Social Sustainability of Transit:
An Overview of the Literature and
Findings from Expert Interviews

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Funding Statement and Declaration of Conflicting Interests

ABSTRACT

<u>Objective</u>: The objectives of this report are to highlight key considerations for transportation equity, and to offer an overview of the policies, programs, and practices comparable transit agencies have adopted in order to address equity. The focus of the review is the specific needs of different ages, incomes, ethnicities, abilities, and genders.

<u>Methods</u>: A literature review and expert interviews were completed. Semi-structured interviews with professionals who work closely with local transit agencies across North America were conducted over email or phone. These professionals generally worked for either the local transit authority or for an organization that worked closely with the agencies. Agencies were selected because of existing policies, procedures, and programs, and because they were mentioned in the literature, or because of similarities to Edmonton.

<u>Results</u>: Findings suggest that unless required by federal or provincial and state regulations, equity has not been highly prioritized by many agencies. However, it is also evident that this is beginning to change. The literature review revealed a number of methods for assessing or measuring equity, ranging from a rough comparison of transit routes and demographic information to geo-spatial models. There are also a number of ways in which different demographics are affected by aspects of a transit system such as fares, design of physical infrastructure, route design, and service frequency. The interviews revealed dissimilarities between Canadian and US agencies, many of which stem from differences in policy mandates and funding from higher levels of government.

Keywords: ability, accessibility, affordability, age, equity, ethnicity, gender, inclusivity, income, livability, race, sustainability

EXECUTIVE SUMMARY

What is Equity and how it can be measured

There are different ways to conceptualize the equity of a transit system, including distinctions between vertical equity (i.e., impacts by subgroups such as high-income versus low-income) and horizontal equity (i.e., all households held equal). Equity can be investigated in relation to accessibility and mobility, with a focus on travel time. Generally, defining fairness, equity, and social sustainability of a complex system such as public transit is difficult, yet these concepts can be implemented through specific programs designed for sub-groups by age cohorts (youth and seniors), race/ethnicity, income, ability, and gender. The goals of making a system equitable can conflict with the goals of making it efficient. For example, efficiency would require providing more service to the busiest routes, but equity would demand spending public resources in areas that may not have high demand but would benefit sub-groups of the population. A balance of these considerations is important in the supply of public goods such as transit.

There are many methods for assessing equity though no method that is universally implemented or accepted. Some methods discussed in this report are area-based measurement techniques; GIS modeling; analysis of transit plans and future projects based on route design incorporating demographic information; as also Lorenz curve and Gini coefficient measures. One of the most important aspects of measuring equity is ensuring access to data that includes key demographic and ridership information at the level of individual transit patrons. Some data collection methods include smartcards, travel diaries, surveys, and interviews. Data sources such as the Edmonton Household Travel Survey 2015 and on-board transit surveys in the short term, and data from smart cards for ongoing evaluation in the long term can be useful in the analysis of equity considerations.

Social Sustainability Considerations across Five (Overlapping) Domains

1. Age

There is research on the impacts of transit supply on seniors' (+65) mobility but less is understood about youth-specific transit programs. Trip rates drop for seniors due to various reasons including losing the ability to drive, resulting in increasing transit-reliance. Seniors tend to have more time than other demographic groups but are generally cost averse. So, on average, this group is more impacted by higher ticket prices than by waiting time. The findings from the literature suggest that greater bus stop density works well i.e., supply is available at all points in the city, largely during the day hours. However, this is generally not a true characteristic of transit, which has better temporal (e.g., peak hour) and spatial (e.g., transit center) supply in high demand areas. Importantly, seniors' need for transit in winter cities such as Edmonton may be different, where exposure to harsh climate and safety considerations due to snow and ice would impact seniors' ability to get to a bus stop and wait for a long time. Other features such as same-day paratransit services can increase mobility, along with better Universal Design (section 4.1.2).

Seniors (and youth) may have similar transit use behaviors, i.e., short trips, than adults who primarily use transit for work/education access. Transit providers, generally, offer some form of subsidy for seniors including specific programs such as $1 fare for off-peak transit rides (e.g., MiWay, Mississauga), and enabling policies such as same-day paratransit rides (e.g., RTC,

Nevada). However, subsidized pricing may not be enough since research shows that transit service is often weak where seniors live.

Summer programs directed at youth have the ability to increase mobility for this demographic. However, this is a topic for program evaluation and research.

2. Race and Ethnicity

The terms "race" and "ethnicity" are used to indicate different groups in Canada and the US. For example, in Canada the idea of race and ethnicity is linked to aboriginals and immigrant groups, while in the US race is linked to people of color such as Blacks, Asians, or Hispanics. Specific to transit, mandates of federal policy and legal challenges to spending on rail versus bus in the US have resulted in a different set of priorities. Publicly available documents reveal that transit agencies in the US are generally more aware of racial disparities that exist on their systems than Canadian agencies.

Within Canada, there is some focus on immigrants in reference to transit supply, but the literature review does not find any systematic studies about the needs of aboriginal populations. In general, research shows that immigrants who initially use transit but eventually choose to use a private vehicle represent a significant loss of potential transit ridership. This is highlighted as an important area for policy consideration by Canadian transit agencies. Many issues that immigrants face with accessing transit are common across other minority groups, so a focus on improving services for this group would improve transit for many disadvantaged groups.

Studies on fare structures agree that distance-based fares are more equitable than flat rates. Policies to encourage transit ridership by lowering fares for optional commuters generally results in some efficiency gain but likely limits funding available for equity-based programs. Depending on the spatial distribution of minority groups, lower fares for short trips, and programs that subsidize long trips by charging lower transfer fees, may be some ways to make transit equitable for long-distance disadvantaged riders.

Other analysis reveals that some transit services disproportionately focus on work and home locations, and less on other necessities such as food stores, thus, for example, limiting food access for minority groups. Broadly, transit providers need to balance between LRT and bus services since both markets are different, with bus riders often belonging to one or more minority group as defined in this report.

3. Income

On average, low-income and high-income commuters are the primary markets for transit; with the middle income groups relying on driving. Optional middle income transit riders do elect to ride on LRT, combining it with driving to the station in a private vehicle. While households from the high and low ends of the income spectrum tend to live in relatively transit-rich areas, low-income households are not optional or choice riders because they have fewer private vehicles. Bus and LRT riders tend to be different, with high-income transit patrons often choosing to ride on LRT. Effective system integration across transit modes is a way to encourage full trips on transit systems, and nudge both efficiency and equity goals.

Within dense locations such as inner city or mature neighborhoods, transit service per capita is often less in supply for low-income areas. Hence, the spatial distribution of low-income households needs to inform the supply of transit services. These differences in supply are

apparent at a city-wide scale as well as micro-scale; for example, in relation to how families in subsidized housing access transit.

Operating cost subsidies on transit are unevenly distributed not only between LRT and bus, but also between center city and choice/optional suburban LRT commuters. Given that certain demographic groups are making different housing location choices—for example, the well-off have been moving into cities from suburbia and low-income groups are moving out—it is important for transit agencies to be flexible in the kind and quantity of service provision.

4. Ability

Safety and independence are the two most important factors associated with transit use for passengers with disabilities. Most transit providers have some policy or program in place to serve the needs of riders with disabilities. Generally, it is important to ensure that standard transit service is designed to suit the needs of the widest range of abilities possible so that less pressure is placed on paratransit services. Riders using wheelchairs are often in conflict with those with strollers. This disabled rider group also is made to feel uncomfortable by vehicle operators according to some studies. The education of both riders and operators is integral to ensuring that disabled passengers feel supported and safe using transit.

From a design perspective, though transit vehicles such as low-floor buses are accessible friendly, stops and stations often are not. Studies reveal that for design of seating arrangements there is a preference for perimeter seating configurations, side-facing seating, and for vertical stanchions and horizontal holds on the back of any front facing seats. Other features such as system-wide improvements can help make journeys efficient not just for those using mobility devices but for others such as those with strollers, food carts, and seniors.

Smart card technology is an effective way to reduce anxiety experienced by seniors and riders with disabilities. Being able to swipe a card reduces the stress of having to interact with the vehicle operator and with presenting exact change. The act of paying with change can cause anxiety for some and can be a challenge for riders with cognitive disabilities. Other models proposed for improving services include a technology-rich system that can provide real time help via video/audio or other means to guide disabled riders as they navigate the system. Some transit providers have braille signs and automated auditory announcements for stops on their systems.

Policies on demand responsive services (paratransit) are often unclear regarding who can use them. For example, riders with non-physical disabilities may also be well served by paratransit, but are sometimes declined service. Some research suggests that paratransit provision is perceived as being more ineffective by those with organic and visual disabilities than by those with ambulatory or intellectual disabilities. To improve services, some transit providers partner with private vendors to supply paratransit to locations in out of service areas.

5. Gender

The literature is sparse with respect to LGBTQ needs and transportation, indicating an area for further research. In this report, the gender lens is used to understand how women's needs are being met by transit providers. This is particularly important because women comprise a large section of transit ridership (since men in households often use private vehicles), especially in immigrant households. In contrast, more native born women choose to drive, suggesting that transit does not meet their needs.

Though women have increased in the workforce, the driving rates of men and women remain similar. Yet mobility patterns of men and women differ significantly, since women, on average, have less access to faster transportation resources than men. In reference to transit, women are influenced by fear when making travel decision. Safety considerations, real and perceived, impede women's travel, limiting women to travel only at certain times in a day. Considerations of sexual harassment or violence on public transit are significant for women. Some studies show that there is a mismatch between women's safety needs and agency strategies. For example, agencies often rely on cameras and focus safety measures largely on the vehicles and stops, while women report the need for human presence and safety on all transit assets including parking lots.

Predictability of service is central to the perceptions of safety for women passengers. Real-time information can improve women's mobility when decisions revolve around how long to wait at a stop. Strategies such as "request to stop services" after certain hours, as on ETS, are found to be beneficial. Some providers have an online or texting tool to report harassment on transit, giving women the ability to report events, often anonymously, without drawing attention.

Areas for Further Study

Based on a review of the literature and expert interviews, this report identifies areas for further investigation. On many North American transit systems, data quality often limits effective program development and rigorous program evaluation. Generally, there is a need to update ridership data collection techniques and incorporate new methodologies for increasing the level of detail obtained—specifically origin-destination and socio-economic information.

For Edmonton, it is vital to analyze the benefits and costs of implementing specific programs that further the objectives of the Edmonton Diversity and Inclusion Policy (C358). Some examples of such programs would include off-peak subsidy rides for seniors during the day, or transit passes for new immigrant and low-income households. Broadly, there is a need to review the current fare structure with a specific focus on the equity impacts of distance-based fares. Longitudinal studies of approved subsidy programs, comparing before and after outcomes on ridership for the targeted groups, would be beneficial for Edmonton.

A requirement to analyze the equity of the transit system for different populations for current service, existing plans, and future projects can result in tailored programs that help attain social sustainability goals. Additionally, investigating the feasibility of incorporating intuitive way-finding into future projects as well as retrofitting existing infrastructure can enhance the legibility of the system for those who most need access to opportunity via transit.

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1. Introduction

During the summer of 2015, the University of Alberta was approached by the City of Edmonton to investigate the social sustainability of the transit system with a focus on concepts such as inclusivity, accessibility to work, the needs of riders with disabilities, poverty reduction, affordability, and livability. Each of these concepts could be considered to be aspects of social sustainability, or as referred to in this report, social equity.

This report is organized according to five domains that were associated with groups identified as experiencing social disadvantage. These five domains are age, race, income, ability, and gender. Other groups and characteristics were excluded due to lack of published studies and data.

Mobility is one of the most important precursors to participation in society. If social equity is not considered, transportation and land-use policies can bias the benefits of investments towards certain groups, such as automobile users and choice transit riders, at the expense of those who rely on public transportation (Wellman, 2014). It is important to ensure that transportation investments do not lead to, what Wellman (2014, p. 334) refers to as "inequity over the power of space and time".

According to Litman (2002) transit investments have diverse and significant impacts, including changing resident's access to economic and social opportunities, altering the proportion of a household budget that is spent on transportation, giving advantage to some groups over others, impacting the location and type of future land development, and varying the direct economic impacts of the investment, such as changing property values. Yet, transit equity, or the 'fairness' of the distribution of the benefits of a transit investment, has not often been a priority in the past (Welch and Mishra, 2013). The objectives of this report are to highlight key considerations of social equity, and offer an overview of the policies, programs, and practices that agencies comparable to Edmonton Transit System (ETS) have adopted in order to address equity.

The questions that directed the literature review and interviews were: How do metrics for affordability, accessibility, and safety relate to transit equity for vulnerable groups? How have other researchers measured and evaluated these metrics in the past? What policies, procedures and programs have other agencies across North America adopted to ensure the social sustainability of public transit systems? Do Canadian and US transit agencies operationalize and evaluate equity in service differently? How do federal mandates, at national or state/provincial levels, incentivize agencies differently?

2. Methodology

The findings of this report are the outcome of a literature review and nine (9) expert interviews. The literature was found in academic transportation and planning journals by using key search words such as equity, sustainability, seniors, youth, low-income, race, immigrants, ethnicity, gender, women, disabilities, barrier-free design, accessibility, fares, and others. The authors focused on peer-reviewed journal articles largely published in the last 10 years to document the current knowledge in transit equity analysis.

Semi-structured interviews were conducted with transit and advocacy professionals across North America. The interview instrument, included in this report as Appendix A, was designed to incorporate major concepts that were identified in the literature. The objective of the interviews was to understand what programs and policies, some of them innovative, were being implemented by other municipal and regional transit authorities.

The research team contacted 19 cities in Canada and the US based on geographic similarities to Edmonton, or because they had been mentioned in the literature, or because of ground-breaking initiatives being implemented by the transit authority in these locations. Responses were received from nine cities; five Canadian and four US. These cities, listed in alphabetical order are Brampton ON, Denver CO, Milwaukee WI, Minneapolis and St. Paul MN, Mississauga ON, Ottawa ON, Portland ME, Vancouver BC, and Winnipeg MB. Appendix B provides a brief overview of each city and agency. Representatives from the transit authorities, and in one case an arm's length advocacy group that facilitated collaboration with minority stakeholders, were contacted initially via phone and email, and interview responses were either sent over email or discussed over the phone.

3. Measuring Equity

Analyzing equity is important because it allows agencies to prioritize future investments in a way that ensures benefits are distributed according to whose quality of life would be most improved by the investments. According to Litman (2002, p. 15) disadvantaged groups must be identified "and given special consideration to ensure that they are not made worse off, and that their needs are accommodated".

There is currently no commonly accepted framework for measuring the equity of a transit system. Further, equity can be understood in a few different ways. *Horizontal equity* is concerned with the fair distribution of a good across a population. In order to measure the horizontal equity of a system, all households would be treated as equals, and the evaluation would involve analyzing if all households were being provided with the same level of service. The other approach, *vertical equity*, aligns more closely with the attitude of this report, and analyses the distribution of goods in relation to different subgroups of the population. For example, when measuring vertical equity it would make sense to evaluate if benefits were distributed differently between low and high-income neighborhoods.

Transit equity can also be measured according to either mobility or accessibility. Key indicators of mobility are speed, level of service, and cost per kilometer, while those for accessibility include the quality of transit options, average trip distance, and cost per trip (Litman, 2002). Equity can also be assessed on a per capita basis or at household, neighborhood, or regional levels (Litman, 2002), with per capita analyses being most informative. The following five sub-sections provide an overview of methods for measuring equity, relying on recent literature and examples, and focusing on vertical equity and accessibility.

3.1 Basic Analysis

Ng (2005) provides a simple method for assessing the vertical equity of transit plans. After identifying which groups face systemic barriers the next step is to identify areas within the city or region that have a high concentration of these populations based on census data. After identifying neighborhoods Ng (2005) suggests ranking them on a scale from one to five based on the concentration of the disadvantaged groups previously identified, with five being the most concentrated. After this ranking, it is important to identify key destinations such as transit hubs and centers of employment. The final step is to evaluate existing or future transit plans with a focus on how they connect the highest ranked communities with the previously identified key destinations.

More specifically, Ferrari et al. (2014) propose a method to measure the performance of a transportation system based on accessibility for those with disabilities, made possible by smart card analysis. Ferrari et al. (2014) use smart card tracking data pared with travel journals to study how improvements to access at each station would increase wheelchair accessibility. This analysis allowed them to determine where efforts should be concentrated in order to have the greatest impact.

3.2 Surveys

The survey tool that Paquette et al. (2011) used to measure the quality of dial-a-ride service for a paratransit service was found to be valid and reliable. Their study was done in collaboration with the 'dial-a-ride' operator for the area and researchers were provided with a full list of active users and their contact information. All users who were alive during the interview stage, lived in the area, and still used the service were included, with the exception of youth. A support person represented those riders who were not able to respond on their own. Paquette et al. (2011) conducted individual interviews with riders, the manager of the dial-a-ride service, and the director of the user's association. Based on these initial interviews, a survey was developed and mailed to a larger sample of users, with special arrangements made for those users who would not be able to respond to a conventional survey. Their survey instrument was included in the paper as an appendix.

3.3 Models

Farber et al. (2014, p. 291), report that in order to have a better understanding of the equity of fare structures transportation agencies should not only use area-based measurement techniques but also "incorporate a joint ordinal/continuous model of trip generation and distance travelled into a GIS Decision Support System". This specification jointly models the number of transit trips taken (a discrete ordinal choice) and the distance traveled on transit (continuous), and overlays findings on a geospatial representation of the region. By relying on a household travel survey, such a methodology would compare out-of-pocket costs and time budgets across modes and subgroups based on routes used by travelers. This would allow planners to compare the costs and benefits of different fare structures for certain demographics.

Manaugh and EI-Geneidy (2010) modeled access to employment based on existing and proposed transit routes. The aim of this research was to investigate whether or not the proposed transit routes would benefit those who were the most dependent on transit. Benefits were defined as reduced travel time and increased access.

In an article titled "Equity Analysis of Transit Service in Large Auto-Oriented Cities in the United States" Sener and Griffin (2014) report the findings of their research, which used national data on income as well as information on service frequency and stop locations to carry out a location-based analysis of access according to income. They applied this model to nine auto-oriented cities in the US including Atlanta, Austin, Dallas, Denver, Houston, Indianapolis, Los Angeles, Seattle, and San Diego.

3.4 Lorenz Curve and Gini Coefficient

Many researchers measured equity using the Lorenz curve, which measures the distribution of a good, generally wealth, using the metrics of supply and demand (Delbosc and Currie, 2011, p. 1253). It is also possible to use this method to analyze the level of access to transit. Delbosc and Currie (2011) used the Lorenz curve to assess the distribution of transit across the populations of Melbourne. For the purpose of their research, level of service was based on the number of stops and stations within walking distance of a census tract. Census data was using for demographic information.

Kaplan et al. (2014) used a GIS model to measure the equity of transit provision within Copenhagen. Using a GIS representation of Copenhagen's multi-modal network including stations, stops, lines, and timetables as well as the transit assignment results of a model, the researchers measured the Gini coefficient of accessibility based on different socio-economic zones' access to locations such as work and secondary education, within Copenhagen.

Welch and Mishra (2013) measured the equity of a transit system using a number of indicators including frequency of service, speed, capacity, and the built environment. These authors integrated routes, schedules, socio-economic and demographic information, and spatial activity patterns into a graph theory approach, to study transit outcomes. They used this approach to calculate the Gini coefficient at varying scales of the system including transit stops and transportation zones.

3.5 Evaluating Fare Structures

Cheng et al. (2015, p. 1121) define fare equity as the "reasonable difference in the distribution of unit cost among different groups". For the sake of their equity analysis Cheng et al. (2015) used the indexes of fare, unit cost, and fare box recovery. They used the Lorenz curve and the resulting Gini coefficients to evaluate the distribution of unit fares among transit passengers. By using this method to analyze flat fares they determined flat fares to be unfair because bus passengers make short trips yet pay the costs of the transit system disproportionately. Further, flat fares are 'unfair' to the bus companies who are not able to recover costs effectively.

4. Literature Review

4.1 Age

As baby boomers continue to age, providing equitable transit to seniors throughout the City of Edmonton will continue to pose a challenge. As cited on the City of Edmonton's Age Friendly Edmonton webpage[1] by 2041, 32% of Edmontonians will be seniors, and the number of those who are 80 and older is projected to increase by as much as 266%.[1] Luckily as transit becomes more accessible for senior riders, it becomes more accessible for all ages, which the City reiterates on its Age Friendly Edmonton site by saying "creating an age friendly city helps us all".

An interesting outcome of researching transportation policies that serve different age groups is the realization that there is little existing research and rare programs implemented that address the transit needs of youth. While this particular population does not typically have the same mobility restriction as seniors, they do have unique needs and rely on transit as a source of independence. Although there is little mention of youth in the literature, it is important that transit providers do their best to attract and retain youth ridership, as the transportation decisions of this cohort will have a large impact on ridership in the future.

Below is a discussion of particular policies and considerations that are pertinent to the equity of a transit system for seniors.

4.1.1 Seniors' Travel Behaviors

The model carried out by Paez et al. (2007) confirmed that, in general, as people age they make fewer trips. However, they also found that this was not a uniform trend, and that those who had access to a vehicle were likely to increase trips after the age of 65. This, coupled with the general decrease in access to a private vehicle due to medical conditions or financial constraints, suggests a potential shift to public transit (Paez et al., 2007). This may also suggest that seniors without access to a vehicle would make more frequent trips if they had better access to transit. Having access to public transportation is extremely important to seniors because it provides independence as physical mobility decreases (Su and Bell, 2009). Notably, Su and Bell (2009) found that effective supply coupled with bus stop density is more important in senior's mode choice than frequency of service.

4.1.2 Universal Design

According to the Centre for Universal Design at the University of North Carolina, universal design (UD) is "the design of products and environments to be usable by all people, to the greatest extent possible, without adaptation or specialized design"[2]. UD consists of seven design principles. Universal designs must be equitable (1) and flexible (2) so that they are useful and

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[1] Aging Friendly Edmonton. City of Edmonton Website. Retrieved from http://www.edmonton.ca/city_government/initiatives_innovation/age_friendly/about-age-friendly-edmonton.aspx
[2] Principles of Universal Design. Centre for Universal Design. University of North Carolina. Retrieved from https://www.ncsu.edu/ncsu/design/cud/about_ud/udprinciplestext.htm)

marketable to people with diverse disabilities. It is also important that the designs are simple and intuitive (3) and that it is easy to perceive important information (4) so that the design effectively communicates the necessary information to the user regardless of their ability. There must also be a tolerance for error (5) so that the design minimizes the hazards associated with human error and must require low physical effort (6). Lastly, to allow for a diversity of body size, posture and mobility there must be adequate size and space for approach and use (7). UD includes the design perspectives of barrier-free design (retrofitting), accessible design (equal opportunity to access), assistive technology (rehabilitative engineering), inclusive design (designing for the widest possible audience), and trans-generational design (improving quality of lives for people of all ages).

According to Audirac (2008), applying Universal Design at the micro and macro scales can help cities to address the exclusion linked to the mobility disadvantage that certain groups such as seniors face. Universal design is proactive, which if implemented, preempts the need for systems to be retrofitted in order to accommodate all populations groups. This is particularly important in the context of Canada's aging population.

Universal Design can be incorporated in many ways. Some of the approaches that Audirac (2008) mentions are physical design solutions such as low floor buses with a leveled curb and audible information on buses and at stations, technological solutions such as universal smart card systems, route design solutions with more frequent and reliable fixed-route transit complemented by flexible route transit. Further, social solutions such as incorporating the input of seniors and those with disabilities, and the education of citizens, transit drivers and staff are also ways to incorporate UD.

4.1.3 Fare Structures

The equity of a transportation system is heavily dependent on the fare structure. Su and Bell (2009) find that fares are a greater determinant of senior's transit use than frequency of service. This could be because seniors are usually more restricted by cost than time, which is the generally the opposite of their advantaged counterparts. Farber et al. (2014) found that because seniors makes shorter trips but travel more frequently than younger age cohorts, distance-based fares are the most equitable fare option for those over the age of 65.

4.1.4 Spatial Distribution and Demand Responsive Service

Using the Lorenz curve, Ricciardi et al. (2015), found that seniors in Perth had the least spatial access to public transportation service of any age group. They suggest that the groups who use public transit most often and who rely on it are also put at the greatest disadvantaged because of the system's route design. A similar study may help to determine if regular service is generally accessible to senior citizens in Edmonton. Access to standard service is particularly important because many seniors in Edmonton who have less serious mobility challenges do not qualify for demand-responsive transportation.

For those seniors who do use demand-responsive service, booking systems that require trips to be scheduled at least a day before service can be very restrictive (Paquette et al., 2011). This

limits seniors' ability to make last-minute plans, including emergency trips, or cancel or change existing plans. When possible, allowing for same-day ride requests would significantly decrease the restrictions that day-ahead request requirements place on the already restricted lives of those seniors who rely on public transit. Some examples of same-day ride services are on the Valley Transportation Authority in and around Santa Clara, California[3] and the Regional Transportation Commission of Southern Nevada.[4]

4.2 Race and Ethnicity

Issues of race, ethnicity, and nationality are often correlated with, or connected in some way, to issues of gender and income as well (representative from Denver, see Section 5). While the topic of race is one that shows the most obvious differences between Canada and the US, it remains an equity issue in both countries with respect to transit.

4.2.1. Immigrants

Serving the travel needs of those who have recently arrived in Canada is extremely important to the social sustainability goals of the public transit system. As Handy (2009, p. V) reports, immigrants represent a disproportionately high percentage of transit riders. According to Handy (2009), some issues that immigrants are concerned with are: the costs associated with travelling with children when there is a fare charge for each child; the difficulty of travelling on transit with large packages: the absence of safe and comfortable bus shelters; a perceived lack of personal safety, particularly on buses; long wait times; and limited routes and infrequent service. These concerns are relevant to many other groups, so if these issues were addressed, it would not only make transit more attractive for new immigrants, but it would also make it more attractive for all Edmontonians.

Although foreign-born residents are far more likely than native-born residents to use alternative forms of transportation, research also shows that many immigrants eventually choose the automobile over public transit (Blumenberg, 2009). This choice to, as Blumenberg (2009) calls it 'assimilate', represents a significant loss of potential ridership for transit agencies. That the majority of immigrants eventually choose the car over transit is perhaps the most pointed example of a transit system's failure to meet this population's needs. Many new immigrants have no transportation options outside of public transit. However, when they are able to make a choice they choose the car. If Canadian transit systems hope to retain this significant ridership segment, they should be considering the specific needs of these groups. This is an equity issue because immigrants (and born Canadians) are more likely to use public transit if they experience limited access to a private vehicle. Such limited access can be due to age, income, or disability.

That those immigrants, who have the option, after a short time in Canada, choose to travel via car instead of transit can be seen as an opportunity. If transit becomes more affordable, convenient, safe, and efficient, immigrants may choose to continue using transit, even if private vehicle transportation becomes an option. Even if these changes didn't make transit more attractive to native-born residents the retention of foreign-born riders has the potential to increase transit

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[3] http://www.vta.org/sfc/servlet.shepherd/version/download/068A0000001FYb8
[4] http://www.rtcsnv.com/transit/paratransit/paratransit-riders-guide/

ridership. In smaller Canadian cities such as Edmonton, the immigrant shift away from transit could be affected, with better integration of immigrant's needs from the initial transit planning stages.

<u>4.2.2. Transit Fares</u>

In a study of the equity of different fare structures, Farber et al. (2014) found that distance-based fares were most beneficial to non-white populations. However, they also found that the impact of distance-based fares varied geographically and that the elderly, low-income, and non-white residents living on the urban fringe were the most negatively impacted by a distance dependent fare structure. This being said, they also reported that the areas that were positively impacted by the distance-based fare structure far outnumbered the areas that would experience negative impacts. A cause to use caution when applying these findings to Edmonton would be Edmonton's recent and dramatic outward expansion, along with different affordability and ethnicity geographies. Though Farber et al. (2014) found that distance based-fares were an equitable option in Wasatch Front, these fares may not have the same results if implemented in Edmonton. A different study, conducted by Nuworsoo et al. (2009) examined the effects of five different fares structures. The fare structures that they evaluated were: a lowered base fare with no transfers so that you had to pay at each boarding along with elimination of pre-paid tickets and monthly passes except for seniors and riders with disabilities; the previous option but retaining monthly passes for youth in addition to seniors and riders with disabilities; raised base fares in all categories except monthly passes for senior, youth, and riders with disabilities plus an increase in the cost of transfer from $0.25 to $0.50; raised base fares in all categories except monthly passes for senior, youth, and riders with disabilities with two free transfers within 1.5 hours of payment; retaining existing structure with the addition of a weekly unlimited ride pass. Nuworsoo et al. (2009) found that out of five fare structures, flat fares per one-way trip were the least equitable. This was because populations such as youth, minorities and low-income riders make more trips and transfer more frequently than other groups. They also determined that for the same reason, the most equitable fare option would be a slight increase in the base fare, with the addition of two free transfers, accompanied by low-cost unlimited transit passes for seniors, youth, and riders with disabilities. This fare design only raised costs for low-income riders by 6% on average, but for wealthy riders by 17% on average, making it the most vertically equitable option.

Farber et al. (2014) mention that designing fares with the goal of increasing ridership may conflict with the objective of equity. For example, investing in infrastructure to try to attract 'optional riders', such as wealthy commuters from the suburbs may detract from investment in essential transit service for riders who have no alternative form of transportation. In contrast, although the implementation of distance-based fares may be the most equitable for the urban poor, as Farber et al. (2014) explain, increasing fares for suburban rail riders who travel long distances may discourage transit use for optional riders. However, an approach that may increase equity and ridership consecutively, depending on the spatial distribution of targeted demographic groups, is decreasing the costs of shorter trips in the inner city.

4.2.3. Non-Work Accessibility

In a study of non-work related trips in Detroit, Grengs (2015) found that vulnerable social groups, including African Americas and Hispanics, experience greater accessibility to destinations such as religious assemblies, child care facilities, hospitals, and convenience stores, but lower accessibility to shopping and supermarkets. These findings bring into question whether or not transit frequency and route design limits access to important goods and services, such as healthy food, for those who depend on transit.

4.2.4. Bus versus Light Rail

As cities continue to grow outwards, planners are faced with the dilemma of deciding how to invest in transit given the limited funding available. Conflicts arise when cities must make a choice between attracting new ridership and providing better transit for those who depend on it, because they have fewer mobility options (Grengs, 2005). Currently, many policies encourage transit officials to focus on encouraging suburban commuters out of their cars and onto transit for economic and environmental reasons (Grengs, 2005). Consequently, in certain locations, those who do not have access to private transportation may experience decreased access due to changes to service (Grengs, 2005).

The distribution of a public good, such as transit, is a salient way to assess any institutionalized discrimination. Wellman (2014) highlights this when he points out that segregation exists within the public transit system itself. Upper and middle class, white riders are more likely to use light rail transit, which generally receives the most subsidies per passenger for operating costs, whereas low income and minority individuals are more likely to rely on bus service, which receives the least subsidization (Wellman, 2014, p. 335). Mayer and Marcantonio (2005, p. 20) cite a legal case filed in April 2005 by Bay Area bus riders, titled *Darensburg v. Metropolitan Transportation Commission,* which highlights this "pervasive [but often unnoticed] form of discrimination". A similar case was also filed between the Los Angeles Bus Riders Union and the Los Angeles Metropolitan Transportation Authority, which was won by the Union in 1996. Both of these cases were filed on the grounds that transportation authorities were investing in transportation infrastructure, such as roads and commuter rail, which served high income and white populations, while cutting back on investment in bus service, which negatively affected low income and colored populations (Mayer and Marcantonio, 2005).

While the nature of targeted federal and provincial funding cannot be decided by agencies such as ETS, it is still possible to make investment decisions using the lens of transportation equity. It is important to think about which groups will benefit from future investments in public transit, as also whether or not these investments are benefitting various subgroups of Edmontonians.

4.3 Income

An interesting finding is that people within the lowest and highest income brackets are now taking public transit at similar rates, and are more likely than their middle income counterparts to take public transportation (Belmonte, 2014). According to Belmonte (2014) the relationship between income and transit use is non-linear (Figure 1). Transit use decreases with increasing

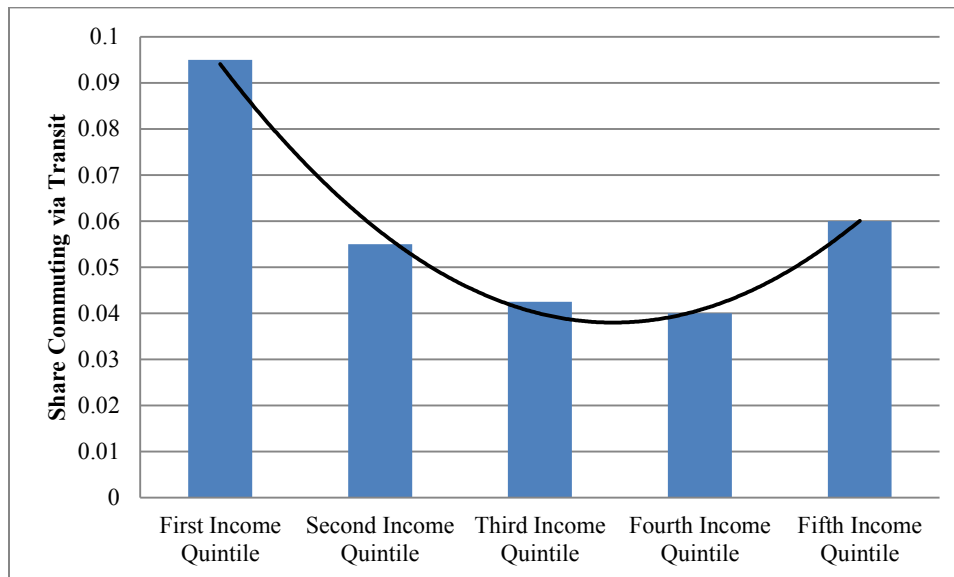income up to a certain point, then after a certain level of income transit use starts to increase again.

Figure 1: Transit Mode Share by Income Quintile (Based on Belmonte, 2014, pg. 12)

Belmonte (2014) proposes that the use of transit by high-income riders could be explained by higher education and the corresponding concern for the environment, or the concentration of wealthy residents in central areas that are well served by public transit. Although low-income residents are often also concentrated closer to central cities, their use of transit is less likely to be a choice and more likely to be their only option based on financial resources. However, according to Wellman (2014), and as discussed in Section 4.2.4, transportation policy often results in the inequitable distribution of costs and benefits, with car drivers and suburban rail commuters deriving the most utility at the detriment of users who depend on public transit.

4.3.1 Fare Structure

As discussed in section 4.2.2, Farber et al. (2014) found that distance-based fares were the most equitable in terms of income. Flat rate fares where riders pay per ride were found by Nuworsoo et al. (2009) to be the least equitable. Any increase to the cost of transfers, or a reduction in the number, or increase in cost of passes that allow for unlimited rides (per month for example), negatively impact specific populations, including low-income riders, who take transit often and transfer frequently (Nuworsoo et al., 2009).

4.3.2 Spatial Distribution

As expected, there is a great deal of variation between locations in regards to which areas of the city are best served by transit. For example, while Wellman (2014) found that suburban commuters were better served by US Transportation policy, Ricciardi et al. (2015) found that the area best served by transit in Perth was the central city. In addition, a study of the spatial distribution of public transit in Perth, Australia revealed that on average, low-income residents received a lower supply of public transit than the average citizens (Ricciardi et al., 2015).

Variation is also evident in the spatial access within the low-income population at a mirco-scale. In a study of the spatial distribution of public transit in Maryland, Welch (2013) found that, although subsidized housing developments were generally located close to quality transit, different levels of connectivity within the housing developments to quality transit created an unequal distribution of accessibility benefits among those living in subsidized units.

In a Canadian study Foth et al. (2013) observed how the equity of the spatial distribution changed between 1996 and 2006 in the Greater Toronto Area. The focus of the study was the relationship between income and access to employment as well as travel time. Their findings show that Toronto's transit system consistently provided greater accessibility and shorter travel times to employment for lower income users as the years progressed. Foth et al. (2013) do not explore causality here, but comment that the transit provider has adapted services well, adjusting to changing commuter patterns, specifically in relation to the movement of wealthy from the suburbs to the downtown core and the opposite movement of low-income residents.

4.3.3 Access to Employment

In 2014, 30 % of US riders who used transit to commute to work belonged to the highest income group, while only 20% belonged to the lowest income group (Belmonte, 2014, p. 30). Belmonte (2014) suggests that a possible explanation is that many low-income jobs are not accessible by transit. As was brought up in section 4.2.4 and discussed by Belmonte (2014) these ridership statistics bring into question the assumption that public transit subsidies for operating costs benefit all riders. There is evidence that these subsides work in favor of higher income households more so than lower income ones.

4.3.4 Non-Work Accessibility

Much attention has been paid to low-income individual's access to employment. However, while employment access can drastically better a person's financial situation, there are many non-work related trips that individuals must make regardless of their income, which are often made more difficult by dependency on transit. Attention should also be paid to the feasibility of these trips. Research done by Grengs (2015) related to this issue was discussed in section 4.2.3 of this report.

4.3.5 Bus versus Light Rail

While the literature review did not show Canadian studies which address the issue of equity by mode, it is widely acknowledged in the United States that upper-middle class white transit riders are far more likely to use LRT while poorer and ethnic minority riders are more likely to use the bus (Wellman, 2014). A representative from an organization in the US that works at an arm's length from the local transit agencies but coordinates with governments on a regular basis confirmed that disparities exist between bus and light rail (see section 5). Although it is not clear if issues of racial disadvantage are as prominent in Canada as they are in the United States, issues of disadvantage due to income are clearly relevant in both countries. This representative reported

that low-income residents do not feel that light rail was built for them, and that affluent commuters have negative perceptions about the bus.

There are important differences between the abilities of high-income and low-income individuals to make choices regarding how they travel. Short wait times, in-vehicle quality of ride, and service reliability are some features that high-income individuals are drawn to in transit. The interview participant who reported the differences in perceptions in modes also noted that while optional riders are able to choose rail, low-income riders who depend on transit have no choice because the bus provides the most basic level of service, and provides access to locations that rail does not. This suggests that both perception and access, or lack thereof, to the resources necessary to have transportation choices influence mode choice.

Wachs (2014) suggests that in order to have the most efficient public transit system modes need to be planned so that they can complement one another. It is also possible that integration may reduce the stigma surrounding the bus and allow income groups across the spectrum to take advantage of the entire transit system. What is important, however, is that light rail is not expanded at the expense of essential bus services that act as a critical tool of access for social and economic participation of disadvantaged populations. Additionally, Blumenberg and Pierce (2013) report that low-income residents are less likely than their high-income counterparts to travel at all or 'trip package', which means to use multiple modes of travel for a single trip. However, those low-income travelers who did trip package had to take a greater number of trips than those of a higher income, and were more likely to trip package without the use of a private vehicle. Further, when looking solely at those who used a single mode of transportation in a day low-income earners took fewer and shorter trips, and were also less likely to use an automobile as their single mode.

4.4 Ability

Carmien et al. (2005) discuss how public transit is essential to participation in public life for those with disabilities. Azenkot et al. (2011) report that safety and independence are the two most important factors associated with transit use, as identified by blind and deaf-blind transit riders who participated in their study. However, it can be challenging for those with disabilities to access and navigate complex public transit systems. While it would be difficult today to find a public transit system that does not have at least one policy or program that concerns access to public transit for those with physical and cognitive disabilities, there is always more that can be done. The following sections give an overview of some of the literature on accessible and safe transit for riders with disabilities.

4.4.1 Comfort and Safety

Using focus groups comprised of wheelchair-seated transit passengers Wretstrand et al. (2008) studied perceptions of comfort and safety. Their research revealed that conflict between wheelchair and stroller users was a source of discomfort for many participants. Having separate designated spots for wheelchairs and strollers or clearer policies on which had priority, could help alleviate this discomfort. The attitude of transit drivers was another source of discomfort for wheelchair users who reported receiving a range of uncomfortable comments from drivers,

ranging from rude to pitying. In addition to this, although perceptions of the quality of transit infrastructure were high, other urban infrastructure often obstructed wheelchair movement to, onto, off of, and from transit. Participants also were unclear or incorrect about when demand-responsive services should be used. This misinformation would not only potentially restrict participant's mobility, but could also cause strain on transit resources. These findings demonstrated the need for clear policies on when demand-responsive services are appropriate and when they are not. As with other groups, predictability of service was also central to participant's perceptions of safety.

<u>4.4.2 Demand Responsive Service</u>

As mentioned above, riders with disabilities can experience barriers when accessing public transit. However, those who have less visible disabilities, which cannot always be detected by sight or may be less understood by operators, may experience even more difficulty accessing service. In a study of Toronto's demand-responsive service it was discovered that citizens with acquired braining injuries (ABIs) were not able to access the paratransit service, which severely limited their mobility (Elsayed, 2011). Of the survey participants with an ABI who had applied for paratransit, 92% were declined even though the effects of ABIs include memory loss and confusion, which could potentially make using standard service difficult and even dangerous (Elsayed, 2001). This study brings to light the importance of taking all forms of disabilities into consideration when deciding who is eligible for demand-responsive transit, and not limiting the service to only those with visible disabilities.

There is variation between different group experiences with demand-responsive services. In a study of dial-a-ride service in Longueuil, located just outside of Montreal, it was found that variation in perceptions of quality of service existed between self-reported sub-groups according to type of handicap (Pauquette, 2012). Users with visual impairment and organic disabilities gave the lowest ratings, on average, for quality of service, while riders with ambulatory and intellectual disabilities gave the highest ratings. As suggested by the Elsayed's (2011) study of those with ABI, this could indicate that some demand-responsive services serve users with certain disabilities differently than others.

While demand-responsive services are required for the mobility of those with certain disabilities, there are some who are in favor of adaptation and the use of technology so that riders can use standard transit service whenever possible. For example, Carmien et al. (2005) suggest that demand-responsive services are limiting for those who are physically capable of using standard transit service provided that that they have the right assistance. While the technology and systems suggested by Carmien et al. (2005, p. 245) are dated, their suggestion that technology can be used to "eliminate the need to master complex navigational artifacts" is just as, if not more relevant, today. The system they propose, which they call the Mobility-for-All Architecture (MFA), is an interface between personal mobile devices, smart vehicle technologies, and a human support network available via technology. Such a system could have real-time support via video or audio, or other methods, to help those with specific disabilities navigate the network. Given that personal smart phones and smart vehicle technologies have only become more sophisticated and popular since 2005, this model most likely has even greater potential to benefit certain groups now than it did 10 years ago.

Ferrari et al. (2014) are also in favor of adapting regular service to meet the needs of those with physical disabilities who are capable of using buses or LRT-style services, but for different reasons than cited by Carmien et al. (2005). Ferrari et al. (2014) point out that the aging population is soon going to make it extremely costly to meet the need for demand-responsive service if other modes of public transportation are inconvenient for those with disabilities, particularly those who require a wheelchair. These concerns highlight the need for pro-active approaches to adaptation, such as Universal Design, which is discussed in section 4.4.3.

4.4.3 Universal Design

Using a full-scale low-floor bus simulation, Bareria et al. (2012) evaluated the level of difficulty that ambulatory passengers with and without walking aids experienced when completing tasks such as boarding, fare payment, seating, and alighting the bus. The results of the simulations demonstrated a need for assistive design features such as handholds, legroom, and room for the storage of walking aids. Their results show a preference for perimeter seating configurations, side facing seating, and for vertical stanchions, and horizontal holds on the back of any front facing seats, but a lack of agreement on the best locations for boarding and alighting.[5] Bareria et al. (2012) also reported that smart-card technology was received well by their study participants, as it reduced payment time and anxiety associated with producing exact change.

Wheelchair enabled riders are also subjected to spending grossly more time navigating transit than those who do not require a mobility assistance device. A smart card analysis carried out by Ferrari et al. (2014) in London, UK revealed that some of the most popular transit journeys took 50% longer and also involved more interchanges for those who were in a wheelchair. The reason that passengers who used a wheelchair had to make more interchanges than those who do not is that not all tube stations in London are accessible. They also found that improving the efficiency of the system for those in a wheelchair, by making train stations and bus stops more accessible and easy to navigate, would improve the efficiently of the entire system by reducing boarding and alighting times.

With a focus on cognitive abilities instead of physical, Carmien et al. (2005) suggested two human centered strategies for improving standard transit service in order to make it more accessible. The first suggestion is to simplify navigation tools within a system in order to make it easier for all riders, not just those with cognitive disabilities, to navigate. Their second suggestion is to proactively design spaces and systems that "transcend the need to understand the complex artifacts [of navigation] and instead serve as a dynamic navigational assistant" (Carmien et al., 2005, p. 245). An example of a proactively designed system that they provide is the Mobility-For-All (MFA) architecture mentioned in section 4.4.2. This method simplifies the navigation system from the outset instead of requiring adaptive strategies that may limit users to routes that require little navigation or those they are familiar with.

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[5] See figure 2 on page 657 in Bareria et al. (2012)

4.5 Gender

The City of Edmonton became a leader in gender equity when it established the Women's Initiative and the Women's Advocacy Voice of Edmonton Committee. The recent launch of the Zero Tolerance for Sexual Harassment Campaign also demonstrates Edmonton's commitment to creating a city where all genders feel confident and safe. While safety is an important aspect of gender equity on public transit and is addressed in this report, there are also more subtle ways in which public transit investments can influence gender equity.

According to Yavuz and Welch (2010), the majority of transit riders are women and as such, the sustainability of a transit system hinges on its ability to meet the needs of this demographic. While native-born women are more likely than men to drive alone to work, the opposite is true for immigrants. Immigrant men are more likely to travel alone by automobile and immigrant women are more likely to use public transit, even after 'transportation assimilation' (Blumenberg, 2009, p. 172). That more native-born women are choosing to drive to work than their male counterpoints suggests that transit does not meet their needs. A report from UK's Department of Transportation published in 2009 stresses that the first step in understanding the current behaviors of female transit riders, and in understanding why more women do not choose to use transit, is to disaggregate travel statistics by gender.

4.5.1 Differences between Men and Women's Travel Needs

According to the European Commission and Directorate General for Mobility and Transport (2014), the mobility patterns of men and women differ significantly. Rosenbloom and Plessis-Fraissard (in Herbel and Gaines, 2010), report that women around the world have less access to 'better' and faster transportation resources than men, have different and more complex travel patterns than men, and are more influenced by fear when making decisions about transportation than men. Although gender equality is always improving, according to Crane (2007), contrary to popular belief there was no revolution in women's travel between 1985 and 2005. Women's commuting distance, by both transit and vehicle, was shorter than men's of the same ethnicity in both 1985 and 2005. Although women's participation in the work force continues to increase, travel behavior between the two genders remains different.

One explanation for this difference is revealed through Taylor and Mauch's (2000) report that women share a disproportionate burden of child-serving and household maintenance travel. While men travel predominantly to work and back, women make more of the shopping and child escorting trips (Rosenbloom and Plessis-Fraissard, in Herbel and Gaines, 2010). Women are also more likely to walk and take the bus, while men are slightly more likely to take the train and much more likely to use a motorcycle or bicycle.

4.5.2 Safety

Women's mobility and participation in public life have been and continue to be impeded by both the real and perceived dangers of crime and violence (Loukaitou-Sideris, 2008). Fears and anxiety surrounding personal safety affect choices to ride transit, and gender is the most significant factor associated with levels of anxiety and fear (Loukaitou-Sideris, 2008). In the

2014 report, *She Moves: Women's Issues in Transportation*, The European Commission Directorate General for Mobility and Transport confirms that women are more concerned with travelling during certain times of the day and that because women rely more on transit than men, there is an urgent need to implement effective safety measures so that women are not discouraged from using transit.

Even though more women use transit than men, studies show that women are generally more fearful of public transportation than their male counterparts (Loukaitou-Sideris and Fink, 2008). Although this is more common in countries with lower levels of gender equality, women universally experience sexual harassment and violence on public transit (Dunckel-Graglia, 2013). This harassment has resulted in women's-only transportation options in Mexico, which women are opting for and Mexican feminists are fighting for, based on the right to equal access to mobility (Dunckel-Graglia, 2013). However, Dunckel-Graglia (2013) reports that these 'physical' changes may have little to no effect on women's fear of crime because women's fear is not the result of crime but of more complex societal power relations.

A study of US transit operators by Loukaitou-Sideris and Fink (2008) found a mismatch between the safety and security needs of women, and the safety and security strategies that North American transit agencies were using. Their survey revealed that there was also a mismatch between operator's perceptions of women's safety and women's opinions on how agencies should address the issue. While a majority of respondents within the transit agencies felt that women had distinct security and safety needs, most did not believe transit agencies should develop specific programs to address these needs. Interestingly, most transit agencies implement special services or policies to make transit more accessible to other vulnerable subgroups of the population, yet resist doing the same for women out of fear of accusations of reverse discrimination (Loukaitou-Sideris and Fink, 2008). While there is significant research on women's perceptions of safety on transit, few researchers, policy makers, or transit authorities in the United States have asked women about their safety needs or preferences (Loukaitou-Sideris, 2008). Based on the findings of Loukaitou-Sideris and Fink's study, women prefer increased surveillance in open areas where there are less people such as bus stops and parking lots, and generally prefer human surveillance over technology. In contrast to these preferences, security measures are often concentrated in more confined and controllable spaces such as trains and platforms, and transit agencies rely heavily on technology to provide security. Related to this is Yavuz and Welch's (2010) finding that the presence of security cameras has a lower impact on women's feelings of safety than it does men's, and that previous experiences of safety-related issues affects women's perceptions of safety much more than men's.

The programs that Loukaitou-Sideris (2008) found women favored most were 'request to stop services' that allow all passengers to request a stop anywhere along the line after a certain time of day, and public awareness campaigns denouncing groping, both of which ETS has already implemented. Increased lighting at bus stops, platforms, parking lots, and on the streets surrounding stops and platforms would also have significant impacts on women's feelings of safety (Loukaitou-Sideris et al., 2008). This may be particularly pertinent in Edmonton where travelling in the dark is unavoidable throughout the winter months. The use of real-time information is also important in reducing the feeling of being stranded when waiting for a bus or train. Having additional security personnel located at transit stops in high-risk neighborhoods

during the early mornings and late evenings, would also go a long way in ensuring feelings of safety (Loukaitou-Sideris et al., 2008).

In order to bridge the gap between the understanding of women's needs and the implementation of policies that address these needs Loukaitou-Sideris et al. (2008) suggest increasing dialogue between academics and practitioners, incorporating women's voices into the planning process, engaging in partnerships with local non-profit groups, and prioritizing safety needs. They also suggest adopting a 'whole journey' approach to safety, focused not only within transit vehicles and stations, but also in parking lots and other external environments that are a part of transit system assets. Other recommendations include tailoring safety to the needs of a particular community, enacting a multi-pronged approach that integrates safety technology as well as security staff, and the use of pilot projects. According to Yavuz and Welch (2010), agencies that employ multiple safety strategies are more likely to address the safety concerns of all genders.

5. Best Practices – Interview Findings

After surveying a number of transportation plans in North America, Manaugh and EI-Geneidy (2010) concluded that transit agencies often prioritized reducing congestion and mitigating environmental impacts over social equity. However, they also found that although equity was not often an explicit objective, many plans incorporated equity implicitly. Although an in-depth review of each agency's transit plan was not within the scope of this project, the results of the interviews largely support Manaugh and EI-Geneidy (2010) findings. A few of the larger transit authorities have made explicit efforts to address equity through programs, practices, or policies. However, only the City of Ottawa has equity policies that cover all five domains identified in this report.

Although equity is not yet a priority for many agencies, the interviews with experts revealed that social equity is a topic that agencies are increasingly concerned with, and that many agencies are looking to incorporate this agenda more directly in the future. For example, a representative from Metro Transit mentioned that the agency has implemented mostly programs and initiatives to help increase equity, and that these programs and initiatives may lead to policy changes in the future.

A common theme among US agencies was that their efforts to improve equity have largely come about and been fostered because of funding or regulatory direction that they received from higher levels of government. In contrast, if Canadian cities mentioned having received a push from outside organizations, it was usually non-profit, advocacy, or community groups that acted as the catalysts for new policies and initiatives.

Although some cities have considered accessibility in network planning, more often mobility-focused metrics such as demand forecasts and travel time seem to be the dominant factors in determining service levels. With the exception of the large agencies that have made equity a priority, decisions regarding future investments appear to be centered around infrastructure costs, almost exclusively. None of the nine agencies interviewed reported that equity had directly influenced decisions about hours of operation, number of vehicles, or the spacing of stops, with the exception of locating stops near senior facilities. All agencies planned these aspects of their

service predominately as a function of ridership, service optimization, or based on customer feedback.

An important consideration mentioned by a few cities, both Canadian and US, was improving public engagement practices. A Metro Transit employee reported that during the reconfiguration of bus service that occurred concurrent to the building out of the 'Green Line' between Minneapolis and St. Paul, the agency used a trusted advocacy approach to public engagement. The model allowed for individuals from within the community who had local knowledge and were trusted by community members to lead the engagement process. A representative from a group in Denver that works closely with the transit agencies to facilitate a connection between affordable housing and transit also mentioned that facilitating productive public engagement was one of the group's main objectives. They assist both the transit agency and the community in order to bridge the gap between the two groups and achieve more productive engagement outcomes.

In contrast to significant local public engagement, the concept of regional cooperation also implicitly revealed itself throughout the interviews, which suggests a balance that some agencies strike between local and regional politics. For example, Mile High Ends in Denver works with ten municipalities within the Denver region to coordinate transit policies with the objective of equity for all ages, incomes, and races. One of their main focuses is the cooperation between various local municipalities. A representative from Translink also suggested that because the regional transit agency is somewhat removed from municipal and neighborhood politics it is able to make more rational decisions about service distribution. If this is accurate, the detachment from politics provides the agency the opportunity to allocate funding based on balancing equity and efficiency considerations, with limited influence from elected officials focusing largely on their constituent's demands. Rural residents were one of the eleven demographics that the City of Ottawa recognized as facing systematic barriers. In order to mitigate these barriers OC Transpo cooperates with other agencies within the region to provide basic service to rural communities within and outside Ottawa city limits.

Some agencies also mentioned the importance of data. Both the Milwaukee County Transit System and Metro Transit administer surveys that allow them to collect bus rider demographic information. Metro Transit goes a step farther by identifying communities with concentrated racial minorities or poverty, and studying the routes that serve these areas and the ridership levels at the time. Similarly, Translink recently took advantage of improvements to technology and implemented a fare card that will allow them to collect enhanced data including origin and destination points. The card will also allow the agency to use variable fare structures and price capping.

In the sections below, specific findings from expert interviews across the five domains identified in this report are presented.

5.1 Age

Each of the nine agencies offer discounted fares for seniors and children (for a detailed breakdown of fares by agency see Appendix C). Most agencies also have discounted fares for

high school youth and young adults who are enrolled in post-secondary education. Programs that offer free or heavily subsidized rides for seniors on certain days of the week or during specific times of the day are also popular. A few agencies offer a small subsidy to seniors for single tickets but a significant subsidy for longer-term passes or smartcard fares. Mississauga recently extended a pilot project that implemented a $1.00 fare for seniors during off-peak hours on weekdays and all day on weekends and holidays. They extended the program so that they could gather further data on the results of the subsidy including changes in ridership levels.

According to a representative from OC Transpo, when the agency conducted an evaluation of the service network in 2011, equity was a key consideration. The review resulted in the addition of transit service in some areas including the implementation of rural shopping routes. According to the OC Transpo employee, these shopping routes cater to seniors and allow elderly residents who do not have access to a car to travel to downtown for appointments or to shop. The agency representative mentioned that these routes not only provide access to important destinations but also reduce the isolation that can result from not having access to a private vehicle while living in a rural setting.

Related to the needs of seniors is the 'adopt a stop' program that was recently taken up in Portland, Maine. The program encourages residents who are physically able to shovel to adopt a local bus stop. They are then responsible for removing the snow surrounding the stop shortly after a snowfall so that residents with reduced mobility can access the stop.

Interestingly, MiWay was the only agency that offered any form of free transit for youth. The agency offers a pass to youth between the ages of 12-14 that allows them to ride transit and access certain recreation facilities for free during the summer months. According to the representative from MiWay transit, this pass was implemented in order to provide youth, who have limited mobility due to the unavailability of family members with vehicles, the ability to leave the house and participate in the community.

5.2 Race and Ethnicity

Any US-based transit agencies that directly or indirectly receive funding from the Federal Transit Administration is required to comply with Title VI. The Title prohibits discrimination based on a person's color, race, or nationality within any organization or program that receives federal funding.[6] Agencies that receive funding are required to supply, at minimum, a copy of the agency's public notice about Title VI, a copy of the agency's instruction on how to file a Title VI complaint, a list of any complaints or lawsuits filed against the agency related to Title VI, a public outreach plan, a plan for providing language assistance, tables outlining the racial breakdown of membership for internally elected committees and boards, and a copy of the Title VI analysis completed for any new transit facilities.[6] According to one of the interview participants, US agencies are also required under Title VI to consider racial equity when making any changes to their fare structure. Title VI has resulted in an acute awareness of racial disparities on transit. However, one of the US respondents noted that although the Title prohibits discrimination it does not ensure equity, as not being discriminated against is not the equivalent

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[6] Title VI Requirement and Guidelines for Federal Transit Administration Recipients. 2012. US Department of Transportation. Retrieved from http://www.fta.dot.gov/documents/FTA_Title_VI_FINAL.pdf

to being treated equitably. Title VI also does not prohibit any form of discrimination based on factors others than race, color, or nationality.

Agencies and advocacy groups that have made equity a priority have gone above and beyond the requirements of Title VI. In addition to pledging access to all regardless of race, color, or national origin Metro Transit in Minneapolis and St. Paul also pledged access regardless of sex, age, disability, or socio-economic status. This commitment to equity began in part because of a light rail project. When the 'Green' light rail line was being built between Minneapolis and St. Paul the route was originally planned to travel through densely populated and racially diverse neighborhoods but make very few stops within these neighborhoods. This triggered a campaign called "Stops for Us" which eventually led to changes in federal policy that had previously favored speed over accessibility. Similarly, Milwaukee County Transit System established three new routes in 2014 with funding from a legal settlement that was the result of the Black Health Coalition of Wisconsin and Milwaukee Inner City Congregations Allied for Hope challenging both the state and federal Department of Transportation for approving a transportation project that had no transit component.

A Translink representative felt that the issue of racial disparity was not as prominent in Vancouver, or Canada in general, as it has been in the US. It was clear from the comparison of US and Canadian cities that Canadian cities consider racial equality less frequently than US agencies. When Canadian cities had considered race and ethnicity it was usually in respect to immigrants. A few Canadian cities have implemented learning courses for newcomers that include an orientation on how to use the public transit system. Winnipeg partners with other organizations so that they are able to provide an interpreter at these training courses. The City of Ottawa has also focused equity efforts internally and provides cultural training to their staff.

Unlike US agencies, Canadian agencies did not report having conducted analyses of the level of service based on ethnic demographic information. There appeared to be an informal awareness of certain areas of cities where certain racial demographics were concentrated, but no Canadian agencies mentioned having done a formal evaluation of how service level corresponded with these neighborhood demographics.

The needs of aboriginal riders were only discussed during one interview. Translink is unique because the agency represents a number of small communities, one of which is a Treaty First Nation, and as a result there is aboriginal representation on the mayor's council, which is one of decision-making bodies of Translink. Similar to the recognition by US cities that race is often associated with income, according to the interview participant the needs of aboriginal residents also bring into question issues of income and homelessness in the Vancouver region.

5.3 Income

Translink is currently reviewing its fare policy, and according to a representative prioritizing 'fairness', which is a term being defined internally. Translink currently operates using a zone model. However, they are concerned with how distance-based fares will affect low-income residents who live in areas far from the city center. The Translink representative pointed out that these riders already face a time burden because of the lengthy transit ride into the city core and

that increased cost would only add to this burden. Of course, this approach to fairness is also counter to fare recovery as the longer the ride, the more costly it is for the agency to provide.

As of December 1, 2015 Metro Transit launched a subsidy for residents who live in affordable housing developments. Two other agencies had also researched implementing a low-income pass, and MiWay has been participating in a pilot study for a low-income pass. Metro Transit, MiWay, and Winnipeg Transit all offer discounted passes to organizations that then give the passes to those who are looking for employment or are homeless.

5.4 Ability

CUTA defines accessible as "(t)he extent to which facilities are barrier free and useable by persons with disabilities, including wheelchair users."[7] All nine agencies considered the majority, if not all, of their fleet to be accessible. The agencies reported having integrated low floor technology, ramps, automatic doors and other barrier free design features. However, while the vehicles themselves are accessible, there still seem to be many bus and rail stations that are not fully accessible. Translink is currently contending a pilot project that, if implemented, will incorporate barrier-free design such as braille into all bus stops across the 23 communities that the agency serves. Winnipeg and Vancouver also have their own barrier-free design guidelines. It also appears to be standard practice to audibly announce each stop, whether it is automated or done by the transit operator. Some agencies adopted these announcements because of provincial legislation.

According to a representative of Winnipeg Transit, there was a human rights challenge against the transit agency on the grounds that the agency charged more for paratransit service than for standard bus service. According to the Winnipeg Transit website, as of June 2014, and most likely as a result of this human rights challenge, all paratransit services are offered at the same fares as standard transit, including reduced fares for seniors, students and youth.[8] Paratransit riders in Winnipeg also ride standard transit for free.

Similarly to programs that familiarize new immigrants with transit, many cities, including Edmonton, offer training programs or literature on how riders who use mobility assistance devices, such as wheelchairs, or have a cognitive disability, can safely and confidently access standard transit.

Although most agencies provide paratransit service, some cities offer more comprehensive service than others. OC Transpo provides funding for community groups that offer paratransit services outside of the OC Transpo service area. This cooperation has the potential to reduce the demand put on OC Transpo's service and in doing so, allows them to provide better service to their customers. Translink also supplements their paratransit service with subsidized taxi service.

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[7] http://www.cutaactu.ca/en/public-transit/publicationsandresearch/resources/CUTA-Assets-Glossary.pdf Also, see http://cutaactu.ca/en/public-transit/publicaffairs/resources/CUTAReport_ValueCaseforAccessibleTransitinCanada.pdf
[8] Fare Structure. Winnipeg Transit. Retrieved from http://winnipegtransit.com/en/handi-transit/fare-structure/

5.5 Gender

Although it is common for agencies to have considered security and safety, it was uncommon for agencies to have identified gender-specific safety issues. Even agencies that have addressed gendered safety issues, such as sexual harassment or feelings of safety after dark, had not yet implemented any policies or programs that address the unique transportation needs of different genders.

The Equity Lens used by the City of Ottawa was the result of collaboration between two women's advocacy groups. As a result, gender equity is a central focus of the policy. However, OC Transpo, like other agencies, has focused solely on safety and has made no mention of the other ways in which transit is gendered.

One safety procedure related closely to gender that has been implemented in a few cities is online or text reporting of harassment on transit. Some agencies have acknowledged that it is unlikely that a rider is going to feel comfortable pressing an emergency button in a situation that they consider uncomfortable and potentially unsafe but not an 'emergency'. Online and text message reporting, which at times can even be anonymous, provides an alternative tool to target harassment. A number of agencies also mentioned 'request a stop' programs that permit riders to request stops anywhere along the bus route after a certain time of day, so that passengers are able to get off as close as possible to their next destination. While this is a policy that has the potential to reduce some of the fears of women or gender-non-conforming riders, it is not targeted at the needs of either of these groups specifically. The Milwaukee County Transit Service implemented a similar beneficial change when they chose to remove seats from buses to create more room for passengers who were travelling with strollers. While this is may be considered a gendered issue, it will benefit riders of any gender that are travelling with a stroller.

6. Areas for Further Study

A few suggestions for further investigation are made here based on the findings of the literature review and expert interviews.

One of the largest barriers people face when accessing transportation is cost. The first area for detailed analysis is a review of the current fare structure[9] with a specific focus on the impacts of distance-based fares, a subsidy for low-income riders, and a subsidy or program for youth riders, particularly in the summer months. Disaggregate smart card data could be an important step forward in analyzing these costs.

A common theme in the literature and interviews was the importance of detailed data about where demographic groups live and work, how they travel, and if the current system results in any inequities in regards to time or cost. Hence, the second area that requires study is how ETS collects and archives ridership data, with a focus on methods for increasing the level of detail obtained including geocoded information on trip-start location and final destination outside the transit system's boundaries, and socio-economic variables regarding riders.

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[9] The authors understand that ETS will be creating a fare strategy and revising the fare structure informed by the findings from this Transit Strategy project.

The third area for further research is to analyze the equity gains for different populations with a view on current service, existing plans, and future projects on ETS. This could include an investigation of the level of accessibility that certain groups in the City of Edmonton have to key destinations such as employment nodes, shopping destinations including grocery stores, and education, medical, and recreation facilities. The literature highlighted that while access to employment is certainly an important determinant of economic opportunity, it is also important that services connect transit-dependent demographic groups to key non-work destinations.

While recognizing that the City of Edmonton already prioritizes meaningful public engagement as an aspect of all projects, the fourth area of study is to evaluate current public engagement strategies. The aim is to ensure that such exercises are adequately capturing the voices of groups including aboriginal, low income, seniors, youth, women, immigrant, as well as other groups that may face barriers to accessing traditional engagement processes. In June 2015 The Status of Women Canada and Social Sciences and Humanities Research Council of Canada jointly funded a project that involved the cooperation of a number of municipalities and organizations. One of the outcomes of this project was a 'Guide for Municipalities'.[10] The Guide covers a number of topics including engagement and delivering inclusive service, which can be used as a framework for evaluating public engagement strategies.

A theme that emerged in the literature was the complexity of modern transit systems, and how difficult it can be for riders with cognitive abilities or those with a language barrier to navigate them. The fifth area for further study is the feasibility of incorporating intuitive way-finding into future ETS projects as well as retrofitting existing infrastructure, including route planning, the names of routes, payment options, directional signage, physical design of stops and stations, and the integration of bus and LRT, to ensure that these system elements can be easily understood.

Overall, there is a need to consider the implications of implementing specific programs, focusing on the five (often overlapping) domains discussed in this report, which further the objectives of the Edmonton Diversity and Inclusion Policy (C358). The City of Ottawa provided 'diversity snapshots'[11] on each of the groups that the City identified as facing barriers including aboriginal, francophone, LGBTQ, rural, and immigrant residents, people living in poverty, people with a disability, seniors, visible minorities, women, and youth. Similarly developed user profiles would help improve analyses on sub-demographic markets that ETS serves.

Finally, some specific policies that can be analyzed include the feasibility of changing the DATS booking system to allow for same-day requests, and current passenger awareness of the request-a-stop program.

7. Conclusions

Social sustainability and equity are complicated ideas that are made more complex when incorporated into multi-modal transit systems. In this report we considered the vertical equity of transit systems with a specific look at how transit investment can affect equity in relation to age,

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[10] http://documents.ottawa.ca/sites/documents.ottawa.ca/files/documents/adv_equity_en.pdf
[11] http://ottawa.ca/en/city-hall/get-know-your-city/statistics-and-economic-profile/equity-and-inclusion-lens

income, ethnicity, ability, and gender. This report has provided an overview of methods for measuring equity, the results of academic studies as well as the best practices in equity currently being implemented by transit agencies across North America. Important considerations are highlighted, and based on these findings, a number of areas for further study are listed that would allow ETS to ensure the social sustainability of current and future transit service.

Highlighted areas for further analyses include investigating the feasibility of implementing ETS-specific equity policies under the five domains (age, income, ethnicity, ability, and gender); studying how detailed ridership data are collected; evaluating the equity of current transit service, existing plans, and future service; analysis of current public engagement strategies; feasibility of installing intuitive way-finding design; and rigorous evaluation of the fare structure.

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Appendix A – Interview Instrument

Interviewer's Name: _____ Date of Interview_____
Time of Interview: _____ Interviewee's ID:_____

Good [morning],

Thank you for agreeing to talk to me about social sustainability and equity on public transportation. As I mentioned before, this research is being done for the City of Edmonton, to gain a better understanding of best practices in equity planning with a specific focus on (a) policies implemented for social sustainability, and (2) the measurement of equity for a transit system.

(Name of agency) was chosen because (name of City) is comparable in physical and social geography (winter, Canadian city, etc.) to the Edmonton Capital Region, and has some interesting policies or practices that could help make a transit system become more equitable.

This discussion will take about half an hour. We won't identify you by name or position in any written reports, but may use a phrase such as "a transportation expert from (name of City) indicated… ".

I would like to begin by asking some general questions about policies at (name of agency).

1. Are you able to recall any policies that address how disadvantaged groups, such as seniors or those with disabilities, are served by public transit? (Prompts: accessibility, youth, ethnicity, race, gender, age, income, etc.)

   a. [If yes] Can you talk a little about these policies?

2. Do you know or remember if the transportation commission or City Council has debated the issue of equity in transit within the past five to ten years? (Prompts: specific policies, procedures, budgets, specific needs, pressure from advocacy groups, etc.)

   a. [If yes] Can you please describe the topic/s of the debate?

   b. If there was consensus, what was it and what were the outcomes?

   c. Have there been discussions about the kinds of services or infrastructure that would be more relevant to servicing specific groups? (Prompts: BRT, Bus, LRT, Hub and spoke networks, etc.)

I would now like to ask some more specific questions that focus on different aspects of equity on public transit.

3. To your knowledge, has (name of agency) ever performed an assessment of the equity of the fare structure? (Prompts: income, affordability, youth, seniors, spatial distribution, distance-based fares, subsidies, etc.)

    a. [If yes] What were the outcomes of the evaluation?

4. I noticed that (name of agency) provides (list subsidies provided). What additional subsidies are available for select populations such as students or low-income residents? (Prompts: U-Pass, School Boards, Senior's discount, Youth or Student rate, etc.)

    a. [If yes] How are these subsidies administered and what have the results been?

5. To your knowledge, are there specific routes or areas of the city for which frequency of service has been changed to account for the needs of specific populations? (Prompts: School year, low-income neighborhoods, seniors, etc.)

6. How does (name of agency) plan hours of operation, number of vehicles, spacing of stops, etc. for populations with limited mobility or accessibility, such as elderly and low-income households?

    a. Are there other bench-marks that (name of agency) follows? (Prompts: internal targets, rules of thumb, etc.)

7. [Canadian Cities] What policies does (name of agency) have to address the needs of new immigrants who travel on the system? What policies does (name of agency) have to address the needs of First Nation riders?

    a. How does the transit authority evaluate the needs of new immigrants and First Nation riders? (Prompts: research, public engagement, education programs, partnerships, etc.)

8. [US Cities] How does (name of agency) track what proportion of the ridership is comprised of different racial groups such as Blacks or Hispanics?

    a. How have past and current transit investments been linked to the needs of racial groups?

9. How has (name of agency) accommodated Universal or Barrier Free design choices when planning infrastructure?

    a. Were there any community groups or organizations that were consulted in order to understand the needs of individuals with limited mobility? (Prompts: wheelchair,

seeing impaired, hearing impaired, seniors, ramps, low-floor vehicle technology, audio announcements, intuitive way-finding, etc.)

10. What special consideration or policies has (name of agency) taken for the mobility of women? (Prompts: safety, route design, consultation, mothers, domestic errands, bus versus LRT, cost of traveling with children, school routes, etc.)

11. As technology such as smart cards and real time information are mainstreamed, how is (name of agency) thinking about using technology to improve service in the future? (Prompts: dynamic bus service, smart phone applications, real time safety audits for efficient response, resource allocation for safety such as cameras or emergency phones, etc.)

12. In closing, is there anything else regarding (name of agency) and its efforts to be equitable and inclusive that you would like to share with me?

Appendix B – Agency Overview

	Name of Agency	Population	Fleet Type	Fleet Size	Number of Routes	Average Weekday Ridership	Annual Operating Budget
Brampton[12,13]	Brampton Transit	523,911 (2011 Municipal Census)	bus, BRT	386 buses	65	83,150 (2015)	$54. 6 million (2015)
Denver[14]	Regional Transportation District (RTD)	663,862 (2014 estimate, US Census Bureau)	bus, light rail	1,011 buses, 172 rail vehicles	138	339,300 (2015)	$466.7 million (2015)
Milwaukee County[15]	Milwaukee County Transit System	956,406 (2014 estimate, US Census Bureau)	bus	400 buses	56	150,177 (2014)	$155.0 million (2014)
Minneapolis and St. Paul[16]	Metro Transit	704,847 (2014 estimate, US Census Bureau)	bus, light rail, commuter rail	905 buses, 86 trains, 18 commuter rail cars	132	288,939 (2014)	$355.1 million (2014)
Mississauga[17,18]	MiWay	713,443 (2011 Federal Census)	bus	460 buses	80	178,476 (2015)	$61.7 million (2015)
Ottawa[19]	OC Transpo	883,391 (2011 Federal Census)	bus, light rail	1,055 buses	145	340,000 (2014)	$408 million (2014)
Portland [20,21]	Metro	66,666 (2014 estimate, US Census Bureau)	bus	unknown	9	325,056 (2015)	$7.5 million (2014)
Vancouver (CMA)[22,23]	Translink	2,313,328 (2011 Federal Census)	bus, light rail, commuter rail, ferry	2,100 vehicles	215 bus routes	unknown	$1,426.9 million (2014)
Winnipeg[24]	Winnipeg Transit	746,100 (2011 Federal Census)	bus	585 buses	approx. 90	unknown	unknown
Edmonton[25,26,27]	Edmonton Transit System	877,926 (2014 Municipal Census)	bus, LRT	1,049 buses, 94 rail vehicles	208	404,506 (2014)	$323 million (2014)

[12] http://www.brampton.ca/EN/residents/transit/About-Us/Pages/Fast-Facts.aspx
[13] http://www.brampton.ca/EN/City-Hall/budget/2016%20Budget/2016-2018%20Proposed%20Business%20Plan%20and%20Budget/2016-2018%20Proposed%20Business%20Plan%20and%20Budget_final.pdf
[14] http://www.rtd-denver.com/factsAndFigures.shtml
[15] http://www.ridemcts.com/docs/default-source/about_us_files/2014-mcts-annual-report.pdf?sfvrsn=2
[16] http://www.metrotransit.org/facts
[17] http://www.mississauga.ca/portal/miway/about
[18] http://www7.mississauga.ca/eCity/Budget/img/serviceareas/business-plans/2016-miway-summary.pdf
[19] http://www.octranspo1.com/about-octranspo/reports
[20] http://gpmetrobus.net/images/stories/food/2015budget1.pdf
[21] http://trimet.org/pdfs/publications/trimetridership.pdf
[22] https://view.publitas.com/translink/2014-annual-report/page/48-49
[23] http://www.translink.ca/en/Plans-and-Projects/Planning-Data.aspx
[24] http://winnipegtransit.com/en/about-us/interestingtransitfacts/
[25] http://www.edmonton.ca/ets/ets-statistics.aspx
[26] http://www.edmonton.ca/transportation/RoadsTraffic/SEP14-Cumulative-Boarding-Summary-Sept2014.pdf
[27] http://www.edmonton.ca/city_government/documents/PDF/2014_Edmonton_Transit_budget.pdf

Appendix C – Overview of Agency Fare Structures (Cash Fare for One Ticket)

	Adult	Para-transit service	Seniors (65+)	Child (6 to 11/12)	Student (13/14 to 18/19)	University	Limited mobility	Low Income
Brampton[28]	$3.75		$1.00	$3.75	$3.75		support person rides for free	
Denver[29]	$2.25 - $5.00	$4.50 - $26.00	$1.10 - $2.50	$1.10 - $2.50	$1.10- $2.50	College Pass	$1.10 - $2.50	reduced fares to eligible organizations that provide assistance to low income individuals
Milwaukee County[30]	$2.25		$1.10 or free	$1.10	$2.25	U-Pass	$1.10 or free	
Minneapolis and St. Paul[31]	$1.75 - $2.25	$3.00 - $4.00	$0.75 - $2.25	$0.75 - $2.25	Student pass	U-Pass and College Pass	$0.75	50% reduction in fares for organizations buying bus tokens for homeless or those seeking employments. Subsidy for affordable housing residents
Mississauga[32]	$3.50		$1.00 pilot ($3.50 during peak)	$3.50	$3.50 or free	$3.50	support person rides for free	pilot study
Ottawa[33]	$3.55	$1.55 - $8.80	$2.70	$1.90	$3.55	U-Pass	Free or discounted. Support person rides for free.	
Portland[34]	$1.50		$0.75	$1.00	$1.00		$0.75	
Vancouver (CMA)[35]	$2.75- $5.50	$2.75	$1.75 - $3.75	$1.75 - $3.75	$1.75 - $3.75 *only applicable with valid Go Card	U-Pass	$1.75 - $3.75 *only applicable with HandyCard	
Winnipeg[36]	$2.60	$2.60	$2.10	$2.10	$2.10	U-Pass (2016)		

[28] http://www.brampton.ca/EN/residents/transit/Fares/Pages/Welcome.aspx
[29] http://www.rtd-denver.com/Fares.shtml
[30] http://www.ridemcts.com/fares-passes
[31] http://www.metrotransit.org/fares
[32] http://www.mississauga.ca/portal/miway/fares
[33] http://www.octranspo1.com/tickets-and-passes
[34] http://gpmetrobus.net/index.php/rider-information/fare-information
[35]http://www.translink.ca/en/Fares-and-Passes/Single-Fares.aspx
[36] http://winnipegtransit.com/en/fares/transit-fares/#gocards

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