stations. These analyses documented the relative job and population densities in neighbourhoods surrounding LRT stations, what their relationships are with the City's bike infrastructure network, and, as a result, if/how cyclists access or egress the LRT station. An analysis of the neighbourhoods generally within the average cyclist access and egress distance (or radius) observed at all LRT stations on the entire system was conducted. Neighbourhoods surrounding LRT stations that are generally representative of the local urban form – as identified through a review of online satellite imagery – were selected for this research method. Details of the average cyclist access and egress distance/radius will be discussed later on in *§ 5.0 Findings* and *§ 6.0 Analysis*.

The site condition analyses involved:

- Identifying the type and availability of active transportation infrastructure within the LRT station radius; and

- Identifying traits of the neighbourhood within the LRT station radius, including land use, and relative population and job density.

The analyses were conducted using:

- Google Maps satellite imagery;

- The official City of Edmonton Bicycle Map, which identifies recognized bike routes, lanes, and shared use paths in the city; and

- The 2014 City of Edmonton municipal census results, which include population profiles for all formally recognized "neighbourhoods" within the City.

The goal of the site condition analyses was to determine if there were any noticeable trends in the data collected from stations and their surrounding neighbourhoods across the entire LRT system. Data regarding the availability of bike infrastructure or the population and job densities in surrounding neighbourhoods, for example, were recorded and tallied, and were also compared against the results of the surveys/structured interviews (discussed later) for each LRT station. Resulting relationships and trends contributed to the identification of specific 'station types' for each LRT station.

4.3 Observations

Observations were conducted to determine how cyclists access and egress Edmonton's LRT stations. Observational research methods "[study] people in their natural setting … [and] involve the… viewing of people's actions … [and the] analysis and interpretation of their behaviour" (Gray, 2004, p. 239). In his discussion of qualitative research methods of the social sciences, Berg suggests that observations involve four simple things: taking in physical settings; developing relationships;

tracking, observing, and asking questions; and locating subgroups (2001b, p. 155). Observations were used to identify the current state of bike-transit integration in Edmonton, and determined how many people currently access Edmonton's LRT stations by bike. The specificities of 'how' these cyclists access the stations (specific routes, origin and destination locations, etc.) were addressed through surveys/structured interviews, discussed below.

Building on the three proposed 'station types' on Edmonton's LRT system, observations took place at approximately three LRT stations per station type, resulting in observations being conducted at a total of approximately nine LRT stations. With a total of fifteen stations on Edmonton's LRT system, observations of nine stations (60% of all stations) will likely provide enough data for analysis.

Observations were done in the summer months on days with good weather and good riding conditions, when ridership is expected to be at its highest. Observations occurred during the morning and afternoon peak travel times (6am-9am and 3pm-6pm). For underground LRT stations with multiple pedestrian access points, observations were made within the vicinity of the 'main' street-level entrance, or for approximately one hour within the vicinity of each street-level entrance to the station if there was more than one 'main' entrance.

The number of people accessing or egressing the station by bike were counted and tallied for every 30-minute period. Observations were made unobtrusively in the public realm and from a distance. As there is no reasonable expectation of privacy, ethics approval was not required for this research method.

4.3.1 Analysis

By observing when certain cyclists accessed or egressed LRT stations (e.g., all at once or spread out evenly) or how they access stations (e.g., access via bike lanes or shared use paths), travel trends for bike-LRT trips were deduced. There was also opportunity to identify certain cyclist typologies. A typology is a "systematic method for classifying similar events, actions, objects, people, or places, into discreet groupings (Berg, 2001b, p. 166). Grouping cyclists into different classifications may complement site condition analyses, as certain stations may see more of a certain type of cyclist accessing it. An analysis of these trends may reveal information about LRT stations not obvious with analysis through satellite imagery, City maps, and neighbourhood profiles.

4.4 Surveys / Structured interviews

Surveys or structured interviews were conducted to understand in more detail how cyclists access Edmonton's LRT stations, and if any subsequent access trends could lead to the development of LRT 'station types.'

Surveys are "detailed and quantified description[s] of a population" (Gray, 2009, p. 219) and can either be descriptive or analytical. Descriptive surveys are "designed to measure the characteristics of a particular population" (p. 220) and "ascertain attitudes, values and opinions" (p. 221); and analytical surveys "test a theory in the field", "[exploring and testing] associations between [dependent and independent] variables" (p. 223). For this research project, a mostly analytical survey was conducted at LRT stations targeted towards people who access and egress by bike. In this project's case, dependent variables were the cyclists who accessed or egressed LRT stations, and independent variables were the LRT stations themselves and the different areas of the city they are located in.

Structured interviewing was the method for how these analytical surveys will be administered. While structured interviews usually take more time and resources to conduct, response rates are usually higher compared to other methods for administering surveys (e.g. postal questionnaires) (p. 233). Structured interviews also allow for the interviewer to clarify unclear or incomplete answers (p. 233).

The surveys/structured interviews and station observations (discussed previously) were conducted on different days, but both were done on days with good weather and riding conditions. The participation of approaching cyclists was verbally requested. If they agreed, they were asked specific questions regarding the length of their bike ride, the route taken, and their final destination. The data collected from these interviews led to the identification of LRT station 'bicycle catchment areas' and specific routes taken by cyclists. The survey/structured interview schedule and responses have been included in *Appendix C*.

Note that hereafter, the terms "structured interviews" and "surveys" will be used interchangeably as they effectively refer to the same research method with respect to this project.

4.4.1 Analysis

Content analyses for the surveys were relatively straightforward due to the structured nature of the questions and answers. A tally of the results of the surveys identified cyclists' trip origin and destination points, the LRT station they travelled to, generally what road or bike infrastructure they travelled on, their trip purpose, and their inclination to bring their bike onto the LRT trains with them. From this data, general travel trends and potential challenges of bike-transit integration in Edmonton were noted. These trends aided in the development of station types, as discussed previously.

4.5 Practitioner (semi-structured) interviews

Semi-structured interviews with Edmonton professionals and practitioners were conducted to determine what the City of Edmonton could do to accommodate and encourage more bike access to LRT stations and bike-transit integration in general.

Regarding interviews, Berg states they "are designed to elicit information using a set of predetermined questions that are expected to elicit subjects' thoughts, opinions, and attitudes about study-related issues" (2001a, p. 69). As well, there are various types of interviews that researchers can use – for example, structured or semi-structured. As interviews involve the use of human subject, ethics approval is required for this research method.

"Semi-structured interviews" (Gray, 2004, pp. 215-217) were used in later parts of the research to determine bike-transit integration policy and infrastructure gaps in Edmonton as identified by people with professional and/or personal experience in this area. This type of interview allows for some structure with "predetermined questions and/or special topics"; however, the interviewer is "expected to probe further beyond the answers given by the subject(s)" (Berg, 2001a, pp. 70-71).

There are some challenges with conducting semi-structured interviews that a researcher must keep in mind. For instance, the researcher must be able to anticipate the "possible routes" that the interviewee may take the conversation in, for which meaningful questions must be prepared and asked (Galetta, 2013, p. 76). The researcher must also be socially skilled enough to pay attention to what the interviewee is saying while also making "well-informed judgements … as to when and when not to interrupt" him/her for the purpose of guiding the interview (Galetta, 2013, p. 76). There are also ethical considerations to conducting semi-structured interviews as a participant's response, once released, may jeopardize his/her professional or personal reputation. Mitigative measures to protect the privacy and/or reputation of interview participants have been addressed in this project's ethics approval.

Approximately seven participants for the semi-structured interviews were selected based on a review of Edmonton's LRT and bicycle policy directives. These participants include City

Councillors, cycling advocates with Edmonton Bicycle Commuters Society, and planners and engineers for the City of Edmonton's Transportation Planning department, City Wide Planning department, and Edmonton Transit System. To mitigate ethical concerns, participants consented to the interview by reviewing and signing a consent form, which outlined the risks and benefits of their participation in the research project. The interviewees were provided an information sheet that included additional information about the research project as well as the researcher's and supervisor's contact information should they have any questions or would like to respond to the questions at a later time. The practitioner interview participants and schedule are included in *Appendix D*.

4.5.1 Analysis

The semi-structured interview transcripts were coded to aid in their analysis. A code is "a word or short phrase that symbolically assigns a summative, salient, [and/or] essence-capturing… attribute for a portion of language-based… data" (Saldaña, 2013, p. 3); and the act of coding can be described as "the 'critical link' between data collection and their explanation of meaning" (p. 3). Through coding the interview transcripts, trends and similarities between interviewees' responses were identified. The qualitative analysis software *ATLAS.ti* was used to code interview transcripts. With the help of this program, a list of codes was developed which identified how often each code came up and what was specifically discussed. This helped to identify different aspects of bike-transit integration that should receive attention and further research. Several forms of coding were used to analyze the interview transcripts, as outlined below.

Holistic coding

The purpose of holistic coding is to " 'chunk' [interview transcripts] into broad topic areas as a first step to seeing what is there" (Saldaña, 2013, p. 142). It is often "preparatory groundwork" for further analysis and more detailed coding (p. 142). The interview transcripts were first holistically coded before descriptively coded, as described next.

Descriptive coding

Descriptive coding "summarizes in a word or short phrase… the basic topic of a passage" (Saldaña, 2013, p. 88). This type of coding is often used in ethnographic studies to determine "what is going on here?" and "what is this a study about?" (p. 88). Descriptive coding is applicable to this research project as participants often identified "basic vocabulary" and " 'bread and butter' categories" for further in-depth analysis (p. 88), which is a hallmark of this type of coding.

Themeing

Data gathered through holistic and descriptive coding was then themed. Themes are "interpretive, insightful discoveries" that help the researcher understand the data and the phenomenon taking place (Saldaña, 2013, p. 176). Saldaña (2013) sees the search for themes as a "strategic choice as part of the research design that includes the primary questions, goals, [and] conceptual framework" (p. 177). Based on which question the interviewees were answering, different themes were identified – e.g. themes regarding how bike-transit integration could be improved, or what the existing barriers to bike-transit integration in Edmonton are. Multiple interviewees providing similar responses might indicate a common theme shared across all participants and their respective professional and personal backgrounds.

4.6 Limitations

There are two main limitations associated with this practicum: the research being confined to the summer months, and the accuracy of data provided by cyclists and practitioners.

Summer bike-LRT trips versus winter bike-LRT trips

Investigating transit station accessibility by bike in this project was based on relatively ideal riding conditions at the height of summer, with comfortable temperatures and little or no precipitation. Completing this research in the winter months would likely make for a different project, given other winter-specific challenges cyclists may face while riding to transit stations (e.g., icy roads, cold temperature, and adverse weather conditions). Encouraging cycling in the winter months has its own set of issues and its own collection of academic literature distinct from that related to bike-transit integration. As such, some of the analysis and resulting conclusions may only be appropriate for bike-transit travel in relatively ideal weather conditions experienced in the summer and fall months.

Data accuracy

The data collected offers only a 'snapshot' of bike-transit integration in Edmonton based on information provided by planning and engineering professionals selected for interviews, and cyclists at LRT stations who were encountered mostly randomly. Due to time and resource constraints, a more statistically significant study was not possible; however, the data collected should still reasonably reflect the current state of bike-transit integration in Edmonton.

The analysis of the data collected from the surveys – in particular, data regarding trip origins and destinations – is only as accurate as how it was provided by the participants. For example, origin and destination locations provided by participants could be affected by their desire to remain more anonymous, despite any assurances that all responses were to remain as such. Additionally, as surveys were only conducted at eleven of the fifteen stations on the LRT system, and only at peak morning and afternoon travel times, the data collected may not necessarily be representative of all bike access trips throughout the entire LRT system.

4.7 Biases

This project was carried out by a researcher who is heavily in favour of active transportation – in particular, cycling – and public transportation as modes for everyday commuting. The researcher has also worked in the field of transportation engineering and transportation planning with the City of Edmonton, and had briefly served on the board of directors for bicycle advocacy group Edmonton Bicycle Commuters Society prior to the commencement of this project. Despite the researcher's interests and volunteer and work experience, this practicum was not formally funded or overseen by Edmonton Bicycle Commuters Society or any City of Edmonton staff in any way whatsoever.

5.0 Findings

The following section discusses data collected from desktop site analyses, observations, structured interviews (i.e. surveys), and semi-structured interviews. Trend and common themes in data will be identified and discussed further.

Note that mention of an "average access and egress radius" is made several times throughout this analysis. This radius is the average distance cyclists bike to LRT station from their trip origin, or to their trip destinations from LRT stations. The average distance is used as a general guideline for inter-station comparisons in the following sections. A more detailed discussion on this average radius and how cyclists access and egress LRT stations specifically can be found in *§ 5.3 Surveys*.

Additionally, as per my research questions, several "station types" will be developed based on the data collected, discussed in *§ 5.4 Station types*. In reality, many different criteria can be used to determine different "types" of stations (e.g. station types based on ridership, local road infrastructure, and/or local population density, perhaps). In this research project, the types will be determined mostly based on data collected from site analyses and surveys.

Below lists several terms that will be referred to regularly and often throughout this section. The definition of these terms are provided below.

City of Edmonton bike infrastructure

***Table 5.1**: City of Edmonton bike infrastructure descriptions*

Term	Description
Shared-use paths (*SUP*)	3m-wide paved pathways shared by both pedestrians and cyclists, separated from vehicular traffic. They are often found adjacent to LRT tracks and high-speed arterial roadways. SUPs in the North Saskatchewan River Valley are typically for recreational use.
Bike lanes	Painted onto roads along with formal bike symbols offering cyclists visual separation from vehicular traffic, but no physical separation from vehicular traffic.
Bike routes	Vehicular roads with bike signage, but no formal bike symbols or lanes painted on the pavement, offering cyclists no visual or physical separation from vehicular traffic.
Signed peak-hour bike/bus/taxi lanes	Vehicular lanes that convert to shared bus/bike/taxi lanes during morning and afternoon rush hours. There are no formal bike symbols painted on the pavement in these lanes, offering cyclists no visual or physical separation from vehicular traffic.

City of Edmonton area descriptions

Edmonton's many neighbourhoods are included in four "areas" as defined by the City (as per City of Edmonton, 2015, p. 12), also discussed previously in §*2.4 Edmonton's urban context*.

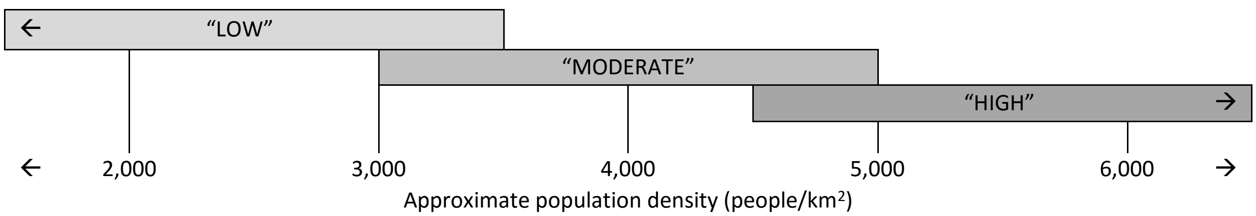
***Table 5.2**: City of Edmonton area descriptions*

Term	Description
"Core" areas	"Downtown and adjacent neighbourhoods."
"Mature" areas	"Neighbourhoods outside the core, generally completed prior to 1970." Some neighbourhoods in these areas are suburban in nature - e.g. almost exclusively single-family homes.
"Established" areas	"Completed neighbourhoods, generally within the Anthony Henday Transportation Corridor [i.e., the circuitous ring urban freeway surrounding the city]." Most neighbourhoods in these areas are typically more suburban in nature – e.g. almost exclusively single-family homes.
"Developing" areas	"Currently developing and planned neighbourhoods where lot registration is not yet complete". Most neighbourhoods in these areas are typically more suburban in nature – e.g. almost exclusively single-family homes.

Population density and access to bike lanes or shared-use paths

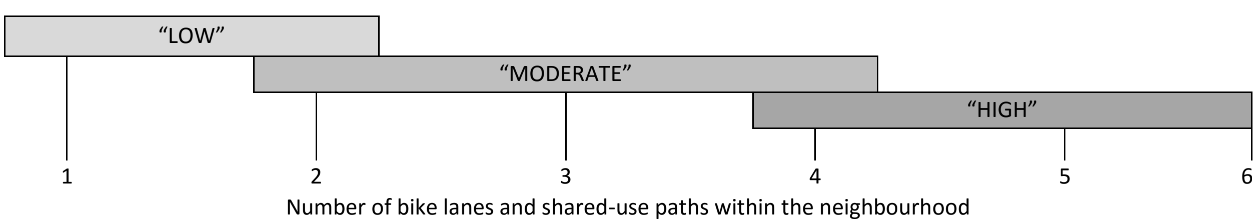
"Low", "moderate", and "high" are used to describe the population densities of City neighbourhoods and the how much access to bike infrastructure these neighbourhoods have. Note that these descriptors are relative and specific to the Edmonton context only, as defined in the tables below.

Figure 5.1*:* City of Edmonton neighbourhood population density definition



In this case, some population densities may fall into two categories. For example, a population density of 3,250 people/km^2 may be considered "low/moderate", and a population density of 4,750 people/km^2 may be considered "moderate/high."

Figure 5.2*:* Neighbourhoods' access to bike lanes and SUPs



In this case as well, some numbers may fall into two categories. For example, two SUPs or bike lanes may be considered "low/moderate", and four SUPs or bike lanes may be considered "moderate/high."

5.1 Site Analyses

Edmonton's Light Rail Transit network spans fifteen stations over its 21-km route, and travels through three general areas of the city: from the city's northeast, through the downtown core, and terminating in the city's south. A review of the neighbourhoods that the LRT system travels through based on the City of Edmonton's 2014 Municipal Census as well as Google Maps satellite imagery shows relatively distinct urban contexts for the aforementioned three areas – northeast, downtown, and south. The findings discussed below have been organized based on these three areas.

5.1.1 Northeast

The northeast portion of the LRT network – generally running from Clareview, the northern terminus, to Stadium – is the oldest part of the system dating back to its opening in 1978. It connects Edmonton's northeast neighbourhoods with downtown and the central business district (CBD) running along a dedicated rail right-of-way owned by Canadian National Railway.

Neighbourhoods

The neighbourhoods served by the LRT in the northeast are mostly mature or established neighbourhoods, as defined by City of Edmonton planning documents. Neighbourhoods around Clareview, the northern terminus, have seen some newer developments in recent years, including newer condominium developments, commercial areas, and community centres. Though more developed than other neighbourhoods in the northeast, neighbourhoods adjacent to Clareview are still relatively suburban containing, almost exclusively, single-family detached homes, and some strip malls and big box stores.

Further south, Coliseum and Stadium stations serve both residential areas as well as recreational and light industrial areas, including sporting venues like Commonwealth Stadium (where the Canadian Football League's Edmonton Eskimos play) and Rexall Place (where the National Hockey League's Edmonton Oilers play). These areas have much lower population density due to expansive surface parking lots required for sporting venues and light industrial developments. In addition to these industrial and recreational land uses, neighbourhoods around these stations are mature with grid-pattern streets, and contain mostly single-family homes and some low-rise apartment buildings, and occasional strip malls and high streets.

Table 5.3 shows characteristics of typical neighbourhoods – as defined and recognized by the City of Edmonton – that are found in the northeast area of the city and adjacent to LRT stations. The table shows that neighbourhoods here have relatively lower population and job densities, and can be described as either 'suburban' or 'inner city.'

Figure 5.3: Locations of the neighbourhoods profiled in ***Table 5.3***
(image source: Google Maps, adapted by author)

Table 5.3: Profiles of typical neighbourhoods found in northeast Edmonton

Neighbourhood	1 – Belvedere	2 – Belmont	3 – Eastwood
Map			
Population	5,446	5,320	4,304
Approximate area (km²)	1.670	1.260	1.130
Population density (people/km²)	3,261	4,222	3,809
Neighbourhood characteristics	Single-family detached homes, some apartment buildings	Single-family detached homes	Single-family detached homes, some apartment buildings and strip malls
Relative population density	Low / moderate	Moderate	Moderate
Relative job density	Low	Low	Low
Access to bike lanes and SUPs	Low	High	Moderate
General description	Mature	Established / suburban	Mature
Median household income*	$33,683	$56,176	$30,065

Data source: City of Edmonton, 2016c; Image sources: City of Edmonton, 2016b
*According to 2001 Census of Canada (City of Edmonton, 2001)

Active transportation routes

A shared-use path (SUP) parallels the LRT tracks from Churchill station (downtown) to just south of Belvedere station. The parallel SUP stops south of Belvedere due to a railway overpass and new developments in the area, which makes the extension of the SUP unfeasible. There are existing, informal plans at the City to gap the active transportation connection between Belvedere and

Clareview through low-volume, local streets; however, the timeframe for this project has not been established. Also located within the access/egress radius of all northeastern stations are an assortment of signed bike routes and other SUPs. Few painted bike lanes exist in this area of the city. Figure 5.4 shows bike infrastructure as identified on the City of Edmonton bicycle map in the city's northeast.

Figure 5.4: City of Edmonton bike infrastructure in the northeast
(Image source: City of Edmonton, 2013, adapted by author)

5.1.2 Downtown

The downtown portion of the LRT network serves the CBD and mixed-use residential and commercial neighbourhoods adjacent. Central was the original southern terminus at the time of the system's opening in 1978. The system was expanded several times over the following decade, eventually reaching Grandin as the new terminus in 1989. In the CBD, the LRT travels under Jasper Avenue, a main downtown thoroughfare. All stations in the CBD are underground, with multiple entrances from street level and underground through the Pedway system – a network of below-, at-, and above-grade walkways connecting office buildings and retail areas in downtown Edmonton.

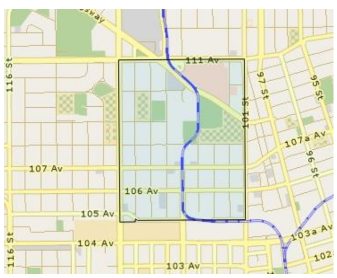
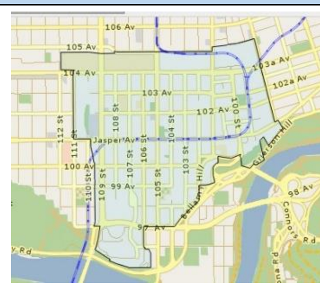
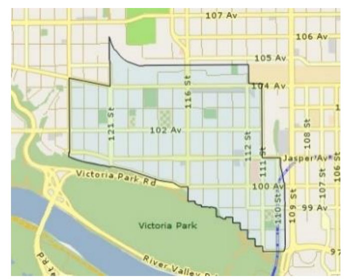
Neighbourhoods

Given downtown Edmonton's mixed-use characteristics and central location, there is a higher job and population density in neighbourhoods adjacent to LRT stations. These stations mostly accommodate those who work and/or live downtown, and consist of high-rise office buildings, surface parking lots, and some high-rise apartment buildings. Residential neighbourhoods adjacent to the CBD – directly north and west – are mostly within walking distance to LRT stations, and contain almost exclusively high-rise or low-rise apartment buildings.

Table 5.4 shows characteristics of typical "neighbourhoods" found in Edmonton's central core and adjacent to LRT stations. The table shows that neighbourhoods have relatively higher population and job densities, and can be described as 'downtown'.

Figure 5.5: Locations of the neighbourhoods profiled in ***Table 5.4***
(image source: Google Maps, adapted by author)

Table 5.4: Profiles of typical neighbourhoods found in northeast Edmonton

Neighbourhood	**1 – Central McDougall**	**2 – Downtown**	**3 – Oliver**
Map			
Population	5,665	13,148	19,135
Approximate area (km^2)	1.210	2.280	1.720
Population density (people/km^2)	4,682	5,767	11,125
Neighbourhood characteristics	Low-rise apartment buildings, some single-family detached homes, MacEwan University	High-rise office and apartment buildings, some low-rise apartment buildings	Low-rise and high-rise apartment buildings, some strip malls
Relative population density	Moderate / high	High	High
Relative job density	Moderate	High	Moderate
Access to bike lanes and SUPs	Low	Moderate	Moderate
General description	Core	Core / downtown	Core / downtown
Median household income*	$21,323	$30,187	$32,389

Data source: City of Edmonton, 2016c; Image sources: City of Edmonton, 2016b
*According to 2001 Census of Canada (City of Edmonton, 2001)

Active transportation routes

Signed bike routes are common in the CBD and other central neighbourhoods. There are few SUPs in these neighbourhoods with the exception of those in the North Saskatchewan River valley. There are some signed peak-hour bike/bus/taxi lanes on major thoroughfares, including Jasper Avenue and 102 Avenue.

The City of Edmonton is currently undertaking a project to install a bi-directional bike lane on 102 Avenue, separated from traffic by a concrete barrier, just west of downtown and the CBD. 102 Avenue is informally and anecdotally known as a major route for cyclists travelling between downtown and the city's western neighbourhoods, already popular with many cyclists today.

Figure 5.6 shows bike infrastructure as identified on the City of Edmonton bicycle map in the city's downtown.

Figure 5.6: City of Edmonton bike infrastructure in the downtown and inner city
(Image source: City of Edmonton, 2013, adapted by author)

5.1.3 South

The south portion of the LRT network serves communities south of the North Saskatchewan River as well as the University of Alberta. The network first reached University station as its new southern terminus in 1992. South of University the LRT emerges from underground and travels at-grade on its own right-of-way separate from vehicular traffic, in the median of 111 Street – a main north/south thoroughfare in south Edmonton. Several expansions in the 2000s extended the southern terminus to its existing location at Century Park in 2010.

Neighbourhoods

There are two main areas served by the south portion of the LRT system: the University of Alberta and adjacent areas, and neighbourhoods in south Edmonton.

University of Alberta

The main neighbourhoods surrounding stations in the northern half of the south portion of the LRT network are either the University of Alberta campus itself, or the mixed-use areas that serve, accommodate, and house many students, staff, and faculty of the University. According to the City of Edmonton, University station sees the most ridership out of all stations on the LRT system – 13.2% of all LRT ridership in terms of boardings and alightings (City of Edmonton, 2014a). These neighbourhoods are defined as core or mature neighbourhoods.

Most areas immediately adjacent to the University of Alberta and University station are denser, with high-rise and low-rise apartment buildings, some single-family detached homes, and several commercial high streets. South Campus / Fort Edmonton Park station is located adjacent to University farmland; however, the neighbourhoods adjacent to this farmland are mature and made up almost exclusively of single-family detached homes.

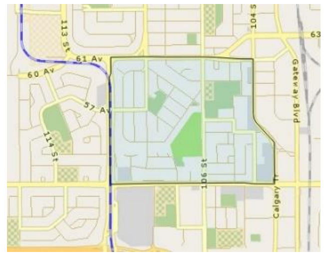
South Edmonton

Like some of the neighbourhoods in the north portion of the LRT system, neighbourhoods around stations south of the University are less dense and more suburban in nature, containing almost exclusively single-family detached homes with occasional large commercial shopping centres and strip malls. Entrance to LRT stations in south Edmonton – Southgate and Century Park – are via overhead walkways from sidewalks, SUPs, and bus transfer areas.

Table 5.5 shows characteristics of typical "neighbourhoods" found in south Edmonton and adjacent to LRT stations. The table shows that some south Edmonton neighbourhoods are similar to those in northeast Edmonton, with relatively lower population and job densities, and can be described as 'suburban' or 'inner city.'

Figure 5.7: Locations of the neighbourhoods profiled in ***Table 5.5***
(image source: Google Maps, adapted by author)

Table 5.5: Profiles of typical neighbourhoods found in northeast Edmonton

Neighbourhood	1 – Queen Alexandra	2 – Pleasantview	3 – Greenfield
Map			
Population	5,038	4,229	3,616
Approximate area (km²)	1.230	1.480	1.530
Population density (people/km²)	4,096	2,857	2,363
Neighbourhood characteristics	Single-family detached homes and low-rise apartment buildings, high street	Single-family detached homes, some low-rise apartment buildings	Single-family detached homes, one strip mall
Relative population density	Moderate	Low	Low
Relative job density	Moderate	Low	Low
Access to bike lanes and SUPs	Moderate	Moderate / high	High
General description	Mature	Mature	Mature / suburban
Median household income*	$31,806	$39,161	$71,563

Data source: City of Edmonton, 2016c; Image sources: City of Edmonton, 2016b
*According to 2001 Census of Canada (City of Edmonton, 2001)

Active transportation routes

Similar to the northeastern section, there is a SUP that parallels the LRT network south of the University, along either the west or east side of 111 Street, and in some cases on both sides. At and around the University there are various signed bike routes, which include sharrows (with no painted bike lane) and counterflow bike lanes on vehicular one-way streets. Several major arteries in south Edmonton feature parallel SUPs, and other streets feature painted bike lanes. Some of these routes have recently been the focus of much research and attention by City Council and staff, as Council has been considering removing these painted bike lanes in exchange for higher-quality separated bike lanes and/or SUPs in its place or in more central, downtown areas (Dubois, 2014b). Some of these lanes and paths lead directly to LRT stations, or will allow cyclists to access the infrastructure that does.

Figure 5.8 shows bike infrastructure as identified on the City of Edmonton bicycle map in south Edmonton.

Figure 5.8: City of Edmonton bike infrastructure in the south
(Image source: City of Edmonton, 2013, adapted by author)

5.1.4 Summary

Based on the above data, some conclusions can be drawn regarding the characteristics of the various neighbourhoods the LRT system travels through.

Neighbourhoods around LRT stations in the extreme northeast or south are mostly suburban in nature, with lower population and job densities. Some neighbourhoods may still be developing, but many others are defined as mature by the City. The number of bike lanes and SUPs in these areas are usually moderate or high, though some lanes and SUPs do not offer good connectivity and access to LRT stations.

Neighbourhoods around LRT stations in central, downtown Edmonton have a much higher job and population density. Access to bike lanes and SUPs in these areas is low.

Neighbourhoods in between the above mentioned areas both north and south of downtown are mature with moderate population and job densities. Some specific areas may have higher population and job densities, like the University of Alberta, for example. Access to bike lanes and SUPs in these areas can be high in certain areas (e.g. around the university), but is generally more moderate.

5.2 Observations

Unobtrusive observations were taken at LRT station entrances and/or beside bike racks near station entrances. For stations with multiple entrances and groups of bike racks, observations were taken from a location where multiple groups of bike racks were easily within view (e.g. at stations in south Edmonton, on a pedestrian overpass leading to the station platform). Morning and afternoon observations were taken at eight of the fifteen stations on the LRT system. Some stations were only observed either in the morning or in the afternoon.

Table 5.6 shows the number of cyclists observed accessing and egressing each LRT station. The station summaries in *Appendix A* provide more details and a specific breakdown of what time each cyclist accessed or egressed a station. The following commentary has been separated into three sections – northeast, downtown, and south – to mirror the previous analysis.

Table 5.6: Summary of observations

Station	Description of surrounding neighbourhood	AM (approx. 06:00-09:00)		PM (approx. 15:00-18:00)		*Total*
		Access	Egress	Access	Egress	
Stadium	Mature	Observations not taken		2	0	***2***
Churchill	Core	0	0	0	0	***0***
Bay / Enterprise Square	Core	0	0	0	0	***0***
Corona	Core	2	0	1	0	***3***
University	Mature	1	0	0	1	***2***
McKernan / Belgravia	Mature	4	0	Observations not taken		***4***
Southgate	Mature	16	0	3	5	***24***
Century Park	Suburban	26	0	3	26	***55***
	Total	***49***	***0***	***9***	***32***	***90***

Observations were only taken for one afternoon at one station in northeast Edmonton, so drawing any conclusions based on this would likely be inaccurate. The one set of observations conducted did reveal few people who accessed and egressed stations by bike in this area of the city, relative to other areas of the city. This can be confirmed in the survey results, discussed in *§ 5.3 Surveys*. A lower number of cyclist access and egress at these stations may be due to some of the stations' close proximity to downtown and the CBD, where a large number of trip destinations are. For example, Stadium and Coliseum are only approximately 2.5 km and 4.5 km away by bike, respectively. As these distances are relatively short and manageable commutes by bike, many cyclists living in around these LRT stations may choose to bike the entire length of their commute instead of integrating their trip with the LRT.

Despite multiple observations taken at multiple station entrances, the downtown stations observed saw very little access and egress by bike. During the process of making the observations however, many bikes were noticed travelling on the roadway adjacent to station entrances. This may indicate that people do indeed bike to, from, and within the downtown core and CBD despite not using the LRT system as often.

LRT stations in south Edmonton saw much more access and egress by compared to other stations on the system. At Southgate and Century Park, many cyclists were observed accessing the stations via the SUP paralleling the LRT line along either side of 111 Street. At the time the observations and structured interviews were performed, a bike locker (with capacity to carry six bikes) was in active use at Century Park. This bike locker was placed at its location on a trial basis by Edmonton Transit Service (ETS) and had been moved to different stations at irregular intervals so that ETS could find out which stations would see the highest usage.

5.2.1 Summary

The observations show that people do indeed take multi-modal bike-LRT trips in Edmonton. Multiple people accessing and egressing LRT stations by bike, on multiple days, at multiple stations shows that bike-transit integration is regularly done by a segment of the commuting population.

The observations show that accessing LRT stations by bike in the morning and egressing stations by bike in the afternoon was common, mirroring regular work or school commuting patterns shared by other commuters who also use the LRT. The purposeful and work- and school-related nature of these trips is a trend also confirmed in the results of the structured interviews.

On several occasions, vandalized bikes and bikes missing parts or wheels were observed already locked to bike racks at stations. Bike security may be considered an issue by some cyclists, and the lack of safe and secure bike parking may also be a deterrent to cycling to LRT stations.

5.3 Surveys

Structured interviews were conducted in August 2015 in both morning and afternoon peak periods at stations across the entire LRT system. A table summarizing the survey responses for each LRT station at which interviews were conducted has been included in *Appendix B*. Data collected from these interviews, as well as from the data analyses above, has been summarized for each individual station ("station summaries"), and has been included in *Appendix A*. All responses recorded from structured interview participants can be found in *Appendix C*.

5.3.1 Trip purpose

Table 5.7: Trip purpose of surveyed cyclists

Trip purpose	Number of cyclists	
Work	53	(69%)
School	8	(10%)
Recreational	3	(4%)
Personal*	13	(17%)
TOTAL	***77***	***(100%)***

*e.g. miscellaneous errands, visiting friends or family, shopping

The survey responses reveal that the majority of cyclists accessing and egressing LRT stations had taken purposeful trips – i.e. trips to or from school or work (79%). As such, bike-LRT trips from stations outside of central Edmonton to stations at the University of Alberta and downtown were popular during the morning, while bike-LRT trips in the opposite direction were popular during the afternoon. The remainder of cyclists accessing and egressing LRT stations had taken recreational or personal trips (21%).

5.3.2 Boarding with bikes

Table 5.8: Cyclists boarding LRT with bike

Boarding with bike	Number of cyclists							
	All		South		Downtown		Northeast	
Yes	35	(45%)	24	(43%)	2	(100%)	9	(47%)
No	42	(55%)	32	(57%)	0	(0%)	10	(53%)
TOTAL	***77***	***(100%)***	***56***	***(100%)***	***2***	***(100%)***	***19***	***(100%)***

Only a slight majority of cyclists did not/were not going to board the LRT with their bikes (55%), while many cyclists did or were going to board the LRT with their bikes (45%). This, despite ETS not allowing bikes on LRT trains during peak morning and afternoon periods (07:30 to 09:00, and 16:00 to 17:30), which is when many of the cyclists – who had boarded or were going to board with their bike – were surveyed. With the exception of stations in the downtown core, this proportion of cyclists who did/were and did not/were not going to board the LRT with their bikes was similar in neighbourhoods across the city.

5.3.3 Access routes

Table 5.9: Cyclists' access routes

Primary infrastructure used	Number of cyclists							
	All		South		Downtown		Northeast	
SUP	25	(33%)	22	(39%)			3	(15%)
SUP + bike lane	2	(3%)	2	(4%)				
SUP + road	16	(21%)	10	(18%)			6	(32%)
Bike lane	5	(6%)	4	(7%)			1	(5%)
Local road	15	(19%)	8	(14%)	1	(50%)	6	(32%)
Arterial road	5	(6%)	4	(7%)			1	(5%)
No data	9	(12%)	6	(11%)	1	(50%)	2	(11%)
TOTAL	***77***	***(100%)***	***56***	***(100%)***	***2***	***(100%)***	***19***	***(100%)***

The type of road and active transportation infrastructure that cyclists used to get to and from stations varied between stations. This is likely due to different infrastructure existing around different stations and neighbourhoods, and different people having different comfort levels cycling on roads with dedicated bike lanes and/or with mixed traffic. When participants were asked which routes they took to get to the LRT station or which route they were going to take to get to their final destination, some could identify their route in more detail than others – e.g. some identified specific streets and SUPs, while others gave more vague statements like "I just biked through that neighbourhood over there [*points*] on small, quiet streets."

Many access trips were taken using infrastructure specific to active transportation, like SUPs. Other trips were taken on vehicular roadways with or without painted bike lanes. The maps found in each station summary in *Appendix A* show generally how cyclists accessed stations. In cases where participants didn't provide enough detail regarding the routes they had or were intending to take, the most direct route (by bike) mapped through Google Maps was used. Approximately 47 survey entries (61%) required some degree of route estimation using Google Maps. Note that this may translate into some inaccuracies in Table 5.9 above.

Northeast

LRT stations in northeast Edmonton didn't see as much bike access as stations in the south; however, the data indicates that the SUP paralleling the LRT tracks was used regularly by those who did access stations. Other SUPs alongside major arteries and bike lanes in newer developments adjacent to Clareview, the northern terminus, were also popular with cyclists. Some cyclists were comfortable riding in mixed traffic on roads with no signed or painted bike route or lane. Many others (approximately 32%) accessed LRT stations using low-volume, local streets without bike route signage or a painted bike lanes.

Downtown

The routes which cyclists took to get to or from stations in central areas and the CBD were more varied, both in terms of length of travel and road infrastructure used. A general lack of painted bike lanes and dedicated active transportation infrastructure in central neighbourhoods meant that cyclists likely travelled on low-volume, local streets and/or streets with signed bike routes. In the absence of bike infrastructure, cyclists could also have likely taken whatever route that was most convenient for them, regardless of vehicular traffic volume.

A larger and potentially more comprehensive collection of access and egress data is not available for downtown LRT stations as, firstly, they saw fewer cyclists in general, and secondly, those who did access or egress by bike typically didn't travel far due to the nature of the neighbourhood being high in job and population density – that is, many cyclists egressing from downtown stations in the morning, for example, traveled only several city blocks (or even shorter distances) to their workplace and final trip destination.

South

For those surveyed, access to and egress from stations in the south were largely made on SUPs and painted bike lanes – approximately 61% of trips involved the use of SUPs, and 9% of trips involved the use of bike lanes. According to the data collected, the SUP paralleling the LRT tracks on 111 Street was used fairly regularly as an access route, confirming what was observed during the station observations, discussed previously. If a SUP did not serve as a direct route between an LRT station and a trip origin or destination, many respondents incorporated a SUP into their trip in some way – i.e., in the case of accessing a station, they would bike on small, local streets or in a bike lane in order to access a SUP, which would then take them directly to a station. Notably, one respondent claimed to regularly bike on the shoulder of the Queen Elizabeth II Highway – the only high-speed, freeway-like artery linking the cities of Edmonton and Calgary – from Century Park, the southern terminus, to his workplace in Nisku, an industrial and business hamlet approximately 10 km south of Edmonton city limits.

5.3.4 Access distances

The average bicycle access distance for all the LRT stations surveyed was 2.26 km, though there was variation in this distance depending on where the station is located, and what the characteristics of the surrounding neighbourhoods are. The data shows, generally, more suburban stations towards either termini saw access and egress distances much greater than those seen at stations in inner city or central neighbourhoods. The station summaries found in *Appendix A* show the location of cyclists' trip origins or destinations and the approximate distance traveled to the respective station.

Table 5.10: Cyclists boarding LRT with bike

Range	Average LRT station access/egress distance			
	All	South	Downtown	Northeast
Low	0.2 km	0.7 km	0.2 km	2.1 km
High	4.1 km	4.1 km	1.4 km	3.3 km
AVERAGE	***2.3 km***	***2.0 km***	***0.8 km***	***2.4 km***

Table 5.10 summarize the average bike access/egress distances surveyed at LRT stations in different parts of the city. LRT stations in northeast Edmonton saw average cyclists access/egress distances ranging from 2.1 km to 3.3 km. These distances are relatively high, compared to the system-wide average. LRT stations in downtown Edmonton saw much shorter bicycle access/egress distances, ranging from 0.2 km to 1.4 km – the former, likely the distance of a city block or two. The relatively high job and population density around LRT stations downtown is a possible contributor to this shorter access/egress distance. LRT stations in south Edmonton saw a larger range of average access/egress distances. Stations at and near the University of Alberta saw distances ranging from 0.7 km to 1.4 km, while stations towards the southern terminus saw average access and egress distances ranging from 1.5 km to 4.1 km. The relatively high job and population density around LRT stations at and near the university is a possible contributor to this shorter access/egress distance.

5.3.5 Summary

The above data shows that the majority of bike-LRT trips taken were purposeful in nature and involved regular commuting to/from school or work. In the morning, bike-LRT trips towards downtown were common, while in the afternoon bike-LRT trips leaving downtown towards either the north or south terminus were common. Active transportation infrastructure – namely, SUPs, but also bike lanes and signed bike routes – when available and easily accessible to/from LRT stations, was used regularly by cyclists. It is likely that many cyclists also chose to use local, low-volume roads as well in order to reach stations or their final destinations. Also, cyclists whose trip origins or destinations were in more suburban neighbourhoods had to travel relatively farther to/from LRT stations compared to cyclists whose origins or destinations were in more central neighbourhoods.

5.4 Station types

Table 5.11 includes a matrix identifying each LRT station in relation to the distinguishable features of the urban contexts they exist in, as outlined and discussed in the sections above. Station types will be identified based on common characteristics shared by various LRT stations.

***Table 5.11**:* Matrix showing which potential station type each LRT station may belong to

Location	Station	Population and job density of neighbourhood LRT station located in			Number of bike lanes or SUPs found within neighbourhood LRT station located in			Average access distance surveyed at LRT station		
		Low		High	Low		High	Low		High
Northeast	Clareview	●					●		●	
	Belvedere		●			●				●
	Coliseum		●			●				●
	Stadium		●			●		●		
Downtown	Churchill			●	●			●		
	Central			●	●			●		
	Bay / Enterprise Sq.			●	●			●		
	Corona			●	●			●		
	Grandin			●	●			●		
South	University		●			●		●		
	Health Sci. / Jubilee		●			●		●		
	McKernan / Belgravia		●			●		●		
	S. Campus / Ft. Edm. Pk.	●					●			●
	Southgate	●					●		●	
	Century Park	●					●			●

The above matrix shows general trends specific to several sets of stations:

- LRT stations found in more suburban areas with a lower population and job density generally have a higher occurrence of bike lanes and SUPS in adjacent neighbourhoods and a higher surveyed bike access distance;

- LRT stations found in mature or established areas with a moderate population and job density generally have a moderate occurrence of bike lanes and SUPs in adjacent neighbourhoods and a lower or moderate surveyed bike access distance; and
- LRT stations found in core areas with higher population and job density generally have a low occurrence of bike lanes and SUPs in adjacent neighbourhoods and a lower surveyed bike access distance.

These trends are the **station types** for Edmonton's LRT stations, as summarized in Table 5.12 below.

Table 5.12: Edmonton's station types

	***Type A* – Core**	***Type B* – Mature**	***Type C* – Suburban**
General density and characteristics of neighbourhoods	• High population and job density • Downtown, CBD • High-rise office buildings • High- and low-rise apartment buildings	• Moderate population and job density • Mature or established areas • Mostly single-family homes with some area of higher job densities	• Low population and job density • Mostly established areas • Almost exclusively single-family homes
Surrounding area's access to bike lanes and SUPs	• Low	• Moderate/low	• Moderate/high
Average bike access distance surveyed at LRT station	• Low • 0 km – 1.5 km (approximately)	• Moderate • 1.5 km – 3.0 km (approximately)	• Moderate / high • Over 3.0 km (approximately)
Applicable LRT stations	• Churchill • Central • Bay / Enterprise Square • Corona • Grandin	• Stadium • University • Health Sciences / Jubilee • McKernan / Belgravia • Southgate	• Clareview • Belvedere • Coliseum • S. Campus / Ft. Edm. Pk. • Century Park

5.4.1 Summary

Figure 5.9 summarizes the station types listed above in visual format.

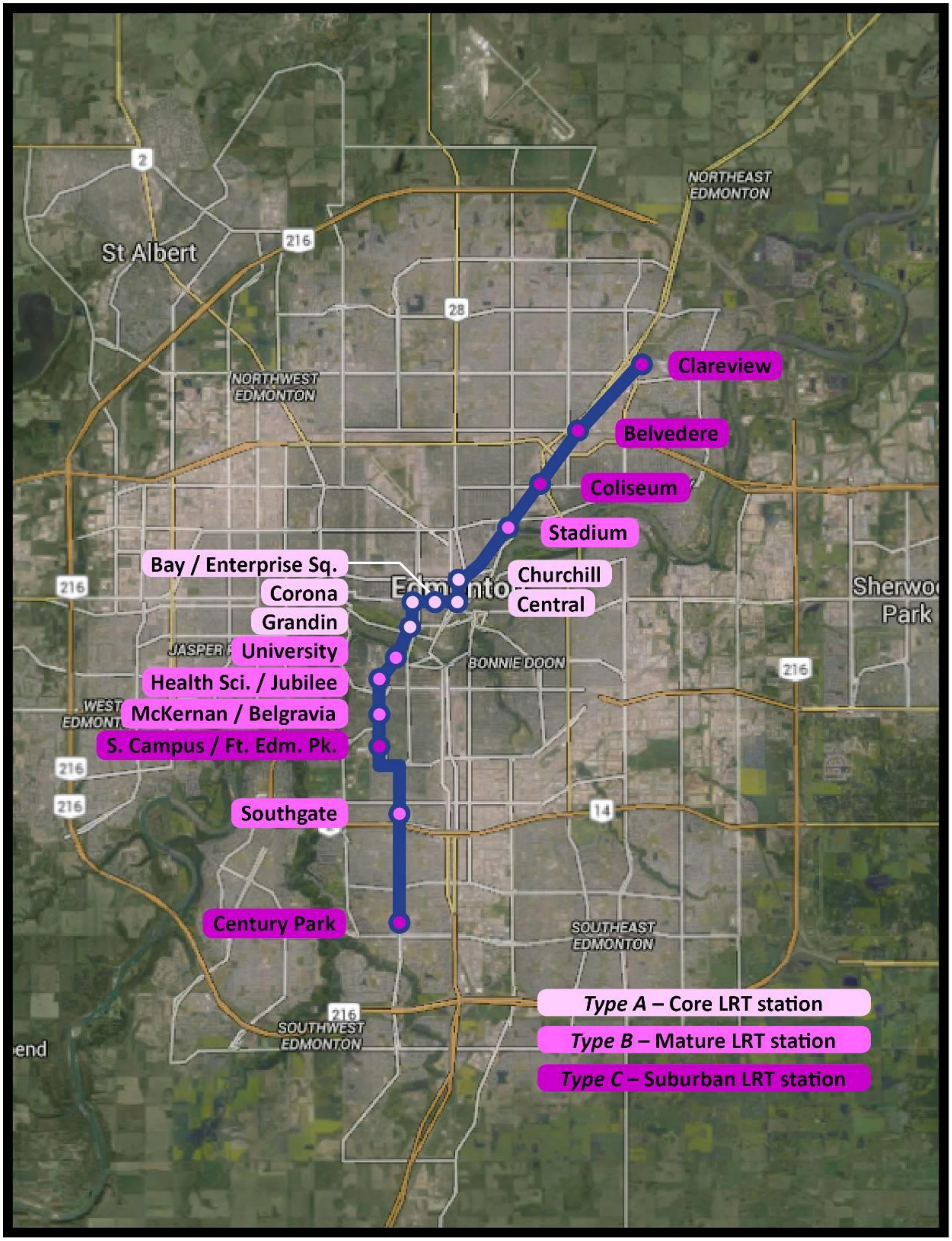


Figure 5.9: Edmonton's LRT station with colour-coded station types shown (image source: Google Maps, adapted by author).

5.5 Practitioner interviews

The above analyses show that bike access to LRT stations and multi-modal bike-LRT trips do indeed occur, despite the perceived challenges relating to bike infrastructure, bike parking, and bike policy. The City of Edmonton employs a team of planners and engineers who look after LRT and bike facilities in the city. The next part of this research project involved asking these professionals to reflect on their perception of the challenges of bike-transit integration in Edmonton and how it could be improved. Any parallels to the data presented previously will be subsequently summarized and discussed.

Participants

A total of seven people participated in six different interviews (one interview involved two participants). The interview participants included a cycling advocate with Edmonton Bicycle Commuters Society, a Professional Engineer who recently worked at City of Edmonton Transportation Planning, two City Councillor familiar with the City's recent push for the implementation of more sustainable modes of transportation and whose wards contain LRT infrastructure and a variety of bike infrastructure, and three Planners with the City of Edmonton who chose to remain anonymous. The list of participants, their affiliations, and the interview schedules can be found in *Appendix D*.

These interviewees all have knowledge of the existing LRT network and the different kinds of bike infrastructure in Edmonton today. They were also aware – prior to the interviews – that bike-transit integration existed in Edmonton, and they had their own ideas and perceptions of what the challenges of bike-transit integration in Edmonton are. Through coding their interview transcripts, trends and themes were noted regarding the existing challenges of bike-transit integration in Edmonton, infrastructure precedents from other jurisdictions that the City could emulate, and suggested projects and improvements moving forward. Discussions of areas in which Edmonton was performing well in – e.g. development projects that encouraged bike-LRT trips – were also noted.

Despite the conversation being about bike-transit integration in Edmonton, discussions with participants usually strayed into other, related – and important – topics as well. For example, participants noted often that a general lack of bike infrastructure in the city does not foster bike-transit integration. These lines of discussion were probed further, when appropriate.

5.5.1 Existing challenges of bike-transit integration

Participants noted various existing challenges to bike-transit integration in Edmonton, which generally fell into two categories: challenges with the 'user experience' as a cyclist on Edmonton streets, and challenges with the regulatory, organizational, and/or financial framework in the City.

5.5.1.1 User experience challenges

In many ways, the interview participants' views of the challenges that cyclists currently face match what was observed during both station observations and surveys.

Some of the City's planners described the existing state of bike-transit integration as "non-existent". City Councillors echoed this statement, describing bike-transit integration in Edmonton as "poor" and "not great", yet "evolving."

Many participants cited a general lack of secure bike parking – ultimately leading to potential vandalism and theft – as one of the main challenges to bike-transit integration. As Tyler Golly, an active transportation engineer with experience both in the public and private engineering sectors in Edmonton, described, the bike parking that *is* available at LRT stations "[doesn't provide] the quality of facility that people would feel comfortable leaving … even moderately priced bikes at … all day, or even for a number of hours."

Another main challenge identified by those interviewed is the lack of dedicated bike infrastructure in the city in general, or maintenance and connectivity issues with existing bike infrastructure, like SUPs. Edmonton planners noted how the integration of bikes and LRT in Edmonton appears to be "an afterthought more than a strategy to integrate modes." This thought is echoed by Chris Chan – Executive Director of advocacy group Edmonton Bicycle Commuters Society (EBC), with years of experience cycling in Edmonton – who says "connectivity to bike routes is broken" at LRT stations and transit centres; and even City Councillor Scott McKeen – Councillor for the ward which contains central Edmonton, including downtown and the CBD – who stated that Edmonton "[doesn't] have a comprehensive bike and bike-integrated network right now".

With respect to boarding LRT trains with a bike, participants recognized that many cyclists do choose to integrate their trips with the LRT in this manner; however, there are challenges with this as well. Golly mentions that LRT trains aren't designed to accommodate bikes, and during busier times, trains can get overly crowded, which is not conducive to carrying bikes. He also mentions the actual act of accessing train platforms – ascending and descending stairs or using elevators – is difficult and inconvenient for many. Chan says that being able to bring your bike onto LRT trains expands the system's coverage; however, he warns that it is problematic that Edmonton Transit System's (ETS) policy doesn't allow for bikes on LRT trains during peak periods (morning and afternoon rush hours), which is common practice on some other cities' public rail transportation networks as well.

5.5.1.2 Challenges at the City

City planners mentioned a lack of specific development guidelines, which makes it difficult to ensure bike infrastructure like SUPs and separated bike lanes get constructed as a condition of new developments. Edmonton's planning department has recently been interested in installing bike stations – either stand-alone or in conjunction with new, private developments – in certain central neighbourhoods (discussed later); however, the general lack of understanding of their purpose and their spatial and financial requirements means neither developers nor City staff know what to include request for in project plans.

Many participants who currently or previously worked at the City of Edmonton cited the "silo-ing" of City departments and the ensuing lack of coordination and communication as a major barrier to the implementation of bike-transit integration in Edmonton. In other words, different departments with different procedures and workflows – and, in many cases, working in different physical locations – results in less coordination and communication on development, active transportation, and public transportation projects that should require a more collaborative and multidisciplinary approach right from the start. Some planners mentioned the sometimes-misaligned goals between departments on certain projects – new developments with an active transportation or LRT component, for example – can ultimately result in a work process and final product that feels uncoordinated. For example, the City's transportation planning department's goal for a project may be the need for free-flowing, unimpeded traffic, while the city-wide planning department's goal may be the need for slower moving traffic and fewer vehicle lanes in order for roads to be more tenable to walking and cycling.

Others cited a general lack of interest from the City that hasn't translated into more comprehensive plans and requirements for bike-transit integration at LRT stations. This was felt both by participants who do and do not work at the City. In describing EBC's cycling advocacy efforts, Chan stated that bike integration with public transit doesn't receive much attention both at EBC and with engineers and planners at the City because it doesn't appear to be the City's main focus.

Councillor McKeen stated that financial constraints are a challenge to bike-transit integration in Edmonton. For example, maintaining park-and-ride and bus transfer facilities at LRT stations (like Century Park) diverts funds away from other projects the encourage active modes of transportation to stations, like the installation of bike racks and SUPs. Both Councillors McKeen and Walters mentioned that active transportation and LRT projects are often dependent on funding available. Councillor Walters suggests that only about 1% of the City's transportation budget goes towards cycling initiatives. Councillor McKeen agrees and supports more investment into bike infrastructure – up to 3% of the transportation budget, in fact.

5.5.2 Existing challenges for creating bike infrastructure in Edmonton

A common theme in the above discussion identified the lack of bike infrastructure. All participants recognized that some form of infrastructure is needed in order for cyclists to safely travel to LRT stations. What often resulted were related discussions of the challenges the City of Edmonton faces with the installation of bike-specific infrastructure.

5.5.2.1 General challenges

The creation of bike infrastructure – including bike lanes and SUPs – can be contentious projects, depending on the neighbourhoods these projects exist in. The ability to garner enough community support for these projects in these neighbourhoods may become a liability. "A lot of people see bike infrastructure as a luxury," says one planner who is familiar with community consultation on bike-related projects in Edmonton. The planner added that at public meetings "[the City gets] feedback from the public that can be quite anti-bike, and that can have an impact on how people perceive the importance of [bike-transit] integration".

Other planners think that more coordination between City departments is needed to ensure that active transportation policy goals and targets are fully understood and met. One planner says that, based on personal experience, different City departments view transportation and planning policy directions differently, despite working on the same projects. Which can lead to the creation of a plan or design that other groups don't understand. This is an example of why different departments need to work together on projects from the start.

Like bike-transit integration, the installation of bike infrastructure is also limited by financial constraints. Councillor Mike Walters – whose ward lies in south Edmonton – says funding is one of the main challenges to creating bike infrastructure in Edmonton, and Edmontonians need the courage to aim for high-quality infrastructure as well as the "the will to spend the money on it."

Edmonton's "winter city" reputation may prove to be a large barrier to the creation and public acceptance of bike infrastructure as well. From planners to engineers to City Councillors, almost all participants cite Edmonton's "winter city" perception as a barrier to investing in and acceptance of bike infrastructure. In their experience, the participants have heard from the public that "bikes don't work in winter cities" and the City should not be investing in more bike infrastructure because "it's winter for nine months of the year." As one planner puts it, many members of the public think the City of Edmonton needs to "come up with an Edmonton approach" to managing its winter city perception; however, despite this, the planner maintains that "there [are] a ton of cities with snow where people ride bikes" and there are still "lots of… comparable examples that [Edmonton] could be learning from."

5.5.2.2 Deterrent to cycling

All participants note that the lack of bike infrastructure acts as a deterrent to cycling, in general, in the city; however, some participants mentioned Edmonton's car-dominant culture and status quo specifically as a considerable barrier as well. One planner mentioned the difficulty in maintaining bicycle infrastructure connectivity when bike lanes and SUPs intersect high-speed vehicular thoroughfares regularly. Chris Chan with EBC regularly cycles around Edmonton and noted that even at newer LRT stations where SUPs exist alongside the LRT tracks, connectivity is broken as cyclists are often required to ride on sidewalks or even dismount and walk through barriers. Councillor McKeen admitted that Edmonton is a spread out, "car-oriented city… behind the curve" on bike infrastructure (and bike-transit integration). He acknowledged that Edmontonians enjoy the perceived independence that cars provide, and the nature of car culture in the city means that people don't really think about using bikes for transportation.

Participants also recognized directly or indirectly that personal safety may be an overarching concern for cyclists and a deterrent to cycling as well. People may be hesitant to ride in traffic even with a dedicated painted bike lane, especially on a larger, high-speed arterial roadways. Councillor McKeen was quick to mention the 102 Avenue separated bike lane project currently underway in his ward. He hopes that bike infrastructure separated from vehicular traffic will encourage younger people and families to ride.

5.5.3 Bike-transit integration precedents

In asking what they thought good infrastructure encouraging bike-transit integration could look like, some interview participants shared several examples and precedents across Canada and abroad in which they've come to be familiar with either personally or through their line of work.

5.5.3.1 Bike Stations

The idea of "bike stations" were brought up consistently throughout many of the interviews with Edmonton planners. Such regular mention suggests that the design and implementation of bike stations could be a reality for the city in the foreseeable future.

Some of the planners admitted that they themselves are unsure of what a bike station would look like in Edmonton. However, bike stations are generally understood to be a secure enclosure for multiple (up to one hundred, as suggested by Councillor Walters) commuting cyclists to lock their bikes in as they continue their trip by bus or LRT. Bike stations would ideally be located at transit stations, but are not limited to such areas, as one planner noted that some bike stations are currently being considered for high-density, existing and future bus corridors.

More than just a secure location to park your bike, many planners also mentioned how the mixed use neighbourhoods that bike stations are typically located in add to the idea of a bike station being a convenient and useful facility not only integrated with transit and LRT, but also integrated with the community as a whole, providing residents with bicycle-related amenities and services. When speaking of bike stations, planners mentioned their visibility would be a good opportunity to promote the act of utilitarian cycling in the neighbourhoods they are installed in. They also suggested that these bike stations could have an integrated café, bike shop, or even bike repair services. In this scenario, people living in smaller apartments or townhomes nearby who do not have the space to store bikes indoors may be able to use the bike stations for their own full-time, personal storage needs.

5.5.3.2 Edmonton precedents and projects: past, present, and future

Past and present

In many cases, participants noted some policy and infrastructure interventions in Edmonton that already encourage bike-transit integration, suggesting that the City doesn't necessarily have to look far for good bike-transit integration precedents. For example, Tyler Golly noted that all of Edmonton's standard buses and articulated buses have bike racks mounted on the front, with space for two bikes per bus. He also noted that City Council has mandated that development of future LRT lines must have parallel active transportation networks – e.g., SUPs.

Other planners have had previous success consulting and coordinating with individual neighbourhoods and community associations directly affected by the implementation of new bike and LRT infrastructure. One planner reflected positively on working with residents in the McKernan neighbourhood – directly east of the McKernan / Belgravia LRT station. The City's community engagement processes allowed local residents to play an active and leading role in shaping their mature neighbourhood growth and infill plan, now officially recognized by the City. This planner suggested that the engagement process used in the McKernan neighbourhood should be replicated for LRT and bike infrastructure projects in other neighbourhoods.

Future

It seemed all participants were optimistic about the future of bike-transit integration in Edmonton, as they regularly discussed various existing and prospective projects that the City will be undertaking, with focus on LRT and active modes of transportation.

102 Avenue and 83 Avenue separated bike lanes

Planners and Councillors regularly mentioned several separated bike lane projects that will be underway in the summer of 2016. A bi-directional bike lane separated from vehicle traffic by a concrete barrier is currently being designed for 102 Avenue just west of downtown, and 83 Avenue on the south side of the city just east of the University of Alberta. Both separated bike lanes are for commuting purposes, serving those who bike to and from central Edmonton, the University of Alberta, and their respective adjacent neighbourhoods. While not specifically related to bike-transit integration, participants understood that building more bike infrastructure is about building a city's capacity to accommodate more cyclists. More cycling in Edmonton in general may inevitably result in more multi-modal bike-LRT trips taken as well.

Bike stations

Previous discussions of bike stations with city planners was fitting as they mentioned that the city-wide planning department is actually interested in installing several bike stations along existing and future transit corridors. At the time of the interview, these planners had been researching bike station precedents from around the world in which they hope to apply to Edmonton. There was no immediate timeline available regarding the installation of these bike stations, though.

Incidentally, and also at the time of the interview, Councillor Walters had been in discussion with representatives from Southgate Mall (adjacent to Southgate station) who had expressed interest in funding and installing their own bike station on mall property, but intended for commuters' use. Other details and timelines for this prospective bike station have not yet been made publicly available. Councillor McKeen mentioned that in the next capital budget, he will be pushing for funding for the installation of bike stations at one or more of the existing LRT stations in south Edmonton.

Valley Line LRT

The new Valley Line LRT – connecting southeast Edmonton to the downtown core, with construction to start summer 2016 – was also mentioned by participants as another example of a project currently underway where bike-transit integration was a focus during the design and planning stages. Tyler Golly who has worked indirectly on this project with City of Edmonton Transportation Planning noted the planning process of new LRT lines like the Valley Line required plans for transit-oriented development around stations, and Station Area Plans. Pedestrian and cyclist access is an important component of these plans. The City had planned for adequate bike parking at Valley Line stations based on a predicted percentage of ridership accessing by bike, which is the bicycle mode share for the station's respective neighbourhood, ranging from 1% to 2%, generally. Golly also noted that the Valley Line LRT will be surface-running and will utilize low-floor vehicles, which makes access by bike to stations, station platforms, and LRT trains much easier.

In working on these projects, some planners appreciated and acknowledged different departments – transportation planning and city-wide planning, for example – often do coordinate and work together. Both planners and engineers do want to install more bike racks at LRT stations and other high-ridership transit centres. They noted that these projects are typically dependent on available funding, however.

Blatchford

Blatchford is a large brownfield development project that will take place in central Edmonton in the coming years at the site of the now-closed Edmonton City Centre Airport (Blatchford Field) north of downtown. The Blatchford development intends to be a mixed-use, “sustainable community that uses 100% renewable energy, is carbon neutral, significantly reduces its ecological footprint, and empowers residents to pursue a range of sustainable lifestyle choices” (City of Edmonton, 2016b). The design of the community will focus heavily on sustainable modes of transportation – walking, cycling, and public transportation.

The future expansion of the newly opened Metro Line will serve the Blatchford community. Tyler Golly acknowledged that Blatchford is a prime example of “where [Edmonton is] doing it right” in terms of planning for pedestrian and cyclist access to LRT stations from the start of the community design process. The coordination between planning and engineering departments has been sufficient, and as a result, everyone understands the common goals of the Blatchford development – a sustainable, mixed-use neighbourhood – and are trying to ensure this goal is met, respective to their work area. Golly cautioned, though, that the good example of bike-transit integration that Blatchford is becoming should not excuse the City from neglecting to address and investigate more opportunities for bike-transit integration at other, older LRT stations in the city.

5.5.4 Suggested projects or improvements

Based on the participants’ experience living, cycling, and taking transit in Edmonton – and, in most cases, working for the City – several projects or improvements were suggested in order to enhance the state of bike-transit integration in the city.

More or better bike parking

The lack of appropriate bike parking was a common theme expressed by all participants. As such, projects involving the provision for more bike parking were regularly suggested. Planners suggested providing a “continuum of assets or infrastructure” at LRT stations, including bike racks, covered parking, or even repair stands, foot pumps, and vending machines selling tools and parts. Of course, bike stations are found on this continuum, and the interest expressed by many regarding their implementation is encouraging. It remains to be seen what kind of amenities and services these bike stations will provide.

Bike share

Tyler Golly discussed the potential for Edmonton to have its own public bike share system in the more distant future, similar to ones found in Montreal, Minneapolis, and Washington, for example. With bike share – where bicycles are made available from docking stations for a fee, usually targeted towards people making short, one-way trips – Chris Chan suggested that many bike-transit integration issues are solved as one wouldn't need to worry about secure facilities for your bike, needing to bring your bike onto the train, or having access to a bike as you leave your destination LRT station. Golly warned, though, that Edmonton is a "long ways away from [bike share]", and that the city would likely need a stronger network of bike routes before bike share can be successful.

Research and data collection

Planners often suggested that more research needs to be done to better understand the existing state of bike-transit integration in Edmonton. The City doesn't know how to plan for more bikes at LRT stations because there's little data that currently exists. Planners would like to see before-and-after data regarding ridership seen on the soon-to-be-installed 102 Avenue and 83 Avenue separated bike lanes, and data regarding how people access special events like concerts or community festivals in central areas of the city. There is also an opportunity to research how existing LRT ridership choose to access stations (route and mode, for example) and under what circumstances these people would be willing to bike, instead of walking, bussing, or driving to a station. Research on the financial implications of investing in proper bike infrastructure could also be undertaken, as suggested by Golly.

Planners state the findings of this research could go on to inform the development of pro-bike and pro-bike-transit-integration policy and regulation. Knowing how many people bike in a neighbourhood or to a transit station could prompt the City to require the inclusion of bike stations at new LRT stations. It may also prompt the City and ETS to change their regulations to allow for bike on trains at all hours, for example.

Inter-departmental coordination

In order to move forward with these projects, all participants recognized the need for more inter-departmental coordination. As mentioned previously, many felt that there was too much "silo-ing" between City departments, and too many working groups looking out for their own interests. More coordination between departments right from the beginning stages of development and infrastructure projects may ensure adequate and appropriate focus on bike infrastructure, and bike-LRT integration. Increased coordination might come in the form of more frequent inter-departmental meetings, or even having related departments working in the same building, as suggested by one planner.

5.5.5 Summary

The opinions reflected by the interview participants chosen for this research project are not necessarily representative of the opinions of the majority of Edmontonians as a whole. However, it appeared that there may be a consensus by some in the professional planning and engineering community in Edmonton – and others – that the state of bike-transit integration in the city could be improved.

Overwhelmingly, interview participants recognized that in order for bike-transit integration to become more viable in Edmonton, the City needs to invest in better bike infrastructure leading to LRT stations so that people feel comfortable and safe while biking. Similarly, participants recognized the City's need to invest in a host of bike parking options at LRT stations ranging from more bike racks to enclosed and secure bike stations so that it is safer and more convenient for cyclists to lock up their bike at a station for the day. While Edmonton is performing well on bike-transit integration due to several infrastructure and development projects to be completed in the coming years, participants noted there are several bike-transit integration precedents from other jurisdictions that the City could follow.

Participants noted some simple projects the City could implement in order to produce immediate benefits to bike-transit integration, including better inter-departmental coordination for municipal projects resulting in less "silo-ing" of working groups, and changes to ETS policy to allow bikes on LRT trains at all hours of the day instead of just off-peak periods.

5.6 Summary of findings

Field research in Edmonton has revealed many people do already integrate bikes with transit by taking bike-LRT trips. These trips are mostly purposeful, usually to school (at the University of Alberta) or to work (in the downtown core), and can occur regardless of the availability of dedicate bike infrastructure. Based on the research findings, three station types were developed:

- ***Core (Type A) station type:*** stations located in central areas in neighbourhoods with high population and job densities, and shorter bike access distances surveyed;
- ***Mature (Type B) station type:*** stations located in mature or established areas in neighbourhoods with moderate population and job densities, and moderate bike access distances surveyed; and
- ***Suburban (Type C) station type:*** stations located in mostly established areas typically more suburban in nature with low population and job densities, and longer bike access distances surveyed.

Members of Edmonton's professional and bike advocacy communities who were interviewed all agreed that bike-transit integration is and should be a legitimate urban transportation strategy, though the current state of it in Edmonton is not ideal. Participants agreed that more bike infrastructure is needed in Edmonton before bike-transit integration can become more popular. They also agreed that some of Edmonton's prospective infrastructure and development projects do acknowledge and encourage bike-transit integration; however, they pointed out several infrastructure precedents – bike stations, namely – from other jurisdictions the City could follow to encourage more cycling to transit stations, and more cycling in general.

6.0 Analysis

The following section provides an analysis of the data findings presented previously. This analysis explores trends associated with bike access distances and trip purpose, and different infrastructure and policy interventions that could be implemented in order to accommodate more bike-LRT trips.

6.1 LRT Station access by bike and other modes

The results of the cyclist surveys show Suburban (Type C) stations generally saw the most bike access, followed by Mature (Type B) stations, as outlined in Table 6.1 below.

Table 6.1: Cyclists surveyed at LRT stations

	Station type			
	A – Core	**B – Mature**	**C – Suburban**	**ALL stations**
Number of cyclists surveyed	2 (3%)	30 (39%)	45 (58%)	77 (100%)

This trend does not seem to be correlated with non-cyclist ridership at the respective LRT stations, per the City of Edmonton's official LRT passenger counts (included in *Appendix B*). The City's LRT passenger counts show LRT ridership at individual stations is more evenly spread out over the entire system, with Century Park (the south terminus) and University stations seeing the most daily ridership. The difference in station access trends between non-cyclist passengers and cyclists indicate the need for a nuanced approach to policy and infrastructure improvements in order to encourage and accommodate bicycle access to LRT stations. The amount of foot and bus passenger traffic that LRT stations see is dependent on a variety of factors, but perhaps different from those relating to bicycle access. For example, Century Park is located adjacent to a bus exchange, park-and-ride, and vehicle drop-off area, which may more easily facilitate trips where commuters access the station by car or bus. Different access modes will require different policy and infrastructure interventions.

6.2 Bike access distance

Table 6.2: Comparison of station types re: average station access distances

Average bike access distance	Station type			
	A – Core	B – Mature	C – Suburban	ALL stations
Minimum	0.188 km	0.650 km	2.085 km	0.188 km
Maximum	1.438 km	1.513 km	4.102 km	4.102 km
Average	***0.776 km***	***1.207 km***	***3.134 km***	***2.260 km***

Table 6.2 above shows bike access distances surveyed at the three LRT station types. Note that different station types saw bikes accessing from different distances. More importantly, a strong correlation was observed between job and population densities in the neighbourhoods surrounding LRT stations and the bike access distances seen at those stations. Core (Type A) LRT stations – located in neighbourhoods with higher job and population densities – generally saw shorter bike access distances, while Suburban (Type C) LRT stations – located in neighbourhoods with lower job and population densities – generally saw longer bike access distances.

Given this correlation, there may be different policy and infrastructure interventions and implications for LRT stations depending on where in the city they are and what their station type is. The survey results shows that people are more willing to bike further distance to access Suburban stations – on average, about 3 km – while people accessing Core stations didn't bike very far – on average, under 1 km. Additionally, the higher number of jobs and households in the vicinity of Core LRT station likely contributed to shorter access distances traveled to/from home or the station; and a lower number of jobs and households in the vicinity of Suburban LRT station likely contributed to longer distances traveled to/from home or the station. As such, each station type may require different and nuanced policy and infrastructure interventions in order to accommodate and encourage more bike-LRT trips, as discussed later.

6.3 Trip purpose and other travel trends

There does not appear to be a strong relationship between trip purpose and station type. The majority of trips surveyed at stations regardless of station type were to/from work or school. Table 6.3 shows bike-LRT trip purposes surveyed at the three LRT station types.

Table 6.3: Comparison of station types re: trip purpose

Trip purpose	Station type							
	A – Core		B – Mature		C – Suburban		ALL stations	
Work	2	(100%)	20	(67%)	31	(69%)	53	(69%)
School	0	(0%)	2	(7%)	6	(13%)	8	(10%)
Recreational	0	(0%)	1	(3%)	2	(4%)	3	(4%)
Personal	0	(0%)	7	(23%)	6	(13%)	13	(17%)
Total	***2***	***(100%)***	***30***	***(100%)***	***45***	***(100%)***	***77***	***(100%)***

There also does not appear to be a strong correlation between different station types and whether surveyed cyclists chose to bring their bikes onto trains. As Table 6.4 shows, most chose not to board the LRT with their bike, but this majority was not large. Note that the figure for Core stations is misleading since not many cyclists were surveyed at these stations.

Table 6.4: Comparison of station types re: bikes on trains

Boarded train with bike?	Station type							
	A – Core		B – Mature		C – Suburban		ALL stations	
Yes	2	(100%)	14	(47%)	19	(42%)	35	(45%)
No	0	(0%)	16	(53%)	26	(58%)	42	(55%)
Total	***2***	***(100%)***	***30***	***(100%)***	***45***	***(100%)***	***77***	***(100%)***

Travel trends for those who boarded the train with their bike were not drastically different than travel trends of LRT commuters in general. In the morning period, most cyclists (43%) who boarded the train with their bikes traveled from Suburban stations to Core or Mature stations, likely heading towards school or work downtown or at the University of Alberta. In the afternoon travel period, the same proportion of cyclists (43%) took the same trip but in the opposite direction: from Core or Mature stations, to Suburban stations. This trend is presented in the "All Stations" summary in *Appendix A*.

These trends imply the need for bike infrastructure at LRT stations to cater to cyclists who commute to central areas of the city for work or for school. In particular, Suburban stations, which are accessed by many cyclists in the morning travel period may need a wide range of bike parking, including bike stations and bike lockers, in order to accommodate those who leave their bike at the station for the entire day. Morning access to Core stations occur as well, but bike infrastructure and interventions at and around these stations may need to cater to cyclists taking shorter access trips – as was the trend seen at these stations – like the implementation of a public bike share system, for example.

6.4 Provision for bike parking

While many surveyed cyclists chose to take their bike onto the train with them, and many more of those surveyed suggested it would be beneficial for ETS to allow bikes onboard trains at all hours – not just non-peak periods – it is likely that not all cyclists will want to or be able to do this. The ability for a cyclist to bring their bike onto a train depends on several factors, including an individual's comfort level, how crowded a train is, or how a station is designed to accommodate bikes - i.e. traversing stairs and using multiple elevators may be too inconvenient for some. Additionally, trains likely don't have the capacity to carry more than a few bikes at a time, even if trains had interior bike racks.

As an alternative to boarding LRT trains with bikes, which many people will choose not to do, there should be a focus on providing a range of adequate and secure bike parking at LRT stations. Suburban stations may benefit the most from this intervention, as these stations saw the most bike-LRT trips and the farthest bike access distances. Additionally, many cyclists surveyed expressed concern relating to bike theft and vandalism. In fact, some of those surveyed had previously had their bike stolen or vandalized at the LRT station while they were away (at work or school) for the day. Participants of the practitioner interviews also acknowledged that bike theft is likely a concern for many cyclists. As such, provision for better bike parking at LRT station would likely be a welcome addition for many cyclists taking bike-LRT trips.

As mentioned previously, bike stations could be an intervention installed at some LRT stations and bus transit corridors at some point in the foreseeable future. Participants of the practitioner interviews identified several precedents Edmonton could follow, which are summarized in Table 6.6 below.

Table 6.5: Bike-LRT infrastructure precedents listed by interview participants

Precedent type	Precedent	Location	Distinguishing characteristics
Infrastructure	BikeStation (Sources: BikeStation, 2016a, 2016b)	Washington, DC	• **Enclosure:** secure, free-standing, "ultra-modern" glass and steel enclosure. • **Storage capacity:** 100 bicycles. • **Operated by:** local bicycle tour company, *Bike and Roll DC*, 66 hours per week. • **Services:** secure bike parking, private change rooms, day-use lockers for rent, and bike rentals, repairs, and sales. • **Target demographic:** tourists and commuters. • **Multi-modal connections:** located directly adjacent to Union Station, a transportation hub and transfer point between interstate Amtrak rail service and Washington's underground rapid transit Metro network. • **Fee structure and access:** monthly or annual fee for access to bike parking and change facilities; access through key fob, and membership provides discounts on bike repairs and rentals • **Other locations:** several BikeStation locations in California, each catering to commuters.
Infrastructure	Union Station bicycle parking station (Source: City of Toronto, 2016)	Toronto, Ontario	• **Enclosure:** secured, indoor facility for "safe, long-term parking to protect [bicycles] against theft, vandalism and bad weather;" • **Storage capacity:** 120 bicycles; • **Operated by:** City of Toronto; • **Services:** secure bike parking, private change rooms, and self-service bike maintenance tools; • **Target demographic:** commuters; • **Multi-modal connections:** located inside Union Station, a multi-modal rail station that provides inter-city rail service on the Via Rail, Amtrak, and GO Transit network, as well as local subway and streetcar service; • **Fee structure and access:** daily, monthly, triannual, or annual fee for key fob access to either of the city's two existing bicycle parking stations; • **Other locations:** Victoria Park subway station (**existing**); and Nathan Phillips Square downtown, Finch West subway station (under construction), and stations on the planned Eglinton Crosstown LRT (**future**).
Policy	*Transit Passenger Facility Design Guidelines* (Translink, 2011b)	TransLink, Vancouver, BC	• **Purpose:** to provide guidelines that foster the creation of safe environments for the most vulnerable users of a transportation system – often pedestrians and cyclists; • **General recommendations:** station design and layout elements, including ideal walkway widths per passenger volume and proper bicycle signage and wayfinding; • **Bike-specific recommendations:** range of bicycle parking provided per station's passenger volume, and optimal bike parking locations to take advantage of CPTED[1] principles; • **Relevant example / case study provided:** Flintholm Station in Copenhagen, Denmark – a light rail train station with connections to bus service and local and regional bike routes – where covered bike parking, good natural surveillance, and convenient integration of parking areas with bike routes make the station a good example of bike-transit integration (p.122).

[1] Crime prevention through environmental design

6.5 Provision for bike infrastructure

The professional community seems to agree that more bike infrastructure is needed in order to encourage more cycling in Edmonton in general, before more bike-transit integration will be seen. The survey results appear to demonstrate this fact as well. Table 6.7 shows the majority of cyclists accessing Mature and Suburban stations bikes on SUPs (or a combination of SUP with another form of road or bike infrastructure), which offer the largest degree of separation from vehicular traffic. More or better bike infrastructure leading to Mature and Suburban station types may cater to the cyclists in these areas who take bike-LRT trips. Not as many cyclists were observed nor surveyed at Core stations likely for a variety of reasons; however, the lack of dedicated bike infrastructure leading to LRT stations in these areas may have contributed to this. The survey results also show many cyclists were comfortable cycling on quieter, local roads to access LRT stations, particularly Mature stations. These roads were mostly used in the absence of SUPs and bike lanes.

Table 6.6: Comparison of station types re: road/bike infrastructure used for access

Road/bike infrastructure	Station type							
	A – Core		B – Mature		C – Suburban		ALL stations	
SUP			9	(30%)	16	(36%)	25	(33%)
SUP + bike lane			1	(3%)	1	(2%)	2	(3%)
SUP + road			3	(10%)	13	(29%)	16	(21%)
Bike lane			4	(13%)	1	(2%)	5	(6%)
Local road	1	(50%)	8	(27%)	6	(13%)	15	(19%)
Arterial road			4	(13%)	1	(2%)	5	(6%)
No data	1	(50%)	1	(3%)	7	(16%)	9	(12%)
Total	***2***	***(100%)***	***30***	***(100%)***	***45***	***(100%)***	***77***	***(100%)***

6.6 Overcoming the auto-centric city-building paradigm

Participants from the practitioner interviews note that the existing car-dominant culture of Edmonton isn't conducive to cycling and the creation of more bike infrastructure. As Councillor McKeen stated in his interview, Edmonton is a city spread out over a large area, so it's hard for members of Council to push for increased investment to bike infrastructure when there is a limited pool of transportation funding that typically goes towards LRT and vehicular road infrastructure. All of this is not helped by Edmonton's 'winter city' perception and how purposeful, utilitarian cycling is still seen by many as a summer-only activity.

The installation of bike infrastructure in key areas may seem a daunting task, but such infrastructure could have the double benefit of getting cyclists to LRT stations safely, and normalizing transportation cycling by making the activity more visible. More infrastructure at LRT stations and on roads leading to transit notes could also set design and construction precedents for the development of new areas of the city and for new LRT lines and stations.

6.7 Lack of policy precedents

When participants of the practitioner interviews were asked about bike-transit integration precedents that Edmonton could follow, the examples provided were almost exclusively infrastructure interventions. There was very little discussion of policy interventions, which may indicate Edmonton is still catching up to other cities and how their transportation networks accommodate cyclists in better and more complete ways.

Based on how interview participants spoke of existing bike-transit integration interventions in Edmonton, it appears that the policy and infrastructure improvements at LRT stations seen in recent years are mostly reactive, as bikes have never been given proper consideration during the design and construction of the LRT system. Provision of bike racks at LRT stations seem to be an afterthought, as is the idea of constructing bike stations at LRT stations. Since LRT vehicles are not designed to carry bikes, the policy to allow bikes onto LRT trains also seem to be an afterthought. This reactive approach to infrastructure intervention may not be effectively encouraging people to cycle to LRT stations, nor accommodating those who already do. However, with its many forthcoming urban projects, Edmonton might be seeing a trend towards a more proactive planning approach for bikes and bike-LRT trips.

7.0 Conclusions

Bike-transit integration is a legitimate urban travel mode observed in cities all over the world, including Edmonton, which this research project has shown. Many people choose to solve the transit accessibility issue – the first mile problem – by bike. These trips which combine both bicycling and urban rail transportation have the potential to foster a more efficient and resilient transportation network less dependent on private automobiles and fossil fuels.

The research suggests that Edmonton's LRT system comprises three distinct station types – Core, Mature, and Suburban – each with cyclist catchment areas of varying size and different infrastructure needs. Provision for more bike infrastructure leading to and at LRT stations might help accommodate and encourage more station access by bike; however, the solution to the first mile problem varies by station type and cannot be generalize across the entire LRT system. The solution requires a comprehensive and nuanced approach involving the proper implementation of both infrastructure and policy interventions.

7.1 Implications for the City of Edmonton

Built form

'Last mile' problems can be significant for cities, particularly in areas where built form and job and population densities do not support the provision for feeder bus services. As many commuters use bikes to access LRT stations instead, the City should note the degree of bike-transit integration at LRT stations is also highly dependent on the local built form and job and population densities of the neighbourhoods in which the stations are situated. If encouraging more bike-transit integration is a goal for the City of Edmonton, as they've identified in their growth plans and policy directives, neighbourhoods surrounding future LRT stations will require a mix of uses, and job and population densities high enough to facilitate short and manageable bike access distances. This presents policy implications for the development of new commercial and residential neighbourhoods, transit corridors, and LRT lines, which will require collaboration between planners and engineers to ensure mutually-supportive densities, land uses, and access to active transportation infrastructure.

Different improvements for different station types

While a nuanced suite of improvements are needed to accommodate bike-transit integration at existing LRT stations, specific policy and infrastructure improvements should be dependent on the station type, as improvements for one station type in an area of the city may not be applicable for another station type in a different area of the city. As Edmonton continues to plan for more LRT and bike infrastructure across the city, it is essential that improvements are implemented in a strategic manner, and that the policy framework exists to do this. For example, Core stations in central Edmonton may not require drastic infrastructure improvements as bike access distances are relatively short. On the other hand, Suburban stations may require more comprehensive bike infrastructure to facilitate longer bike access distances. This may require amendments to infill plans of existing neighbourhoods or growth plans of future neighbourhoods to ensure that adequate and appropriate infrastructure is incorporated with future public infrastructure projects or private developments.

Additionally, despite the benefits that SUPs and similar bike infrastructure may provide to cyclists, and despite the majority of cyclists choosing to bike on SUPs at some point during their access trips, it is likely that not all streets leading to LRT stations require bike infrastructure interventions. Installation of SUPs and bike lanes – especially those protected from vehicular traffic – can be an expensive and lengthy process. Local streets without bike route signage or bike lanes, used by many other cyclists to access LRT stations, would likely not require significant investments in bike infrastructure as the low vehicular volume of these streets already render them relatively safe for cycling. Similarly, not all LRT station will need infrastructure interventions either. Core stations that don't see as much bike access likely don't need bike stations, for example. Such infrastructure is space-intensive and may not be possible in central areas of the city where the availability of space is limited. There are already many bike racks on sidewalks downtown – though, not necessarily specifically designed for commuters' use – and many workplaces in the downtown core may already offer their own secure bike parking. Mature and Suburban LRT stations that see cyclists accessing from several kilometres away may benefit more from a wide range of bike parking infrastructure like covered bike parking and bike stations.

Bike-transit integration policy

Given the lack of policy precedents specific to bike-transit integration known to City staff and administration, Edmonton has the potential to become a leader in bike-transit integration policy in order to both encourage more bike access to transit station, and facilitate the implementation of more bike infrastructure to and at LRT stations. A potential suite of policies would likely go beyond simple interventions like allowing bikes onto trains during all hours of the day. Pro-bike and pro-bike-transit-integration policy could be written into neighbourhood plans and zoning bylaws, including, for example, the requirement of bike infrastructure (lanes and SUPs) and/or bike parking (bike stations) with new developments within a certain radius of an existing or future LRT station.

Strategic placement of bike infrastructure

This research project has shown that people who access LRT stations by bike tend to do so from adjacent bike infrastructure, like the SUP running parallel to the LRT tracks in northeast and south Edmonton. As Edmonton's LRT system expands, it's necessary for planners to consider how both LRT and bike infrastructure complement one another. While bike infrastructure is needed to encourage more cycling in general, a non-integrative approach to adding bike infrastructure in Edmonton will likely not encourage more bike-transit integration. Cyclists will bike where bike infrastructure exists. Similarly, bike-transit integration will occur where adequate infrastructure leading to LRT stations exist. Future LRT lines may require parallel bike infrastructure as well, and future LRT stations may require better physical connections to this infrastructure. Planners may also need to consider how existing and future bike infrastructure projects will affect active transportation connectivity to existing LRT stations.

In Edmonton, it also appears that investments in bike and LRT infrastructure are focused towards communities in the south, where neighbourhoods are generally more socio-economically well off. These neighbourhoods saw the highest amount of bike-transit integration and LRT ridership, which suggests that the ability for a neighbourhood or LRT station to attract more cyclists and bike-transit integration is dependent on how much investment takes place. More investments in LRT and bike infrastructure will need to occur north of downtown if more bike-transit integration is to occur in these neighbourhoods.

Measuring the success of bike-transit integration

Edmonton does not have a formal bike-transit integration program. The integration of bikes and bike infrastructure with the LRT system is based on best practices and what the City has done in the past. The City and its planners may need to look at establishing a formal structure or program for the integration of bikes and bike infrastructure with LRT infrastructure. A more formal structure may allow for the development of metrics to measure the relative "success" of existing and future bike infrastructure at and around LRT stations – e.g. how many cyclists use specific SUPs to access stations, how many bikes can be parked at a station, and how many bikes can a station comfortably accommodate for those who intend to bring their bikes onto the train with them. Metris could also be developed to guide the development of new bike infrastructure by determining how well this infrastructure will be connected with the LRT system and other bike infrastructure.

Implications for Edmonton Transit System

Many people choose to bring their bikes onto LRT trains despite regulations against this at peak morning and afternoon travel periods. While many cyclists are comfortable with breaking this rule, others are not, rendering this rule a major barrier for those who wish to board the train with their bike during rush hours. It may be worthwhile for Edmonton Transit System to look at changing the existing regulations concerning bringing bikes onto trains. Presumably, bikes are not allowed on trains during peak periods because they take up too much space. As the City procures new trains for its expanding LRT system, trains with adequate space for bikes and/or interior bike racks could be considered. Existing trains could also be retrofitted to provide a more barrier-free environment for those who bring their bike onto trains.

7.2 Implications for planning practice

Land use and transportation connection

A strong relationship between land use and urban transportation has been shown in this practicum, where auto-centric and sprawled growth doesn't support cycling and transit ridership. Urban growth with higher job and population densities and a mix of land uses *does* support more cycling, transit ridership, and bike access to transit stations. Many cities in North America have goals to increase active transportation and public transportation mode share; however, these cities still subscribe to an auto-centric model of development and growth. In order to accomplish cities' mode share targets, planners must fully embrace denser, mixed-use growth that supports more active and public transportation.

Equitable approach to infrastructure investment

A mode shift away from automobiles and towards active and public transportation will only occur if infrastructure exists to support this. Cities and their planners must find a balance between implementing improvements based on existing demand, and implementing improvements based on the vision of higher-level planning documents and goals. For example, it may make sense to install high-quality bike infrastructure in areas that already see a high number of cyclists, but doing so may impede a city's ability to install infrastructure and encourage cycling in other areas and transportation corridors. Further, it is also important for planners to focus investments in infrastructure equitably across a city, regardless of areas' or neighbourhoods' age and socio-economic standing.

Support for planning goals and projects

Comprehensive transportation and planning policies are also beneficial for growing cities. Achievement of the goals and targets set out in these policies, however, is dependent on the conscientious efforts of both planners and municipal leaders. Planning projects that promote thoughtful and sustainable growth cannot be completed without the support – budgetary or otherwise – of managers and high-level decision-makers. In many cases, planners must play a complex, multi-faceted role by not only performing their professional duties, but also advocating for these projects, and garnering the necessary support in order for these projects to come to fruition.

7.3 Opportunities for further research

There are various opportunities for additional research relating to bike-transit integration in Edmonton that can be done to complement this practicum. Additional detailed surveying of cyclists accessing LRT stations, and an analysis of cyclist origin and destination locations and specific routes taken using geographic information systems (GIS) can be done to better understand the motivation of cyclists and why specific routes are chosen over others. There is also an opportunity to research in more depth the modes of transportation that existing commuters use to access the LRT network, and under what circumstances these people would consider cycling. Understanding the winter implications of LRT station access by bike would also be valuable as Edmonton experiences snow and winter weather for at least several months of the year. This additional research would provide a much more detailed analysis of bike-transit integration in Edmonton, and what could be done in order to encourage more bike access to LRT stations. Additional research may prove to be timely and appropriate for Edmonton, considering the recent opening of the Metro Line – Edmonton's newest LRT line – and the planning and implementation of several other LRT lines in the next few years.

7.4 Closing

The issue of transit accessibility in cities is topical and current, given the steady growth that Edmonton continues to see, and the City's commitment to encouraging more sustainable modes of transportation less reliant on automobiles and fossil fuels. The analysis of the findings of this practicum indicates the first mile problem in Edmonton can only be solved with thoughtful implementation of both policy and infrastructure interventions that promote both bike access to LRT stations and urban cycling in general. This research provides important insight into understanding the many issues regarding accessing Edmonton's LRT station by bike and how more bike access to LRT stations can be encouraged. The conclusions of this research project are specific to the Edmonton context; however, they may be applicable to other cities with a similar built form, active transportation network, and public rail transportation system.

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Appendix A: Station summaries

All Stations

Image source: Google Maps, adapted by author

Station types

Clareview (north terminus)	*C*
Belvedere	*C*
Coliseum	*C*
Stadium	*B*
Churchill	*A*
Central	*A*
Bay / Enterprise Square	*A*
Corona	*A*
Grandin	*A*
University	*B*
Health Sciences / Jubilee	*B*
McKernan / Belgravia	*B*
South Campus / Fort Edmonton Park	*C*
Southgate	*B*
Century Park (south terminus)	*C*

Summary of surveys

Structured interview date(s), time(s):
Multiple dates, August 2015

Bike access interviewed	31
Bike egress interviewed	46
Total bikes interviewed	**77**
Bike access declined	7
Bike egress declined	6
Total bikes declined	**13**
Bike access missed	24
Bike egress missed	14
Total bikes missed	**38**
Bike intercept rate	70.3%
Interview response rate	85.6%
Interview response rate per all observed bikes	60.2%

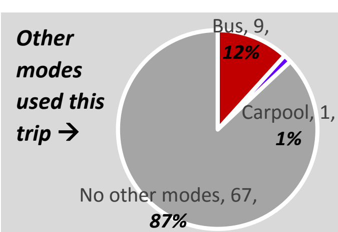
*For those who boarded train with their bike**:*

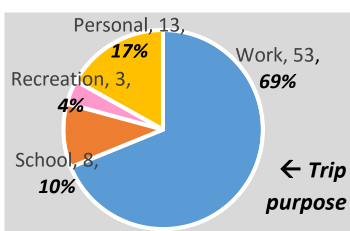
Number of people ***accessing*** stations by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	39
Average bike access distance	**2.095 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	66
Average bike egress distance	**2.425 km**

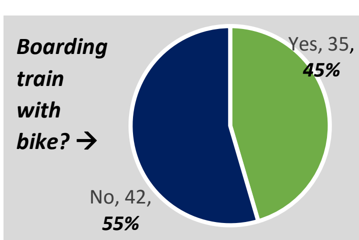
* See [APPENDIX X] for detailed breakdown of data

Other trip details

from information collected in structured interviews







Cyclist origins and destinations

showing bike-LRT travel between station types for both morning and afternoon peak periods, with top three inter-type trips highlighted in red

Inter-type travel for *bike→LRT→bike* trips AM + PM				%	
A	→	*A*	0	0%	23%
A	→	*B*	6	9%	
A	→	*C*	10	14%	
B	→	*A*	7	10%	40%
B	→	*B*	5	7%	
B	→	*C*	16	23%	
C	→	*A*	6	9%	37%
C	→	*B*	12	17%	
C	→	*C*	8	11%	
	Total		*70*		

Inter-type travel for *bike→LRT→bike* trips AM				%	
A	→	*A*	0	0%	17%
A	→	*B*	2	9%	
A	→	*C*	2	9%	
B	→	*A*	3	13%	35%
B	→	*B*	1	4%	
B	→	*C*	4	17%	
C	→	*A*	4	17%	48%
C	→	*B*	6	26%	
C	→	*C*	1	4%	
	Total		*23*		

Inter-type travel for *bike→LRT→bike* trips PM				%	
A	→	*A*	0	0%	26%
A	→	*B*	4	9%	
A	→	*C*	8	17%	
B	→	*A*	4	9%	43%
B	→	*B*	4	9%	
B	→	*C*	12	26%	
C	→	*A*	2	4%	32%
C	→	*B*	6	13%	
C	→	*C*	7	15%	
	Total		*47*		

Observations

Collection of bike racks	Max capacity
West racks	50 bikes
East racks	54 bikes
Total capacity	**104 bikes**

	Observation date: None					***Observation date:*** None			
	West racks		**East racks**			**West racks**		**East racks**	
Time period	**Access**	**Egress**	**Access**	**Egress**	**Time period**	**Access**	**Egress**	**Access**	**Egress**
06:00–06:29					**15:00–15:29**				
06:30–06:59					**15:30–15:59**				
07:00–07:29		Observations	not taken at this		**16:00–16:29**		Observations	not taken at this	
07:30–07:59		station for this	time period		**16:30–16:59**		station for this	time period	
08:00–08:29					**17:00–17:29**				
08:30–09:00					**17:30–18:00**				
Total					***Total***				

Image source: Google Maps, adapted by author

Summary of surveys

Structured interview date(s), time(s):
Tue 11 August 2015, 15:30–18:00, west racks
Fri 14 August 2015, 06:15–09:00, east racks

Bike access interviewed	4
Bike egress interviewed	7
Total bikes interviewed	**11**
Bike access declined	0
Bike egress declined	0
Total bikes declined	**0**
Bike access missed	1
Bike egress missed	2
Total bikes missed	**3**
Bike intercept rate	78.6%
Interview response rate	100%
Interview response rate per all observed bikes	78.6%

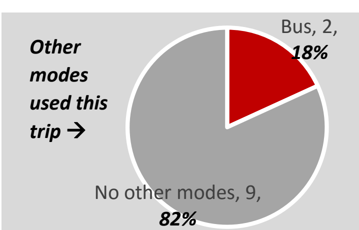
For those who boarded train with their bike:*

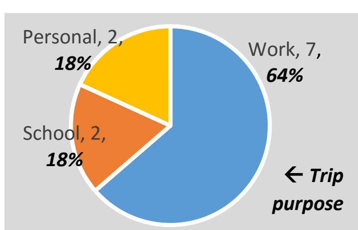
Number of people ***accessing*** station by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	4
Average bike access distance	**1.833 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	9
Average bike egress distance	**2.338 km**

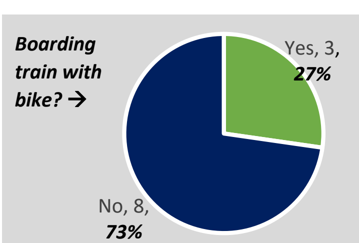
* See [APPENDIX X] for detailed breakdown of data

Other trip details

from information collected in structured interviews







Local neighbourhood characteristics

Population density	Low
Job density	Low
Access to bike lanes	Moderate
Access to SUPs	Moderate
General description	**Suburban**

Cyclist origins and destinations

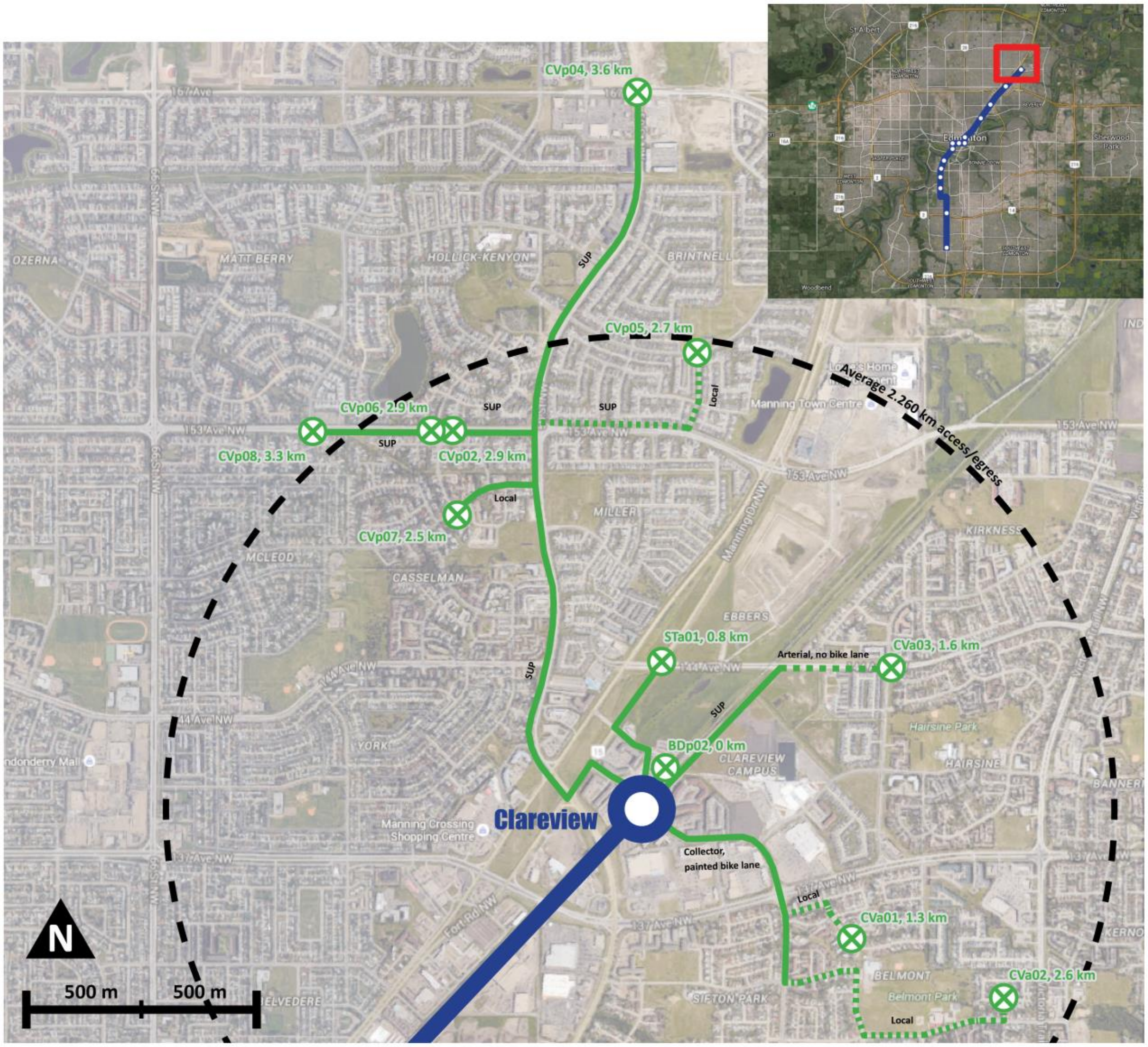


Image source: Google Maps, adapted by author

Legend

LRT and station

2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide

Arterial Road, 21m–28m wide
Collector Road, 11.5m–14.5m wide
Local Road, 8m–9m wide
SUP Shared use path, 3m wide

Trip origin or destination for cyslists accessing or egressing station by bike

Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)

SGp05, 2.0 km Interviewee ID, distance travelled to/from station

		All those who had / were going to board LRT with bike at this station (i.e. *bike → LRT → bike*)				Only those interviewed at this station (i.e. *walk/bus/bike → LRT → bike* OR *bike → LRT → walk/bus/bike*)			
		Access, will travel to…		Egress, traveled from…		Access, will travel to…		Egress, traveled from…	
Station	Type	AM	PM	AM	PM	AM	PM	AM	PM
Clareview	*C*								
Belvedere	*C*				1				
Coliseum	*C*		1				1		1
Stadium	*B*			1		1			
Churchill	*A*					1			1
Central	*A*				1				1
Bay / Enterprise Square	*A*								
Corona	*A*								
Grandin	*A*								
University	*B*	1				1			4
Health Sciences / Jubilee	*B*								
McKernan / Belgravia	*B*								
S. Campus / Ft. Edm. Pk.	*C*								
Southgate	*B*								
Century Park	*C*								

Inter-type travel for *bike→LRT→bike* trips AM + PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	1
B	→	*A*	
B	→	*B*	
B	→	*C*	1
C	→	*A*	
C	→	*B*	1
C	→	*C*	2

Inter-type travel for *bike→LRT→bike* trips AM			
A	→	*A*	
A	→	*B*	
A	→	*C*	
B	→	*A*	
B	→	*B*	
B	→	*C*	1
C	→	*A*	
C	→	*B*	1
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	1
B	→	*A*	
B	→	*B*	
B	→	*C*	
C	→	*A*	
C	→	*B*	
C	→	*C*	2

Observations

Collection of bike racks*	Max capacity
Main racks	20 bikes
Total capacity	**20 bikes**

*The station is located adjacent to numerous formal and informal bike racks and bike parking areas not specifically intended for commuters' use

Observation date: None			***Observation date:*** None		
	Main racks			Main racks	
Time period	**Access**	**Egress**	**Time period**	**Access**	**Egress**
06:00–06:29			**15:00–15:29**		
06:30–06:59			**15:30–15:59**		
07:00–07:29	Observations	not taken at this	**16:00–16:29**	Observations	not taken at this
07:30–07:59	station for this	time period	**16:30–16:59**	station for this	time period
08:00–08:29			**17:00–17:29**		
08:30–09:00			**17:30–18:00**		
Total			***Total***		

Image source: Google Maps, adapted by author

Summary of surveys

Structured interview date(s), time(s):
Fri 14 Aug 2015, 15:15–18:00, main racks

Bike access interviewed	2
Bike egress interviewed	2
Total bikes interviewed	**4**
Bike access declined	2
Bike egress declined	1
Total bikes declined	**3**
Bike access missed	2
Bike egress missed	0
Total bikes missed	**2**
Bike intercept rate	77.8%
Interview response rate	57.1%
Interview response rate per all observed bikes	44.4%

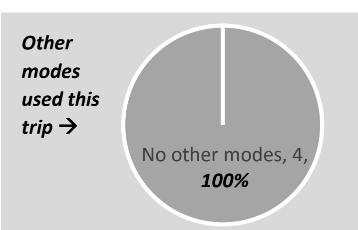
For those who boarded train with their bike†:

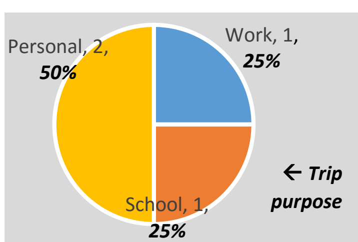
Number of people ***accessing*** station by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	2
Average bike access distance	**4.525 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	6
Average bike egress distance	**1.633 km**

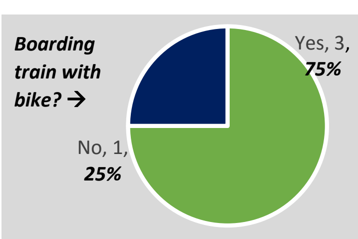
† See [APPENDIX X] for detailed breakdown of data

Other trip details

from information collected in structured interviews







Local neighbourhood characteristics

Population density	Low
Job density	Moderate
Access to bike lanes	Low
Access to SUPs	Low
General description	**Mature, recreational or industrial**

Cyclist origins and destinations

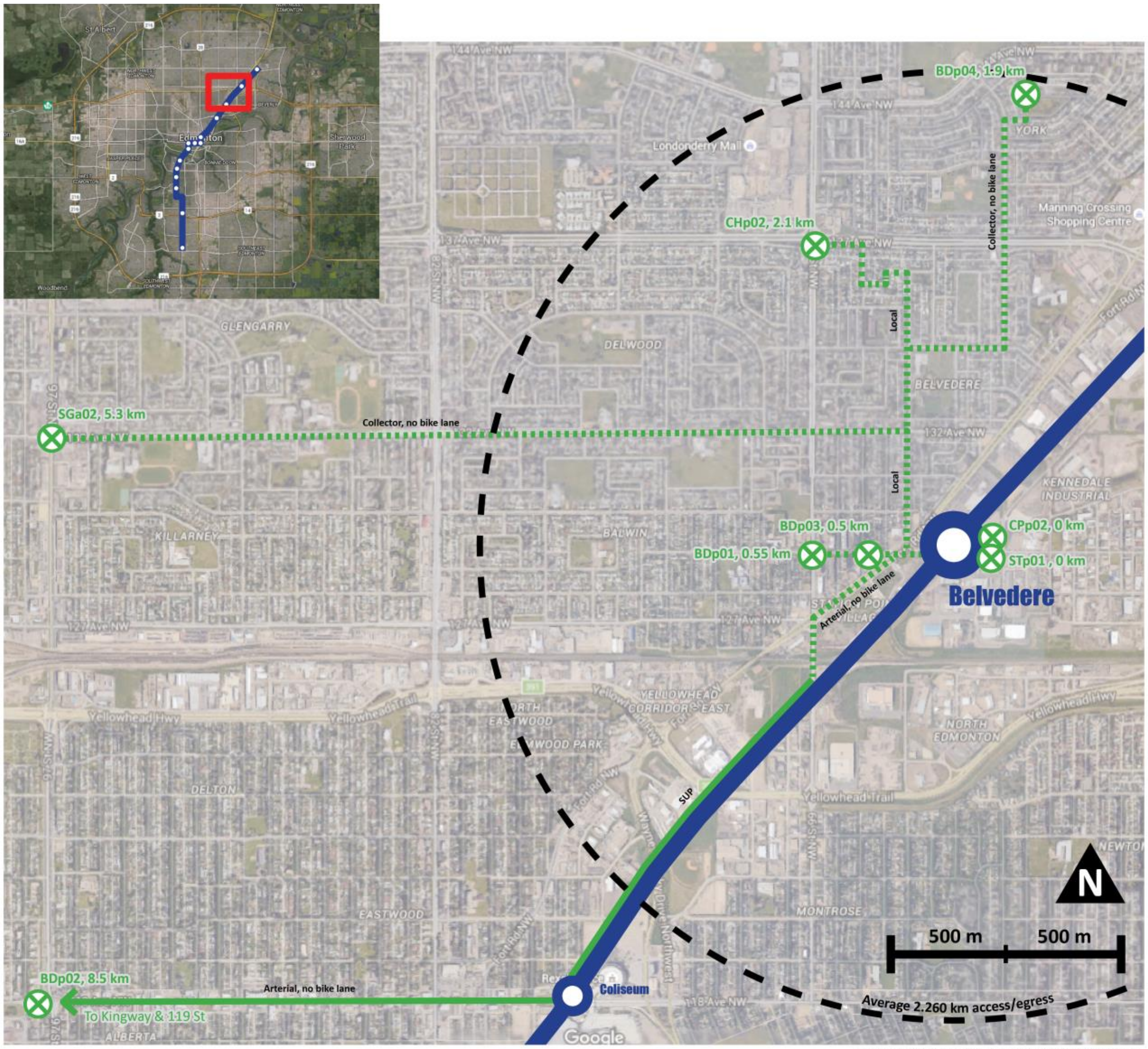


Image source: Google Maps, adapted by author

Legend

- LRT and station
- 2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide
- **Arterial** Road, 21m–28m wide
- **Collector** Road, 11.5m–14.5m wide
- **Local** Road, 8m–9m wide
- **SUP** Shared use path, 3m wide
- Trip origin or destination for cyslists accessing or egressing station by bike
- Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)
- SGp05, 2.0 km — Interviewee ID, distance travelled to/from station

Station	Type	All those who had / were going to board LRT with bike at this station (i.e. *bike* → *LRT* → *bike*) — Access, will travel to… AM	PM	Egress, traveled from… AM	PM	Only those interviewed at this station (i.e. *walk/bus/bike* → *LRT* → *bike* OR *bike* → *LRT* → *walk/bus/bike*) — Access, will travel to… AM	PM	Egress, traveled from… AM	PM
Clareview	*C*								
Belvedere	*C*								
Coliseum	*C*								
Stadium	*B*								
Churchill	*A*								
Central	*A*								
Bay / Enterprise Square	*A*								
Corona	*A*								
Grandin	*A*								
University	*B*								
Health Sciences / Jubilee	*B*								
McKernan / Belgravia	*B*								
S. Campus / Ft. Edm. Pk.	*C*		1						
Southgate	*B*								
Century Park	*C*			1					

Inter-type travel for *bike*→*LRT*→*bike* trips AM + PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	1
B	→	*A*	
B	→	*B*	
B	→	*C*	
C	→	*A*	1
C	→	*B*	
C	→	*C*	

Inter-type travel for *bike*→*LRT*→*bike* trips AM			
A	→	*A*	
A	→	*B*	
A	→	*C*	
B	→	*A*	
B	→	*B*	
B	→	*C*	
C	→	*A*	1
C	→	*B*	
C	→	*C*	

Inter-type travel for *bike*→*LRT*→*bike* trips PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	1
B	→	*A*	
B	→	*B*	
B	→	*C*	
C	→	*A*	
C	→	*B*	
C	→	*C*	

Coliseum

Station Type: C – Suburban

Observations

Collection of bike racks*	Max capacity
Main racks	20 bikes
Total capacity	**20 bikes**

*The station is located adjacent to numerous formal and informal bike racks and bike parking areas not specifically intended for commuters' use

	Observation date: None **Main racks**			***Observation date:*** None **Main racks**	
Time period	**Access**	**Egress**	**Time period**	**Access**	**Egress**
06:00–06:29			**15:00–15:29**		
06:30–06:59			**15:30–15:59**		
07:00–07:29	Observations	not taken at this	**16:00–16:29**	Observations	not taken at this
07:30–07:59	station for this	time period	**16:30–16:59**	station for this	time period
08:00–08:29			**17:00–17:29**		
08:30–09:00			**17:30–18:00**		
Total			***Total***		

Image source: Google Maps, adapted by author

Summary of surveys

Structured interview date(s), time(s):
Structured interviews not conducted at this station

Bike access interviewed	
Bike egress interviewed	
Total bikes interviewed	
Bike access declined	
Bike egress declined	
Total bikes declined	
Bike access missed	
Bike egress missed	
Total bikes missed	
Bike intercept rate	
Interview response rate	
Interview response rate per all observed bikes	

For those who boarded train with their bike†:

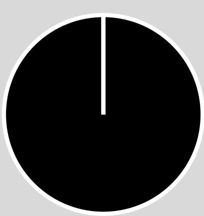
Number of people ***accessing*** station by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	1
Average bike access distance	**4.000 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	1
Average bike egress distance	**2.600 km**

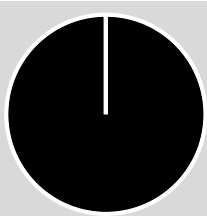
† See [APPENDIX X] for detailed breakdown of data

Other trip details

Not available; structured interviews not conducted at this station

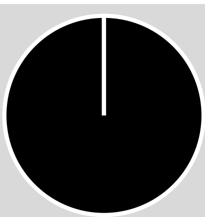
Other modes used this trip →





← Trip purpose

Boarding train with bike? →



Local neighbourhood characteristics

Population density	Low
Job density	Moderate
Access to bike lanes	Low
Access to SUPs	Moderate
General description	**Mature, recreational or industrial**

Cyclist origins and destinations

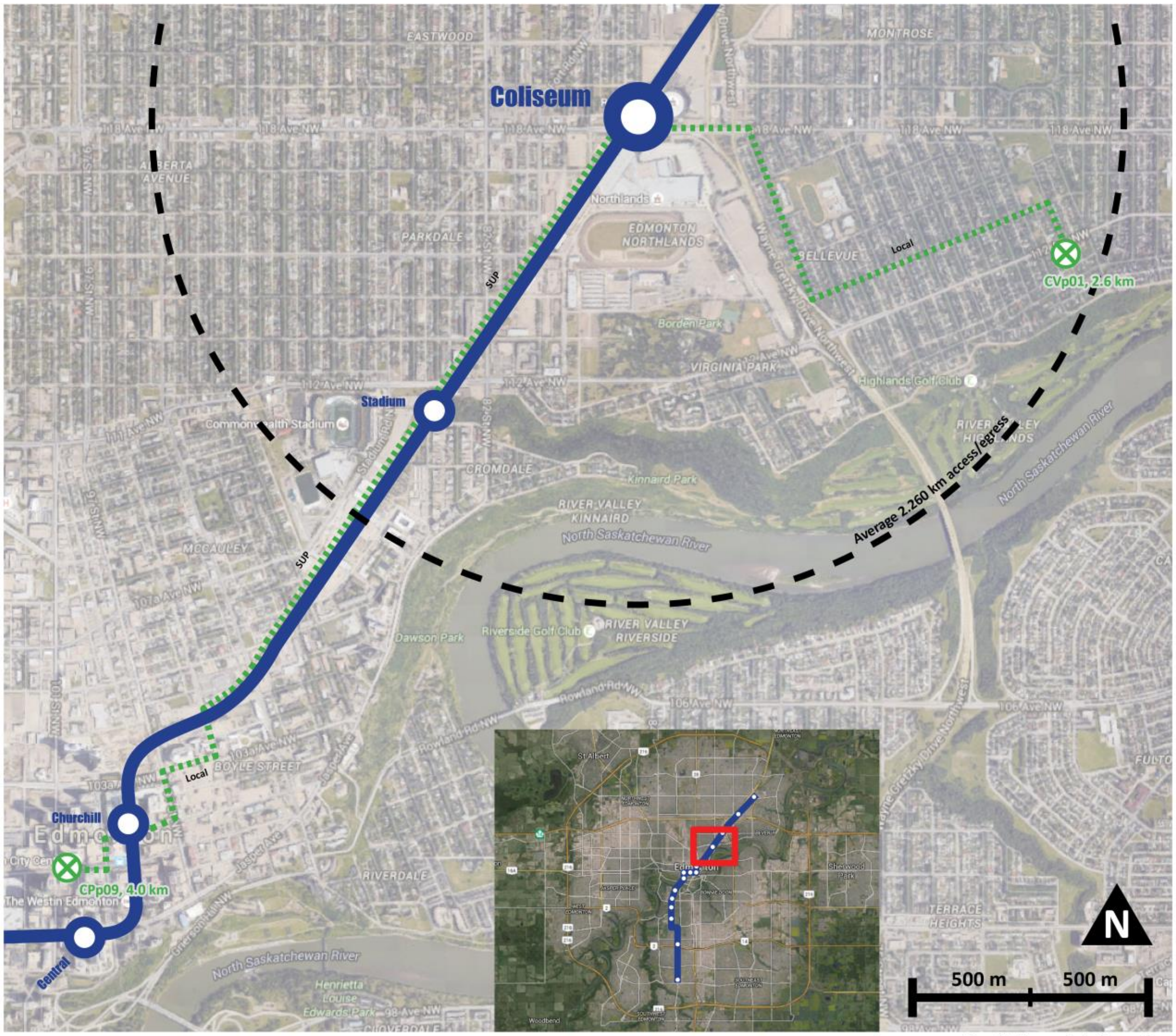


Image source: Google Maps, adapted by author

Legend

LRT and station

2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide

Arterial Road, 21m–28m wide
Collector Road, 11.5m–14.5m wide
Local Road, 8m–9m wide
SUP Shared use path, 3m wide

Trip origin or destination for cyslists accessing or egressing station by bike

Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)

SGp05, 2.0 km Interviewee ID, distance travelled to/from station

		All those who had / were going to board LRT with bike at this station (i.e. *bike → LRT → bike*)				Only those interviewed at this station (i.e. *walk/bus/bike → LRT → bike* OR *bike → LRT → walk/bus/bike*)			
		Access, will travel to...		Egress, traveled from...		Access, will travel to...		Egress, traveled from...	
Station	Type	AM	PM	AM	PM	AM	PM	AM	PM
Clareview	C				1				
Belvedere	C								
Coliseum	C								
Stadium	B								
Churchill	A								
Central	A								
Bay / Enterprise Square	A								
Corona	A								
Grandin	A								
University	B								
Health Sciences / Jubilee	B								
McKernan / Belgravia	B								
S. Campus / Ft. Edm. Pk.	C								
Southgate	B								
Century Park	C		1						

Inter-type travel for *bike→LRT→bike* trips AM + PM			
A	→	A	
A	→	B	
A	→	C	
B	→	A	
B	→	B	
B	→	C	
C	→	A	
C	→	B	
C	→	C	2

Inter-type travel for *bike→LRT→bike* trips AM			
A	→	A	
A	→	B	
A	→	C	
B	→	A	
B	→	B	
B	→	C	
C	→	A	
C	→	B	
C	→	C	1

Inter-type travel for *bike→LRT→bike* trips PM			
A	→	A	
A	→	B	
A	→	C	
B	→	A	
B	→	B	
B	→	C	
C	→	A	
C	→	B	
C	→	C	1

Stadium

Station Type: B – Mature

Observations

Collection of bike racks	Max capacity
East racks	8 bikes
West racks	8 bikes
Total capacity	**16 bikes**

	Observation date: Thu 18 Jun, 2015					***Observation date:*** Tue 9 Jun, 2015			
	East racks		West racks			East racks		West racks	
Time period	**Access**	**Egress**	**Access**	**Egress**	**Time period**	**Access**	**Egress**	**Access**	**Egress**
06:00–06:29					**15:00–15:29**				
06:30–06:59					**15:30–15:59**	Observations at			
07:00–07:29		Observations	not taken at this		**16:00–16:29**	these racks not		1	
07:30–07:59		station for this	time period		**16:30–16:59**	taken for this			
08:00–08:29					**17:00–17:29**	time period			
08:30–09:00					**17:30–18:00**			1	
Total					***Total***			***2***	***0***

Image source: Google Maps, adapted by author

Summary of surveys

Structured interview date(s), time(s):
Wed 19 Aug 2015, 15:15–18:00, east racks
Mon 17 Aug 2015, 06:15–09:00, west racks

Bike access interviewed	3
Bike egress interviewed	1
Total bikes interviewed	**4**
Bike access declined	2
Bike egress declined	0
Total bikes declined	**2**
Bike access missed	3
Bike egress missed	0
Total bikes missed	**0**
Bike intercept rate	66.7%
Interview response rate	66.7%
Interview response rate per all observed bikes	44.4%

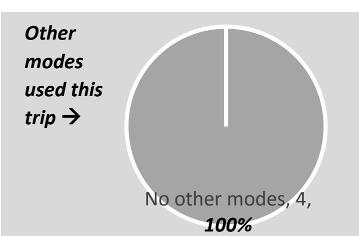
For those who boarded train with their bike:*

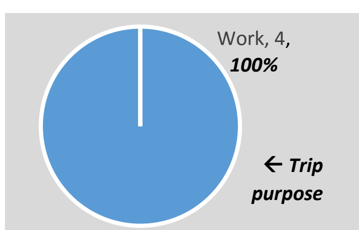
Number of people ***accessing*** station by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	3
Average bike access distance	**1.183 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	3
Average bike egress distance	**1.050 km**

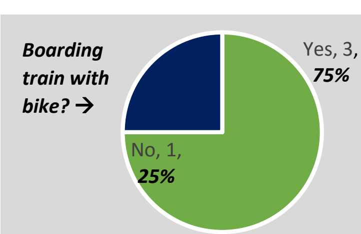
* See [APPENDIX X] for detailed breakdown of data

Other trip details

from information collected in structured interviews







Local neighbourhood characteristics

Population density	Moderate
Job density	Moderate
Access to bike lanes	Low
Access to SUPs	Moderate
General description	**Mature, recreational or industrial**

Cyclist origins and destinations

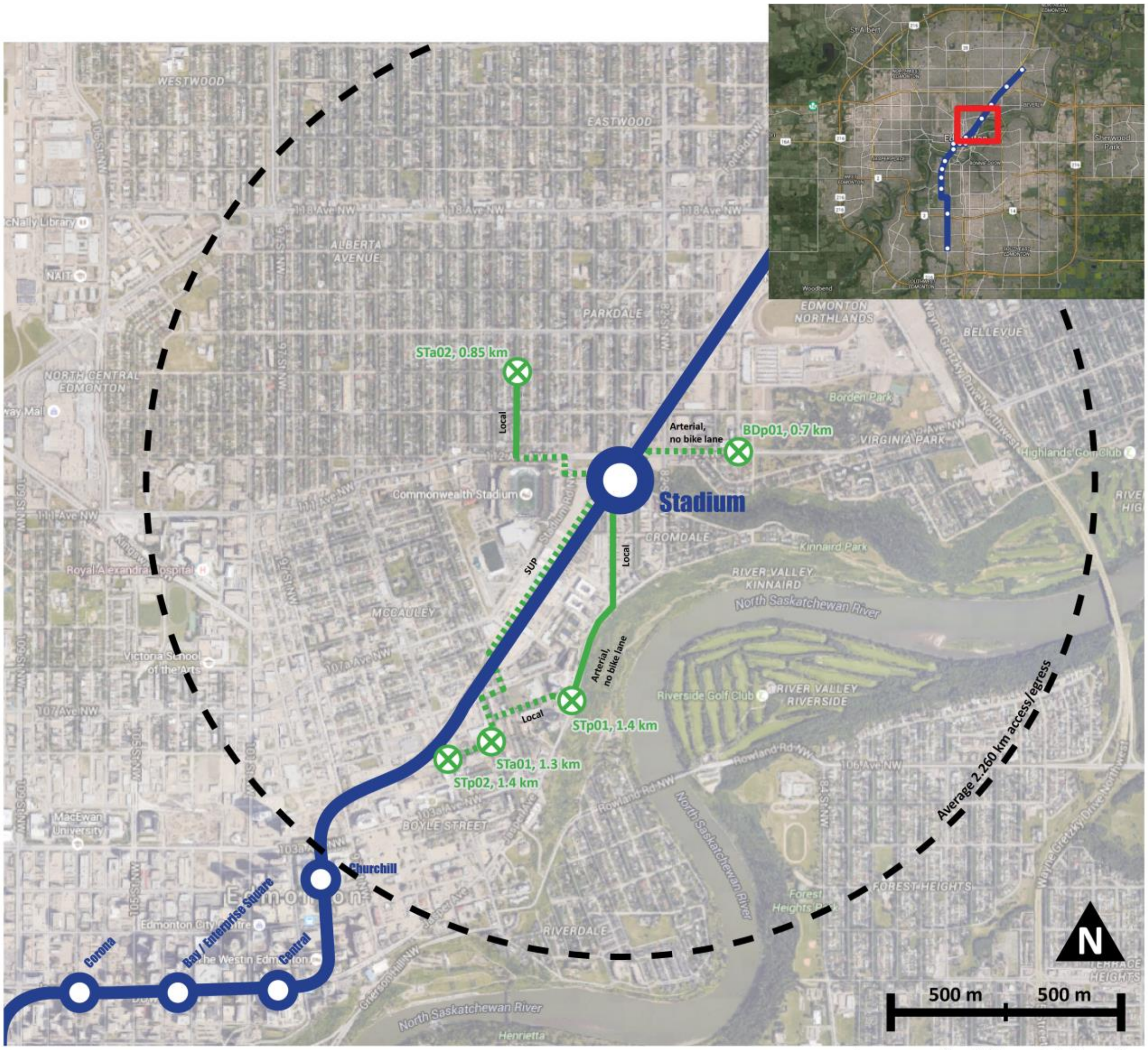


Image source: Google Maps, adapted by author

Legend

LRT and station

2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide

Arterial Road, 21m–28m wide

Collector Road, 11.5m–14.5m wide

Local Road, 8m–9m wide

SUP Shared use path, 3m wide

Trip origin or destination for cyslists accessing or egressing station by bike

Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)

SGp05, 2.0 km — Interviewee ID, distance travelled to/from station

Station	Type	All those who had / were going to board LRT with bike at this station (i.e. *bike* → *LRT* → *bike*) — Access, will travel to… AM	PM	Egress, traveled from… AM	PM	Only those interviewed at this station (i.e. *walk/bus/bike* → *LRT* → *bike* OR *bike* → *LRT* → *walk/bus/bike*) — Access, will travel to… AM	PM	Egress, traveled from… AM	PM
Clareview	*C*	1				1			1
Belvedere	*C*		1		1		1		
Coliseum	*C*								
Stadium	*B*								
Churchill	*A*	1				1			
Central	*A*								
Bay / Enterprise Square	*A*								
Corona	*A*								
Grandin	*A*								
University	*B*			1					
Health Sciences / Jubilee	*B*								
McKernan / Belgravia	*B*								
S. Campus / Ft. Edm. Pk.	*C*								
Southgate	*B*								
Century Park	*C*								

Inter-type travel for *bike→LRT→bike* trips AM + PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	
B	→	*A*	1
B	→	*B*	1
B	→	*C*	2
C	→	*A*	
C	→	*B*	1
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips AM			
A	→	*A*	
A	→	*B*	
A	→	*C*	
B	→	*A*	1
B	→	*B*	1
B	→	*C*	1
C	→	*A*	
C	→	*B*	
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	
B	→	*A*	
B	→	*B*	
B	→	*C*	1
C	→	*A*	
C	→	*B*	1
C	→	*C*	

Churchill

Station Type: A – Core

Observations

Collection of bike racks	Max capacity
Numerous*	
Total capacity	10s of bikes

*Located in downtown Edmonton, the station is adjacent to numerous bike racks not specifically intended for commuters' use

	Observation date: Wed 29 Jul, 2015 Various racks by main entrance			***Observation date:*** Tue 9 Jun, 2015 Various racks by main entrance	
Time period	**Access**	**Egress**	**Time period**	**Access**	**Egress**
06:00–06:29			15:00–15:29		
06:30–06:59			15:30–15:59		
07:00–07:29			16:00–16:29		
07:30–07:59			16:30–16:59		
08:00–08:29			17:00–17:29		
08:30–09:00			17:30–18:00		
Total	***0***	***0***	***Total***	***0***	***0***

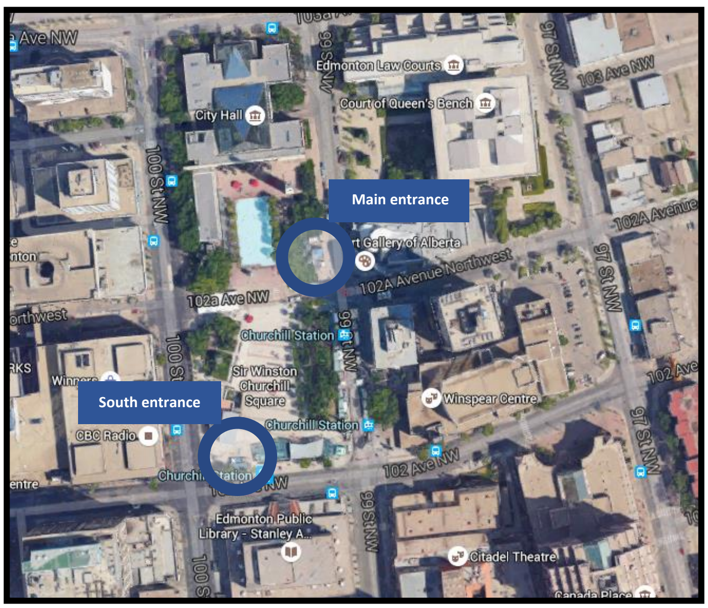


Image source: Google Maps, adapted by author

Summary of surveys

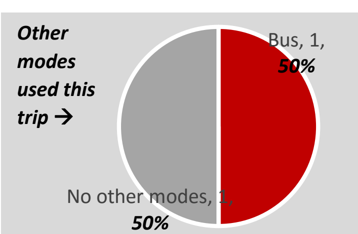
Structured interview date(s), time(s): Thu 13 Aug 2015, 18:30†, on station platform; Tue 11 Aug 2015, 15:13†, on station platform	
Bike access interviewed	2
Bike egress interviewed	0
Total bikes interviewed	**2**
Bike access declined	0
Bike egress declined	0
Total bikes declined	**0**
Bike access missed	0
Bike egress missed	0
Total bikes missed	**0**
Bike intercept rate	100%
Interview response rate	100%
Interview response rate per all observed bikes	100%
For those who boarded train with their bike‡:	
Number of people ***accessing*** station by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	2
Average bike access distance	**0.325 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	2
Average bike egress distance	**0.050 km**

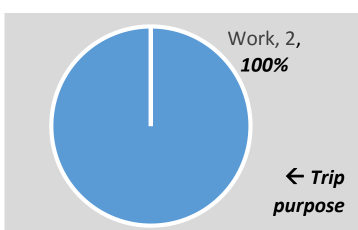
† Structured interviews held at this station were done irregularly and in passing only

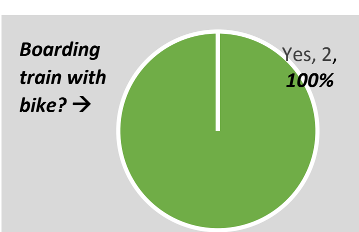
‡ See [APPENDIX X] for detailed breakdown of data

Other trip details

from information collected in structured interviews







Local neighbourhood characteristics

Population density	High
Job density	High
Access to bike lanes	Low
Access to SUPs	Low
General description	**Downtown**

Cyclist origins and destinations

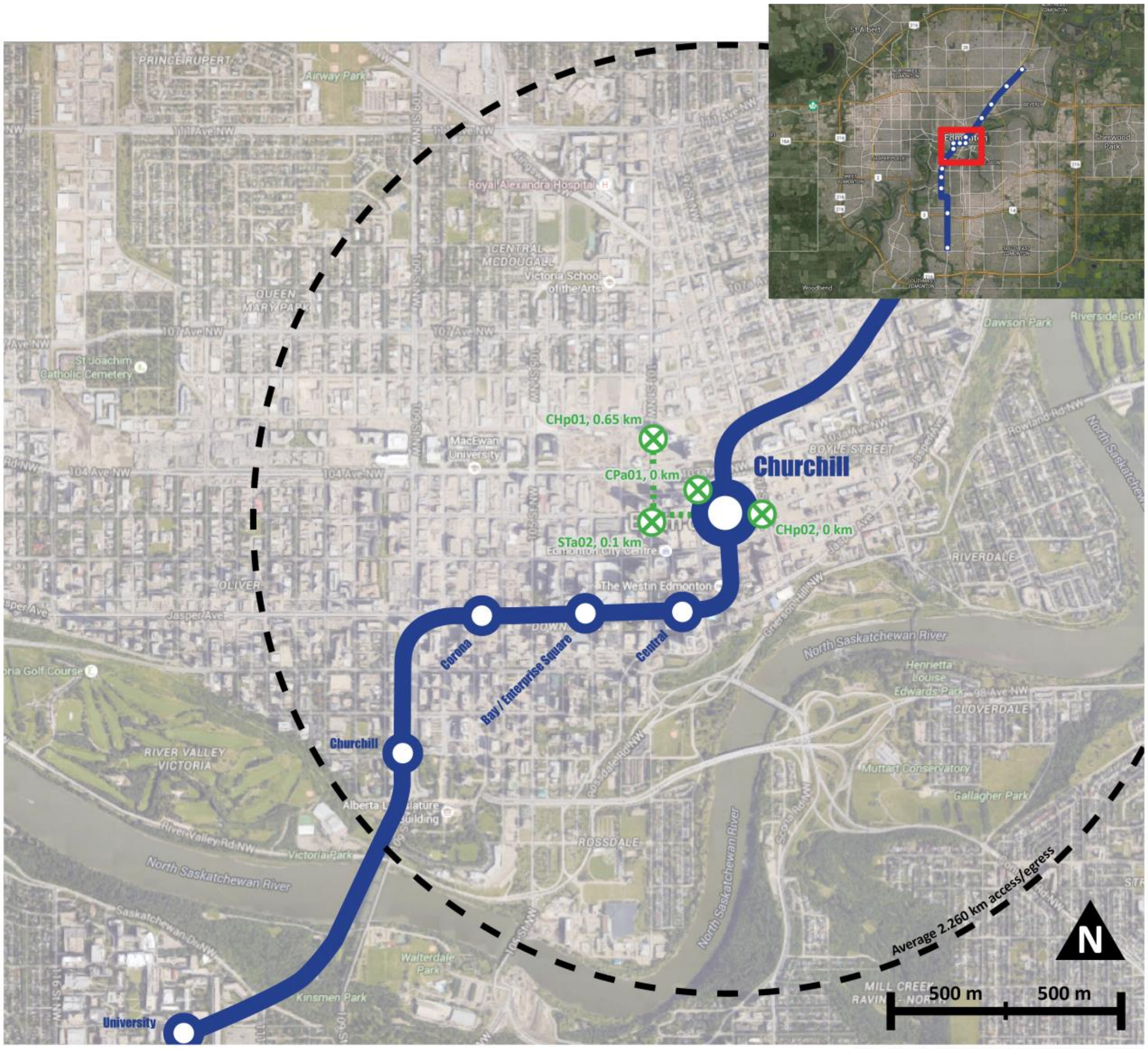


Image source: Google Maps, adapted by author

Legend

LRT and station

2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide

Arterial Road, 21m–28m wide
Collector Road, 11.5m–14.5m wide
Local Road, 8m–9m wide
SUP Shared use path, 3m wide

Trip origin or destination for cyslists accessing or egressing station by bike

Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)

SGp05, 2.0 km — Interviewee ID, distance travelled to/from station

		All those who had / were going to board LRT with bike at this station (i.e. *bike → LRT → bike*)				Only those interviewed at this station (i.e. *walk/bus/bike → LRT → bike* OR *bike → LRT → walk/bus/bike*)			
		Access, will travel to...		Egress, traveled from...		Access, will travel to...		Egress, traveled from...	
Station	Type	AM	PM	AM	PM	AM	PM	AM	PM
Clareview	*C*								
Belvedere	*C*		1				1		
Coliseum	*C*								
Stadium	*B*			1					
Churchill	*A*								
Central	*A*								
Bay / Enterprise Square	*A*								
Corona	*A*								
Grandin	*A*								
University	*B*		1				1		
Health Sciences / Jubilee	*B*								
McKernan / Belgravia	*B*								
S. Campus / Ft. Edm. Pk.	*C*								
Southgate	*B*								
Century Park	*C*			1					

Inter-type travel for *bike→LRT→bike* trips AM + PM			
A	→	*A*	
A	→	*B*	1
A	→	*C*	1
B	→	*A*	1
B	→	*B*	
B	→	*C*	
C	→	*A*	1
C	→	*B*	
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips AM			
A	→	*A*	
A	→	*B*	
A	→	*C*	
B	→	*A*	1
B	→	*B*	
B	→	*C*	
C	→	*A*	1
C	→	*B*	
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips PM			
A	→	*A*	
A	→	*B*	1
A	→	*C*	1
B	→	*A*	
B	→	*B*	
B	→	*C*	
C	→	*A*	
C	→	*B*	
C	→	*C*	

Observations

Collection of bike racks	Max capacity
Numerous*	
Total capacity	**10s of bikes**

*Located in downtown Edmonton, the station is adjacent to numerous bike racks not specifically intended for commuters' use

Observation date: None **Numerous racks**			***Observation date:*** None **Numerous racks**		
Time period	**Access**	**Egress**	**Time period**	**Access**	**Egress**
06:00–06:29			**15:00–15:29**		
06:30–06:59			**15:30–15:59**		
07:00–07:29	Observations	not taken	**16:00–16:29**	Observations	not taken
07:30–07:59	at this	station	**16:30–16:59**	at this	station
08:00–08:29			**17:00–17:29**		
08:30–09:00			**17:30–18:00**		
Total			***Total***		

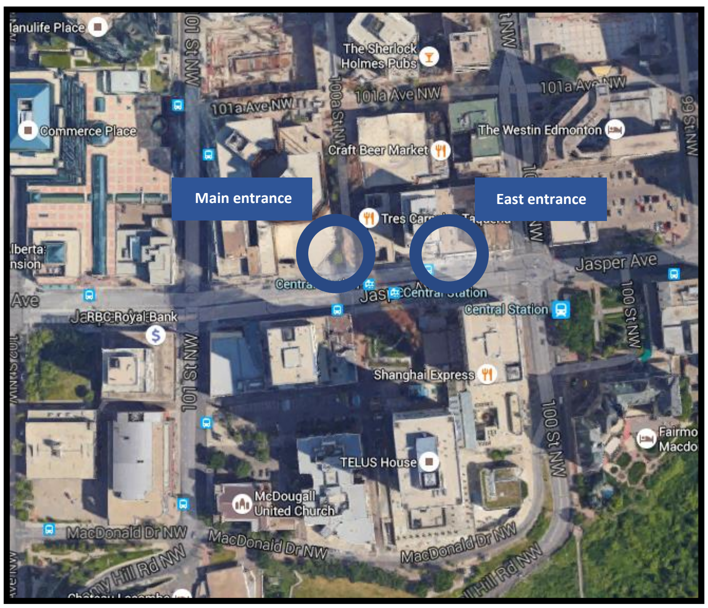
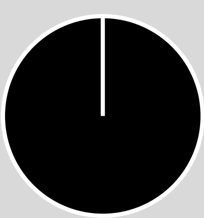


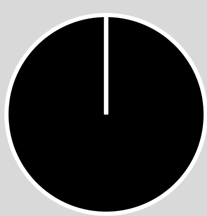
Image source: Google Maps, adapted by author

Other trip details

Not available; structured interviews not conducted at this station

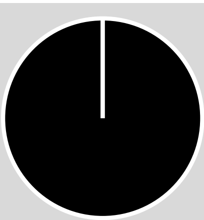
Other modes used this trip →





← Trip purpose

Boarding train with bike? →



Summary of surveys

Structured interview date(s), time(s): Structured interviews not conducted at this station		
Bike access interviewed		
Bike egress interviewed		
Total bikes interviewed		
Bike access declined		
Bike egress declined		
Total bikes declined		
Bike access missed		
Bike egress missed		
Total bikes missed		
Bike intercept rate		
Interview response rate		
Interview response rate per all observed bikes		
<u>For those who boarded train with their bike†:</u>		
Number of people ***accessing*** station by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	2	
Average bike access distance		**1.460 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	1	
Average bike egress distance		**0.200 km**

† See [APPENDIX X] for detailed breakdown of data

Local neighbourhood characteristics

Population density	High
Job density	High
Access to bike lanes	Low
Access to SUPs	Low
General description	**Downtown**

Cyclist origins and destinations

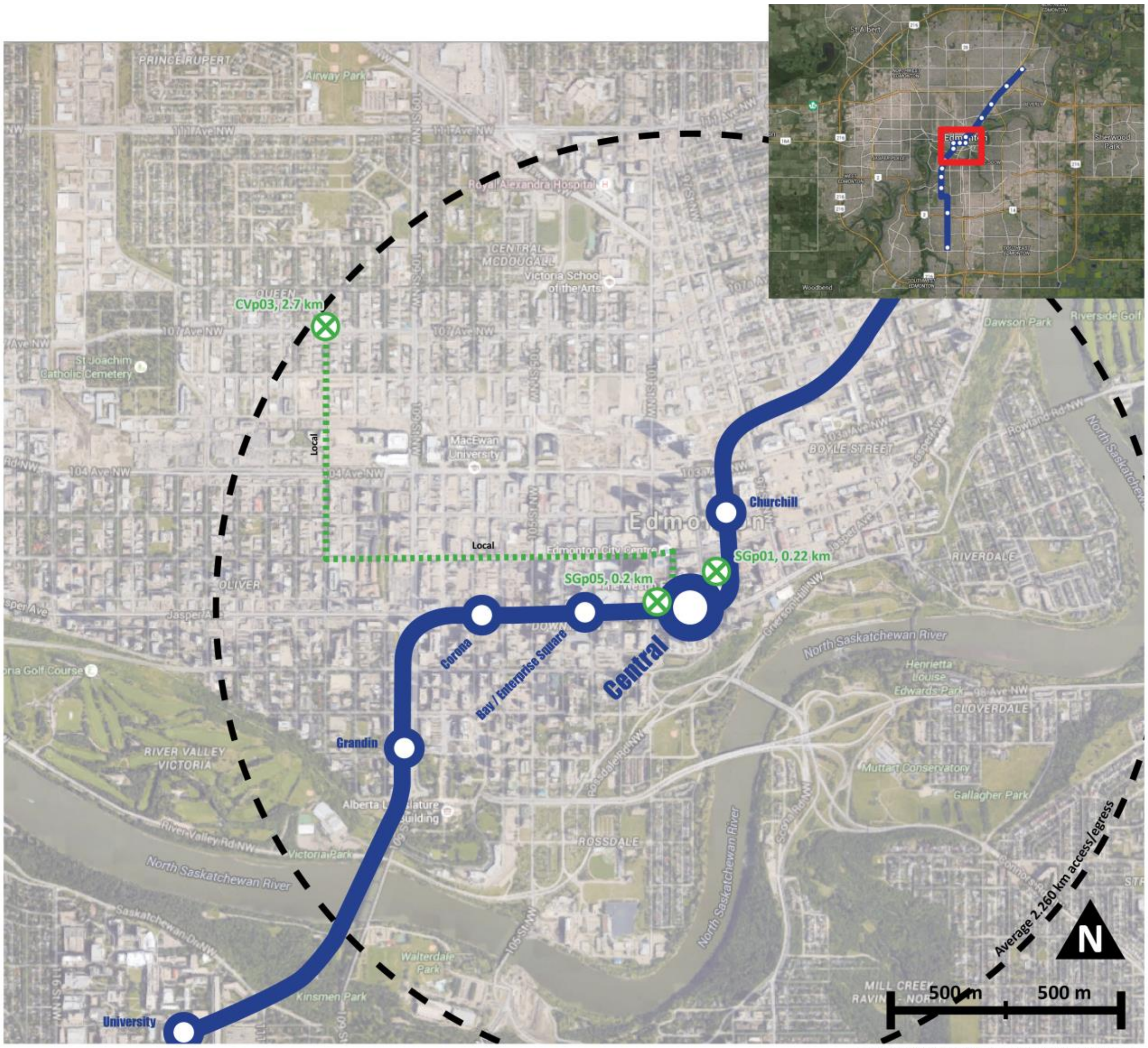


Image source: Google Maps, adapted by author

Legend

- LRT and station
- 2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide
- **Arterial** Road, 21m–28m wide
- **Collector** Road, 11.5m–14.5m wide
- **Local** Road, 8m–9m wide
- **SUP** Shared use path, 3m wide
- Trip origin or destination for cyslists accessing or egressing station by bike
- Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)
- SGp05, 2.0 km — Interviewee ID, distance travelled to/from station

		All those who had / were going to board LRT with bike at this station (i.e. *bike → LRT → bike*)				Only those interviewed at this station (i.e. *walk/bus/bike → LRT → bike* OR *bike → LRT → walk/bus/bike*)			
		Access, will travel to...		Egress, traveled from...		Access, will travel to...		Egress, traveled from...	
Station	Type	AM	PM	AM	PM	AM	PM	AM	PM
Clareview	C		1						
Belvedere	C								
Coliseum	C								
Stadium	B								
Churchill	A								
Central	A								
Bay / Enterprise Square	A								
Corona	A								
Grandin	A								
University	B								
Health Sciences / Jubilee	B								
McKernan / Belgravia	B								
S. Campus / Ft. Edm. Pk.	C								
Southgate	B		1		1				
Century Park	C								

Inter-type travel for *bike→LRT→bike* trips AM + PM			
A	→	A	
A	→	B	1
A	→	C	1
B	→	A	1
B	→	B	
B	→	C	
C	→	A	
C	→	B	
C	→	C	

Inter-type travel for *bike→LRT→bike* trips AM			
A	→	A	
A	→	B	
A	→	C	
B	→	A	
B	→	B	
B	→	C	
C	→	A	
C	→	B	
C	→	C	

Inter-type travel for *bike→LRT→bike* trips PM			
A	→	A	
A	→	B	1
A	→	C	1
B	→	A	1
B	→	B	
B	→	C	
C	→	A	
C	→	B	
C	→	C	

Bay / Enterprise Square

Station Type: A – Core

Observations

Collection of bike racks*	Max capacity
Numerous*	
Total capacity	**10s of bikes**

*Located in downtown Edmonton, the station is adjacent to numerous informal bike racks not specifically intended for commuters' use

	Observation date: Wed 24 Jun 2015 **Various racks by west entrance**			***Observation date:*** Wed 29 Jul 2015 **Various racks by east entrance**	
Time period	**Access**	**Egress**	**Time period**	**Access**	**Egress**
06:00–06:29			15:00–15:29		
06:30–06:59			15:30–15:59		
07:00–07:29			16:00–16:29		
07:30–07:59			16:30–16:59		
08:00–08:29			17:00–17:29		
08:30–09:00			17:30–18:00		
Total	***0***	***0***	***Total***	***0***	***0***

Image source: Google Maps, adapted by author

Summary of surveys

Structured interview date(s), time(s):
Mon 10 August 2015, 15:15–18:00, east entrance
Wed 12 August 2015, 06:15–09:00, west entrance

Bike access interviewed	0
Bike egress interviewed	0
Total bikes interviewed	**0**
Bike access declined	0
Bike egress declined	0
Total bikes declined	**0**
Bike access missed	0
Bike egress missed	0
Total bikes missed	**0**
Bike intercept rate	n/a
Interview response rate	n/a
Interview response rate per all observed bikes	n/a

For those who boarded train with their bike†:

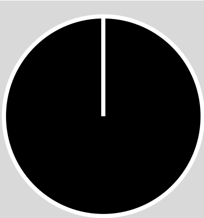
Number of people ***accessing*** station by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	1
Average bike access distance	**0.000 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	1
Average bike egress distance	**0.450 km**

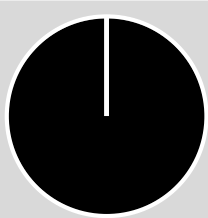
† See [APPENDIX X] for detailed breakdown of data

Other trip details

Not available; no cyclists were encountered

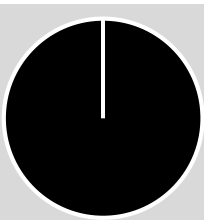
Other modes used this trip →





← Trip purpose

Boarding train with bike? →



Local neighbourhood characteristics

Population density	High
Job density	High
Access to bike lanes	Low
Access to SUPs	Low
General description	**Downtown**

Cyclist origins and destinations

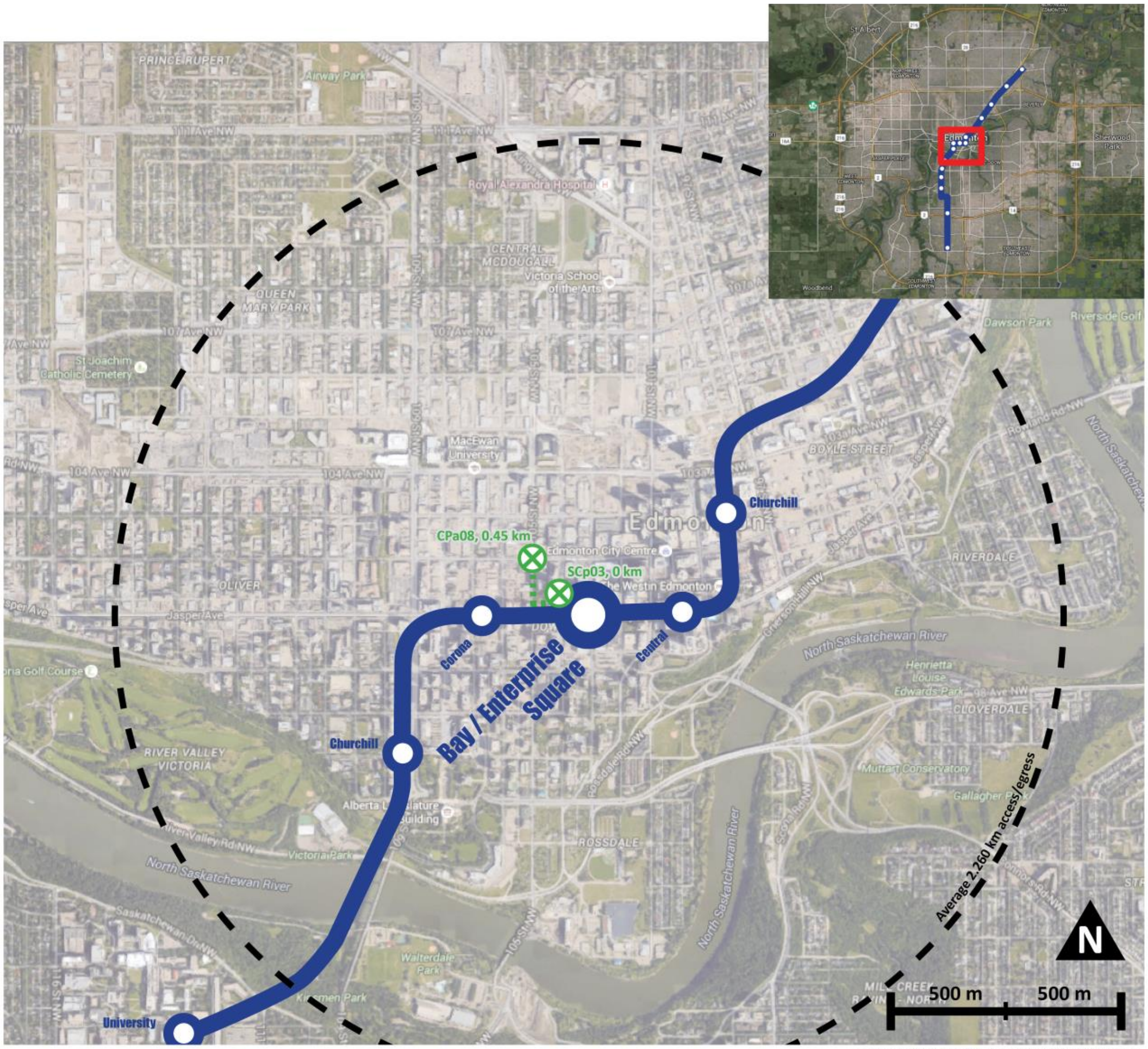


Image source: Google Maps, adapted by author

Legend

- LRT and station
- 2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide
- **Arterial** Road, 21m–28m wide
- **Collector** Road, 11.5m–14.5m wide
- **Local** Road, 8m–9m wide
- **SUP** Shared use path, 3m wide
- Trip origin or destination for cyslists accessing or egressing station by bike
- Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)
- SGp05, 2.0 km — Interviewee ID, distance travelled to/from station

Station	Type	All those who had / were going to board LRT with bike at this station (i.e. *bike → LRT → bike*) Access, will travel to… AM	PM	Egress, traveled from… AM	PM	Only those interviewed at this station (i.e. *walk/bus/bike → LRT → bike* OR *bike → LRT → walk/bus/bike*) Access, will travel to… AM	PM	Egress, traveled from… AM	PM
Clareview	*C*								
Belvedere	*C*								
Coliseum	*C*								
Stadium	*B*								
Churchill	*A*								
Central	*A*								
Bay / Enterprise Square	*A*								
Corona	*A*								
Grandin	*A*								
University	*B*								
Health Sciences / Jubilee	*B*								
McKernan / Belgravia	*B*								
S. Campus / Ft. Edm. Pk.	*C*		1						
Southgate	*B*								
Century Park	*C*			1					

Inter-type travel for *bike→LRT→bike* trips AM + PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	1
B	→	*A*	
B	→	*B*	
B	→	*C*	
C	→	*A*	1
C	→	*B*	
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips AM			
A	→	*A*	
A	→	*B*	
A	→	*C*	
B	→	*A*	
B	→	*B*	
B	→	*C*	
C	→	*A*	1
C	→	*B*	
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	1
B	→	*A*	
B	→	*B*	
B	→	*C*	
C	→	*A*	
C	→	*B*	
C	→	*C*	

Observations

Collection of bike racks	Max capacity
Numerous*	
Total capacity	10s of bikes

*Located in downtown Edmonton, the station is adjacent to numerous informal bike racks not specifically intended for commuters' use

	Observation date: Wed 10 Jun 2015			***Observation date:*** None	
	Area around main entrance			Area around main entrance	
Time period	**Access**	**Egress**	**Time period**	**Access**	**Egress**
06:00–06:29			15:00–15:29		
06:30–06:59			15:30–15:59		
07:00–07:29	1†		16:00–16:29		
07:30–07:59			16:30–16:59	1†	
08:00–08:29			17:00–17:29		
08:30–09:00	1†		17:30–18:00		
Total	***2***	***0***	***Total***	***1***	***0***

†Cyclists who entered the station with their bike

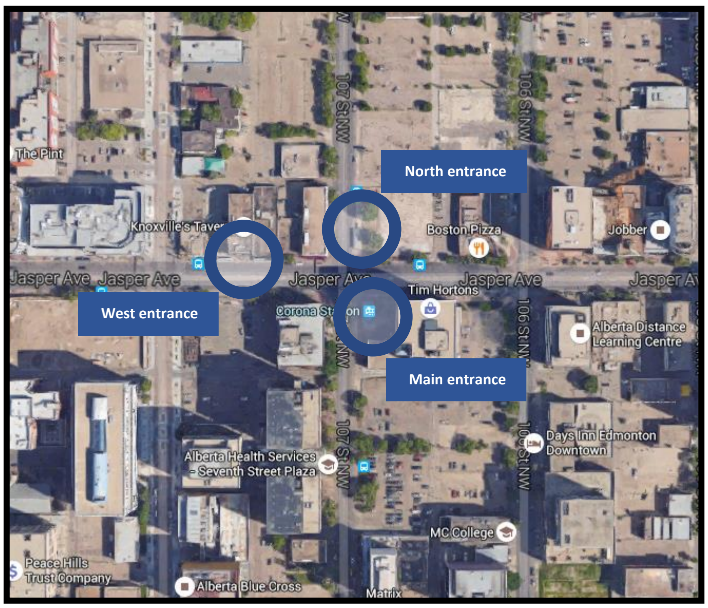
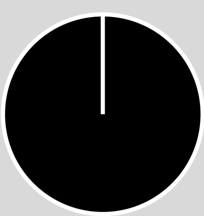


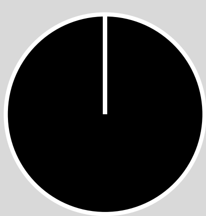
Image source: Google Maps, adapted by author

Other trip details

Not available; structured interviews not conducted at this station

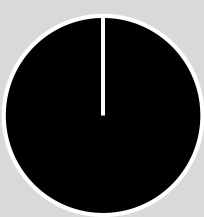
Other modes used this trip →





← Trip purpose

Boarding train with bike? →



Summary of surveys

Structured interview date(s), time(s):

Structured interviews not conducted at this station

Bike access interviewed	
Bike egress interviewed	
Total bikes interviewed	
Bike access declined	
Bike egress declined	
Total bikes declined	
Bike access missed	
Bike egress missed	
Total bikes missed	
Bike intercept rate	
Interview response rate	
Interview response rate per all observed bikes	

For those who boarded train with their bike‡:

Number of people ***accessing*** station by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	2
Average bike access distance	**2.750 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	2
Average bike egress distance	**0.125 km**

‡ See [APPENDIX X] for detailed breakdown of data

Local neighbourhood characteristics

Population density	High
Job density	High
Access to bike lanes	Low
Access to SUPs	Low
General description	**Downtown**

Cyclist origins and destinations

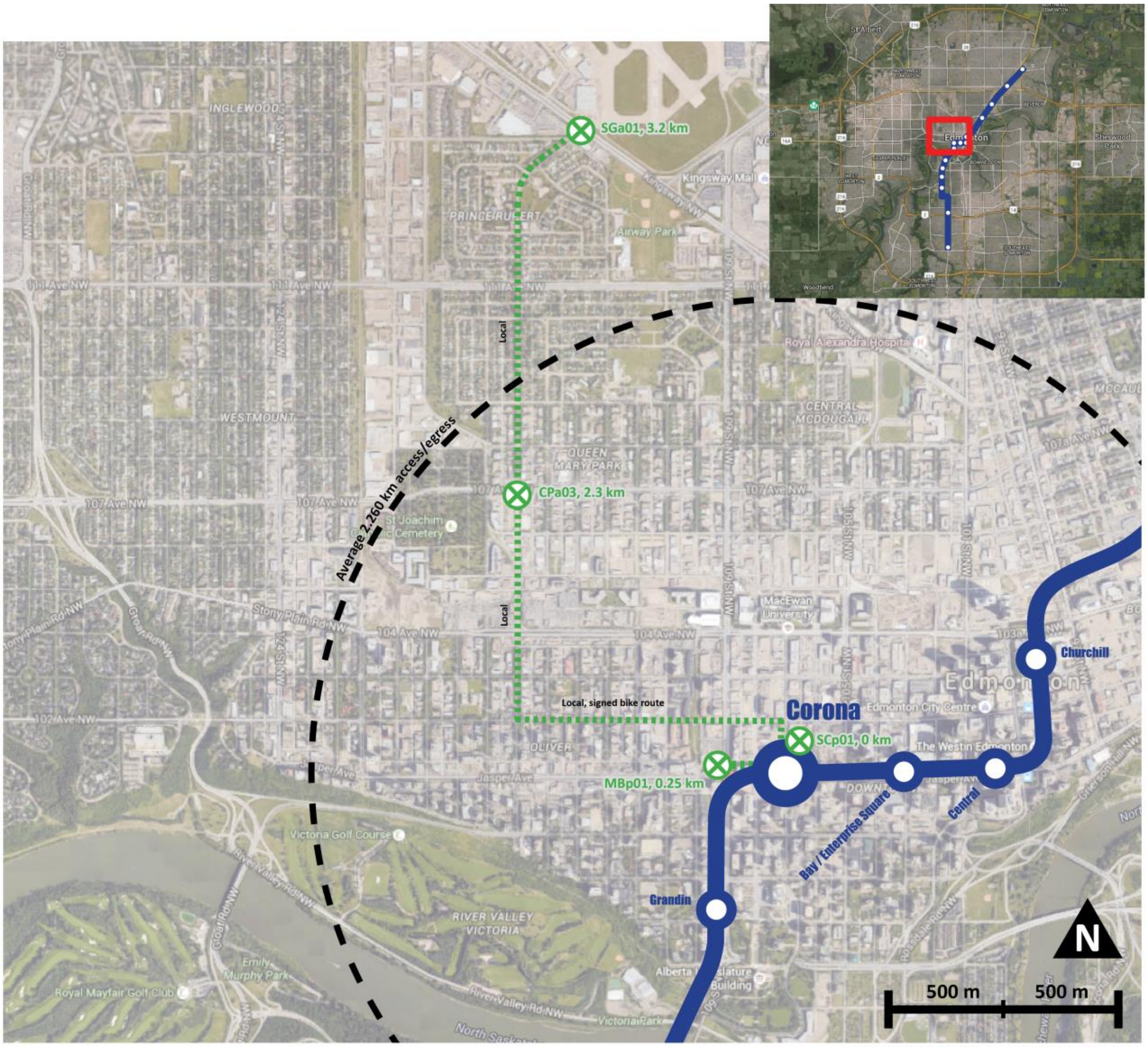


Image source: Google Maps, adapted by author

Legend

LRT and station

2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide

Arterial Road, 21m–28m wide
Collector Road, 11.5m–14.5m wide
Local Road, 8m–9m wide
SUP Shared use path, 3m wide

Trip origin or destination for cyslists accessing or egressing station by bike

Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)

SGp05, 2.0 km — Interviewee ID, distance travelled to/from station

		All those who had / were going to board LRT with bike at this station (i.e. *bike* → *LRT* → *bike*)				Only those interviewed at this station (i.e. *walk/bus/bike* → *LRT* → *bike* OR *bike* → *LRT* → *walk/bus/bike*)			
		Access, will travel to...		Egress, traveled from...		Access, will travel to...		Egress, traveled from...	
Station	Type	AM	PM	AM	PM	AM	PM	AM	PM
Clareview	*C*								
Belvedere	*C*								
Coliseum	*C*								
Stadium	*B*								
Churchill	*A*								
Central	*A*								
Bay / Enterprise Square	*A*								
Corona	*A*								
Grandin	*A*								
University	*B*								
Health Sciences / Jubilee	*B*								
McKernan / Belgravia	*B*				1				
S. Campus / Ft. Edm. Pk.	*C*				1				
Southgate	*B*	1							
Century Park	*C*	1							

Inter-type travel for *bike→LRT→bike* trips AM + PM			
A	→	*A*	
A	→	*B*	1
A	→	*C*	1
B	→	*A*	1
B	→	*B*	
B	→	*C*	
C	→	*A*	1
C	→	*B*	
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips AM			
A	→	*A*	
A	→	*B*	1
A	→	*C*	1
B	→	*A*	
B	→	*B*	
B	→	*C*	
C	→	*A*	
C	→	*B*	
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	
B	→	*A*	1
B	→	*B*	
B	→	*C*	
C	→	*A*	1
C	→	*B*	
C	→	*C*	

Grandin

Station Type: A – Core

Observations

Collection of bike racks*	Max capacity
Main racks	8 bikes
Total capacity	**8 bikes**

*Located in inner-city Edmonton, the station is adjacent to numerous informal bike racks not specifically intended for commuters' use

	Observation date: None			***Observation date:*** None	
	Main racks			**Main racks**	
Time period	**Access**	**Egress**	**Time period**	**Access**	**Egress**
06:00–06:29			**15:00–15:29**		
06:30–06:59			**15:30–15:59**		
07:00–07:29	Observations	not taken	**16:00–16:29**	Observations	not taken
07:30–07:59	at this	station	**16:30–16:59**	at this	station
08:00–08:29			**17:00–17:29**		
08:30–09:00			**17:30–18:00**		
Total			***Total***		

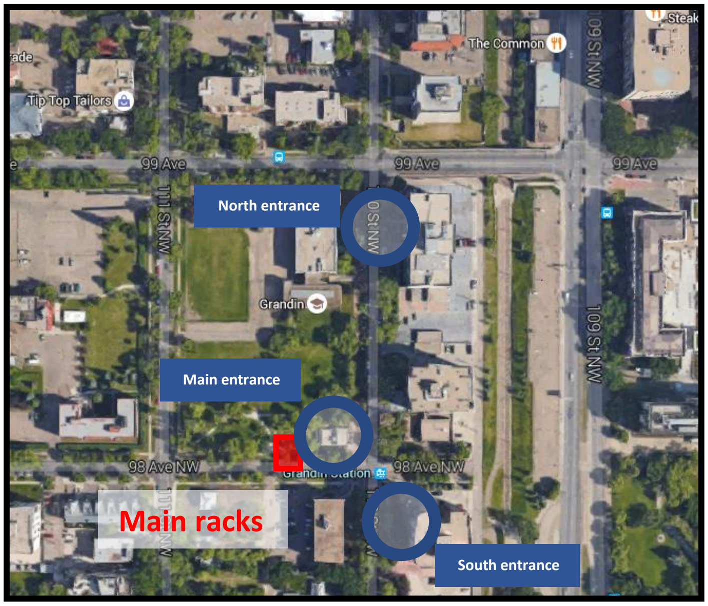
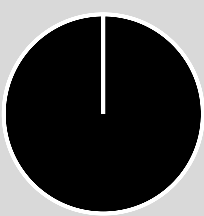


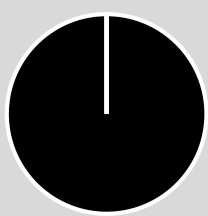
Image source: Google Maps, adapted by author

Other trip details

Not available; no cyclists were encountered

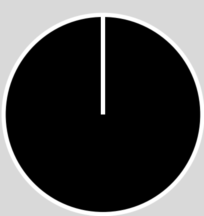
Other modes used this trip →





← Trip purpose

Boarding train with bike? →



Summary of surveys

Structured interview date(s), time(s):
Wed 19 August 2015, 06:15–09:00, main racks

Bike access interviewed	0	
Bike egress interviewed	0	
Total bikes interviewed		**0**
Bike access declined	0	
Bike egress declined	0	
Total bikes declined		**0**
Bike access missed	0	
Bike egress missed	0	
Total bikes missed		**0**
Bike intercept rate		n/a
Interview response rate		n/a
Interview response rate per all observed bikes		n/a

For those who boarded train with their bike†:

Number of people ***accessing*** station by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	1
Average bike access distance	**1.200 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	0
Average bike egress distance	**n/a**

† See [APPENDIX X] for detailed breakdown of data

Local neighbourhood characteristics

Population density	High
Job density	High
Access to bike lanes	Low
Access to SUPs	Moderate
General description	**Downtown**

Cyclist origins and destinations

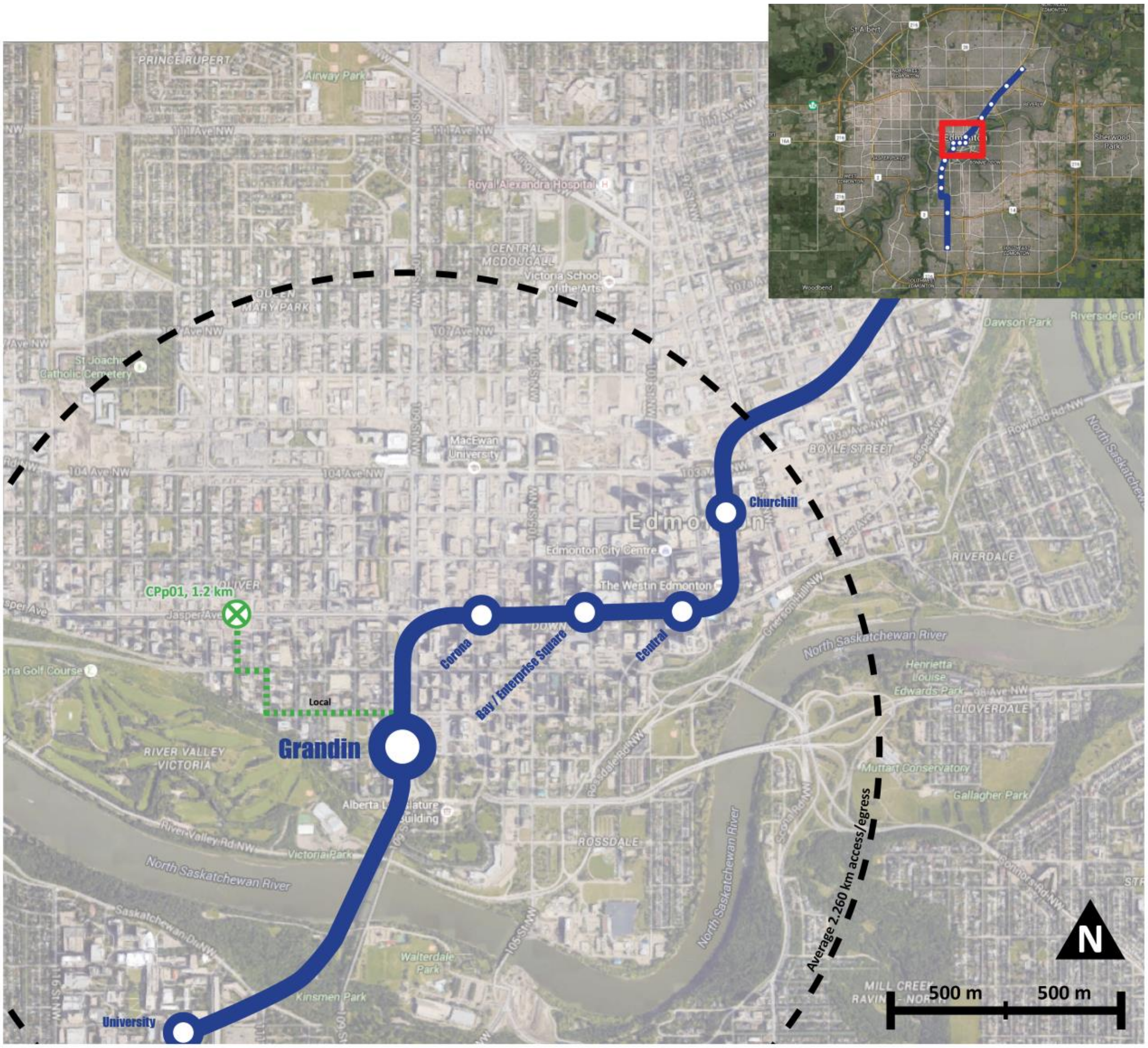


Image source: Google Maps, adapted by author

Legend

- LRT and station
- 2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide

Arterial	Road, 21m–28m wide
Collector	Road, 11.5m–14.5m wide
Local	Road, 8m–9m wide
SUP	Shared use path, 3m wide

- Trip origin or destination for cyslists accessing or egressing station by bike
- Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)
- SGp05, 2.0 km — Interviewee ID, distance travelled to/from station

		All those who had / were going to board LRT with bike at this station (i.e. *bike* → *LRT* → *bike*)				Only those interviewed at this station (i.e. *walk/bus/bike* → *LRT* → *bike* OR *bike* → *LRT* → *walk/bus/bike*)			
		Access, will travel to...		Egress, traveled from...		Access, will travel to...		Egress, traveled from...	
Station	**Type**	AM	PM	AM	PM	AM	PM	AM	PM
Clareview	*C*								
Belvedere	*C*								
Coliseum	*C*								
Stadium	*B*								
Churchill	*A*								
Central	*A*								
Bay / Enterprise Square	*A*								
Corona	*A*								
Grandin	*A*								
University	*B*								
Health Sciences / Jubilee	*B*								
McKernan / Belgravia	*B*								
S. Campus / Ft. Edm. Pk.	*C*								
Southgate	*B*								
Century Park	*C*		1						

Inter-type travel for *bike→LRT→bike* trips AM + PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	1
B	→	*A*	
B	→	*B*	
B	→	*C*	
C	→	*A*	
C	→	*B*	
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips AM			
A	→	*A*	
A	→	*B*	
A	→	*C*	
B	→	*A*	
B	→	*B*	
B	→	*C*	
C	→	*A*	
C	→	*B*	
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	1
B	→	*A*	
B	→	*B*	
B	→	*C*	
C	→	*A*	
C	→	*B*	
C	→	*C*	

University

Station Type: B – Mature

Observations

Collection of bike racks*	Max capacity
North racks	20 bikes
West racks	10 bikes
East racks	18 bikes
Total capacity	**48 bikes**

*Located on the University of Alberta campus, the station is adjacent to numerous bike racks not specifically intended for commuters' use

	Observation date: Tue 28 Jul 2015							***Observation date:*** Tue 28 Jul 2015					
	North racks		West racks		East racks			North racks		West racks		East racks	
Time period	**Acc.**	**Egr.**	**Acc.**	**Egr.**	**Acc.**	**Egr.**	**Time period**	**Acc.**	**Egr.**	**Acc.**	**Egr.**	**Acc.**	**Egr.**
06:00–06:29							**15:00–15:29**						
06:30–06:59							**15:30–15:59**						
07:00–07:29							**16:00–16:29**						
07:30–07:59					1		**16:30–16:59**						1
08:00–08:29							**17:00–17:29**						
08:30–09:00							**17:30–18:00**						
Total	***0***	***0***	***0***	***0***	***1***	***0***	***Total***	***0***	***0***	***0***	***0***	***0***	***1***

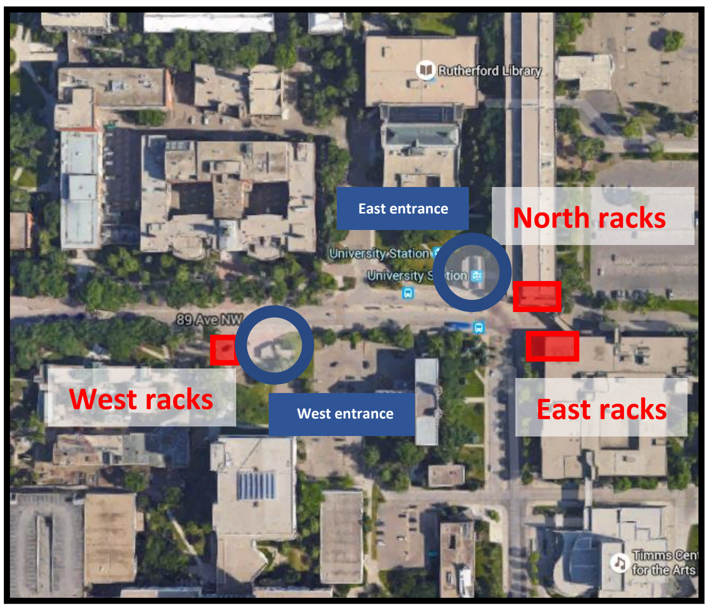


Image source: Google Maps, adapted by author

Summary of surveys

Structured interview date(s), time(s):
Thu 13 August 2015, 06:30–09:00,
east and north racks

Bike access interviewed	2
Bike egress interviewed	2
Total bikes interviewed	**4**
Bike access declined	0
Bike egress declined	0
Total bikes declined	**0**
Bike access missed	0
Bike egress missed	0
Total bikes missed	**0**
Bike intercept rate	100%
Interview response rate	100%
Interview response rate per all observed bikes	100%

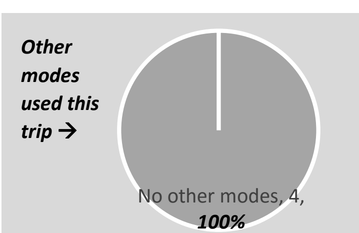
For those who boarded train with their bike†:

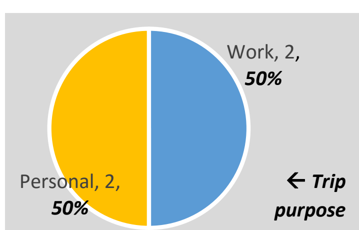
Number of people ***accessing*** station by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	5
Average bike access distance	**0.700 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	4
Average bike egress distance	**2.000 km**

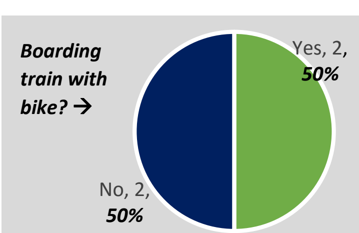
† See [APPENDIX X] for detailed breakdown of data

Other trip details

from information collected in structured interviews







Local neighbourhood characteristics

Population density	High
Job density	Moderate
Access to bike lanes	High
Access to SUPs	High
General description	**Mature, institutional**

Cyclist origins and destinations

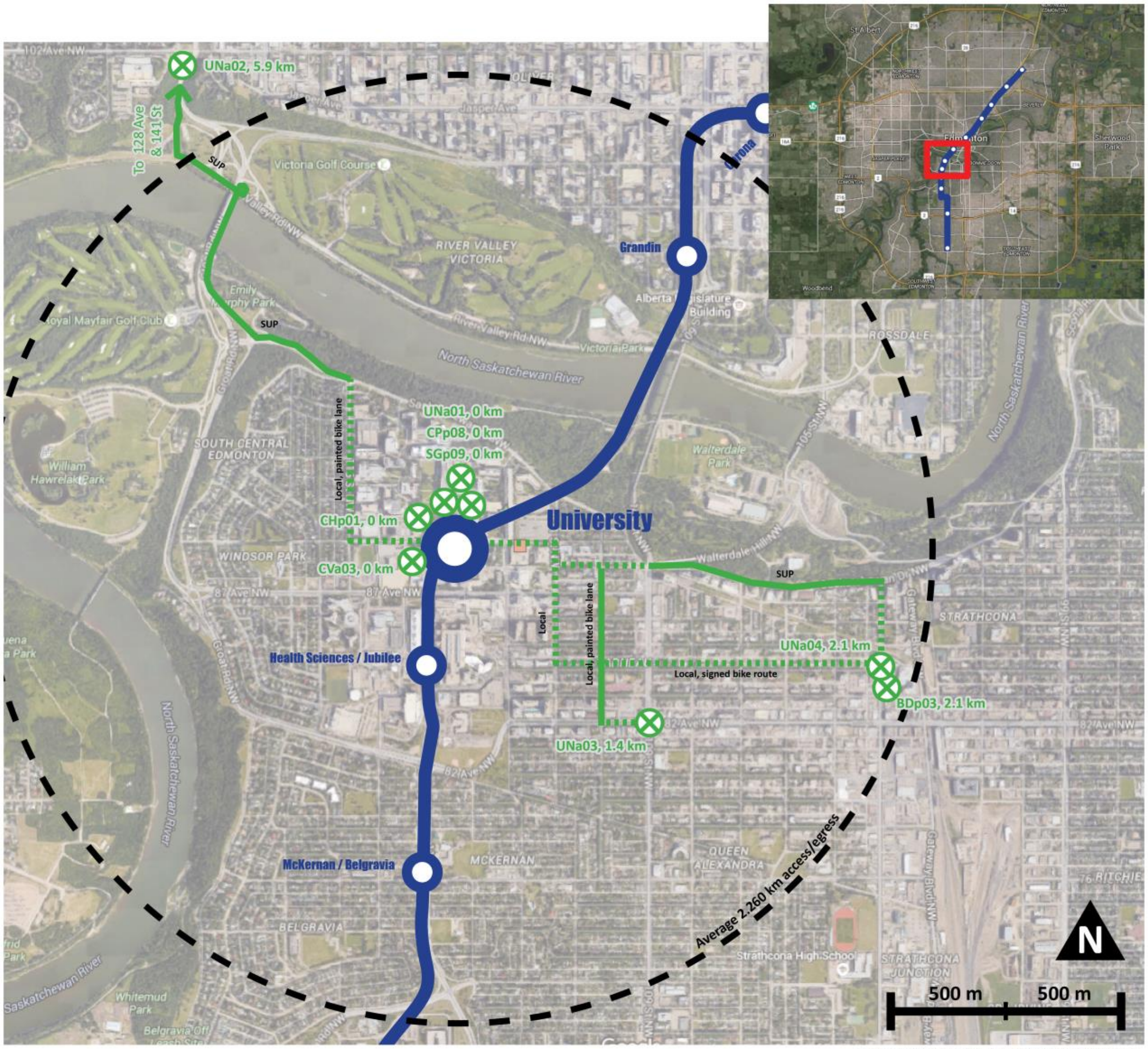


Image source: Google Maps, adapted by author

Legend

- LRT and station
- 2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide

Arterial Road, 21m–28m wide
Collector Road, 11.5m–14.5m wide
Local Road, 8m–9m wide
SUP Shared use path, 3m wide

- Trip origin or destination for cyslists accessing or egressing station by bike
- Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)
- SGp05, 2.0 km — Interviewee ID, distance travelled to/from station

		All those who had / were going to board LRT with bike at this station (i.e. *bike* → *LRT* → *bike*)				Only those interviewed at this station (i.e. *walk/bus/bike* → *LRT* → *bike* OR *bike* → *LRT* → *walk/bus/bike*)			
		Access, will travel to…		Egress, traveled from…		Access, will travel to…		Egress, traveled from…	
Station	Type	AM	PM	AM	PM	AM	PM	AM	PM
Clareview	*C*			1					
Belvedere	*C*		1						
Coliseum	*C*								
Stadium	*B*	1				1		1	
Churchill	*A*				1				
Central	*A*					1			
Bay / Enterprise Square	*A*								
Corona	*A*								
Grandin	*A*								
University	*B*								
Health Sciences / Jubilee	*B*								
McKernan / Belgravia	*B*								
S. Campus / Ft. Edm. Pk.	*C*								
Southgate	*B*		1						
Century Park	*C*		1	1				1	

Inter-type travel for *bike→LRT→bike* trips AM + PM			
A	→	*A*	
A	→	*B*	1
A	→	*C*	
B	→	*A*	1
B	→	*B*	1
B	→	*C*	2
C	→	*A*	
C	→	*B*	2
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips AM			
A	→	*A*	
A	→	*B*	
A	→	*C*	
B	→	*A*	1
B	→	*B*	
B	→	*C*	
C	→	*A*	
C	→	*B*	2
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips PM			
A	→	*A*	
A	→	*B*	1
A	→	*C*	
B	→	*A*	
B	→	*B*	1
B	→	*C*	2
C	→	*A*	
C	→	*B*	
C	→	*C*	

Health Sciences / Jubilee

Station Type: B – Mature

Observations

Collection of bike racks	Max capacity
Numerous*	
Total capacity	**100s of bikes**

*Located on the University of Alberta campus, the station is adjacent to numerous bike racks not specifically intended for commuters' use

	Observation date: None			***Observation date:*** None	
	Numerous	racks		Numerous	racks
Time period	**Access**	**Egress**	**Time period**	**Access**	**Egress**
06:00–06:29			**15:00–15:29**		
06:30–06:59			**15:30–15:59**		
07:00–07:29	Observations	not taken	**16:00–16:29**	Observations	not taken
07:30–07:59	at this	station	**16:30–16:59**	at this	station
08:00–08:29			**17:00–17:29**		
08:30–09:00			**17:30–18:00**		
Total			***Total***		

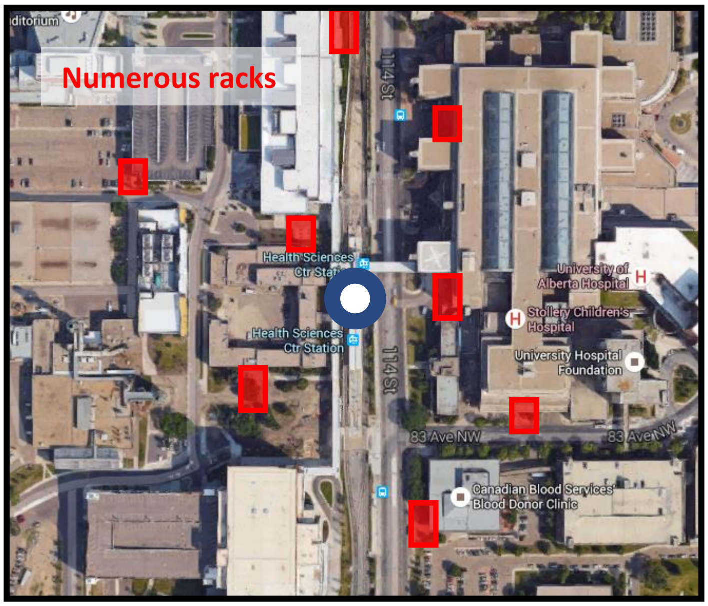


Image source: Google Maps, adapted by author

Summary of surveys

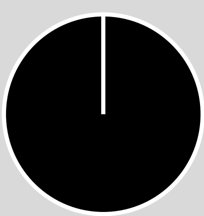
Structured interview date(s), time(s):	Structured interviews not conducted at this station
Bike access interviewed	
Bike egress interviewed	
Total bikes interviewed	
Bike access declined	
Bike egress declined	
Total bikes declined	
Bike access missed	
Bike egress missed	
Total bikes missed	
Bike intercept rate	
Interview response rate	
Interview response rate per all observed bikes	
For those who boarded train with their bike†:	
Number of people ***accessing*** station by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	4
Average bike access distance	**1.300 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	1
Average bike egress distance	**0 km**

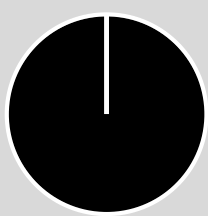
† See [APPENDIX X] for detailed breakdown of data

Other trip details

Not available; structured interviews not conducted at this station

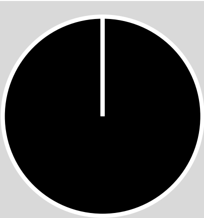
Other modes used this trip →





← Trip purpose

Boarding train with bike? →



Local neighbourhood characteristics

Population density	Moderate
Job density	Moderate
Access to bike lanes	Low
Access to SUPs	Moderate
General description	**Mature, institutional**

Cyclist origins and destinations

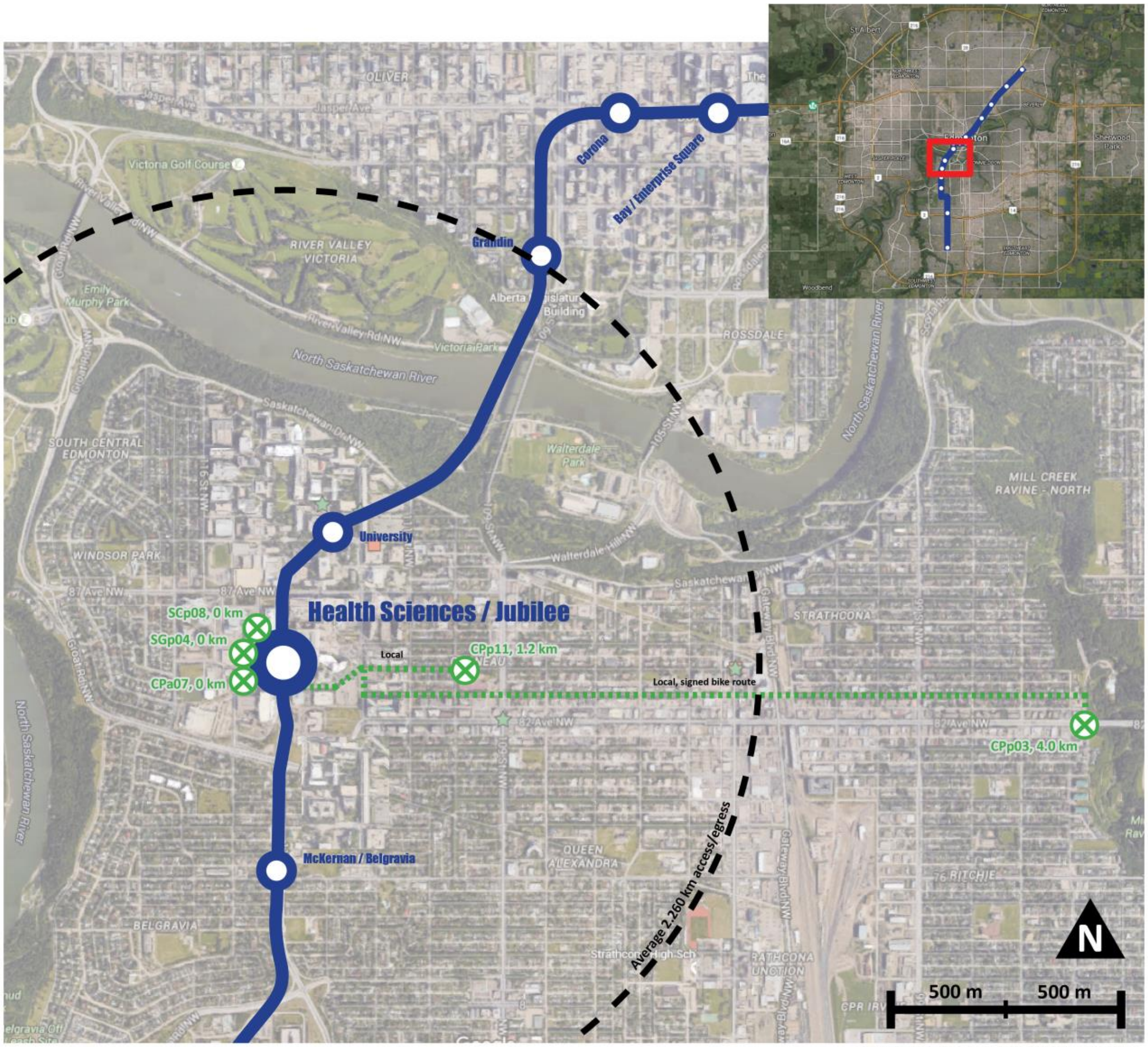


Image source: Google Maps, adapted by author

Legend

- LRT and station
- 2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide
- **Arterial** Road, 21m–28m wide
- **Collector** Road, 11.5m–14.5m wide
- **Local** Road, 8m–9m wide
- **SUP** Shared use path, 3m wide
- Trip origin or destination for cyslists accessing or egressing station by bike
- Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)
- SGp05, 2.0 km — Interviewee ID, distance travelled to/from station

		All those who had / were going to board LRT with bike at this station (i.e. *bike → LRT → bike*)				Only those interviewed at this station (i.e. *walk/bus/bike → LRT → bike* OR *bike → LRT → walk/bus/bike*)			
		Access, will travel to...		Egress, traveled from...		Access, will travel to...		Egress, traveled from...	
Station	Type	AM	PM	AM	PM	AM	PM	AM	PM
Clareview	C								
Belvedere	C								
Coliseum	C								
Stadium	B								
Churchill	A								
Central	A								
Bay / Enterprise Square	A								
Corona	A								
Grandin	A								
University	B								
Health Sciences / Jubilee	B								
McKernan / Belgravia	B								
S. Campus / Ft. Edm. Pk.	C		1						
Southgate	B		1						
Century Park	C		2	1					

Inter-type travel for *bike→LRT→bike* trips AM + PM			
A	→	A	
A	→	B	
A	→	C	
B	→	A	
B	→	B	1
B	→	C	3
C	→	A	
C	→	B	1
C	→	C	

Inter-type travel for *bike→LRT→bike* trips AM			
A	→	A	
A	→	B	
A	→	C	
B	→	A	
B	→	B	
B	→	C	
C	→	A	
C	→	B	1
C	→	C	

Inter-type travel for *bike→LRT→bike* trips PM			
A	→	A	
A	→	B	
A	→	C	
B	→	A	
B	→	B	1
B	→	C	3
C	→	A	
C	→	B	
C	→	C	

McKernan / Belgravia

Station Type: B – Mature

Observations

Collection of bike racks	Max capacity
North racks	4 bikes
South racks	8 bikes
East racks	6 bikes
Total capacity	**18 bikes**

	Observation date: Thu 11 Jun 2015							*Observation date:* None					
	North racks		South racks		East racks			West racks		East racks		South racks	
Time period	**Acc.**	**Egr.**	**Acc.**	**Egr.**	**Acc.**	**Egr.**	**Time period**	**Acc.**	**Egr.**	**Acc.**	**Egr.**	**Acc.**	**Egr.**
06:00–06:29							**15:00–15:29**						
06:30–06:59							**15:30–15:59**						
07:00–07:29							**16:00–16:29**	Observations		not taken at		this station	
07:30–07:59							**16:30–16:59**	for this		time period			
08:00–08:29							**17:00–17:29**						
08:30–09:00			2		2		**17:30–18:00**						
Total	***0***	***0***	***2***	***0***	***2***	***0***	***Total***						

Image source: Google Maps, adapted by author

Summary of surveys

Structured interview date(s), time(s):
Mon 17 August 2015, 15:15–18:00, east racks
Tue 18 August 2015, 06:15–09:00, south racks

Bike access interviewed	3
Bike egress interviewed	3
Total bikes interviewed	**6**
Bike access declined	0
Bike egress declined	0
Total bikes declined	**0**
Bike access missed	6
Bike egress missed	1
Total bikes missed	**7**
Bike intercept rate	46.2%
Interview response rate	100%
Interview response rate per all observed bikes	46.2%

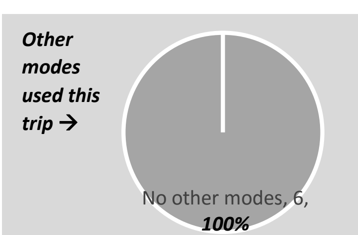
For those who boarded train with their bike:*

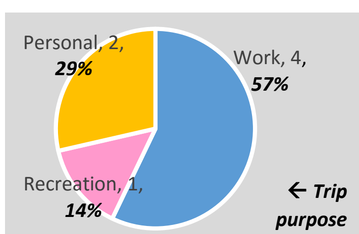
Number of people ***accessing*** station by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	3
Average bike access distance	**1.425 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	3
Average bike egress distance	**1.383 km**

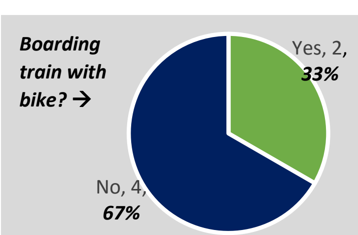
* See [APPENDIX X] for detailed breakdown of data

Other trip details

from information collected in structured interviews







Local neighbourhood characteristics

Population density	Moderate
Job density	Moderate
Access to bike lanes	Moderate
Access to SUPs	Moderate
General description	**Mature, institutional**

Cyclist origins and destinations

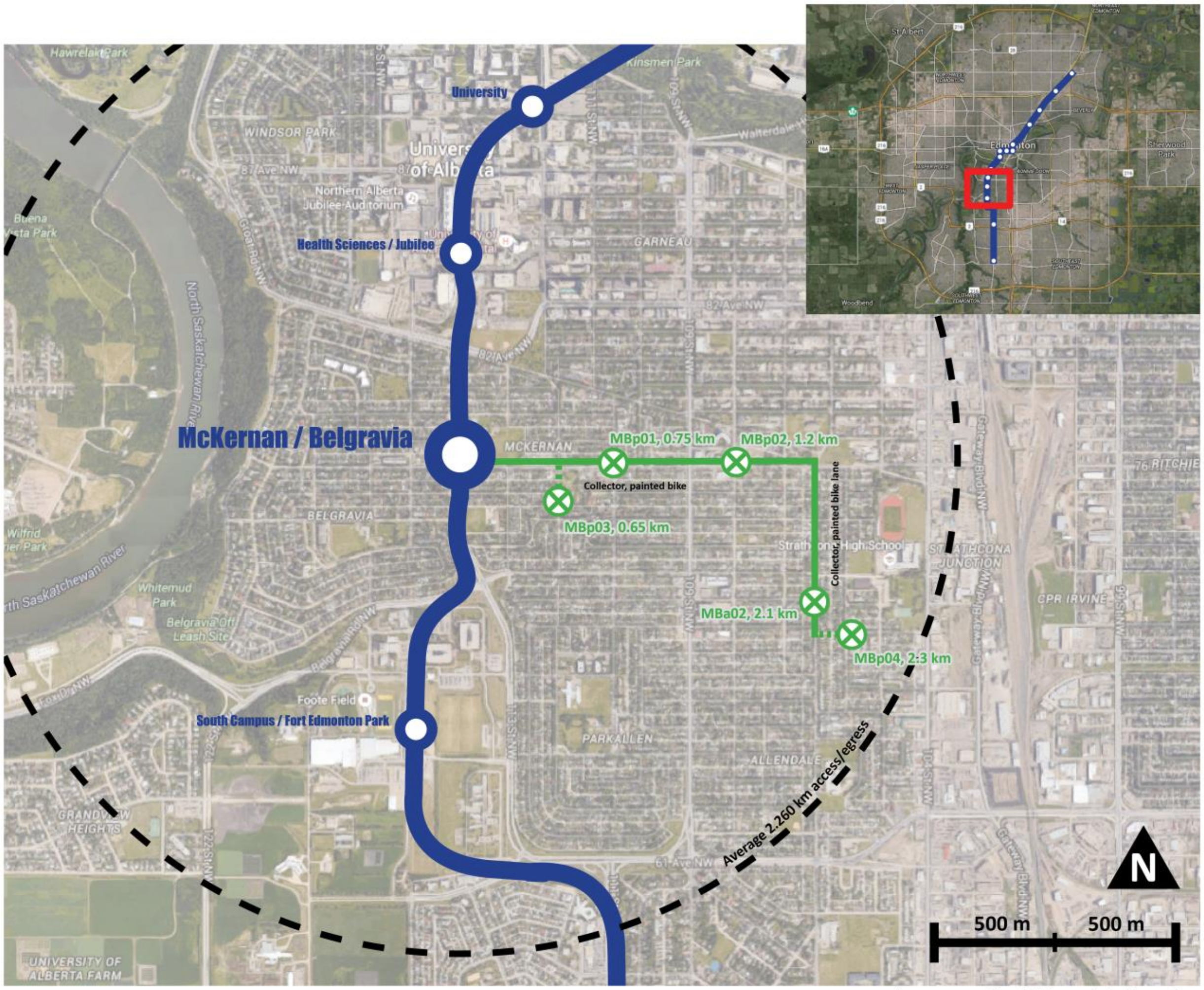


Image source: Google Maps, adapted by author

Legend

LRT and station

2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide

Arterial	Road, 21m–28m wide
Collector	Road, 11.5m–14.5m wide
Local	Road, 8m–9m wide
SUP	Shared use path, 3m wide

Trip origin or destination for cyslists accessing or egressing station by bike

Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)

SGp05, 2.0 km — Interviewee ID, distance travelled to/from station

Station	Type	All those who had / were going to board LRT with bike at this station (i.e. *bike → LRT → bike*) — Access, will travel to… AM	PM	Egress, traveled from… AM	PM	Only those interviewed at this station (i.e. *walk/bus/bike → LRT → bike* OR *bike → LRT → walk/bus/bike*) — Access, will travel to… AM	PM	Egress, traveled from… AM	PM
Clareview	*C*								
Belvedere	*C*								
Coliseum	*C*					1			
Stadium	*B*								
Churchill	*A*								2
Central	*A*								
Bay / Enterprise Square	*A*					1			
Corona	*A*		1				1		
Grandin	*A*								
University	*B*								
Health Sciences / Jubilee	*B*								
McKernan / Belgravia	*B*								
S. Campus / Ft. Edm. Pk.	*C*								
Southgate	*B*								
Century Park	*C*				1				1

Inter-type travel for *bike→LRT→bike* trips AM + PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	
B	→	*A*	1
B	→	*B*	
B	→	*C*	
C	→	*A*	
C	→	*B*	1
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips AM			
A	→	*A*	
A	→	*B*	
A	→	*C*	
B	→	*A*	
B	→	*B*	
B	→	*C*	
C	→	*A*	
C	→	*B*	
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	
B	→	*A*	1
B	→	*B*	
B	→	*C*	
C	→	*A*	
C	→	*B*	1
C	→	*C*	

Observations

Collection of bike racks	Max capacity
North racks	48 bikes
South racks	48 bikes
Total capacity	**96 bikes**

	Observation date: None			
	North racks		**South racks**	
Time period	**Access**	**Egress**	**Access**	**Egress**
06:00–06:29				
06:30–06:59				
07:00–07:29		Observations	not taken	
07:30–07:59		at this	station	
08:00–08:29				
08:30–09:00				
Total				

	Observation date: None			
	North racks		**South racks**	
Time period	**Access**	**Egress**	**Access**	**Egress**
15:00–15:29				
15:30–15:59				
16:00–16:29		Observations	not taken	
16:30–16:59		at this	station	
17:00–17:29				
17:30–18:00				
Total				

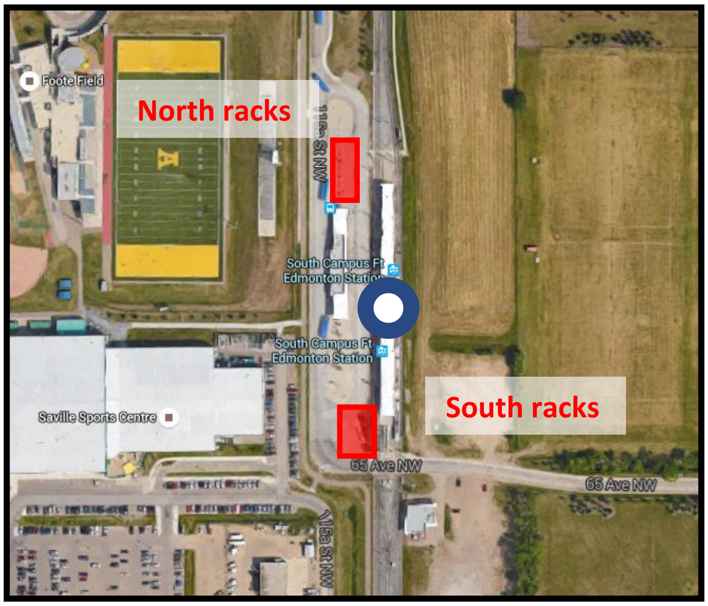


Image source: Google Maps, adapted by author

Summary of surveys

Structured interview date(s), time(s):
Tue 18 August 2015, 15:20–18:00, south racks

Bike access interviewed	1
Bike egress interviewed	9
Total bikes interviewed	**10**
Bike access declined	0
Bike egress declined	3
Total bikes declined	**3**
Bike access missed	1
Bike egress missed	5
Total bikes missed	**6**
Bike intercept rate	68.4%
Interview response rate	76.9%
Interview response rate per all observed bikes	52.6%

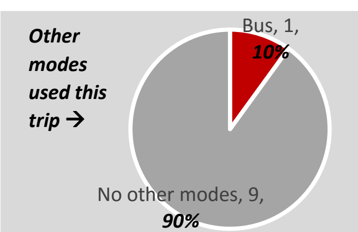
For those who boarded train with their bike:*

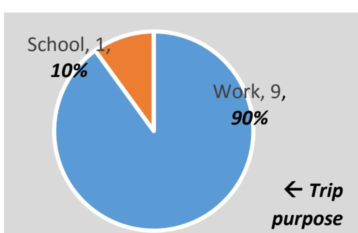
Number of people ***accessing*** station by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	1
Average bike access distance	**3.500 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	9
Average bike egress distance	**2.711 km**

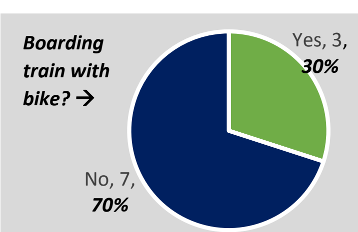
* See [APPENDIX X] for detailed breakdown of data

Other trip details

from information collected in structured interviews







Local neighbourhood characteristics

Population density	Low
Job density	Low
Access to bike lanes	Low
Access to SUPs	High
General description	**Suburban**

Cyclist origins and destinations

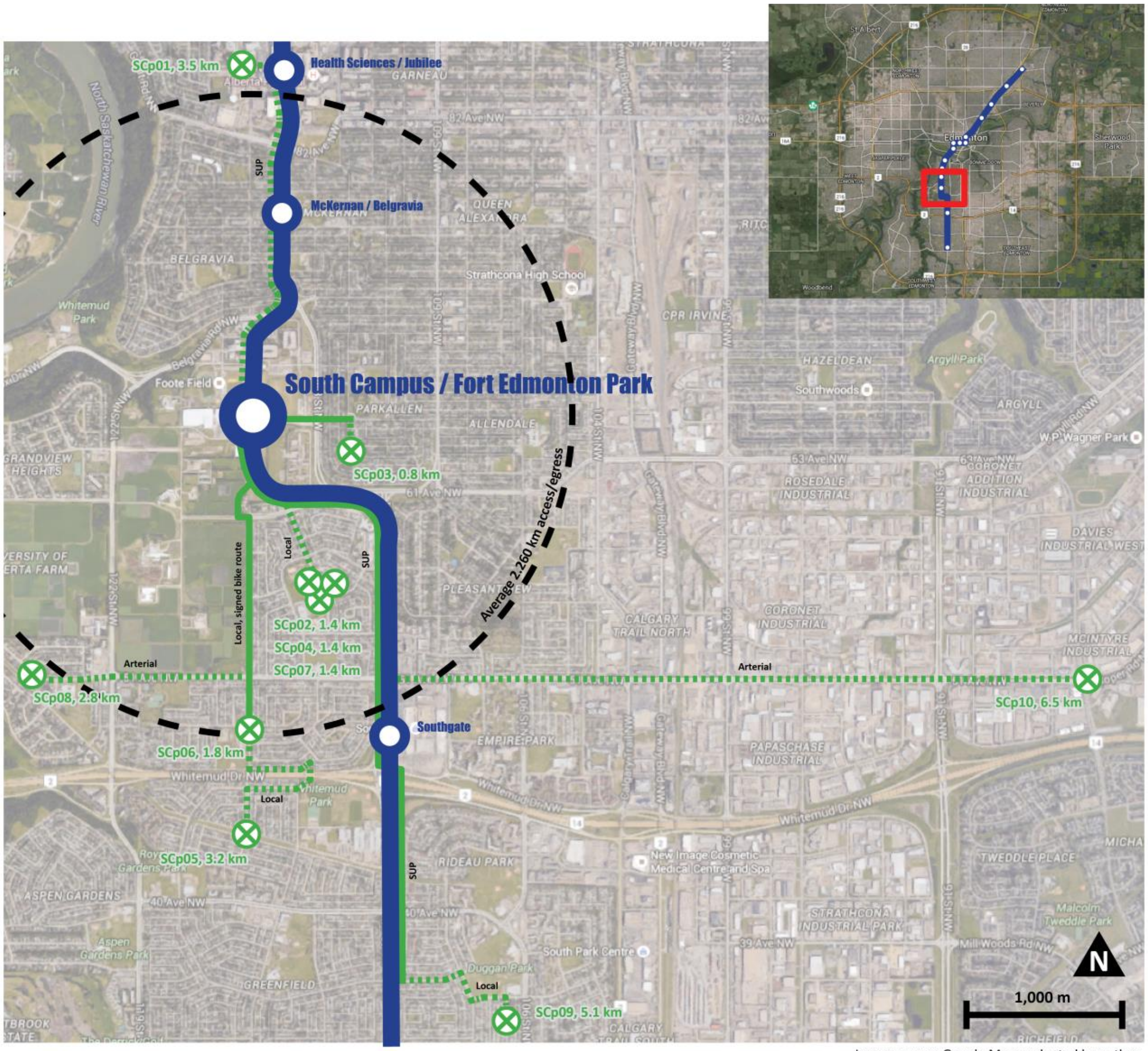


Image source: Google Maps, adapted by author

Legend

LRT and station

2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide

Arterial Road, 21m–28m wide
Collector Road, 11.5m–14.5m wide
Local Road, 8m–9m wide
SUP Shared use path, 3m wide

Trip origin or destination for cyslists accessing or egressing station by bike

Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)

SGp05, 2.0 km — Interviewee ID, distance travelled to/from station

Station	Type	All those who had / were going to board LRT with bike at this station (i.e. *bike → LRT → bike*) Access, will travel to… AM	PM	Egress, traveled from… AM	PM	Only those interviewed at this station (i.e. *walk/bus/bike → LRT → bike* OR *bike → LRT → walk/bus/bike*) Access, will travel to… AM	PM	Egress, traveled from… AM	PM
Clareview	*C*								
Belvedere	*C*								
Coliseum	*C*								
Stadium	*B*								
Churchill	*A*								1
Central	*A*								
Bay / Enterprise Square	*A*				1				1
Corona	*A*		1				1		
Grandin	*A*								
University	*B*								2
Health Sciences / Jubilee	*B*				1				4
McKernan / Belgravia	*B*								
S. Campus / Ft. Edm. Pk.	*C*								
Southgate	*B*								
Century Park	*C*								

Inter-type travel for *bike→LRT→bike* trips AM + PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	1
B	→	*A*	
B	→	*B*	
B	→	*C*	1
C	→	*A*	1
C	→	*B*	
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips AM			
A	→	*A*	
A	→	*B*	
A	→	*C*	
B	→	*A*	
B	→	*B*	
B	→	*C*	
C	→	*A*	
C	→	*B*	
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	1
B	→	*A*	
B	→	*B*	
B	→	*C*	1
C	→	*A*	1
C	→	*B*	
C	→	*C*	

Southgate

Station Type: B – Mature

Observations

Collection of bike racks	Max capacity
West racks	12 bikes
East racks	24 bikes
Total capacity	**36 bikes**

	Observation date: Tue 09 Jun 2015					***Observation date:*** Thu 11 Jun 2015			
	West racks		East racks			West racks		East racks	
Time period	Access	Egress	Access	Egress	Time period	Access	Egress	Access	Egress
06:00–06:29					**15:00–15:29**				
06:30–06:59					**15:30–15:59**	1		1	
07:00–07:29	3		5		**16:00–16:29**		2	1	
07:30–07:59	2		1		**16:30–16:59**		2		
08:00–08:29	2				**17:00–17:29**		1		
08:30–09:00			3		**17:30–18:00**				
Total bikes observed	***7***	***0***	***9***	***0***	***Total bikes observed***	***1***	***5***	***2***	***0***

Image source: Google Maps, adapted by author

Summary of surveys

Structured interview date(s), time(s):
Mon 10 August 2015, 06:10–09:00, west racks
Wed 12 August 2015, 15:15–18:00, west racks
Thu 20 August 2015, 15:15–18:00, east racks

Bike access interviewed	4
Bike egress interviewed	12
Total bikes interviewed	**16**
Bike access declined	1
Bike egress declined	1
Total bikes declined	**2**
Bike access missed	11
Bike egress missed	2
Total bikes missed	**13**
Bike intercept rate	58.1%
Interview response rate	88.9%
Interview response rate per all observed bikes	51.6%

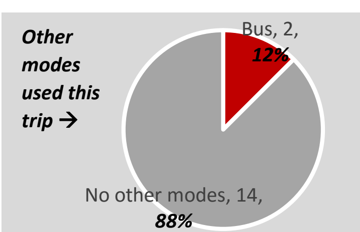
For those who boarded train with their bike:*

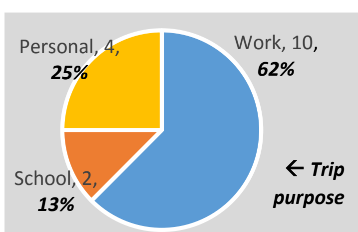
Number of people ***accessing*** station by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	4
Average bike access distance	**1.400 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	12
Average bike egress distance	**1.625 km**

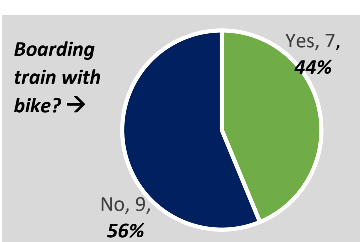
* See [APPENDIX X] for detailed breakdown of data

Other trip details

from information collected in structured interviews







Local neighbourhood characteristics

Population density	Low
Job density	Low
Access to bike lanes	Moderate
Access to SUPs	High
General description	**Suburban**

Cyclist origins and destinations

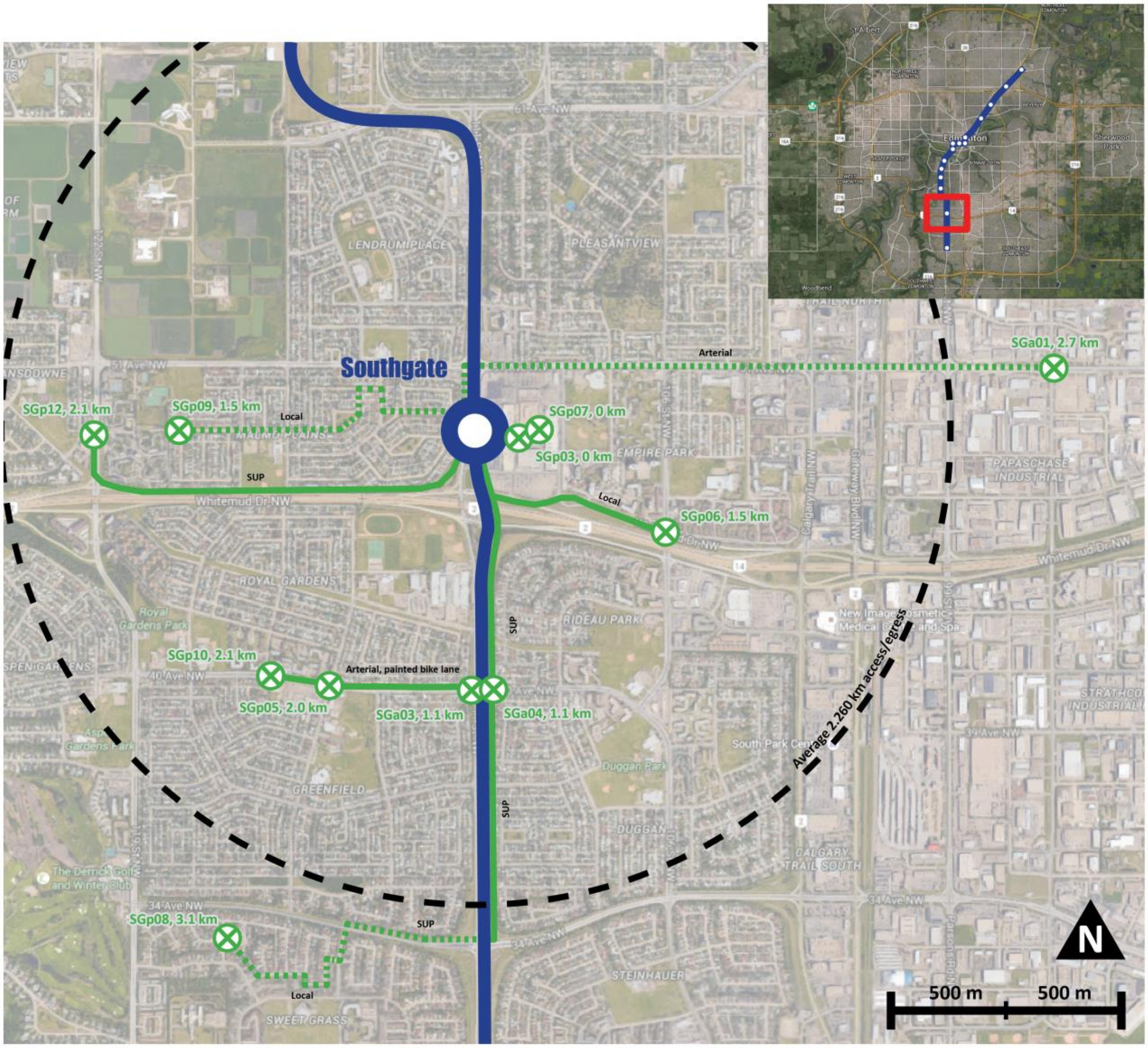


Image source: Google Maps, adapted by author

Legend

- LRT and station
- 2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide
- **Arterial** Road, 21m–28m wide
- **Collector** Road, 11.5m–14.5m wide
- **Local** Road, 8m–9m wide
- **SUP** Shared use path, 3m wide
- Trip origin or destination for cyslists accessing or egressing station by bike
- Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)
- SGp05, 2.0 km — Interviewee ID, distance travelled to/from station

		All those who had / were going to board LRT with bike at this station (i.e. *bike → LRT → bike*)				Only those interviewed at this station (i.e. *walk/bus/bike → LRT → bike* OR *bike → LRT → walk/bus/bike*)			
		Access, will travel to...		Egress, traveled from...		Access, will travel to...		Egress, traveled from...	
Station	Type	AM	PM	AM	PM	AM	PM	AM	PM
Clareview	*C*								
Belvedere	*C*	1				1			
Coliseum	*C*								
Stadium	*B*								
Churchill	*A*					1			1
Central	*A*		1		1		1		2
Bay / Enterprise Square	*A*								
Corona	*A*			1				1	
Grandin	*A*								2
University	*B*				1	1			2
Health Sciences / Jubilee	*B*				1				2
McKernan / Belgravia	*B*								
S. Campus / Ft. Edm. Pk.	*C*								
Southgate	*B*								
Century Park	*C*				1				2

Inter-type travel for *bike→LRT→bike* trips AM + PM			
A	→	*A*	
A	→	*B*	2
A	→	*C*	
B	→	*A*	1
B	→	*B*	2
B	→	*C*	1
C	→	*A*	
C	→	*B*	1
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips AM			
A	→	*A*	
A	→	*B*	1
A	→	*C*	
B	→	*A*	
B	→	*B*	
B	→	*C*	1
C	→	*A*	
C	→	*B*	
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips PM			
A	→	*A*	
A	→	*B*	1
A	→	*C*	
B	→	*A*	1
B	→	*B*	2
B	→	*C*	
C	→	*A*	
C	→	*B*	1
C	→	*C*	

Century Park

Station Type: C – Suburban

Observations

Collection of bike racks	Max capacity
West racks	12 bikes
East racks	10 bikes
South racks	48 bikes
Total capacity	**70 bikes**

Observation date: Tue 23 Jun 2015

Time period	West racks Acc.	West racks Egr.	East racks Acc.	East racks Egr.	South racks Acc.	South racks Egr.
06:00–06:29	1					
06:30–06:59	2		1		2	
07:00–07:29	2		1		2	
07:30–07:59	5		1		5	
08:00–08:29					2	
08:30–09:00	1				1	
Total	***11***	***0***	***3***	***0***	***12***	***0***

Observation date: Wed 10 Jun 2015

Time period	West racks Acc.	West racks Egr.	East racks Acc.	East racks Egr.	South racks Acc.	South racks Egr.
15:00–15:29			1	1		
15:30–15:59		1		3		2
16:00–16:29		3		3		1
16:30–16:59	1	5		2		1
17:00–17:29		1				
17:30–18:00			1	1		2
Total	***1***	***10***	***2***	***10***	***0***	***6***

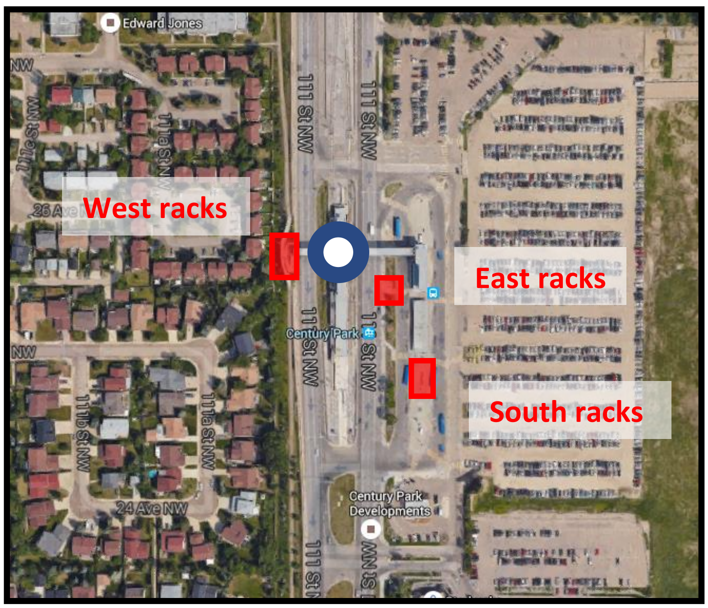


Image source: Google Maps, adapted by author

Summary of surveys

Structured interview date(s), time(s):
Tue 11 August 2015, 06:00–09:00, west racks
Thu 13 August 2015, 15:15–18:00, south racks

Bike access interviewed	10
Bike egress interviewed	10
Total bikes interviewed	**20**
Bike access declined	2
Bike egress declined	1
Total bikes declined	**3**
Bike access missed	0
Bike egress missed	4
Total bikes missed	**4**
Bike intercept rate	85.2%
Interview response rate	87.0%
Interview response rate per all observed bikes	74.1%

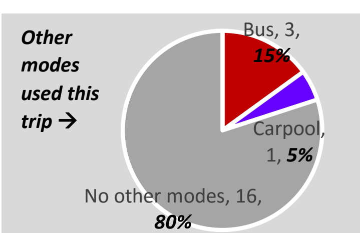
For those who boarded train with their bike:*

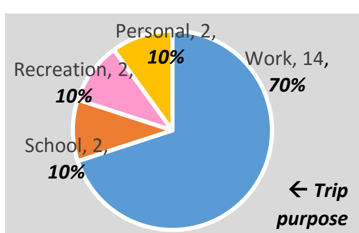
Number of people ***accessing*** station by bike (including those interviewed while egressing from another station, who had boarded the train with their bike):	12
Average bike access distance	**3.379 km**
Number of people ***egressing*** station by bike (including those interviewed while accessing another station, who intended to board the train with their bike):	11
Average bike egress distance	**4.825 km**

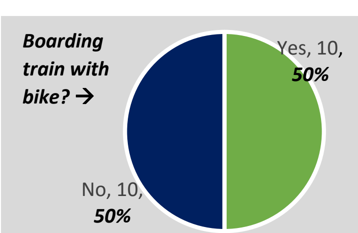
* See [APPENDIX X] for detailed breakdown of data

Other trip details

from information collected in structured interviews







Local neighbourhood characteristics

Population density	Low
Job density	Low
Access to bike lanes	High
Access to SUPs	High
General description	**Suburban**

Cyclist origins and destinations

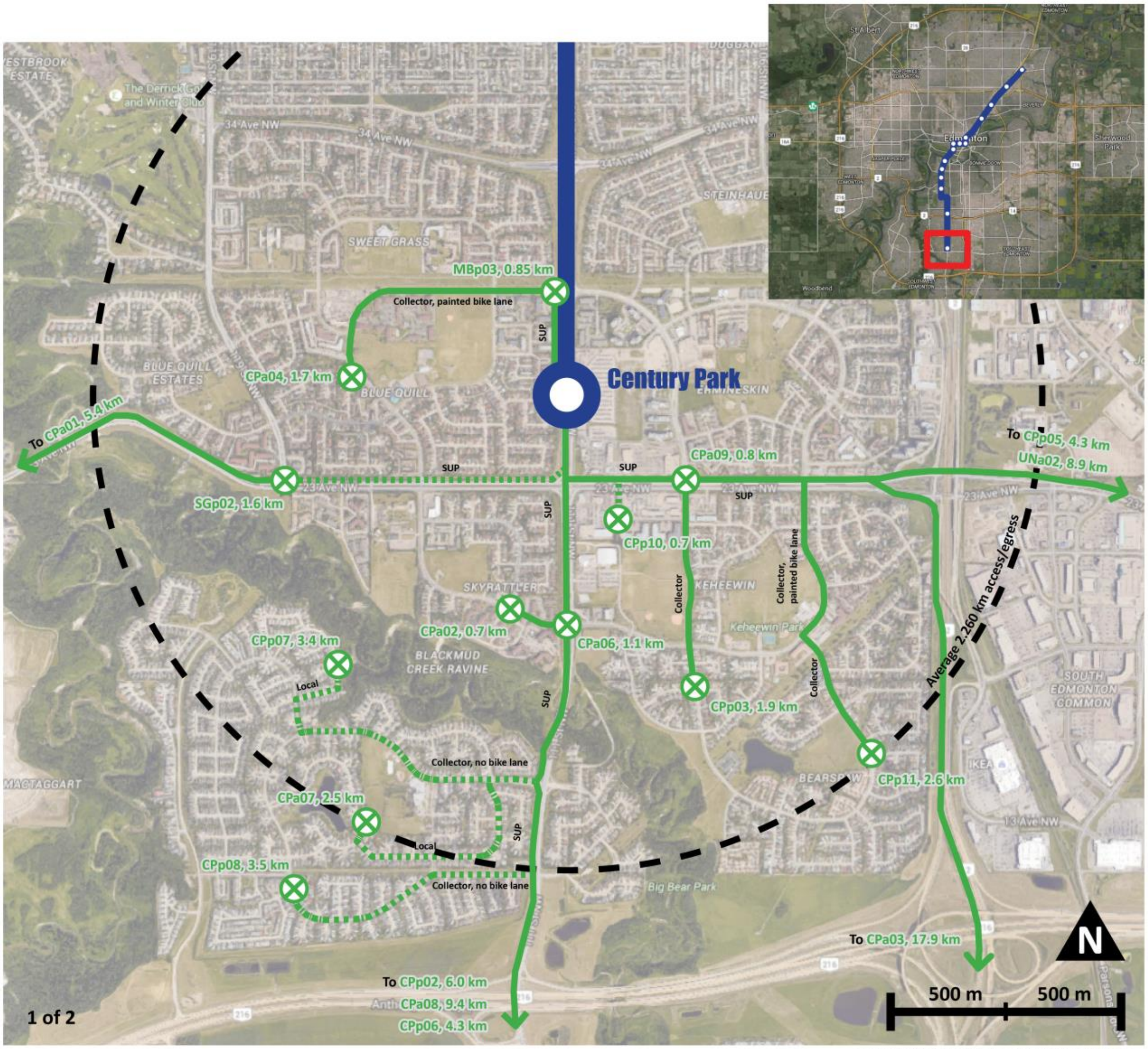


Image source: Google Maps, adapted by author

Legend

LRT and station

2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide

Arterial Road, 21m–28m wide
Collector Road, 11.5m–14.5m wide
Local Road, 8m–9m wide
SUP Shared use path, 3m wide

Trip origin or destination for cyslists accessing or egressing station by bike

Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)

SGp05, 2.0 km Interviewee ID, distance travelled to/from station

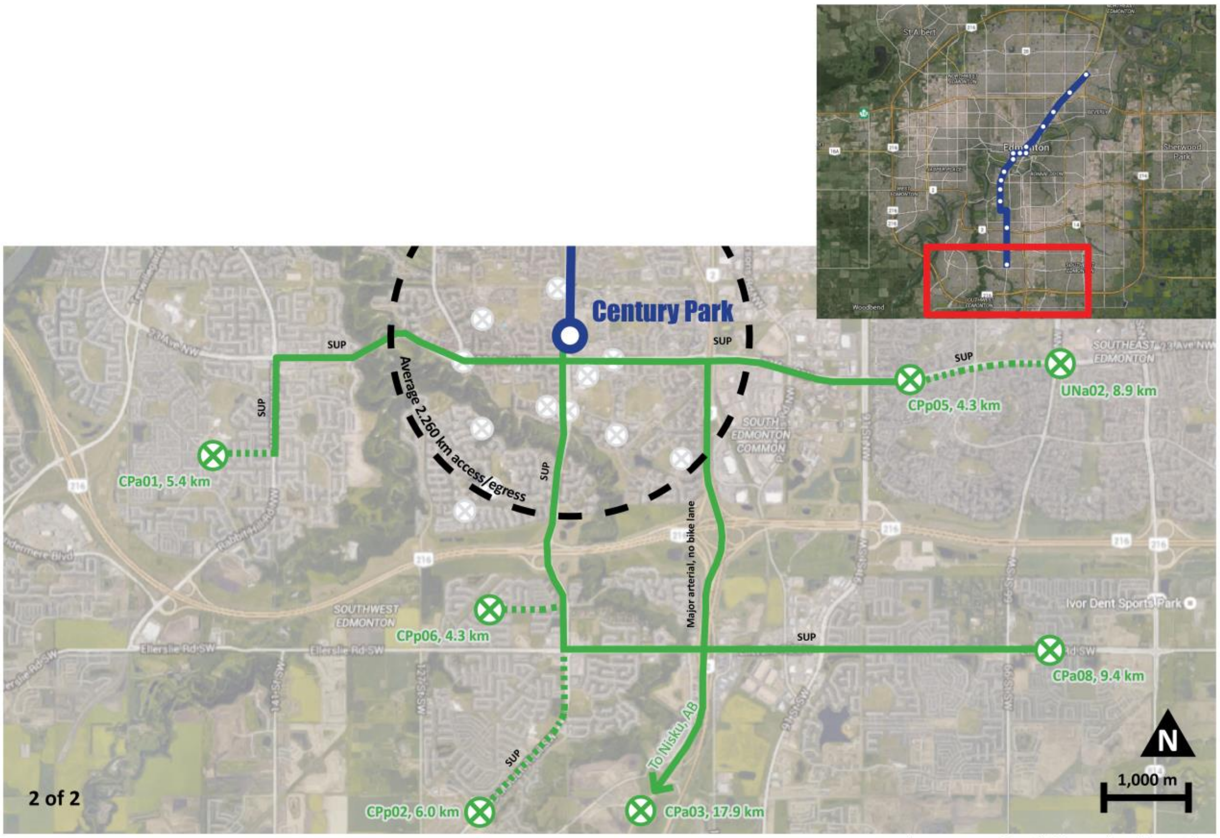


Image source: Google Maps, adapted by author

Legend

LRT and station

2.260 km radius from station indicating average access and egress distance to stations by bike, system-wide

Arterial Road, 21m–28m wide
Collector Road, 11.5m–14.5m wide
Local Road, 8m–9m wide
SUP Shared use path, 3m wide

Trip origin or destination for cyslists accessing or egressing station by bike

Access or egress route by bike (as identified by interviewee; or shortest distance by road or SUP when no specific route was identified)

SGp05, 2.0 km — Interviewee ID, distance travelled to/from station

		All those who had / were going to board LRT with bike at this station (i.e. *bike* → *LRT* → *bike*)				Only those interviewed at this station (i.e. *walk/bus/bike* → *LRT* → *bike* OR *bike* → *LRT* → *walk/bus/bike*)			
		Access, will travel to…		Egress, traveled from…		Access, will travel to…		Egress, traveled from…	
Station	Type	AM	PM	AM	PM	AM	PM	AM	PM
Clareview	*C*								
Belvedere	*C*		1				1		
Coliseum	*C*				1				1
Stadium	*B*								
Churchill	*A*	1				1			1
Central	*A*								
Bay / Enterprise Square	*A*	1				1			1
Corona	*A*			1		1		1	1
Grandin	*A*				1				1
University	*B*	1			1	1			1
Health Sciences / Jubilee	*B*	1			2	4			4
McKernan / Belgravia	*B*		1						
S. Campus / Ft. Edm. Pk.	*C*								
Southgate	*B*		1						
Century Park	*C*								

Inter-type travel for *bike→LRT→bike* trips AM + PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	2
B	→	*A*	
B	→	*B*	
B	→	*C*	3
C	→	*A*	2
C	→	*B*	4
C	→	*C*	2

Inter-type travel for *bike→LRT→bike* trips AM			
A	→	*A*	
A	→	*B*	
A	→	*C*	1
B	→	*A*	
B	→	*B*	
B	→	*C*	
C	→	*A*	2
C	→	*B*	2
C	→	*C*	

Inter-type travel for *bike→LRT→bike* trips PM			
A	→	*A*	
A	→	*B*	
A	→	*C*	1
B	→	*A*	
B	→	*B*	
B	→	*C*	3
C	→	*A*	
C	→	*B*	2
C	→	*C*	2

Appendix B: Survey response summary

Section		All stations	Century Park	Southgate	South Campus / Fort Edmonton Park	McKernan / Belgravia	Health Sciences / Jubilee	University	Grandin	Corona	Bay / Enterprise Square	Central	Churchill	Stadium	Coliseum	Belvedere	Clareview
Survey results	Total AM peak hours structured interviews conducted	21.83	3.00	2.83	0.00	2.75	0.00	2.00	2.75	0.00	3.00	0.00	0.00	2.75	0.00	0.00	2.75
	Total PM peak hours structured interviews conducted	24.92	2.75	5.50	2.67	2.75	0.00	0.00	0.00	0.00	3.00	0.00	0.25	2.75	0.00	2.75	2.50
	Total hours structured interviews conducted	***46.75***	***5.75***	***8.33***	***2.67***	***5.50***	***0.00***	***2.00***	***0.00***	***0.00***	***6.00***	***0.00***	***0.25***	***5.50***	***0.00***	***2.75***	***5.25***
	Bike access interviewed	31	10	4	1	3		2	0		0		2	3		2	4
	Bike egress interviewed	46	10	12	9	3		2	0		0		0	1		2	7
	Total bikes interviewed	***77***	***20***	***16***	***10***	***6***		***4***	***0***		***0***		***2***	***4***		***4***	***11***
	Bike access declined interview	7	2	1	0	0		0	0		0		0	2		2	0
	Bike egress declined interview	6	1	1	3	0		0	0		0		0	0		1	0
	Total declined interviews	***13***	***3***	***2***	***3***	***0***		***0***	***0***		***0***		***0***	***2***		***3***	***0***
	Bike access missed	24	0	11	1	6		0	0		0		0	3		2	1
	Bike egress missed	14	4	2	5	1		0	0		0		0	0		0	2
	Total bikes missed*	***38***	***4***	***13***	***6***	***7***		***0***	***0***		***0***		***0***	***3***		***2***	***3***
	Total bikes observed†	128	27	31	19	13		4	0		0		2	9		9	14
	Total bikes interviewed	77	20	16	10	6		4	0		0		2	4		4	11
	Average bikes per hour observed‡	2.7	4.7	3.7	7.1	2.4		2.0	0.0		0.0		8.0	1.6		3.3	2.7
	Average bikes per hour interviewed§	1.6	3.5	1.9	3.7	1.1		2.0	0.0		0.0		8.0	0.7		1.5	2.1
	Bike intercept rate¶	***70.3%***	***85.2%***	***58.1%***	***68.4%***	***46.2%***		***100.0%***	***n/a***		***n/a***		***100.0%***	***66.7%***		***77.8%***	***78.6%***
	Interview response rate‖	***85.6%***	***87.0%***	***88.9%***	***76.9%***	***100.0%***		***100.0%***	***n/a***		***n/a***		***100.0%***	***66.7%***		***57.1%***	***100.0%***
	Interview response rate per all observed bikes*	***60.2%***	***74.1%***	***51.6%***	***52.6%***	***46.2%***		***100.0%***	***n/a***		***n/a***		***100.0%***	***44.4%***		***44.4%***	***78.6%***
	Boarded LRT with bike	35	10	7	3	2		2	0		0		2	3		3	3
	Did not board LRT with bike	42	10	9	7	4		2	0		0		0	1		1	8
	Combined bike/LRT trip with bus	9	3	2	1	0		0	0		0		1	0		0	2
	Combined bike/LRT trip with carpool	1	1	0	0	0		0	0		0		0	0		0	0
	Did not combine bike/LRT trip with other modes	67	16	14	9	6		4	0		0		1	4		4	9
	Purpose of trip: work	53	14	10	9	4		2	0		0		2	4		1	7
	Purpose of trip: school	8	2	2	1	0		0	0		0		0	0		1	2
	Purpose of trip: recreational	3	2	0	0	1		0	0		0		0	0		0	0
	Purpose of trip: personal	13	2	4	0	1		2	0		0		0	0		2	2
	Bikes in the winter	13	3	1	1	1		1	0		0		0	2		2	2
	Does not bike in the winter	64	17	15	9	5		3	0		0		2	2		2	9
	Number of people accessing station by bike	39	4	4	1	3	4	5	1	2	1	2	2	3	1	2	4
	Number of people egressing station by bike	66	12	12	9	3	1	4	0	2	1	1	2	3	1	6	9
	Total number of people accessing or egressing by bike††	***105***	***16***	***16***	***10***	***6***	***5***	***9***	***1***	***4***	***2***	***3***	***4***	***6***	***2***	***8***	***13***
	Average access distance by bikes to this station (km)	***2.095***	***3.379***	***1.400***	***3.500***	***1.425***	***1.300***	***0.700***	***1.200***	***2.750***	***0.000***	***1.460***	***0.325***	***1.183***	***4.000***	***4.525***	***1.833***
	Average egress distance by bikes from this station (km)	***2.425***	***4.825***	***1.625***	***2.711***	***1.383***	***0.000***	***2.000***	***n/a***	***0.125***	***0.450***	***0.200***	***0.050***	***1.050***	***2.600***	***1.633***	***2.338***
	Average access and egress distances (km)‡‡	***2.260***	***4.102***	***1.513***	***3.106***	***1.404***	***0.650***	***1.350***	***1.200***	***1.438***	***0.225***	***0.830***	***0.188***	***1.117***	***3.300***	***3.079***	***2.085***
	Number of trip origins and destinations outside of average access/egress radius ("average radius")	23	8	2	5	0	1	1	0	1	0	0	0	0	1	2	2
	Proportion of trip origins and destinations outside of average radius	21.9%	50.0%	12.5%	50.0%	0.0%	20.0%	11.1%	0.0%	25.0%	0.0%	0.0%	0.0%	0.0%	50.0%	25.0%	15.4%
Site analyses	Neighbourhood characteristics		Single family homes, strip malls, some townhomes	Single family homes, large shopping mall	Single family homes, strip malls, UofA farmland	Single family homes, strip malls, UofA campus, some townhomes and highrise apts.	Single family homes, strip malls, UofA campus, some townhomes and highrise apts.	Single family homes, strip malls, UofA campus, some highrise apts. and offices	UofA campus, downtown highrise apts. and offices	Downtown highrise and lowrise apts. and offices some single family homes	Downtown highrise and lowrise apts. and offices some single family homes	Downtown highrise and lowrise apts. and offices some single family homes	Downtown highrise and lowrise apts. and offices some single family homes	Single family homes, some lowrise apts., strip malls, sporting venues	Single family homes, strip malls, sporting venues, light industrial areas	Single family homes, strip malls, light industrial areas	Single family homes, big box stores, developing areas
	Population density		Low	Low	Low	Moderate	Moderate	High	High	High	High	High	High	Moderate	Low	Low	Low
	Job density		Low	Low	Low	Moderate	Moderate	Moderate	High	High	High	High	High	Moderate	Moderate	Moderate	Low
	Access to bike lanes		High	Moderate	Low	Moderate	Low	High	Low	Low	Low	Low	Low	Low	Low	Low	Moderate
	Access to SUPs		High	High	High	Moderate	Moderate	High	Moderate	Low	Low	Low	Low	Moderate	Moderate	Low	Moderate
	Neighbourhood description§§		***Suburban***	***Suburban***	***Suburban***	***Mature, institutional***	***Mature, institutional***	***Mature, institutional***	***Downtown***	***Downtown***	***Downtown***	***Downtown***	***Downtown***	***Mature, recreational or industrial***	***Mature, recreational or industrial***	***Mature, recreational or industrial***	***Suburban***
Station facts	Year station opened		2010	2010	2009	2009	2006	1992	1989	1983	1983	1978	1978	1978	1978	1978	1981
	Grade		At-grade	At-grade	At-grade	At-grade	At-grade	At-grade	Below	Below	Below	Below	Below	At-grade	At-grade	At-grade	At-grade
	Boarding (2014, weekday service)	98,144	11,760	8,739	5,473	1,958	7,066	12,548	2,532	8,551	4,611	6,070	8,030	3,110	4,398	4,726	8,572
	Alighting (2014, weekday service)	98,144	11,099	9,205	4,756	1,838	6,888	13,354	2,381	8,555	4,975	5,911	7,554	3,137	5,732	4,781	7,978
	Station total¶¶	***196,288***	***22,859***	***17,944***	***10,229***	***3,796***	***13,954***	***25,902***	***4,913***	***17,106***	***9,586***	***11,981***	***15,584***	***6,247***	***10,130***	***9,507***	***16,550***
	% of system-wide ridership	100.0%	9.1%	9.1%	5.2%	1.9%	7.1%	13.2%	2.5%	8.7%	4.9%	6.1%	7.9%	3.2%	5.2%	4.8%	8.4%
	Station type		***C***	***B***	***C***	***B***	***B***	***B***	***A***	***A***	***A***	***A***	***A***	***B***	***C***	***C***	***C***

* Bikes observed accessing or egressing the station – usually from another entry point – but could not be physically reached due to the location of where the researcher was situated

† [Total bikes interviewed] + [Total declined interviews] + [Total bikes missed]

‡ [Total bikes observed] / [Total hours structured interviews conducted]

§ [Total bikes interviewed] / [Total hours structured interviews conducted]

¶ [Total bikes interviewed] + [Total declined interviews] / [†]

‖ [Total bikes interviewed] / [Total bikes interviewed] +[Total declined interviews]

** [Total bikes interviewed] / [†]

†† Including those interviewed while egressing from another station, who had boarded the train with their bike; and those accessing another station, who intended to board the train with their bike

‡‡ Colour-coded as follows:

0 km – 1.5 km	1.5 km – 3.0 km	+ 3.0 km

§§ Colour-coded as follows:

Lower job/pop. density		Higher job/pop. density

¶¶ Colour-coded as follows:

0 – 10,000	10,000 – 20,000	+ 20,000

Appendix C: Survey response details

Individual survey responses

	01 STATION	02 DATE	03 TIME PERIOD START	04 TIME PERIOD END	05 LOCATION	06 WEATHER	07 ID	08 Time	09 Access or egress?	10 Will/did you take your bike onto the train with you?	11 Would you like to be able to?	12 What route did you take to get here / What route will you take to get to your final destination?	13 Do you always take this route?	14 Why?	15 What type of roadway is this?	16 Will you use other modes for this trip?	17 Why?	18 What is the purpose of your trip?	19 What station are you travelling to/from?	20 How will you get to your final destination?
1	Southgate	2015-08-20	3:15:00 PM	6:00:00 PM	East racks	Sunny, mild	SGp01	3:22:00 PM	Egress	Yes	n/a	LRT SUP			SUP	No		Work	Central	
2							SGp02	3:31:00 PM	Egress	Yes	Yes; unable to during rush hour	LRT SUP			SUP	Yes; bus		Work	Century Park	Bus
3							SGp03	3:39:00 PM	Egress	No	No; don't need to	"just nearby"			SUP	Yes; bus		Work	Churchill	
4							SGp04	4:26:00 PM	Egress	Yes	n/a	LRT SUP			SUP	No		School	Health Sci.	
5							SGp05	4:40:00 PM	Access	Yes	n/a	LRT SUP			SUP	No		Personal	Central	
6							SGp06	4:55:00 PM	Egress	No	No; it's too convenient	Whitemud			Arterial	No		Work	Central	Bike
7							SGp07	5:26:00 PM	Egress	No	No; it's too convenient	LRT SUP			SUP	No		Personal	Century Park	Bike
8	Stadium	2015-08-19	3:15:00 PM	6:00:00 PM	East bike racks	Sunny, hot	STp01	4:39:00 PM	Access	Yes	n/a	"the alley nearby"			Local	No		Work	Belvedere	
9							STp02	5:28:00 PM	Egress	No		Jasper			Arterial	No		Work	Clareview	
10	South Campus Fort Edmonton	2015-08-18	3:20:00 PM	6:00:00 PM	South entrance	Sunny, warm	SCp01	3:28:00 PM	Access	Yes	n/a	Jasper			Arterial	Yes; bus		Work	Corona	
11							SCp02	3:33:00 PM	Egress	No	Yes; unable to during rush hour	LRT SUP			SUP	No		Work	University	
12							SCp03	4:09:00 PM	Egress	Yes	n/a	65 Ave			Local	No		Work	Bay / Enterprise Sq.	
13							SCp04	4:13:00 PM	Egress	No	No; don't need to	SUP, 65 Ave			SUP + road	No		Work	Health Sci.	
14							SCp05	4:50:00 PM	Egress	No	No; it's too inconvenient / it's convenient enough	LRT SUP			SUP	No		Work	Churchill	
15							SCp06	4:55:00 PM	Egress	No	Yes; unable to during rush hour	115 St			Local	No		Work	Health Sci.	
16							SCp07	4:56:00 PM	Egress	No		LRT SUP			SUP	No		School	Health Sci.	
17							SCp08	4:59:00 PM	Egress	Yes	Yes; prefer to keep bike in eyesight	LRT SUP, 115 St			SUP + road	No		Work	Health Sci.	
18							SCp09	5:04:00 PM	Egress	No	No; don't need to	LRT SUP			SUP	No		Work	Bay / Enterprise Sq.	
19							SCp10	5:44:00 PM	Egress	No	No; don't need to	LRT SUP			SUP	No		Work	University	
20	McKernan Belgravia	2015-08-18	6:15:00 AM	9:00:00 AM	West racks	Sunny, cool	MBa01	7:46:00 AM	Access	No	Yes; unable to during rush hour	76 Ave			Bike lane	No		Work	Bay / Enterprise Sq.	
21							MBa02	7:59:00 AM	Access	No	No; don't need to	76 Ave			Bike lane	No		Work	Coliseum	
22	McKernan Belgravia	2015-08-17	3:15:00 PM	6:00:00 PM	East racks	Cloudy, intermittent rain	MBp01	3:19:00 PM	Access	Yes	n/a	109 St			Arterial	No	Intimida	Personal	Corona	
23							MBp02	3:54:00 PM	Egress	No	No; it's too inconvenient / it's convenient enough	76 Ave			Bike lane	No		Work	Churchill	
24							MBp03	4:31:00 PM	Egress	Yes	n/a	76 Ave			Local	No		Recreational	Century Park	
25							MBp04	4:37:00 PM	Egress	No	Yes; unable to during rush hour	76 Ave, 106 St	No	Depends on traffic	Bike lane	No		Work	Churchill	
26	Stadium	2018-08-17	6:15:00 AM	9:00:00 AM	West racks	Sunny, cool	STa01	7:41:00 AM	Access	Yes	n/a	LRT SUP, Manning Road			SUP + road	No		Work	Clareview	
27							STa02	8:24:00 AM	Access	Yes		88 St			Local	No		Work	Churchill	
28	Belvedere	2015-08-14	3:15:00 PM	6:00:00 PM	West racks	Sunny, mild	BDp01	3:31:00 PM	Access	Yes	n/a	101 St			Local	No		School	Stadium	
29							BDp02	4:07:00 PM	Access	Yes		118 Ave, LRT SUP			SUP + road	No		Personal	Clareview	
30							BDp03	4:11:00 PM	Egress	Yes	Yes; in inclement weather	109 St, river valley SUP			SUP + road	No		Personal	University	
31							BDp04	4:37:00 PM	Egress	No	Yes; unable to during rush hour	Local roads			Local	No		Work	University	
32	Clareview	2015-08-14	6:15:00 AM	9:00:00 AM	East racks	Sunny, cool	CVa01	6:57:00 AM	Access	No	Yes; unable to during rush hour	40 St, 139 Ave			Bike lane	No		Work	Churchill	
33							CVa02	7:46:00 AM	Access	No	Yes; unable to during rush hour	40 St, 139 Ave			Local	Yes; bus		Personal	Stadium	Bus
34							CVa03	8:15:00 AM	Access	Yes		LRT SUP			SUP	No		Work	University	
35	Century Park	2015-08-13	3:15:00 PM	6:00:00 PM	East racks	Sunny, hot	CPp01	3:25:00 PM	Egress	Yes		SUP, local streets			SUP + road	Yes; carpool		Work	Grandin	Car
36							CPp02	3:42:00 PM	Access	Yes		Bus				Yes; bus		Work	Belvedere	
37							CPp03	3:52:00 PM	Egress	Yes		23 Ave SUP, 109 St			SUP + road	No		Recreational	Health Sci.	
38							CPp04	3:59:00 PM	Egress	No		Bus				Yes; bus		Work	Corona	
39							CPp05	4:38:00 PM	Egress	No	Yes; unable to during rush hour	23 Ave SUP			SUP	No		Work	Bay / Enterprise Sq.	
40							CPp06	4:54:00 PM	Egress	No	No; it's too inconvenient / it's convenient enough	111 St SUP			SUP	No		Recreational	Health Sci.	
41							CPp07	5:08:00 PM	Egress	No	No; it's too inconvenient / it's convenient enough	111 St SUP			SUP	No		Work	Health Sci.	

Individual survey responses

	01 STATION	21 What intersection, postal code, neighbourhood, or landmark are you travelling FROM?	22 What intersection, postal code, neighbourhood, or landmark are you travelling TO?	23 Do you bike in the winter?	24 Do you have any concerns with locking your bike here (for the day)?	26 ACCESS DISTANCE: Approximate travel distance from origin to LRT	Only those who accessed with bike	Only those who accessed with bike AND boarded train with bike	28 EGRESS DISTANCE: Approximate travel distance from LRT to desination	Only those who egressed with bike	Only those who egressed with bike AND boarded train with bike	29 Missed (access)	30 Declined (access)	31 Missed (egress)	32 Declined (egress)	33 Total structured interviews	34 Bikes on bus observed	35 Access or egress from bike racks but did not use transit
1	Southgate	Churchill Square	"Close by"	No; bad roads	n/a	0.22	0.22		-	-	0	1	1	1	1	7	1	5
2		23 Ave & 119 St	Mill Woods	No; no answer	n/a	1.6	1.6		9.6	9.6	7							
3		Churchill Square	Southgate Mall	No; no answer		0			0	0								
4		University of Alberta	?	No; no answer	n/a	0	0		-	-	0							
5		40 Ave & 114 St	Southgate Starbucks	No; no answer	Yes; worried about theft	2	2	1.2	0.2	0.2								
6		ATB Building	Whitemud & 106 St	No; no answer	n/a	0.1			1.5	1.5								
7		South Edmonton Common	Southgate Mall	No; too cold		6.7			0	0								
8	Stadium	Jasper & 90 Ave	Belvedere Station	No; no answer		1.4	1.4	1.4	0	0		3	2	0	0	2		
9		Clareview Station	105 Ave & 95 St	No; too cold	Yes; worried about vandalism	0			1.4	1.4								
10	South Campus Fort Edmonton	Agriculture Forestry Centre, UofA	Jasper & 107 St	No; no answer	n/a	3.5	3.5	2.5	0	0		1	0	5	3	10	3	0
11		Admin Building, UofA	Lendrum Place (neighbourhood)	No; no answer		0.27			1.4	1.4								
12		Jasper & 104 St	63 Ave & 112 St	No; no gear	Yes; no answer	0	0		0.8	0.8	0.66							
13		University of Alberta	Lendrum Place (neighbourhood)	No; no answer	Yes; need more bike racks	0			1.4	1.4								
14		CN Tower	Royal Gardens (neighbourhood)	Sometimes	Yes; have had 1 or more bikes stolen	0.3			3.2	3.2								
15		University of Alberta	Malmo Plains (neighbourhood)	No; no answer	Yes; presence of street people	0			1.8	1.8								
16		University of Alberta	Lendrum Place (neighbourhood)			0			1.4	1.4								
17		University of Alberta	51 Ave & 125 St	No; no answer	Yes; worried about theft	0	0		2.8	2.8	2							
18		Enterprise Square	Duggan (neighbourhood)	No; no answer		0			5.1	5.1								
19		University of Alberta	51 Ave & 86 St	No; no answer		0			6.5	6.5								
20	McKernan Belgravia	?	Bay / Enterprise Square	No; no answer		-	-		0			1	0	0	0	2		
21		71 Ave & 106 St	Fort & 120 Ave	No; safety concerns		2.1	2.1		0.6									
22	McKernan Belgravia	76 Ave & 111 St	Jasper & 109 St	No; safety concerns		0.75	0.75	0.75	0.25	0.25		5	0	1	0	4		
23		Canada Place	76 Ave & 108 St	No; no answer	No	0.2			1.2	1.2								
24		Saddleback & 111 St	75 Ave & 112 St	No; no answer		0.85	0.85		0.65	0.65	0.45							
25		City Hall	70 Ave & 105a St	Sometimes		0			2.3	2.3								
26	Stadium	105 Ave & 94 St	Miller & Manning	Yes		1.3	1.3	1.3	0.8	0.8		0	0	0	0	2		
27		114 Ave & 88 St	City Centre Mall	Yes		0.85	0.85	0.65	0.1	0.1								
28	Belvedere	112 Ave & 79 St	129 Ave & 66 St	Yes		0.55	0.55	0.55	0.7	0.7		2	2	0	1	4		
29		Kingsway & 119 St	Clareview Station	Yes		8.5	8.5	6.5	0	0								
30		84 Ave & 104 St	"nearby"	No; too cold		2.1	2.1		0.5	0.5	0							
31		University of Alberta	142a Ave & 57 St	No; no answer	Yes; no answer	0			1.9	1.9								
32	Clareview	135a Ave & 38 St	105 Ave & 101 St	No; no answer	No	1.3	1.3		0.65			1	0	0	0	3		1
33		133 Ave & 31 St	111 Ave & 128 St	No; no answer	No	2.6	2.6		4.9									
34		144 Ave & 6 St	University of Alberta	No; no answer		1.6	1.6	1.2	0	0								
35	Century Park	Jasper & 115 St	Beaumont, AB	No; no answer		1.2	1.2		18.2		13.5	0	0	4	1	11	5	2
36		James Mowatt & Cunningham	Belvedere Station	Yes		6	6	5.5	0	0								
37		Whyte & 95a St	16 Ave & 109 St	No; no gear	No	4	4		1.9	1.9	1.3							
38		Corona Station	?	Yes		0			-	-								
39		Jasper & 104 St	23 Ave & 85 St	Yes		0			4.3	4.3								
40		University of Alberta	MacEwan & 119 St	No; no answer		0			4.3	4.3								
41		University of Alberta	14 Ave & 115 St	No; no answer		0			3.4	3.4								

Individual survey responses

	01 STATION	02 DATE	03 TIME PERIOD START	04 TIME PERIOD END	05 LOCATION	06 WEATHER	07 ID	08 Time	09 Access or egress?	10 Will/did you take your bike onto the train with you?	11 Would you like to be able to?	12 What route did you take to get here / What route will you take to get to your final destination?	13 Do you always take this route?	14 Why?	15 What type of roadway is this?	16 Will you use other modes for this trip?	17 Why?	18 What is the purpose of your trip?	19 What station are you travelling to/from?	20 How will you get to your final destination?
42	Century Park (cont'd)						CPp08	5:10:00 PM	Egress	Yes		111 St SUP			SUP	No		Work	University	
43							CPp09	5:50:00 PM	Egress	Yes	Yes; unable to during rush hour	Bus				Yes; bus		Work	Coliseum	
44							CPp10	5:54:00 PM	Egress	No	No; it's too inconvenient / it's convenient enough	23 Ave SUP				No		Personal	Churchill	
45							CPp11	6:05:00 PM	Egress	Yes		23 Ave SUP, 105 St			SUP + road	No		Personal	Health Sci.	
46	University	2015-08-13	6:30:00 AM	8:30:00 AM	Main entrance	Sunny, warm	UNa01	7:32:00 AM	Access	Yes		Local roads			Local	No		Personal	Stadium	
47							UNa02	7:52:00 AM	Egress	Yes		Groat SUP			SUP + road	No		Work	Century Park	
48							UNa03	7:55:00 AM	Access	No		110 St			Local	No		Work	Central	
49							UNa04	8:05:00 AM	Egress	No	Yes; unable to during rush hour	Ada Blvd, 111 Ave			Local	No		Personal	Stadium	
50	Southgate	2015-08-12	3:15:00 PM	6:00:00 PM	West racks	Sunny, warm	SGp08	3:35:00 PM	Egress	No	No; it's too inconvenient / it's convenient enough	LRT SUP			SUP + road	No		Work	Health Sci.	
51							SGp09	4:07:00 PM	Egress	Yes		Local roads			Local	No		Personal	University	
52							SGp10	4:32:00 PM	Egress	No	Yes; unable to during rush hour	111 St SUP, 40 Ave			SUP + bike lane	No		Work	Grandin	
53							SGp11	5:00:00 PM	Egress	No	No; it's too inconvenient / it's convenient enough	Local roads			Local	No		Personal	Grandin	
54							SGp12	5:18:00 PM	Egress	No	No; it's too inconvenient / it's convenient enough	Whitemud SUP			SUP	No		Work	University	
55	Clareview	2015-08-11	3:30:00 PM	6:00:00 AM	West racks	Sunny, hot	CVp01	3:53:00 PM	Access	Yes		50 St SUP			SUP + road	No		Personal	Coliseum	
56							CVp02	4:01:00 PM	Egress	No	No; no answer	Miller, Manning			Local	No		Work	Churchill	
57							CVp03	4:33:00 PM	Egress	Yes		Unknown				No		Work	Central	
58							CVp04	4:39:00 PM	Egress	No	Yes; no answer	50 St SUP			SUP	No		Work	University	
59							CVp05	4:53:00 PM	Egress	No	No; no answer					Yes; bus		School	Coliseum	
60							CVp06	5:02:00 PM	Egress	No	Yes; unable to during rush hour	Manning, Miller, 50 St SUP			SUP + road	No		Work	University	
61							CVp07	5:12:00 PM	Egress	No	No; no answer	Manning, McLeod, 50 St SUP			SUP + road	No		Work	University	
62							CVp08	5:35:00 PM	Egress	No	No; it's too inconvenient / it's convenient enough	50 St SUP, 153 Ave			SUP	No		School	University	
63	Century Park	2015-08-11	6:00:00 AM	9:00:00 AM	West racks	Sunny, mild	CPa01	6:45:00 AM	Access	Yes		23 Ave, Rabbit Hill SUP			SUP	No		Work	Churchill	
64							CPa02	6:27:00 AM	Access	No		LRT SUP, Saddleback			SUP + road	No		Work	Corona	
65							CPa03	6:47:00 AM	Egress	Yes		QE2, 23 Ave SUP			SUP + road	No		Work	Corona	
66							CPa04	7:42:00 AM	Access	No	No; no answer	LRT SUP, Saddleback			SUP + bike lane	No		School	Health Sci.	
67							CPa05	7:50:00 AM	Access	No	No; no answer	23 Ave SUP			SUP	No		Work	University	
68							CPa06	7:55:00 AM	Access	No		LRT SUP			SUP	No		Work	Health Sci.	
69							CPa07	8:12:00 AM	Access	Yes		LRT SUP				No		Work	Health Sci.	
70							CPa08	8:37:00 AM	Access	Yes		LRT SUP, Ellerslie SUP			SUP + road	No		Work	Bay / Enterprise Sq.	
71							CPa09	8:41:00 AM	Access	No	No; no answer	LRT SUP, 23 Ave SUP			SUP	No		School	Health Sci.	
72	Southgate	2015-08-10	6:10:00 AM	9:00:00 AM	East racks	Sunny, warm	SGa01	7:40:00 AM	Egress	Yes		Kingsway, 109 St			Arterial	No		Work	Corona	
73							SGa02	7:50:00 AM	Access	Yes						No		Work	Belvedere	
74							SGa03	8:06:00 AM	Access	No	Yes; unable to during rush hour	LRT SUP			SUP	No		Work	Churchill	
75							SGa04	8:34:00 AM	Access	No	Yes; unable to during rush hour	LRT SUP			SUP	No		School	University	
76	Churchill	2015-08-13				Sunny, warm	CHp01	6:30:00 PM	Access	Yes						No		Work	University	
77	Churchill	2015-08-11				Sunny, hot	CHp02	3:13:00 PM	Access	Yes					Local	Yes; bus		Work	Belvedere	

Type A	***Type B***	***Type C***
Core LRT station	Mature LRT station	Suburban LRT station

Individual survey responses

	01 STATION	21 What intersection, postal code, neighbourhood, or landmark are you travelling FROM?	22 What intersection, postal code, neighbourhood, or landmark are you travelling TO?	23 Do you bike in the winter?	24 Do you have any concerns with locking your bike here (for the day)?	26 ACCESS DISTANCE: Approximate travel distance from origin to LRT	Only those who accessed with bike	Only those who accessed with bike AND boarded train with bike	28 EGRESS DISTANCE: Approximate travel distance from LRT to desination	Only those who egressed with bike	Only those who egressed with bike AND boarded train with bike	29 Missed (access)	30 Declined (access)	31 Missed (egress)	32 Declined (egress)	33 Total structured interviews	34 Bikes on bus observed	35 Access or egress from bike racks but did not use transit
42	Century Park (cont'd)	University of Alberta	9a Ave & 116 St	No; no answer	No	0	0		3.5	3.5	2.4							
43		City Centre Mall	Welsh & 66 St			4	4		8.7	8.7	6.4							
44		Churchill Station	21 Ave & 110 St	No; no answer	Yes; no answer	0			0.7	0.7								
45		84 Ave & 110 St	13 Ave & 105 St			1.2	1.2		2.6	2.6	2							
46	University	University of Alberta	?	Yes		0	0	0	-	-		0	0	0	0	4	0	0
47		23 Ave & 66 St	128 Ave & 141 St	No; no answer		8.9	8.9		5.9	5.9	5.5							
48		Whyte & 109 St	Jasper & 103 St	No; no answer		1.4	1.4		0									
49		112 Ave & 65 St	84 Ave & 104 St	No; no answer		2.3			2.1	2.1								
50	Southgate	University of Alberta	33 Ave & 116 St	Sometimes	Yes; worried about theft	0			3.1	3.1		9	0	0	0	5		2
51		University of Alberta	48 Ave & 117a St	No; safety concerns		0	0		1.5	1.5	1.3							
52		99 Ave & 109 St	40 Ave & 115 St	No; no gear	No	0.2			2.1	2.1								
53		100 Ave & 114 St	?	No; no answer	Yes; no answer	0.85			-	-								
54		University of Alberta	48 Ave & 122 St	No; too cold	No	0			2.1	2.1								
55	Clareview	?	Highlands (neighbourhood)	No; no answer		-	-	0	2.6	2.6		0	0	2	0	8	2	
56		102a Ave & 99 St	153 Ave & 54 St	No; no answer	Yes; worried about theft	0			2.9	2.9								
57		107 Ave & 112 St	?	Yes		2.7	2.7		-		0							
58		Whyte & 104 Ave	167 Ave & 50 St	Sometimes	No	2.4			3.6	3.6								
59		Princess Elizabeth & 106 St	Britnell Blvd	No; no answer	Yes; no answer	3.3			2.7	2.7								
60		University of Alberta	153 Ave & 54 St			0.6			2.9	2.9								
61		University of Alberta	McLeod & 54 St	No; no gear	No	0			2.5	2.5								
62		University of Alberta	153 Ave & 59a St	No; no answer	Yes; no answer	0			3.3	3.3								
63	Century Park	Terwillegar Blvd & Terwillegar Com	102a Ave & 99 St	No; safety concerns	Yes; worried about theft	5.4	5.4	4.1	0	0		0	2	0	0	9		1
64		Saddleback & 112 St	Jasper & 107 St	No; no answer	Yes; have had 1 or more bikes stolen	0.7	0.7		0									
65		107 Ave & 116 St	Nisku	No; no gear		2.3	2.3		17.9	17.9	13.3							
66		26 Ave & 116 St	Van Vliet, University of Alberta	No; no answer	No	1.7	1.7		0.4									
67		23 Ave & 119 St	University of Alberta	No; no answer	No	1.6	1.6		0									
68		Saddleback & 111 St	Research Transition, University of Alberta	No; too cold	Yes; have had 1 or more bikes stolen	1.1	1.1		0									
69		Twin Brooks (neighbourhood)	Health Sciences, University of Alberta			2.5	2.5	1.9	0	0								
70		Watt & Ellerslie	102 Ave & 105 St	No; too cold		9.4	9.4	6.4	0.45	0.45								
71		23 Ave & 109 St	Gym, University of Alberta	No; no answer	No	0.8	0.8		0.3									
72	Southgate	Kingsway & Tower	"97 Street industrial area" (51 Ave & 97 St)			3.2	3.2		2.7	2.7	2.5	1	0	1	0	4		
73		?	132 Ave & 97 St	No; no answer		-	-	0	5.3	5.3								
74		40 Ave & 111 St	103a Ave & 100 St	No; safety concerns	Yes; have had 1 or more bikes stolen	1.1	1.1		0.3									
75		40 Ave & 111 St	Education, University of Alberta	No; no answer	Yes; worried about theft	1.1	1.1		0.3									
76	Churchill	Epcor Tower	University of Alberta	No; no answer		0.65	0.65	0.6	0	0						1		
77	Churchill	Churchill Square	137 Ave & 66 St	No; no answer		0	0	0	2.1	2.1						1		
						Average	Average	Average	Average	Average	Average	Sum	Sum	Sum	Sum	Sum	Sum	Sum
						1.478243243	2.094772727	1.919444444	2.342253521	2.425	3.43	24	7	14	6	77	11	11

Appendix D: Practitioner interview participants and schedule

Table D.1: List of practitioner interview participants

Participant	Affiliation	Professional title
Chris Chan	Edmonton Bicycle Commuters Society	Executive Director
Tyler Golly	Stantec (formerly City of Edmonton Transportation Planning)	Professional Engineer
Scott McKeen	City of Edmonton Council	Ward 6 City Councillor
Michael Walters	City of Edmonton Council	Ward 10 City Councillor
Planner 1*	City of Edmonton	Planner
Planner 2*	City of Edmonton	Planner
Planner 3*	City of Edmonton	Planner

*Participants requested anonymity

Interview schedule for ***all interviewees***:

1. Describe your current professional role.
2. How does your work relate to bicycle planning, or LRT planning, or both?
3. What is the state of bike-transit integration (using bicycles to access LRT stations and/or combining the two modes in one trip) in Edmonton?
4. Do you, yourself, bike? For what purpose?
5. What steps are being taken by the City to improve bike-transit integration?
6. Can you describe a project that is a good example of bike-transit integration in Edmonton or elsewhere?
    a) Why do you think this project was successful or unsuccessful?
7. What do you perceive to be the barriers of bike-transit integration in Edmonton?
8. To what degree do you think policy directives for more cycling, transit, and bike-transit integration are given adequate consideration as Edmonton continues to grow?
    a) Can these policies be improved? If so, how?

Additional questions for ***Ward Councillors***:

1. What kind of challenges to accessing LRT stations are there in your ward?
    a) If so, what are they? If not, why not?
2. How many of your constituents bicycle? For what types of trips?
    a) How many of your constituents take the LRT? For what types of trips?

3. Generally speaking, how receptive are your constituents to alternative and sustainable modes of transportation (i.e., transportation that does not rely on single-occupancy private automobiles, such as walking, cycling, public transportation, and carpooling)?
4. Generally speaking, what kind of feedback have you received from your constituents about municipal projects involving bikes?
    a) Involving LRT?

Additional questions for ***City of Edmonton staff***:

1. How often do you coordinate with different City departments on projects related to bicycle infrastructure?
    a) LRT infrastructure?
2. How would you describe the communication and collaboration between Transportation Planning, City Wide Planning, and Edmonton Transit System / LRT?
    a) How can these relationships be strengthened?

Additional questions for ***Edmonton Bicycle Commuters Society***:

1. What are the main things your organization supports and advocates for?
2. What kind of feedback have you received from your membership about LRT projects?
3. What policies or infrastructure projects could be implemented to support more bike-transit integration?