Attitudinal Variables Influencing Transit Ridership

Measuring the Impact of Express Bus Service in Kingston, Ontario
**EXECUTIVE SUMMARY**

This report explores transit behaviour in a mid-sized Canadian city context. The understanding of transportation behaviour in our communities is not simply an academic discussion; it has real world implications for policymakers and planners. Increased prevalence of subsidies for transit systems in cities are a “response to a variety of public policy concerns over worsening traffic congestion, air quality, energy consumption, mobility for those without private vehicle access, and disruptions due to street and highway expansion” (Taylor, Miller, Iseki, & Fink, 2009, p. 61). Indeed, as one of his first major actions, Prime Minister Justin Trudeau announced on August 23, 2016 that the first phase of the Investing in Canada program would be dedicated to improving public transit (Canada, 2016). This subsidy is targeted to providing more effective and efficient transit systems in primarily mid-sized cities.

Despite the increased investment in transit subsidies by policymakers, little research contributes to the understanding of transit behaviour in mid-sized Canadian cities. It is known that multiple variables influence transit ridership in municipalities such as the built form, demographics, trip characteristics, transportation demand management policies, or psychological factors (Eluru, Chakour, & El-Geneldy, 2012). However, the degree to which these various factors predict transit ridership is not clearly understood or agreed upon. To effectively plan our communities, policymakers need to understand who uses public transit and why.

The report addresses the following four research questions:

1. How have the commute patterns of Queen’s University employees changed since 2013 when express transit service was first introduced in Kingston?
2. How have the attitudes towards Kingston Transit among Queen’s University employees changed with the redevelopment of Kingston’s transit system?
3. Based on known determinants of transit ridership, what factors best predict who will switch to year-round transit ridership amongst the subject population?
4. What has the City of Kingston and Queen’s University done, and what are these institutions currently doing, to address attitudinal predictors of transit ridership?

To address these research questions, a mixed-methods case study approach was employed. Descriptive statistics and hypothesis testing were used in order to analyze survey data collected in 2013 and 2016 from staff commuting to Queen’s University in Kingston, Ontario. Survey data explored the changing transportation patterns amongst the population over this period. Statistical analysis was also used to examine how attitudinal variables to transit ridership had changed since the introduction of express service in 2013. Binary logistic regression was employed to analyze how independent variables predict transit shifting amongst the population. Key informant interviews and document analysis supported the statistical research by providing greater context towards how these institutions have been addressing the identified barriers and predictors of transit shifting.

The findings of this research indicate that Queen’s University employees have gradually begun to adopt Kingston Transit as a primary means to commute to work. 45 employees shifted to transit on a year round basis through the scope of this study, representing a statistically significant increase from 2013 to 2016.
Commuting by automobile still remains the primary method of commuting by the sample population in 2016, with 57.4% of all year round trips made using a private automobile.

Overall willingness to use Kingston Transit has increased over time, indicating more favourable opinions since the introduction of express service. The primary barriers and facilitators identified by respondents indicate that access to transit, specifically where one lives, is highly influential to transit ridership. Over time, access to transit significantly increased as a primary barrier for those outside of 3km from Queen’s University. Other barriers and facilitators to transit use that experienced increase over time include the service being unavailable or ownership of a parking pass as a barrier. The primary barriers and facilitators identified generally remained constant over time, with few statistically significant changes and general fluctuations in response proportions.

Seven variables were found to have statistically significant influence towards predicting transit shifting amongst the sample population between 2013 and 2016. The largest degree of influence was reported walking distance to transit stops. Those in proximity to an express stop had the highest degree of influence, followed by those reporting walking distance to a bus stop, and finally those who were in proximity to multiple bus stops. Demographically, females were approximately 4.7 times more likely to shift to transit, while other characteristics such as age, income, or household composition were not found to have significant influence. Owning a parking permit in 2013 had a negative influence on shifting to transit, as those without a pass were over five times as likely to shift to riding transit by 2016. However, respondents who report sensitivity to fluctuations in parking costs were also more likely to shift over this period. Finally, those who report a maximum time willing to commute by transit between 20 and 30 minutes, were more likely to shift to transit than other reported durations.

The City of Kingston and Queen’s University were found to address barriers to transit ridership through a variety of different means. The City of Kingston addresses the barriers of access, efficiency, and automobile reliance through upgrades to the transit system and supporting infrastructure, heightened parking regulations, and strategic marketing of transit. Queen’s University primarily addressed the barriers of automobile dependence and access through heightened parking regulations, promotion of transit passes, and initiatives to heighten the pedestrian experience at the destination.

To conclude, this report proposes five recommendations to offer guidance to policymakers and planners:

**Recommendation 1: Increased coordination of parking initiatives.**

Parking provided by Queen’s University and the City of Kingston should work to find a balance between supply and cost of parking for commuters, through increased coordination. This will appropriately allow those who wish to commute by car to campus to continue doing so, but to make transit a more appealing and realistic alternative to others who may find the changes too much of an inconvenience. A combined effort by both Queen’s University and City of Kingston employees will undoubtedly provide the most comprehensive and fair balance between parking availability and cost.
**Recommendation 2:** Provide better connections to express/bus routes for those within shorter and longer commute distances.

While Kingston Transit is actively improving infrastructure and intermodal connections based in the policy directions reviewed, more should be done to reduce the perceived distance to accessing transit. Continued work to upgrade transit shelters, bicycle infrastructure, and ensuring sidewalk access throughout the trip duration should be a focus moving forward for Kingston Transit. Specifically, areas and bus stops which are not on a main artery of any of the express routes should be targeted, in order to continue to provide access to those within longer and shorter commuting distances.

**Recommendation 3:** Extend the Queen’s University restrictive parking Zone 3 and modify policies for Zone 2.

Queen’s University should consider revisiting the boundaries and policies which establish the three zones for allocating parking passes. Zone 3, as the most restrictive in terms of allowance, could be expanded to include a broader geographic area. Additionally, policies in Zone 2 could become more restrictive like what already exists for Zone 3, in which parking permits do not automatically renew upon expiry. Provided with a decision to re-register for a parking pass, commuters may be more encouraged to test transit as an alternative.

**Recommendation 4:** Eliminate parking pass decommissioning fee and replace it with an activation deposit.

Current policy charges the user $25 to decommission a campus parking pass (Queen’s, n.d.). This fee can discourage staff from cancelling their parking pass in order to try transit, particularly for shifting mid-year. Instead of a cancellation fee, the University can consider establishing a refundable administrative deposit at the time of purchasing a parking pass. It can equal the same $25 fee currently in place, however provide more upfront cost to the user. When an employee considers cancelling their parking pass it will not appear that they have to pay more to do this, as their deposit has already been included in the cost of parking. While this will not increase the overall cost of parking on campus, it can make it appear as if it is, making the cost of a parking pass appear more appealing.

**Recommendation 5:** Continue realizing directions, goals, and initiatives set out in policy.

The City of Kingston and Queen’s University were found to provide strong direction in policy which supports the promotion of alternative forms of transportation to the private automobile. Initiatives by both institutions were realizing this policy, which has coincided with a statistically significant growth in transit shifters within the extent of this study. Therefore, both institutions should continue with the initiatives that they are currently involved with. Continued improvements to transit infrastructure, specifically at major destinations and downtown, combined with parking management strategies should continue to be a primary focus for both organization moving forward.
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1 INTRODUCTION

1.1 BACKGROUND
On August 23, 2016, Prime Minister Justin Trudeau and Premier of Ontario Kathleen Wynne announced that the first phase of the Investing in Canada program would be dedicated to enhancing public transit (Canada, 2016). The program is seeking to jointly invest $2.97 billion in transit improvements across Ontario, including mid-sized cities (population 50,000-500,000) such as Barrie, Sudbury, and Kingston (Press, 2016). The priority of this investment indicates significant desire at both the Federal and Provincial levels to improve the availability and efficiency of transit systems, and a recognition as to the potential positive impacts that public transit can have on these communities.

Mid-sized cities across Canada have historically experienced low levels of transit ridership and high automobile dependence (Turcotte, 2011), for various reasons. It is well documented that the organization and densities of cities are highly influential to the effectiveness and efficiency of transit systems and, as Turcotte (2011) notes, “It is much easier to provide efficient public transit in the high-density residential neighbourhoods typical of the central areas of major cities.” Movement in mid-sized cities with lower residential densities is often unimpeded by traffic congestion (Turcotte, 2008), which makes travel by private automobile more efficient (ie. less travel time) than by public transit. Indeed, in Canada’s eight largest Census Metropolitan Areas (CMA) 69% of trips are made by private automobile, compared to 81% of trips in CMAs with populations below 250,000 (Turcotte, 2008).

One approach to overcome low ridership and the negative stigma associated with public transit in mid-sized cities is through improvements to the transit system. However, few studies have examined whether such improvements in mid-sized cities lead to attitudinal shifts towards public transit, and ultimately translate into increased ridership. Additionally, while many studies have identified the characteristics of people that ride public transit, the dearth of longitudinal research on this topic means that very few studies have examined the characteristics of people that become transit riders following public transit improvements. Knowing more about the people that are willing to shift their daily mode of travel has important implications for public transit planning.

1.2 STUDY PURPOSE AND RESEARCH QUESTIONS
Since 2013, the city of Kingston, Ontario (population 159,561) has experienced significant investments in its public transit system. Notably, Kingston Transit has recently undergone major service change that introduced three express bus routes operating at 10-minute intervals at peak periods (Kingston Transit, 2011). Kingston Transit carried 1.1 million more annual passengers in 2015 compared to 2011, an increase of 31% over four years (Kingston, 2016). This research aimed to assess attitudinal changes towards public transit in Kingston since these improvements have been made to the transit system, and to identify the factors that predict the likelihood of a person switching to public transit for their commute to work.
study drew from a longitudinal dataset compiled from staff at Queen’s University in Kingston, Ontario, and was driven by the following research questions:

1. **How have the commute patterns of Queen’s University employees changed since 2013 when express transit service was first introduced in Kingston?**
2. **How have the attitudes towards Kingston Transit among Queen’s University employees changed with the redevelopment of Kingston’s transit system?**
3. **Based on known determinants of transit ridership, what factors best predict who will switch to year-round transit ridership amongst the subject population?**
4. **What has the City of Kingston and Queen’s University done, what are these institutions currently doing, and what do they plan to do in the future, to address barriers to transit ridership?**

The research questions were derived from existing literature summarized in Chapter Two, which discusses the factors that influence transit ridership. The first three research questions were addressed through statistical analyses of the longitudinal dataset, compiled yearly since October 2013 by my supervisor, Dr. Collins. The final research question was addressed through semi-structured interviews and document analysis. Since most studies in this field are cross-sectional in scope, this study makes a critical contribution to the understanding of how public transit improvements impact ridership, and offers insights regarding how amenable public perceptions and attitudes towards transit are to change in a low-density automobile oriented midsized city.

### 1.3 Report Structure

This report has been divided into five main chapters: Introduction; Literature Review; Methodology; Findings and Analysis; and Recommendations. Chapter Two provides a review of existing literature pertaining to the topic of transit, focusing on literature examining factors that influence transit ridership; it discusses the environmental, social, health, and financial impacts of transit ridership; and it provides precedents for the research. Chapter Three introduces the City of Kingston case study and outlines the three key methodologies employed in the research (statistical analysis, document analysis, and semi-structured interviews). Chapter Four presents the findings from the study and Chapter Five provides a commentary on the results, offering recommendations for policy and future research.
2 LITERATURE REVIEW

This chapter will review the existing literature pertaining to transportation and transit ridership. The section is broadly organized into two major sections: the impacts of transit; and factors that predict transit ridership. The impact that public transit can have on individuals or communities is categorized by three major themes of equity and financial implications, health impacts, and environmental sustainability. With regards to predicting ridership levels, six major categories of influence are explored. Most research on transit ridership is focused on built form variables, however attitudinal variables and other transportation demand management policies are also known to influence ridership. This section concludes by identifying common research methodologies and sample populations in transit research, arguing that gaps exist, and proposing how this research will add to the existing body of literature.

2.1 IMPACTS OF TRANSIT

Public transit ridership provides numerous benefits at individual and community levels, particularly when compared to single occupancy vehicle use. The American Public Transportation Association (APTA, 2017) broadly categorizes the benefits of public transit into three overarching themes including energy/environmental benefits, financial and economic benefits, and health/social benefits. A recent study in Hamilton, for example, examined how the introduction of Light Rail Transit would impact the city economically, environmentally, and in terms of population health (Topalovic, Carter, Topalovic, & Krantzberg, 2012). The results indicated (amongst other things) a potential to increase land values upwards of 15% near major nodes, to reduce greenhouse gases by 20%, and a general decrease in sedentary lifestyle habits that contribute to cardiovascular diseases amongst the population (Topalovic, et al. 2012). The following section will be dedicated to further exploring environmental, financial, and health impacts of public transit, to further demonstrate why modal choice is an increasingly important topic of discussion, and why transitioning environments to be supportive of public transportation is essential to the sustainability of communities.

2.1.1 Health and Well Being

Chronic diseases such as diabetes, obesity, cancer, respiratory issues, and cardiovascular illness are referred to as the major health issues of the 21st century, most of which are associated in part with the built environment and accompanying lifestyle choices (Williams & Wright, 2007). Inactivity as a result of automobile reliance is becoming a significant contributor to the prevalence of these chronic diseases. Using public transit is increasingly being considered an active mode of transportation, given the amount of walking that is involved at both the origin and destination of a trip (Ewing & Cervero, 2010; Besser & Dannenberg, 2005). For instance, one study in New York City found that train commuters took, on average, 30% more steps than automobile commuters, thus being 4 times as likely to meet a recommended minimum 10,000 daily steps for physical activity (Wener & Evans, 2007). Similarly, a study by Besser and Dannenberg (2005) found that transit users achieve upwards of 30 minutes of physical activity each day, solely from walking to and from transit. The conclusions of this study are consistent with research at a broader scale. Examining the results of the 2001 National Household Travel Survey (NHTS), Edwards (2008) found that taking public transit is related to, on average, 8.3 minutes of additional walking.
compared to those taking a private automobile, translating to approximately $5,500 of cost savings per individual in avoided medical expenses in a United States context (Edwards, 2008). The results of these studies show a clear association between transit ridership and an increase in walking, which offers tremendous potential for chronic disease prevention.

2.1.2 Environmental Impacts
Transportation accounts for a significant source of a city’s ecological footprint. In North America, this is due in large part to the prevalence of low density development and the reliance that such development creates on the private automobile. A study out of Toronto examined differences in greenhouse gas emissions and energy use through the life cycle in a low density versus high density development (Norman, MacLean, & Kennedy, 2006). The study found that transportation alone accounts for 40-60% of greenhouse gas emissions in this life cycle, and that low density developments produce twice the emissions of their high density counterparts (Norman et al., 2006). Additionally, lower density developments had lower transit ridership levels but accounted for greater greenhouse gas emissions for public transit, likely as a result of the greater distances being travelled to service the population (Norman et al., 2006). In both scenarios however, emissions from transit only accounted for between 2 and 5% of all transportation related emissions (Norman et al., 2006), begging the question as to what potential emissions savings exist through greater public transit use and less reliance on single occupancy vehicles.

If all trips taken by public transit in the United States in 2005 were replaced by single occupancy vehicles, there would be an additional 6.9 million metric tonnes of carbon dioxide released into the atmosphere, attributable to both movement and idling due to congestion (Davis & Hale, 2007). It is sometimes argued that reduction of greenhouse gas emissions experienced by public transit is marginal, if not insignificant, when not accounting for congestion benefits (Harford, 2006). However, advancements in transportation technologies could be reshaping this argument in the future, eliminating excessive emissions by busses (Kolpakov & Reich, 2013; Yoon et al., 2013). Regardless of the real impacts, perceived environmental benefits of using public transit as an alternative to a private automobile are frequently cited as motive by public transit riders (Joireman, Van Lange, & Van Vugt, 2004). A comprehensive examination of the life cycles of different transit systems from initial construction to ridership maturity indicates that, over time, these systems do have positive impacts on carbon emissions and smog formulation (Chester, Pincetl, Elizabeth, Eisenstein, & Matute, 2013). The potential to decrease emissions through transit improvements may take time to see concrete results, however the potential as a more sustainable modal choice is evident.

2.1.3 Economic Impacts and Social Equity
Public transportation provides a necessary utility to cities, enhancing social equity and allowing affordable alternatives to those who simply cannot afford a private automobile. Indeed, Prime Minister Justin Trudeau referenced the idea that the Federal investment in public transit would make transit systems more inclusive to everyone, indicating a desire for increased social equity (Canada, 2016). In fact, access to public transit can have significant influence on labour force participation in large metropolitan areas (Sanchez, 1999). Transportation justice is an emerging theory which suggests that particular individuals and areas are more susceptible to the presence of public transportation (Beiler & Mohammed, 2016). Growing research indicates a desire to develop standardized methods for identifying transportation justice
Literature Review

areas, in order to strategically target highly vulnerable populations (Beiler & Mohammed, 2016). Clearly public transit represents, to many, a more affordable and realistic alternative to private automobiles, providing equitable access to communities and essential services within the city.

Research has also been conducted on the costs of regular transit use compared to the private automobile. When accounting for factors such as fare cost, gas, and automobile depreciation, Weisbrod & Reno (2009) found a savings per trip (average of 5km) of $1.81 when taking public transit over a private automobile, translating to a total yearly savings of $905. If public transit leads to a reduction in automobile ownership, user savings are even greater. Weisbrod & Reno (2009) also estimated that the costs for vehicle ownership to range from $4,232 to $6,901/year, depending on automobile type. These household expenses could be eliminated by users who are able to replace automobile ownership with public transit.

Significant infrastructure investment, including transit, can result in an increase to surrounding land values (Peterson, 2009). For example, in his analysis of income in Toronto, Hulchanski (2007) finds significant correlation between transportation infrastructure and income levels. Individuals with incomes above the metropolitan average are concentrated in close proximity to dedicated underground rail stations, while those with lower incomes are farther away from the core of the city and rely primarily on bus service (see Figure 2-1) (Hulchanski, 2007). Similarly, property values amongst those in close proximity to transit are approximately 169% greater than the Toronto average (Hulchanski, 2007). The increased values of land surrounding light rail stations can be experienced as soon as one year before construction even begins (Hess & Almeida, 2007). One criticism of this body of literature, however, is that it focuses too heavily on the impacts of rail transit and the automobile, specifically in large cities, while ignoring small towns and fixed bus routes (Faulk & Hicks, 2010). Despite this criticism, it is noteworthy that while infrastructure improvements can be intended to enhance social equity, they can potentially contribute to polarization and gentrification of populations based on land values and income.

![Figure 2-1: Three Cities in Toronto (Hulchanski, 2007)](image-url)
2.2 TRANSPORTATION, LAND USE, AND MODAL CHOICE

Within urban planning literature, modal choice is one of the most extensively researched topics and the focus of numerous studies (Ewing & Cervero, 2010). Indeed, mode of commute to work is one of the questions posed by Statistics Canada’s Census of the Population. According to the 2006 census, 76.8% of the population residing in CMAs relied on an automobile either as the main driver or passenger in commuting to work, while only 15.1% relied on public transit (Statistics Canada, 2009). Further, public transit use varied considerably across Canada’s CMAs, from as low as 1.8% in Abbotsford to as high as 22.2% in Toronto (Statistics Canada, 2009).

Many factors influence the disparity in ridership levels between municipalities, as well as between the populations within these municipalities. In particular, Zhou (2012) describes six factors that influence modal choice amongst individuals: 1) built form variables such as density and land use; 2) mode specific factors including access, convenience, or cost; 3) attributes and demographics such as marital status, age, or gender; 4) characteristics of the trips, such as purpose or distance; 5) travel demand management measures which include transit subsidies or parking costs; and 6) psychological factors that can include habits, attitudes, or health concerns. Zhou’s (2012) model does not represent an agreed standard, however it provides a comprehensive overview of the broad factors that influence ridership levels. Further examining these six various factors in relation to transit ridership provides a greater understanding of why people choose to travel the way in which they do.

2.2.1 Built Form Variables

In his book Human Transit, Jarrett Walker (2012) identified seven factors that influence transit ridership. Yet, he ultimately concludes that,

> The physical design of cities determines transit outcomes far more than transit planning does. Your particular location in the city, and the nature of the development and street patterns, will govern the quality of transit you can expect. (p. 7)

Walker’s (2012) theory regarding the influence of built form on modal choice is by no means revolutionary. Indeed, Ewing and Cervero (2010) conducted a comprehensive review of over 200 studies of the built environment and travel behaviour. Through this review, they found that seven variables are consistently identified as determinants of travel behaviour (density, diversity, design, destination accessibility, distance to transit, demand management, and demographics). Their review also found that proximity to transit trips was especially strongly linked to the likelihood of riding public transit (2010). Where someone lives has clear implications for the modes of transportation that are available, in particular the availability of public transportation.

2.2.2 Mode Specific Factors

Mode specific factors such as cost of trip, access, or convenience can influence transit ridership numbers. One can look to ridership numbers analyzed alongside gasoline prices to examine what influence the fluctuation of gas has on a population’s use of public transit. Research by the American Public Transportation Association (2012) found strong links between gas price and transit ridership levels (See Figure 2-2). For example, an increase in gasoline prices per gallon from $3.053 in 2007 to $4.114 in 2008,
corresponded with an increase in transit ridership of 3.42% (APTA, 2012). While other external factors contribute to transit ridership levels, gas prices were found through regression analysis to account for 44% of the variation in transit ridership (APTA, 2012).

It is often argued, however, that the ease of mobility and freedom of a personal vehicle can offset any cost savings from alternative transportation services, and that less freedom is an inconvenience associated with transit (Nor, Nor, & Abdullah, 2006). Additionally, the walking distance to bus stations has been linked to ridership levels, (Eluru, Chakour, & El-Geneidy, 2012) indicating access and convenience as primary barriers to transit adoption.

2.2.3 Demographic Characteristics
Socio-demographic factors have shown strong relationships to modal choice in the literature. This can include income, number of vehicles owned, age, gender, family structure, or a variety of other factors (Bhat, 1997; Crane, 2007; McDonald, 2015). As with all of the variables discussed, no clear consensus exists as to what degree or direction of influence these factors have on transit ridership, however clear trends in data can emerge. For example, communities with high levels of children under 14 are significantly less likely to use public transit (Pasha, Rifaat, Tay, & Barros, 2016). This could be a result of having to make numerous stops in one’s commute. Not surprisingly, as income increases, the use of public transit decreases (Pasha, et al., 2016). Similar relationships can be found between unemployment and transit ridership; as unemployment increases, so does use of public transit (Pasha, et al., 2016). Often users with lower incomes rely on transit not by choice but out of necessity, while those with higher incomes are able to afford the extra cost of a more convenient private automobile. In some studies it can
be found that females are more likely to rely on transit (Collins & Agarwal, 2015), while the opposite may also be found in other studies (Pasha, et al., 2016).

Statistics Canada’s Census of the Population allows insight into some of the demographic characteristics of those who rely on public transportation. In 2007, it was reported that those most likely to use public transit are households within the lowest income bracket and households with teenagers (Statistics Canada, 2010). Similarly, owning a vehicle significantly reduced the use of public transit amongst Canadians (Statistics Canada, 2010). While clearly a broad understanding of which Canadians use public transit, it does indicate that patterns can exist.

No clear consensus exists on the direction of influence these traits have, however it can be agreed upon that some level of influence generally exists. Often in regression analysis, researchers will control for demographic characteristics (Ewing & Cervero, 2010). This can be done in order to understand how other variables influence transit ridership, as opposed to producing results that are more heavily influenced by age, gender, income, or any other demographic trait that clearly influences the way in which transit is used.

2.2.4 Characteristics of Trip
Technological advancements in fare payment methods make trip characteristic data collection easier than ever before (Trepanier, Tranchant, & Chapleau, 2007). The characteristics of a trip, including trip duration, purpose, and type of service can influence transit ridership levels. For instance, it is argued that a reduction in the amount of transfers needed to arrive at a destination will greatly promote transit ridership (Eluru et al. 2012). Direct service to core areas can therefore yield increased ridership levels. Total travel time similarly has negative influence towards ridership levels (Eluru et al. 2012). Longer bus rides have been shown to be more detrimental to ridership levels than longer rail trips (Eluru et al. 2012), which suggests that different modal options influence perceptions of the characteristics of a trip.

Studies indicate that the purpose of a trip can influence attitudes and perceptions of the mode (Habib, Kattan, & Islam, 2010). Thompson, Brown, and Bhattacharya (2012) suggest that it is access to employment which primarily determines the success of transit systems. This argument proposes that work related trips generate the most ridership levels and increased willingness to select transit as an alternative.

2.2.5 Transportation Demand Management
Transportation demand management is a set of strategies aimed to adjust travel behaviour amongst populations (Ferguson, 1990). This can include various initiatives towards modifying costs of different modes, including parking rates, tolls, or transit subsidies. It is often a combination of these various initiatives that makes transportation demand management most effective in reducing automobile dependence amongst commuters (Barla, Lapierre, Daziano, & Herrmann, 2015).

Modifying the cost and availability of parking can influence the behaviour automobile users (Rotaris & Danielis, 2014). When cost of parking far exceeds the convenience of the private automobile, transit can seem like a more appealing and realistic alternative to certain populations. For instance, those with lower income levels exhibit higher levels of elasticity to automobile use in regards to changes in the cost of
parking (Barla, et al. 2015). Additionally, parking supply has been shown to account for upwards of 92% of variation for transit ridership in major Canadian cities (Morrall & Bolger, 1996). Authors of this study concluded that the availability of surface parking adjacent to and within central business areas accounts for the greatest negative influence toward transportation ridership and policy (Morrall & Bolger, 1996).

The level to which transit is subsidized can influence its efficiency, affordability, and as a result ridership levels. Buehler (2009) suggests that the longstanding dedication to transit subsidies in Germany results in more efficient use of funds and increased ridership levels when compared to the United States. Indeed, when Boston’s transit agency experienced budget crises, transit ridership suffered as a result (Gomez-Ibanez, 1996). The priority of funding that transit receives has a clear influence towards its overall success in comparison to other modes.

Rotaris and Danielis (2014) produced a model and performed a scenario analysis on the above discussed transportation demand management methods at the University of Trieste in Italy. Their model suggests that a subsidized transit fare is the most effective method to increasing ridership levels (Rotaris & Danielis, 2014). Alternatively, increasing the cost of parking will yield similar increases in public transportation ridership (Rotaris & Danielis, 2014). A reduction in parking supply and also proximity to the workplace would also modestly increase bus ridership by between 3% and 16% (Rotaris & Danielis, 2014). These results summarize some major findings of transportation demand management strategies, specifically in regards to parking availability, cost, and subsidy for a major trip generating institution such as a university.

2.2.6 Attitudinal Variables and Commute Satisfaction

Residential self-selection refers to that possibility that individuals select the neighbourhood they wish to live in based on existing beliefs and values and, if not controlled for, will produce biased numbers in favour of the built environment (Cao, Mokhtarian, & Handy, 2009). This suggests that the connection between the built environment and transit ridership may be associative, rather than causal (Bhat & Naveen, 2009), and that attitudes may influence why people live where they do to some degree. Ewing and Cervero (2010) discovered 38 studies that account for this residential self-selection, and nearly all of them reached statistically significant relationships between the built environment and travel behaviour. Residential self-selection, however, reduced the magnitude of this relationship in nearly all of the studies (Ewing and Cervero, 2010). The idea that the built environment has an effect on travel behaviour, but individual values and perceptions also have a role in modal choice, is effectively summarized by Cao, Mokhtarian, and Handy (2009),

People choose places to live based on a variety of factors including travel preferences. At the same time, environments vary in the degree to which they support different modes: it is easier, safer and nicer to walk in some environments than others. (p. 389-390)

Thus, the built environment clearly influences access to transit and therefore transit usage, however individual behaviours and values that influence where people live, and how they behave in that space, also play a key role in determining modal choice. This indicates that more attention needs to be given towards people’s attitudes and perceptions of transit, and how these factors influence ridership.
Attitudes and personality traits have been linked to modal choice to various extents. Attitudes regarding flexibility, comfort and environmental considerations have been shown to influence one’s modal choice (Johansson, Heldt, & Johansson, 2006). For instance, the millennial generation is experiencing considerably different mobility patterns than previous generations (McDonald, 2015), and research is only beginning to examine the factors that influence these changes. The reduction in automobile licensing and vehicle usage amongst millennials is apparent, and McDonald (2015) hypothesises two explanations for this trend. Her first hypothesis is that the lifestyles of this cohort, that is being unemployed, a student, and deferring marriage and children, require less travel demand than previous generations. Her second hypothesis argues that there has been a change in attitude from previous generations, whereby millennials prefer living in dense cities where transit and walking are more accessible. Indeed, McDonald’s (2015) research found that both hypotheses hold true, such that the attitudes of millennials regarding transit influence their automobility and the decision to live in particular areas that have greater access to transit infrastructure.

Satisfaction with one’s commute is strongly influenced by mode choice. A recent survey of employees in Xi’an, China found the most satisfied commuters were those who cycled, followed by those who walked, the automobile, and lastly, those taking public transit (Ye & Titheridge, 2016). They also found that satisfaction significantly decreased amongst transit commuters when transfers were necessary or overcrowding persisted, and that those with positive attitudes toward their mode choice experienced higher levels of satisfaction within their commute (Ye & Titheridge, 2016). A similar study was conducted amongst university students at McMaster University in Hamilton, Ontario (Paez & Whalen, 2010). The researchers found that public transit commuters were the most dissatisfied with commute, followed by automobile users, and that active commuters were the most satisfied. They also found that active and automobile commuters were more likely to view the trip as pleasurable, while transit riders did not. This lack of pleasure in the journey could be a key barrier to adopting public transit for many commuters.

To further understand the complexity of commuting behaviours and attitudes, Ory et al. (2004) examine four variables regarding travel behaviour from a survey of approximately 4,000 commuters in the San Francisco Bay Area: objective mobility (i.e., actual travel time and distance); subjective mobility (i.e., perceived commute time and distance); desired mobility (i.e., desired commute time and distance); and commuting satisfaction. The researchers found that 40% of respondents either disliked or strongly disliked commuting, while 21% enjoyed commuting, with the variation mostly attributable to differences in objective mobility. Interestingly, household size positively impacted travel liking, with the authors surmising that the commute provided a chance for respondents to be alone. This latter finding suggests that the lack of privacy in commuting by public transit may pose a barrier for some to use this mode.

While some studies on commuting have examined a variety of travel modes, others have focused exclusively on the attitudes and attributes of transit riders. In their literature review of commuters’ preferences for public transportation, Majumdar and Lentz (2012) identified four broad categories: convenience of service (i.e., cost savings, service frequency, time savings); ease of mobility (e.g., connections to park & rides, express service); environmental attitudes; and personal convenience (e.g.,
health considerations, physical limitations, cleanliness of transit, weather) (Majumdar & Lentz, 2012). Their review illustrates the variety of attitudes and perceptions that can shape levels of transit ridership.

2.2.7 Summary
It is clear that various factors influence modal choice and transit ridership within and between municipalities. However, the degree to which these multiple predictors influence transit ridership remains unclear. Understanding and predicting human behaviour is critical to the improvement, provision, and promotion of public transit systems. While the built environment has been heavily studied regarding its influence on modal choice, individual behaviours, perceptions, and attitudes towards transit and their impacts on modal choice remains less well understood. It is the intersection of individuals’ perceptions with built environment factors that seem to influence modal choice, and research should continue to attempt to better understand to what degree all of these factors influence modal choice.

2.3 REVIEW OF PROMINENT METHODOLOGIES IN TRANSPORTATION RESEARCH

2.3.1 Statistical Measures
Transportation and transit research primarily relies on quantitative data and analytical methods when predicting transit ridership. In their meta-analysis of 62 modal choice studies, Ewing and Cervero (2010) found linear regression, logistic regression, and negative binomial regression as the three most commonly employed statistical methods used by researchers. All of these 62 studies were examining the ways in which the built environment influenced transit ridership (Ewing & Cervero, 2010). All of these studies also had some type of control included in the study, the main control being socioeconomic variables (Ewing & Cervero, 2010).

Regression is useful in this body of research in that it can provide researchers with values that directly indicate the level of influence different factors have on transit ridership for populations, essentially predicting what factors influence transit ridership. For instance, in their analysis of parking supply, Morrall and Bolger (1996) find that in major Canadian cities, parking availability accounts for 92% of the variation in downtown transit use. Further, researchers are able to add multiple variables to the equation to determine how multiple factors influence the same phenomenon (transit ridership). In the same study, Morrall and Bolger (1996) were able to add the variable of park and ride stalls to the equation, which explained 83% of the variation. Typically, studies examine one or a few of the predicted variables that influence transit ridership (Taylor, Miller, Iseki & Fink, 2009), potentially providing a narrower view of what is really influencing riders. Additionally, this causal research is criticized for not following a standardized model, leading to methodological inconsistency (Taylor, et al. 2009). It is argued that these multivariate regression studies that are so common, “share surprisingly little in terms of data, methods, or findings” (Taylor, et al. 2009, p. 64). One further criticism regarding the methodological approaches to regression analysis in transit research is its lack of generalizability or statistical significance reliability (Taylor, et al. 2009). This is primarily attributed to the apparent small sample sizes typically used in previous research (Taylor, et al. 2009).
2.3.2 **Major Cities and Universities: Narrowly Defined Sample Groups**

While transportation studies have been conducted in a variety of settings and contexts, most studies have focused on larger cities, particularly in the United States. For instance, of the 62 studies reviewed by Ewing and Cervera (2010), studies sites included cities like Portland Oregon (8 studies), Seattle Washington (5 studies), San Francisco California (11 studies), Boston Massachusetts, Baltimore Maryland, and Toronto Ontario. These cities all have populations over 600,000, leaving a potential gap in understanding of the experiences in smaller municipalities. Considering the previously discussed factors that influence transit ridership, built form is one of the most determining factors for modal choice and the built form of densely population large cities will differ significantly from mid-sized cities under 500,000 people.

Universities are substantial trip generators and destinations for significant numbers of individuals, and as such have been a convenient target for many transportation studies. Often this research is focused on understanding student behaviours in relation to transit use (Shannon et al., 2006; Paez & Whalen, 2010; Rodriguez & Joo, 2004; Whalen, Paez, & Carrasco, 2013). While students may be great targets for conveniently accessible, large populations of individuals, the subject sample may not be completely representative of a broader population. For instance, research of students at McGill University in Montreal found that transit represented 55% of all trips, and automobile use accounted for only 16% of trips (Jacques et al., 2011). Delmelle and Delmelle (2012) find similarly low rates of automobile usage at the University of Idaho, where walking is the most represented mode of travel. Thus transportation studies that reflect more representative populations are needed.

2.3.3 **Understanding Transit Service Change**

Very few studies have examined the changes to transit service over time, and even fewer have examined the impacts of transit changes on transportation behaviours and transit ridership. One study examined the accuracy of projected ridership numbers after the introduction of regional express bus service to the Cambridge-Kitchener-Waterloo region (referred to as iXpress) (Casello & Hellinga, 2008). The study found that actual ridership initially did not meet the projected numbers, but that following the introduction of supporting technologies such as transit signal priority, real time arrival information system, or a web based trip planner, ridership increased to above projections (Casello & Hellinga, 2008). The limitations of this research are the short timeframe from which the sample was drawn, and the lack of information that was gathered about the users, specifically what factors would predict shifting.

A study by Brown and Werner (2007) tracked 51 low income families in Salt Lake City Utah between 2005 and 2006 before and after the introduction of a new light rail station. The authors were able to determine that ridership levels increased significantly from 50% to 68.75% following the introduction of the new rail stop, as did the levels of physical activity among riders. In a follow-up study on the same sample, Brown and Werner (2008) collected data on transit-related attitudes of the different populations (transit riders, new riders, and non-riders) in the study. They found that existing transit riders had positive associations towards transit, and their attitudes were unchanged following the introduction of the new rail line. Meanwhile, new riders generally had a favourable transit attitudes before the introduction of the new rail line, indicating that their transition to transit is enabled when access is enhanced. This study represents
the most comprehensive analysis of attitudinal variables during a major change in service to the author’s knowledge.

2.3.4 Research Gaps and Opportunities
The body of knowledge regarding transportation and the factors that influence ridership clearly is expansive. This review presents only a fraction of the literature that is available within this field, however clear gaps emerged. Very little research was found that examined perceptions and attitude towards transit systems during a major change in service. Additionally, due to the frequent use of university students as sample populations, generalizability of regression analyses is often not applicable. An understanding of the primary factors influencing other populations is therefore often overlooked. Additionally, challenges associated with supplying effective transit are often based primarily upon built form factors, specifically density and population. Much of the presented literature has been conducted within large metropolitan areas, resulting in a lack of understanding of the factors that influence transit ridership in less dense medium sized cities. This research seeks to fill these gaps in research, using the commonly applied methods of regression and descriptive statistical analyses.
3 Methodology

This study utilized a case study methodology (Yin, 2009) to evaluate changes in public transit-based policies and commuting patterns in the city of Kingston Ontario. Specifically, commuting pattern changes were captured from a population of employees of Queen’s University in Kingston, while both university and City-based policies and programs were studied. A mixed methods approach to data collection was employed to strengthen and complement the results. Mixed methods allows the researcher to blend both qualitative and quantitative analysis to understand the research problem better than either approach would produce alone (Creswell & Plano Clark, 2007). Specifically, an embedded design is being used in which qualitative research supplements the main quantitative method (Creswell & Plano Clark, 2007). When using embedded research design, typically “quantitative and qualitative data are used to answer different research questions within the study” (Hanson et al. as cited within Creswell & Plano Clark, 2007, p. 68-69) – a sentiment reflected within this methodological design. The qualitative and quantitative methodologies were conducted concurrently.

Research began with a comprehensive review of existing literature pertaining to transit (see Chapter Two). Following the review, changes in commute patterns were evaluated using statistical analyses of a quantitative longitudinal dataset. To complement the quantitative findings, policy documents were reviewed from the City of Kingston and Queen’s University, and key informant interviews were conducted with staff from relevant departments within these institutions. The statistical analyses were guided by the first three research questions, while the policy analysis and key informant interviews were guided by the fourth research question:

1. How have the commute patterns of Queen’s University employees changed since 2013 when express transit service was first introduced in Kingston?
2. How have the attitudes towards Kingston Transit among Queen’s University employees changed with the redevelopment of Kingston’s transit system?
3. Based on known determinants of transit ridership, what factors best predict who will switch to year-round transit ridership amongst the subject population?
4. What has the City of Kingston and Queen’s University done, and what are these institutions currently doing, to address barriers to transit ridership?

The specific methods employed in each component of this study are described in detail below, beginning with an overview of the case study being examined.

3.1 City of Kingston

The following research focuses on the city of Kingston Ontario as a case study to examine patterns of transit use, drawing from the local university’s faculty and staff as the target population. Regionally, Kingston is located near three major urban centres in Ontario: Toronto approximately 250km to the west, Montreal 270km to the east, and Ottawa roughly 150km north (See Figure 3-1). According to the 2011 census, Kingston has a population of approximately 159,561, making it the 11th largest CMA in the province and 25th largest in Canada (Statistics Canada, 2016). Kingston is defined as a mid-sized city, since its population falls within the range of 50,000 and 500,000 people (Bunting, Filion, Hoernig,
North American mid-sized cities such as Kingston are typically characterized by low density development and dispersed land uses, leading to automobile dominated travel patterns (Bunting et al., 2007).

As expected for a mid-sized city, Kingston is highly dispersed over a total political boundary of 1,938.92 km² (Figure 3-2), resulting in a population density of approximately 82.3 persons/km² (Statistics Canada, 2016). Kingston’s population density is significantly lower than the densities of other CMAs in Canada, with the average density for all CMA in Canada being 249.58 persons/km² (Statistics Canada, 2016). Kingston’s density is also low when compared to other midsized cities in Ontario, such as Barrie (1750 persons/km²) and Burlington (947 persons/km²) (Collins & Agarwal, 2015). With such low density and dispersed land uses arises the challenge of providing efficient transit that service in all 1938.92 square kilometers of city.
The prevailing low density of development in Kingston translates into commute patterns that are highly automobile dominant, with 82% of trips made to work made in a private automobile (SPCK&A, 2009). In 2002, only 16% of households in Kingston did not own an automobile, and 42% of households owned two or more vehicles (SPCK&A, 2009). Those who use an automobile as their primary mode of commute have double the income of those who use other modes of transportation (SPCK&A, 2009). Based on 2006 census data, Kingston Transit users had the lowest income of all modes of transportation, with 61% of individuals using public transit with an annual employment income less than $20,000. Thus, reliance on public transit in Kingston appears to be strongly driven by affordability factors.

Kingston Transit provides a unique research opportunity to study the impacts of public transit improvements on ridership and attitudes towards transit. As of May 2015, Kingston Transit had introduced three new express bus routes to service the urban and suburban areas of Kingston, operating at 10-minute intervals during peak periods (Kingston Transit, 2011). This transit change comes as a result of the Transit Redevelopment Plan, which addresses the challenge of balancing efficiency and effectiveness in such a low density automobile dominated city. The previous system without express service was identified to suffer from five key flaws: limited route capacity; system delays; infrequent service and hours of operation; inadequate infrastructure and accessibility; and non-competitive travel times (Kingston Transit, 2011). Today, Kingston Transit currently operates 16 regular service bus routes and three express routes. The three express routes were gradually introduced to the existing transit fabric, one in September 2013, and the remaining two in May 2015 (Kingston Transit, 2011). These three routes were implemented along...
Methodology

key commuter corridors, and converge on major trip destinations, including Queen’s University. Figure 3-3 provides an overview of the express routes introduced between 2013 and 2015.

![Kingston Transit Express Routes](image)

*Figure 3-3: Kingston Transit Express Routes (Kingston, 2017)*

### 3.2 STATISTICAL ANALYSIS

In October of 2013 and 2016, Dr. Collins administered an online survey to Queen’s University staff who were living within the Kingston Transit service area to capture information about their commuting behaviours (Appendix A). The longitudinal dataset that has been generated from these surveys served as the primary dataset for this project.

The 2013 survey had a total N of 1356 and a response rate of 43%; the 2016 survey had a total N of 1820 and a response rate of 48%. The surveys covered a range of topics, including how respondents travel to and from work on a daily basis, their attitudes towards Kingston transit, and their demographic profile. Table 3-1 describes the specific survey variables that were used in the statistical analyses performed for this study. Respondents who self-reported taking public transit on a year-round basis as the primary means to commute to Queen’s in 2016, and took some other mode to commute to Queen’s in 2013, were coded as “Shifters”. All other respondents were coded as “Non-Shifters”. This categorization better captures respondents who are dedicated “Shifters” at a year-round basis.

The longitudinal dataset was managed and analyzed using IBM SPSS 24. Cross-tabulations were used to analyze self-reported mode share and attitudes in each year, while Wilcoxon Signed Ranks tests were performed to determine whether there were statistically significant changes over time among respondents. Two independent-samples t-test and tests of proportions were used to compare responses between those Shifters and Non-Shifters. Finally, a Binary Logistic Regression was performed to identify the factors that best predict the likelihood that a Queen’s employee would become a Shifter. Survey variables included in the model were those that best aligned with the six categories of influence for transit ridership outlined by
Zhou (2012). A summary of the variables examined in the regression analysis can be found in Table 3-1. Values shown in parenthesis are those variables used as the reference for regression. All analyses employed a 95% level of confidence.

Table 3-1: Summary of Variables for Regression

<table>
<thead>
<tr>
<th>Zhou (2012)</th>
<th>Variables (Reference)</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built Form Variables</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Mode Specific Factors</td>
<td>Number of automobiles owned:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>➢ 0 (3+)</td>
<td>2016</td>
</tr>
<tr>
<td></td>
<td>➢ 1 (3+)</td>
<td>2016</td>
</tr>
<tr>
<td></td>
<td>➢ 2 (3+)</td>
<td>2016</td>
</tr>
<tr>
<td>Demographics</td>
<td>Income under 90,000 (90k+)</td>
<td>2016</td>
</tr>
<tr>
<td></td>
<td>Children under 14 (no children)</td>
<td>2016</td>
</tr>
<tr>
<td></td>
<td>Age 50+ (&lt;50)</td>
<td>2016</td>
</tr>
<tr>
<td></td>
<td>Female (male)</td>
<td>2016</td>
</tr>
<tr>
<td>Trip Characteristics</td>
<td>Walking distance to:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>➢ ONE bus stop (none)</td>
<td>2016</td>
</tr>
<tr>
<td></td>
<td>➢ ONE express stop (none)</td>
<td>2016</td>
</tr>
<tr>
<td></td>
<td>➢ MULTIPLE (none)</td>
<td>2016</td>
</tr>
<tr>
<td></td>
<td>Distance to Queen’s:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>➢ 3-5km (20+km)</td>
<td>2016</td>
</tr>
<tr>
<td></td>
<td>➢ 5-10km (20+km)</td>
<td>2016</td>
</tr>
<tr>
<td></td>
<td>➢ 10-20km (20+km)</td>
<td>2016</td>
</tr>
<tr>
<td></td>
<td>Not dissatisfied (dissatisfied)</td>
<td>2013</td>
</tr>
<tr>
<td>TDM</td>
<td>Parking permit 2013 (no permit)</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td>Inflexible work hours (flexible)</td>
<td>2016</td>
</tr>
<tr>
<td>Psychological factors</td>
<td>Max time willing to use KT:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>➢ 1-10min (unwilling)</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td>➢ 10-20min (unwilling)</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td>➢ 20-30min (unwilling)</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td>➢ 30+ (unwilling)</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td>Primary Barriers:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>➢ Overly time consuming (yes)</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td>➢ Service unavailable (no)</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td>Primary Facilitators:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>➢ Lived closer to express/bus (yes)</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td>➢ Parking on campus became too expensive (No)</td>
<td>2013</td>
</tr>
</tbody>
</table>

3.3 **Document Analysis**

Document analysis, according to Bowen (2009), is “a systematic procedure for reviewing or evaluating documents” (p. 27) which “requires that data be examined and interpreted in order to elicit meaning, gain
understanding, and develop empirical knowledge” (p. 27). Document analysis began by finding relevant sources. Then, documents were read and summarized, before being coded and synthesized based on major identified themes. Document analysis followed the above procedure to gain a greater understanding of the kinds of transit-supportive policies and programs that Queen’s University and the City of Kingston have implemented, or plan to implement in the future. These initiatives were then judged on their capacity to address any of the barriers to transit use that were identified by respondents to the surveys.

Key documents from the City of Kingston and Queen’s University were gathered from their respective websites. The documents retrieved were generally known to be influential prior to the undertaking of this research, and were selected on this basis. Through the analysis, it became apparent that more information needed to be gained regarding parking regulations at Queen’s University, which led to the inclusion of the Queen’s Parking Regulations in the scope of research. Each document holds significant influence in policy and planning direction for their respective organization, and so further analysis of these will result in a greater understanding of the directions of these organizations. In total, three relevant documents were retrieved from the City of Kingston and two from Queen’s University (see Table 3-1).

Table 3-2: List of Documents Analyzed

<table>
<thead>
<tr>
<th>Document Analysis List</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Queen’s University</strong></td>
</tr>
<tr>
<td>Campus Master Plan (2014)</td>
</tr>
<tr>
<td>Queen’s Parking Regulations (n.d.)</td>
</tr>
<tr>
<td><strong>City of Kingston</strong></td>
</tr>
<tr>
<td>Official Plan (2015)</td>
</tr>
<tr>
<td>Transportation Master Plan (2015)</td>
</tr>
<tr>
<td>Transit Redevelopment Plan (2011)</td>
</tr>
</tbody>
</table>

Each of these documents were reviewed to identify goals, objectives, policies, guidelines, strategic directions, or other initiatives pertaining to a reduction in automobile dependence or an increase in transit support/usage. The various objectives were then organized within distinct themes, to illuminate the broad intent of each organization.

### 3.4 Key Informant Interviews

To expand upon the document review findings, key informant semi-structured interviews were conducted with a staff member at the City of Kingston and a staff member from Queen’s University. These interviews were used to gather more information about the initiatives identified from the document analysis, and to capture the opinions of key informants regarding the capacity of these initiatives to address the needs and specific barriers that Queen’s employees face regarding transit use. Further, it allows insight towards the current and future initiatives that each organization is undertaking, as these may not be reflected in the published documents.

The semi-structured approach to the interviews allowed the researcher to have flexibility to explore various topics while keeping the conversation directed at answering the above research question (Dunn, 2010). The interviews were conducted in person and lasted approximately 30 minutes in length. The
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Interviews were audio recorded, and transcribed verbatim. The interview transcripts were then reviewed, coded based on key themes similar to the above document analysis procedure.

3.4.1 Ethics Approval
This component of the study involved human subjects, and therefore ethics approval was sought and granted on October 26, 2016 by the Queen’s University General Research Ethics Board. In compliance with the conditions submitted as part of the ethics approval, each participant was distributed a letter of information and consent form prior to involvement in the research. These documents outlined the purpose of the study, their contribution to the research, that their participation is voluntary without compensation, the process to withdraw participation, assurance of confidentiality, and expected duration of participation. The consent forms and letters of information distributed to participants inviting them to participate can be found in Appendix B.

3.5 Limitations
A few limitations exist with this research that must be acknowledged. First, it is possible that individuals who use public transit were more likely to respond to the questionnaire, especially over multiple years. If this is true, then there is the risk that our sample overestimates the proportion of transit riders in the population of Queen’s employees, thus producing biased results. It is also likely that the survey respondents were those that have an interest in the topic of commuting. However, it is unclear whether this interest varies by commute mode, and thus, whether the sample would be biased as a result. Similarly, the definition of “shifter” and “non-shifter” employed in the analysis may not accurately represent the actual behaviour change occurring. The categorization used may underestimate shifting to transit, as it ignores those who may rely on active modes during warmer months, but have also shifted from a private automobile to transit at other times of the year. Numerous categorizations could have been used (for example those who shifted to transit at least one additional season), which would produce differing results within the analysis.

Time was also a limiting factor for data collection. In one sense the system has yet to reach full ridership maturity, given the introduction of the final express route in 2015, and the continued improvements that are being made to transit infrastructure around the city. It is suggested that new transit lines can take several years (2-4) to reach ridership maturity, allowing citizens the time to switch modes (Polzin & Page, 2003). Analyzing Kingston Transit at a later stage when it has reached full ridership maturity would provide a more stable and accurate description of changes that occurred.

In a similar note to the above, time and resource constraints on behalf of the researcher limited the depth of analysis available. With more time or resources, further statistical analysis and/or interviews could have been completed. For instance, interviews with the staff members surveyed could provide significantly more detailed descriptions of the attitudes and perceptions towards transit and modal choice. We understand from this research what factors are influential in regards to transit ridership for the sample population. However we know little else about why such barriers exist.
When conducting the Binary Logistic Regression analysis, several issues were encountered which limited the scope of the research. First, the sample of the population shifting to transit was low (n=45), and not all respondents answered every question in the survey. When one variable examined within the regression is unanswered by a participant, it eliminates that participant from the survey. This limited some of the variables which could realistically be examined. Similarly, when examining of the barriers or facilitators to transit ridership in the regression analysis, some variables were identified by none of the transit shifters. When these values were added to the regression model, they produced statistical errors and had to be removed from analysis.

Finally, factor analysis was intended to be used to reduce the number of variables within the regression. However, the data being used was categorical and not continuous, rendering it inappropriate for statistical factor analysis in SPSS to this researcher’s knowledge or ability.
4 FINDINGS AND ANALYSIS

This chapter presents an overview of the results from the analysis of the three primary research methodologies: statistical analysis, document review, and interviews with key individuals. The chapter begins by identifying key demographic characteristics of the survey sample in order to provide context for the quantitative results, before discussing how transportation characteristics have changed since 2013. Next, this chapter discusses the primary barriers to riding transit as well as primary facilitators that would encourage ridership as identified by the sample. I then examine whether there were statistically significant changes in respondents’ perceptions of these barriers or facilitators from 2013 to 2016. Similar tests were conducted after applying a filter which excludes those in close proximity to Queen’s University. Using this same distance filter, I then explore how the attitudes differed between those identified as Shifters versus Non-Shifters. The quantitative section of this chapter concludes with an examination of the factors that were influential in predicting shifting to transit through Binomial Logistic Regression. The final component of this chapter presents the results from the document analysis and literature review, comparing findings to what were discovered to be primary barriers and facilitators in the statistical analysis.

The findings would indicate that there has been a modest increase in transit ridership amongst Queen’s University staff since the introduction of express service in 2013. Many of the respondents cite location and access as the primary barriers to switching to public transit. The primary facilitators that would encourage transit ridership are similarly shown to be attributed to increased access. Several factors were found to predict transit shifting amongst the population, including notably demographic factors, psychological factors, and variables attributed to access. The results of the interviews and document review indicate several strategies by each institution to target various barriers to transit adoption.

4.1 CHARACTERISTICS OF SAMPLE POPULATION

Before discussing the findings of the survey analysis, it is first important to identify key characteristics of the sample being analyzed (see Table 4-1). The analysis filtered the sample to only include participants who responded in both years, therefore the sample is the same and generally demographic characteristics were expected to remain constant. Respondents in both 2013 and 2016 were over two thirds (66.8%) female, and one third male (32.9%). The mean age for respondents was 50.83 in 2016, ranging between 24 and 82 years. Roughly one-third of respondents have high household income levels, with the most frequently reported income was the highest possible category, greater than $180,000. By comparison, the average household income in Kingston is $89,815 (Kingston Economic Development, 2017). Further, responses indicate that only 12% of participants have household income less than $60,000, compared to Kingston as a whole which reports 48% of households have incomes less than $60,000 (Kingston Economic Development, 2017).

Approximately 22.3% of respondents had dependent children under the age of 14 at the time of the survey in 2016. A majority (53.5%) of these families had only one dependent, while 36.1% had two and 10.4% had three. Having dependent children can influence one’s decision to take transit due to the need to make
additional stops within a regular commute. There was a reduction in this number from the first survey in 2013, in which 31.5% of respondents had one or more dependents living a home, likely due simply to aging children. This reduction in dependent children could lead to greater freedom in mobility for respondents, and could help to explain some of the findings in the following analysis.

The respondents to this survey had high levels of access to private automobiles; 91.6% of respondents answered ‘Yes’ when asked if they had regular access to drive or be driven in a private automobile to commute to Queen’s in 2016. A majority of respondents owned either one (41.7%) or two (43.6%) automobiles.

Table 4-1: Characteristics of Sample Population (n=863)

<table>
<thead>
<tr>
<th></th>
<th>2013 (%)</th>
<th>2016 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>67.7</td>
<td>66.8</td>
</tr>
<tr>
<td>50+ years of age</td>
<td>48.7</td>
<td>60.3</td>
</tr>
<tr>
<td>Household income &lt;90k</td>
<td>37.6</td>
<td>32</td>
</tr>
<tr>
<td>No children &lt; 14 years</td>
<td>77.7</td>
<td>68.5</td>
</tr>
<tr>
<td>Work 4 or 5 days/week</td>
<td>89.4</td>
<td>89.9</td>
</tr>
<tr>
<td>Access to automobile</td>
<td>91.4</td>
<td>91.6</td>
</tr>
<tr>
<td>Queen’s parking permit</td>
<td>46.6</td>
<td>45.5</td>
</tr>
<tr>
<td>Live within 5 km of Queen’s</td>
<td>37.7</td>
<td>37.9</td>
</tr>
</tbody>
</table>

Other descriptive characteristics are known about the sample population, including information regarding place of work and distance to travel to work. Queen’s University has two main campus locations separated by over 1km of residential neighbourhood. Each campus therefore has unique access both by automobile and public transit. A vast majority of respondents (93% in 2016) were primarily located at Main Campus, situated closer to the downtown core. This results in a population that is well within walking distance to work, as almost 28% of respondents reported living within 3km of Queen’s University (See Table 4-2). The sample population generally make their trips to campus four (10.5%) to five (79.4%) times per week.

Table 4-2: Travel Distance Between Home and Queen’s University (N=863)

<table>
<thead>
<tr>
<th>Travel Distance to Queen’s</th>
<th>Population (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 3 kms</td>
<td>27.9</td>
</tr>
<tr>
<td>3-5 kms</td>
<td>10.0</td>
</tr>
<tr>
<td>5-10 kms</td>
<td>20.4</td>
</tr>
<tr>
<td>10-20 kms</td>
<td>20.7</td>
</tr>
<tr>
<td>20+ kms</td>
<td>21.0</td>
</tr>
</tbody>
</table>

4.2 Increasing Transit Ridership

Through an analysis of descriptive statistics, transit ridership has clearly increased since the introduction of express service in 2013. Participants were asked to indicate their primary mode of travel to work during each of the four major seasons. The response options were assigned to one of five categories. Respondents were assigned to exclusively passive if they were dropped off on campus, drove their own vehicle or carpooled and parked. Somewhat passive commuters were those drove or carpooled, but parked off campus, walking the difference to campus. Those taking transit for any part of the commute were
categorized within the *transit* cohort. The *active commuter* category are those who exclusively walk or cycle to campus. Finally, any respondent whose primary mode varied across any four of the seasons was categorized as *varies by season*.

Table 4-3: Commute Mode by Season

<table>
<thead>
<tr>
<th>Mode</th>
<th>Fall % in 2016</th>
<th>Fall % change from 2013</th>
<th>Winter % in 2016</th>
<th>Winter % change from 2013</th>
<th>Spring % in 2016</th>
<th>Spring % change from 2013</th>
<th>Summer % in 2016</th>
<th>Summer % change from 2013</th>
<th>Year Round % in 2016</th>
<th>Year Round % change from 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entirely Passive</strong></td>
<td>52.8</td>
<td>-0.5</td>
<td>55</td>
<td>-0.1</td>
<td>51.1</td>
<td>-1.1</td>
<td>50.3</td>
<td>-0.6</td>
<td>49.2</td>
<td>-0.1</td>
</tr>
<tr>
<td><strong>Somewhat Passive</strong></td>
<td>10</td>
<td>-3.8*</td>
<td>10.8</td>
<td>-3.7*</td>
<td>9.2</td>
<td>-3*</td>
<td>9.2</td>
<td>-2.8*</td>
<td>8.2</td>
<td>-2.9*</td>
</tr>
<tr>
<td><strong>Transit</strong></td>
<td>9.8</td>
<td>4.4*</td>
<td>11.7</td>
<td>4.7*</td>
<td>9.2</td>
<td>4.8*</td>
<td>8.9</td>
<td>4.7*</td>
<td>7.8</td>
<td>3.9*</td>
</tr>
<tr>
<td><strong>Active</strong></td>
<td>27.4</td>
<td>-0.8</td>
<td>22.5</td>
<td>-0.9</td>
<td>30.4</td>
<td>-0.8</td>
<td>31.6</td>
<td>-1.4</td>
<td>22.3</td>
<td>-0.5</td>
</tr>
<tr>
<td><strong>Varies by Season</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12.4</td>
<td>-0.6</td>
</tr>
</tbody>
</table>

*Indicates statistical significance at 95% confidence

Table 4-3 provides the commute modes by season and year-round in 2016, as well as the percentage changes since the introduction of express service in 2013. A majority of participants in each season and year-round primarily commute by entirely passive means – upwards of 55% in the winter months. In 2016, transit ridership was the lowest year round commute mode, representing 7.8% of all trips. Transit ridership, while low comparative to other modes, experienced an increase of almost 4% year round. All other modal options experienced a decrease in ridership since 2013, the largest of which being *somewhat passive* commuters (-2.9%). The commute modes categorized as *somewhat passive* and *transit* experienced statistically significant year-round change.

During the winter months, transit ridership was at its highest (11.7%) and active commuting was at its lowest (22.5%). Presumably, those who walk or cycle to work during warmer months transition to commuting by transit when the seasons change.

4.2.1 Characteristics of Shifters

In total, 45 participants shifted to riding public transit year-round by 2016. This represents 5% of all respondents. Those identified as Shifters are respondents who initially did not commute by transit year round but throughout the study period identified that in all four seasons they primarily relied on transit to commute to Queen’s. Thus, this variable underestimates the true number of transit Shifters, because it excludes anyone who may have shifted to transit for 3 seasons or less, or those who begin occasionally riding transit as alternate mode.

Table 4-4 compares eight key demographic and commuting characteristics of Shifters versus Non-Shifters. As can be seen, all but two variables exhibit statistically significant differences between the two populations. None of those who shifted to transit owned a permit to park on or near Queen’s campus, while 55% of Non-Shifters do. Shifters also had lower access to private automobiles (80%) and almost all commuted to Queen’s on a regular basis. A higher proportion of Shifters (61%) to Non-Shifters (30%) had a household income of less than $90,000. This could potentially indicate a shift that is financially motivated. Additionally, those who shifted were statistically more likely to be female than those who were Non-Shifters.
Table 4-4: Key Demographics of Shifters and Non-Shifters

<table>
<thead>
<tr>
<th></th>
<th>Shifter (N=45)</th>
<th>Non-Shift (N=861)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>89%</td>
<td>66%</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td>50+ years of age</td>
<td>49%</td>
<td>49%</td>
<td>.321</td>
</tr>
<tr>
<td>Household income &lt;90k</td>
<td>61%</td>
<td>30%</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td>No children &lt; 14 years</td>
<td>89%</td>
<td>77%</td>
<td>.021*</td>
</tr>
<tr>
<td>Work 4 or 5 days/week</td>
<td>98%</td>
<td>89%</td>
<td>.001*</td>
</tr>
<tr>
<td>Access to automobile</td>
<td>80%</td>
<td>92%</td>
<td>.052</td>
</tr>
<tr>
<td>Queen’s parking permit</td>
<td>0%</td>
<td>55%</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td>Live within 5 km of Queen’s</td>
<td>23%</td>
<td>39%</td>
<td>.019*</td>
</tr>
</tbody>
</table>

*Indicates statistical significance at 95% confidence

4.3 Changing Attitudes

Descriptive statistics were employed to determine the main barriers and potential facilitators to transit ridership identified by respondents in 2013 and 2016. These barriers and facilitators were visualized to better understand the trends in responses. Wilcoxon Signed Rank Tests were then employed to determine which barriers and facilitators generated a statistically significant change from 2013 to 2016.

4.3.1 Willingness to Use KT

Respondents were asked general questions to indicate their willingness to use Kingston Transit. Measuring changes in these levels over time can indicate whether the introduction of express service has had a significant influence towards people’s perspectives of the service. Two questions were administered in both 2013 and 2016, which when examined help to determine if there was any significant change. Those questions asked respondents to indicate their willingness to use Kingston Transit to commute, and also the maximum time they would be willing to spend taking Kingston Transit to get to work. Using a Wilcoxon Signed Ranks test we can determine whether any significant change was experienced between 2013 and 2016.

The first question indicating willingness to shift to transit, asked exactly this: “How has Kingston Transit’s introduction of express bus service influenced your willingness to use Kingston Transit to commute to Queen’s?” When asked this question, participants were able to report that their willingness has increased, decreased, or stayed the same. In both 2013 and 2016, the most frequent response was that willingness remained the same. However, this answer did experience a 6.9% decrease in response over this period. The introduction of express service did not appear to negatively influence respondents’ perceptions of the service; less than 1% of responses indicated a decrease in willingness to use Kingston Transit in 2016. This is even further reduced from the already low response rate in 2013 of 2.4%. The response that willingness has increased due to express service experienced 8.3% more responses in 2016 compared to 2013. In total, one quarter of the sample in 2016 indicated that willingness to use Kingston Transit had increased since the introduction of express service is 2013. With an N of 821, all of these responses experienced statistically significant change over time.

Examining the time that the sample is willing to take Kingston Transit to commute to work provides further clarity regarding respondents’ perceptions of transit. Participants were able to indicate that they
were unwilling to take Kingston Transit to commute to work, or chose among one of four time interval categories. Figure 4-1 graphically represents the response rates of the sample population’s time willing to take Kingston Transit to commute to work. The most frequent response was that individuals are unwilling to take the service; the unwillingness response did decrease over time, though this change was not statistically significant. Among the willing, the most common responses ranged between 11 and 30 minutes. Indeed, willingness to spend between 21-30 minutes to commute by transit to Queen’s University increased significantly from 2013 to 2016. Those willing to take transit for the longest duration (more than 30 minutes) decreased by a statistically significant margin by 2016. These contrasting results potentially suggest greater level of tolerance for transit, however higher expectations for the time a trip should take since the introduction of express service.

![Figure 4-1: Maximum Time Willing to Take Kingston Transit to Work (N=818)](image)

### 4.3.2 Barriers

Respondents were asked to identify the barriers (if any) that prevent them from using Kingston Transit to commute to Queen’s University. A series of 10 issues were presented to respondents, and they could indicate whether they felt any of these were barriers to their use of Kingston Transit to commute to Queen’s. Figure 4-2 graphically represents the responses to this question in 2013 and 2016. As can be seen, for 6 of these, the proportion of respondents that had identified them as barriers had decreased from 2013 to 2016. This decrease could potentially indicate that these barriers have been addressed or overcome through the introduction of express service, or are caused by some other external factor.

Four of the ten barriers to transit ridership experienced statistically significant change from 2013 to 2016. Two of these responses generated a significant reduction (i.e., *commute includes stops and costs too much*), and two of them an increase (i.e., *stops too far and fear for safety*). Since commute stops often involve dropping off and/or picking up young children from school, the decrease in respondents identifying this as a barrier may be attributable to the decrease in dependent children reported among the sample from 2013 to 2016. The decline in those identifying costs as a barrier may be attributable to the introduction of a subsidized bus pass program for Queen’s employees in March 2014.
The increase in those reporting stop distance as a barrier is may be attributable to the fewer number of bus stops for the express service; if the location of bus stops change and citizens become unfamiliar with these changes, or the distance increases beyond a comfortable walking distance, respondents may be more likely to indicate this as a barrier to use. Finally, fearing for one’s safety doubled in responses in 2016, however the initial response rate was already extremely low representing in both years the second lowest responded value.

![Figure 4-2: Identified Barriers](image)

### 4.3.2.1 Primary Barriers

Respondents were asked to identify the one factor that was the primary barrier to them taking transit. This question helps us to understand what is most valued by the sample by only offering one selection (Figure 4-3). The ten categories were identical to the above discussed options.

It is clear that location remains a key determinant of whether or not people are willing to take transit. The two highest reported primary barriers towards transit ridership for a daily commute can be attributed to location. In 2016, 28.1% of respondents indicated that they lived *close enough to walk or cycle* to work as the primary barrier to not taking Kingston Transit. Meanwhile, *service unavailable* was the second most frequent response, identified as the primary barrier by a quarter of respondents in 2016. Service being unavailable is self-reported and subjective to the user. In both years, factors specific to the transit system itself, namely safety, accessibility, and costs, were the least important barriers to ridership.

Only three barriers generated statistically significant change between 2013 and 2016: *living close enough to walk or cycle; owning a parking permit; and bus stop being too far*. The largest magnitude of increase was that respondents owned a parking permit, more than doubling in response rate from 4.6% in 2013 to 9.3% in 2016. Living close enough to walk or cycle was the only barrier that generated a statistically significant reduction over time.
Findings and Analysis

4.3.3 Facilitators

Participants were asked to indicate what factors would increase their willingness to use Kingston Transit to commute to work. Referred to as facilitators, respondents were provided nine values to select from. The results from this question in 2013 and 2016 are shown in Figure 4-4.

Moving further away from campus was the most commonly identified facilitator in both years, while moving closer to campus was the second most commonly identified facilitator in 2016. The least commonly facilitator in both 2013 and 2016 was if transit was more pleasant.

Five of these facilitators generated a statistically significant change from 2013 to 2016. Three of the five decreased significantly over time (gas becoming too expensive, parking becoming too expensive, and parking near campus as being unavailable), while two facilitators increased significantly over time (moved closer to campus and moved farther away from campus). These attitudinal shifts point to the importance of transportation demand management strategies and distance to work as key determinants of transit shifting.
4.3.3.1 Primary Facilitators

Participants were also asked to indicate the facilitator that would be most influential towards encouraging them to use Kingston Transit to commute to Queen’s. As with the barriers, this helps to identify the most important factors for the population (Figure 4-5).

The four most frequent responses have to do with location and access. In 2016, 52.3% of the most influential factors would be moving closer or farther away from campus. Moving further from campus alone represented one third of all responses – significantly higher than any other value. The next highest reported issues similarly revolved around access and location, specifically in relation to bus stops. Participants frequently identified that living closer to bus stops (13.7%) or express stops (13.3%) would influence their decision to ride transit.
4.3.4 Residents Outside of 3km

Respondents were asked to self-report the distance from Queen’s University to their home based on predetermined categories, the results of which can be seen in Table 4-2. Considering such a high proportion of respondents live within 3km of Queen’s University (27.9%), and that the primary barrier is reported as living close enough to campus to walk or cycle, it proves useful to filter this cohort out of the analysis. Filtering out respondents who live within 3km provides a clearer understanding of the issues facing those within more realistic transit commuting distance.

Using the 3km filter yields some change towards the Wilcoxon Signed Ranks test on both the primary barriers and facilitators. For both the barriers and facilitators, all previous statistically significant changes were replicated. Additionally, the barriers and facilitators saw little change in regards to the order of response rate. In other words, issues which were previously reported most frequently, continued to experience the same level of frequency.

When examining change over time of the primary barriers (see Figure 4-6), all three previously significant changes were replicated. This includes the stop being too far, owning a parking permit, and living too close. The direction of influence for all three of these variables remained the same as before the filter was applied. The key difference after applying the filter was that the response of service being unavailable experienced a statistically significant increase, where previously no statistical significance was determined. Generally, the ranking of the primary barriers remained the same. The primary difference after applying the filter was that living close enough to walk or bike was no longer the most reported barrier, falling to the sixth highest reported barrier in 2016. All other barriers remained generally in the same order as before the filter was applied.
Similarly, the facilitator responses experienced only one new significant change from 2013 to 2016 after applying the 3km filter (see Figure 4-7). The previously statistically significant facilitator of gas being too expensive continued to experience statistically significant reduction over time. The response that living closer to an express stop as a primarily facilitator experiences a newly statistically significant increase after the application of the 3km filter. Before the application of the filter, moving further from campus was the most frequently reported response by a significant margin. However, after applying the filter, this response became the 7th most reported primary facilitator in 2016. All other primary facilitators generally remained in the same order as before the filter was applied.
4.3.5 Shifters and Non-Shifters in 2013

The next logical step in the analysis was to determine how the aforementioned attitudes vary between Shifters versus Non-Shifters. Using descriptive statistics and Independent samples t-tests, the attitudinal variables of both populations in 2013 were compared, while filtering out those living within 3km of Queen’s University. Since transit shifters identified no barriers or facilitators to transit use in 2016, this attitudinal analysis was not performed for the 2016 dataset. And, by restricting the analysis to the 2013 cohort, we can better understand what attitudes were present before shifting to transit occurred.

Table 4-5 displays the results of the primary barriers in 2013 for shifters versus non-shifters. As can be seen, of the 11 available responses, two are significantly different between the two populations at 95% confidence. Shifters were significantly less likely to report that service was unavailable, and also that transit costs too much. Interestingly, the primary barrier identified by Shifters to taking transit was owning a car, which is only the third most identified barrier by Non-Shifters. Additionally, service being unavailable is the most frequently identified barrier for Non-Shifters, but represents the seventh most reported for Shifters. The remaining barriers were generally reported in a similar fashion between the two populations.

Table 4-5: Primary Barriers of Shifters and Non-Shifters 2013

<table>
<thead>
<tr>
<th>BARRIERS 2013</th>
<th>Non-Shifters (n=526)</th>
<th>Shifters (n=34)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service is unavailable</td>
<td>29.1%</td>
<td>3.7%</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td>Commute includes stops</td>
<td>15.1%</td>
<td>14.8%</td>
<td>.868</td>
</tr>
<tr>
<td>I have a car</td>
<td>13.7%</td>
<td>29.6%</td>
<td>.121</td>
</tr>
<tr>
<td>Too time consuming</td>
<td>13.3%</td>
<td>11.1%</td>
<td>.643</td>
</tr>
<tr>
<td>Close enough to walk or cycle</td>
<td>8.1%</td>
<td>18.5%</td>
<td>.218</td>
</tr>
<tr>
<td>I own a parking permit</td>
<td>5.2%</td>
<td>7.4%</td>
<td>.721</td>
</tr>
<tr>
<td>Transit schedule inconvenient</td>
<td>5%</td>
<td>0%</td>
<td>.361</td>
</tr>
<tr>
<td>Bus stop too far</td>
<td>4.5%</td>
<td>3.7%</td>
<td>.78</td>
</tr>
<tr>
<td>Costs too much</td>
<td>3.4%</td>
<td>0%</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td>The routes do not go where I want</td>
<td>2.5%</td>
<td>3.7%</td>
<td>.779</td>
</tr>
<tr>
<td>Disability prevents use</td>
<td>0.2%</td>
<td>7.4%</td>
<td>.318</td>
</tr>
</tbody>
</table>

*Indicates statistical significance at 95% confidence

Table 4-6 displays the results of the primary facilitators in 2013 for Shifters versus Non-Shifters. Provided with 14 potential response options, Shifters and Non-Shifters identified two facilitators that were significantly different between the groups. Shifters were statistically less likely to report increased reliability, or living closer to an express stop as primary facilitators for transit use. In fact, none of the 33 Shifters reported either of these two response options as a primary facilitator to transit use.

The most frequent responded facilitators were similar between groups. Both Shifters and Non-Shifters indicated that use of transit would increase if Queen’s offered a transit pass (and Shifters were significantly more likely to report this as a facilitator), and if there was greater access to express service.
Table 4-6: Primary Facilitators of Shifters and Non-Shifters 2013

<table>
<thead>
<tr>
<th>FACILITATORS 2013</th>
<th>Non-Shifters (n=505)</th>
<th>Shifters (n=33)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to express in my area</td>
<td>20.7%</td>
<td>20%</td>
<td>.613</td>
</tr>
<tr>
<td>Employer offered transit pass</td>
<td>19.3%</td>
<td>36%</td>
<td>.06</td>
</tr>
<tr>
<td>Lived closer to bus stop</td>
<td>11.5%</td>
<td>4%</td>
<td>.235</td>
</tr>
<tr>
<td>Moved closer to campus</td>
<td>14.4%</td>
<td>4%</td>
<td>.09</td>
</tr>
<tr>
<td>Rely on transit</td>
<td>7.5%</td>
<td>0%</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td>Lived closer to express stop</td>
<td>7.2%</td>
<td>0%</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td>Parking too expensive</td>
<td>5.9%</td>
<td>4%</td>
<td>.866</td>
</tr>
<tr>
<td>Moved further from campus</td>
<td>5.6%</td>
<td>16%</td>
<td>.142</td>
</tr>
<tr>
<td>Parking became unavailable</td>
<td>3.9%</td>
<td>4%</td>
<td>.834</td>
</tr>
<tr>
<td>Gas became too expensive</td>
<td>1.3%</td>
<td>8%</td>
<td>.223</td>
</tr>
<tr>
<td>Transit more pleasant</td>
<td>1.3%</td>
<td>4%</td>
<td>.469</td>
</tr>
<tr>
<td>Traffic congestion too high</td>
<td>0.7%</td>
<td>0%</td>
<td>.158</td>
</tr>
<tr>
<td>Buses had higher priority</td>
<td>0.3%</td>
<td>0%</td>
<td>.318</td>
</tr>
<tr>
<td>Buses could accommodate more bikes</td>
<td>0.3%</td>
<td>0%</td>
<td>.318</td>
</tr>
</tbody>
</table>

*Indicates statistical significance at 95% confidence

4.4 PREDICTING THE SHIFT

Binary Logistic Regression was performed to determine how multiple variables predict the likelihood of shifting to public transit on a year-round basis following the introduction of express bus service in Kingston. Chapter 2 discussed six primary variable categories that have been shown to influence transit ridership as identified by Zhou (2012). Table 3-1 summarizes these categories and the independent variables that were used in the regression analysis. Variables were selected based on Zhou’s (2012) model for predicting transit ridership, with all attempts made to examine as many influencing factors as possible, while removing redundant variables. As discussed in the limitations section, a factor analysis was not possible due to the format of the survey variables, so this variable reduction process was performed manually by the researcher.

The variables presented are filtered based on distance, removing all respondents who live within 3km of Queen’s University. As can be seen, Table 3-1 indicates that some variables are derived from the 2013 dataset, and other variables are selected from the 2016 dataset. Some variables make logical sense to be based in 2013 while others should logically be taken from the 2016 dataset. For example, we can examine what influence the attitudinal variables have on transit ridership only in 2013 because a majority of transit shifters skip this question due to their modal shift. Conversely, examining flexible work hours in 2013 would not make logical sense, as flexible work hours could be something which has changed by 2016 and since influenced the decision to ride transit.

The full model (Table 4-7) containing all 15 predictor variables was statistically significant ($X^2 (24, N=457) = 73.646, \ p=<0.001$) indicating that the model was able to distinguish between those who did and did not shift to using transit. The model as a whole explained between 14% (Cox and Snell R square) and
35% (Nagelkerke R square) of variation in transit shifting. The model correctly classified 92.3% of observed cases, and is a good fit based on the results of a Hosmer-Lemeshow goodness of fit test.

In almost all of the examined categories of transit influence, some degree of influence by the predictor variables was observed. The strongest predictor of transit ridership in this model was walking distance to an express bus stop. This variable recorded an odds ratio of 31.867, indicating that those who reported being walking distance from an Express bus stop in 2016 were over 31 times more likely to shift to transit than those who indicated they were not within walking distance to transit.

In regards to demographics, only gender was a significant predictor for transit shifting; respondents who identified as female were over four times more likely to shift to transit than males. Not surprisingly, respondents who did not own a parking permit in 2013 were over five times as likely to shift to transit by 2016.

Of the attitudinal variables examined, two had statistically significant influence on the likelihood of shifting to transit. Of particular interest is that individuals who identified parking costs in 2013 as a primary facilitator to transit ridership were 3.4 times more likely to shift than those who did not. Additionally, it was found that willing to spend between 21 and 30 minutes to commute to campus in 2013 was highly predictive of transit shifting compared to those who were unwilling. This finding is interesting because no other value of willingness was found to influence transit shifting when compared to those who were unwilling.
### Table 4-7: Logistic Regression of Variables Influence on Shifting to Transit (N=457)

<table>
<thead>
<tr>
<th>Variables (Reference)</th>
<th>ODDS Ratio</th>
<th>P-Value</th>
<th>95% Confidence Interval Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Built Form Variables</strong></td>
<td>N/A</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td><strong>Mode Specific Factors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of automobiles owned:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 (3+)</td>
<td>.517</td>
<td>.643</td>
<td>.032</td>
<td>8.403</td>
</tr>
<tr>
<td>1 (3+)</td>
<td>.524</td>
<td>.325</td>
<td>.145</td>
<td>1.898</td>
</tr>
<tr>
<td>2 (3+)</td>
<td>.322</td>
<td>.088</td>
<td>.088</td>
<td>1.183</td>
</tr>
<tr>
<td><strong>Demographics</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income under 90,000 (90k+)</td>
<td>1.902</td>
<td>.147</td>
<td>.798</td>
<td>4.532</td>
</tr>
<tr>
<td>Children under 14 (no children)</td>
<td>2.213</td>
<td>.196</td>
<td>.664</td>
<td>7.368</td>
</tr>
<tr>
<td>Age 50+ (&lt;50)</td>
<td>1.363</td>
<td>.510</td>
<td>.543</td>
<td>3.423</td>
</tr>
<tr>
<td>Female (male)</td>
<td>4.682</td>
<td>.009*</td>
<td>1.459</td>
<td>15.017</td>
</tr>
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<td><strong>Trip Characteristics</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking distance to:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONE bus stop (none)</td>
<td>11.172</td>
<td>.032*</td>
<td>1.234</td>
<td>101.178</td>
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<tr>
<td>ONE express stop (none)</td>
<td>31.867</td>
<td>.002*</td>
<td>3.642</td>
<td>278.812</td>
</tr>
<tr>
<td>MULTIPLE (none)</td>
<td>19.003</td>
<td>.002*</td>
<td>2.462</td>
<td>146.663</td>
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<td>Distance to Queen’s:</td>
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<td></td>
<td></td>
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<tr>
<td>3-5km (20+km)</td>
<td>.195</td>
<td>.296</td>
<td>.047</td>
<td>1.868</td>
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<tr>
<td>5-10km (20+km)</td>
<td>.208</td>
<td>.329</td>
<td>.058</td>
<td>1.859</td>
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<tr>
<td>10-20km (20+km)</td>
<td>.418</td>
<td>.498</td>
<td>.092</td>
<td>2.692</td>
</tr>
<tr>
<td>Not dissatisfied (dissatisfied)</td>
<td>1.875</td>
<td>.424</td>
<td>.402</td>
<td>8.741</td>
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<td><strong>Transportation</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parking permit 2013 (no permit)</td>
<td>5.144</td>
<td>.002*</td>
<td>1.787</td>
<td>14.804</td>
</tr>
<tr>
<td><strong>Demand Management</strong></td>
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<td></td>
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<tr>
<td>Inflexible work hours (flexible)</td>
<td>1.469</td>
<td>.382</td>
<td>.620</td>
<td>3.480</td>
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<td><strong>Psychological Factors</strong></td>
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<td></td>
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<tr>
<td>Max time willing to use KT:</td>
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<td></td>
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<tr>
<td>1-10min (unwilling)</td>
<td>1.316</td>
<td>.926</td>
<td>.078</td>
<td>16.568</td>
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<tr>
<td>10-20min (unwilling)</td>
<td>3.829</td>
<td>.123</td>
<td>.695</td>
<td>21.105</td>
</tr>
<tr>
<td>20-30min (unwilling)</td>
<td>8.767</td>
<td>.010*</td>
<td>1.671</td>
<td>45.999</td>
</tr>
<tr>
<td>30+ (unwilling)</td>
<td>4.829</td>
<td>.087</td>
<td>.796</td>
<td>29.293</td>
</tr>
<tr>
<td>Primary Barriers:</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Overly time consuming (yes)</td>
<td>1.252</td>
<td>.654</td>
<td>.469</td>
<td>3.340</td>
</tr>
<tr>
<td>Service unavailable (no)</td>
<td>1.956</td>
<td>.397</td>
<td>.414</td>
<td>9.243</td>
</tr>
<tr>
<td>Primary Facilitators:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lived closer to express/bus (yes)</td>
<td>1.358</td>
<td>.783</td>
<td>.154</td>
<td>12.005</td>
</tr>
<tr>
<td>Parking on campus became too expensive (No)</td>
<td>3.482</td>
<td>.030*</td>
<td>1.127</td>
<td>10.755</td>
</tr>
</tbody>
</table>

*Indicates statistical significance at 95% confidence

### 4.5 Influencing Populations Through Policy

The following sections detail the results from an analysis of 5 key policy documents from the City of Kingston and Queen’s University, as well as two semi structured interviews with key representatives of each organization. The purpose is to examine how each organization identifies and addresses barriers and facilitators towards transit ridership, comparing to the primary issues identified from the quantitative...
component of this research. This section explores all relevant past, present, and anticipated initiatives by these organizations in promoting transit ridership.

4.5.1 *Kingston Transit*
Three primary documents were known to have influence with regards to transit initiatives by the City of Kingston. Those include the *Official Plan*, *Transportation Master Plan*, and *Transit Redevelopment Plan*. In many ways these documents share similar objectives and approaches to transit in the City of Kingston. Through the analysis, it became clear that since 2008, the City of Kingston has been strategically working to make transit as competitive with the private automobile as possible. They did this through three primary means: modifying specific trip characteristics in a variety of ways, strategic transportation demand management policies, and a marketing strategy targeted to commuting populations.

4.5.1.1 Trip Characteristics
The primary means by which Kingston Transit has been addressing barriers to transit use is through upgrades and modifications to the bus system itself and supporting infrastructure. This is the most visible of the ways in which barriers have been addressed, and seeks mainly to improve convenience of service, improve access to transit, and make transit a viable competitor to the private automobile in terms of speed. This is accomplished mainly through the introduction of express service, increased service frequency, refining of local routes, improved intermodal connections, and transit shelter upgrades.

The introduction of express service in itself addresses an identified barrier that transit takes too long. Through this reshaping of the backbone of the provided service, changes were introduced gradually in five phases (Kingston Transit, 2011). These phases generally did one of two things: introduced new express routes, or modified existing collector buses to better connect with express (Kingston Transit, 2011). Three separate express routes connect major destinations such as downtown or Cataraqui Centre, along major transportation and development corridors. This service is intended to be faster, with longer distances between stops allowing for quick access to major destinations. This introduction has been coupled with the modifications of various local bus routes, to more efficiently connect with the express service (Kingston Transit, 2011). The refining of local bus routes is a primary goal moving forward for Kingston Transit, as identified by Participant A, “we need to make the local bus network that is serving the residential areas more robust and better in tune with the express bus service”, when discussing future goals. These route changes enhance the accessibility of the system, and help to provide service to a larger geographic area while ensuring efficiency.

The headway of Kingston Transit express bus service began at 15 minutes during peak periods, has been increased to 10 minutes, and has aspirations to move towards 7.5 minute headway at peak periods. The goal of increased headway is for convenience to the user, as cited by Participant A: “…increase the frequency such that people aren’t concerned about when the next bus comes, they just go to the stop and it is a convenient thoughtless process”. The increase in headway is also anticipated to extend to evenings, Sundays, and also holidays (Kingston, 2015a).

To make transit trips more comfortable to the user, Kingston Transit has made it a priority to improve bus shelters and transfer points throughout the city. The city has implemented a series of design guidelines for
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transit shelters, which “include larger concrete pads, additional shelters and benches and improved accessibility” (Kingston, 2015a, p. 52). These guidelines provide more uniformity throughout the city, enhancing the user experience and level of comfort. Kingston Transit has targeted major destinations and transfer points for immediate investment for shelter improvements, with the first priorities being to improve the downtown and Cataraqui Centre transfer points (Kingston, 2015a).

In addition to transit enhancement, improvements to intermodal connections have also been recommended and introduced through the various policies. Intermodal connections enhance accessibility to transit, and have been cited to include both active and passive means (Kingston, 2015b). Indeed, The Transportation Master Plan (Kingston, 2015a) referenced how park and ride locations have already been installed in proximity to express and local service, with plans to provide additional park and ride locations where deemed appropriate.

Finally, in order to increase the efficiency of the service and make transit a more competitive travel time, Kingston Transit is beginning to explore opportunity to introduce transit priority lanes within major corridors (Kingston Transit, 2011). Additionally, Kingston Transit has begun to explore technological enhancements to the existing fleet, in order to potentially provide on board signal priority (Kingston, 2015a). If buses can move faster through traffic than private automobiles, it naturally feels like less of a burden and its utility is greatly enhanced.

4.5.1.2 Transportation Demand Management

In order to make transit a competitive alternative to the private automobile, the introduction of express service was coupled with the tightening of parking regulations. Parking regulations were modified in order to prevent oversupply and increase/introduce costs where appropriate. To make transit seem more appealing to automobile users, parking naturally had to seem less convenient; “it was linking what was happening in transit to the destination side parking availability, to ensure that one, people were staring to pay for what that actually would cost, but that transit became a competitive alternative to that” (Participant A).

Previously, regular commuters were able to park downtown at their destinations at little to no cost, and the City of Kingston identified this as a barrier to the success of the transit system. In order to accomplish this, the City of Kingston increased parking rates to exceed transit pass costs in identified areas (Participant A). The cost of parking more than doubled in some areas, to become more competitive with what the market would allow (Participant A). When the cost of parking exceeds the cost of a transit pass, transit will appear as a more worthwhile alternative. Additionally, some downtown areas were allowing free parking all day, in areas where commuters could park and walk a short distance to work. These identified areas have since been transitioned to pay-and-display parking and for long-term parking permits (Participant A).

4.5.1.3 Marketing Strategy

One final area which the City of Kingston has been attempting to reduce barriers to transit ridership, is to market the availability of express service and potentially increase awareness or appeal of the service.
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Through strategic branding, outreach, partnerships, and online enhancements, Kingston Transit has combined the introduction of express service with a targeted marketing strategy (Participant A).

Through the interview process, it became clear that education regarding the changes to the transit system were integral to its success and adoption by regular commuters. Employees at these major institutions are provided with opportunities to try Kingston Transit to commute free of charge for trial periods; “Talking with potential riders, we were engaging people who had our parking permits, talking to them about options, providing people options to test out the service for two weeks” (Participant A). Additionally, institutions such as Queen’s University are able to participate in transit pass programs, in which employees have fees directly removed from their pay. This eliminates an additional step for users, increasing its accessibility.

The awareness of the transit system was similarly increased through special branding of the express service itself (Kingston Transit, 2011). Perceptions of service availability can be enhanced through this unique branding; that is, someone will know when they are at an express stop as opposed to a regular collector route.

4.5.1.4 Limitations
The City of Kingston has shown clear direction within policy to providing more efficient and effective public transportation to residents. Parking policies may need to be revisited and continually monitored in order to eliminate free parking within conveniently walkable distances to major destinations. Participant B anecdotally described how Queen’s University employees were parking beyond the paid permit areas, to residential streets with free parking. It appears as if some commuters are willing to walk additional lengths to continue accessing free parking. Extending the geographic coverage of paid parking could increase the walking distance beyond a comfortable range for these employees.

4.5.2 Queen’s University
As a major employer and trip generator within the City of Kingston, policies and strategies implemented by Queen’s University can shape the way in which thousands of individuals commute on a daily basis. The tools with which Queen’s University has to operate, however, are much less abundant than Kingston Transit. The institution has been making contributions towards promoting alternative forms of transportation to campus, as per the direction in the Campus Master Plan (Queen’s University, 2011, p. 44) Principle 4.6 which states, “Encourage public transit by working with Kingston Transit and ensuring transit waiting areas are safe and comfortable environments.” Queen’s University has primarily addressed barriers to transit ridership through management of parking cost and supply, however it has also been working with the City of Kingston to promote Kingston Transit and enhance the rider experience at the destination side.

4.5.2.1 Parking Management
Queen’s University offers four primary types of parking permits: permit to park on main campus; west campus permit; summer permit; and daily permits. There are no pricing differences between permits to park on main campus versus west campus, with each reported as $100.24/month. There exists a waiting list for surface parking lots on Main Campus (Participant B), indicating that the demand is exceeding
supply. However, employees can pay a premium to park underground at main campus if they should desire, at a rate of $131.56/month.

Queen’s University has designated zones in order to better allocate and control parking permits. They identify three zones (Figure 4-8), the closest of which is labeled as Zone 3 nearest to the downtown. Parking permits are permitted for Main Campus based on available space (Queen’s University, n.d.). Individuals who live in Zone 3 are not guaranteed a parking permit, and if successful are not automatically renewed at the end of the year (Queen’s University, n.d.). With providing a limited supply of parking, it appears as if Queen’s University is targeting populations that will be more in need than others, encouraging more active means of travel as a result.

West Campus has been identified as an area to allocate growing surface parking needs (Queen’s University, 2011). Not only this, Main Campus is anticipated to convert much of the available surface parking to new structures, with the overflow parking moving to West Campus or underground (Queen’s University, 2011). With this shift of parking to approximately 1km away, Queen’s University has begun to introduce a shuttle service between campuses (Queen’s University, 211). This added step to parking on campus, could act as a facilitator for people within realistic proximity to transit.
4.5.2.2 Transit Improvements and Promotion
Planning staff at Queen’s University and at the City of Kingston, meet periodically to discuss needs and strategies in the area (Participant B). Through these discussions, Queen’s University planning staff are able to provide recommendations towards potential improvements on campus, which could enhance the transit user experience. One of the primary goals of the Campus Master Plan (Queen’s University, 2011) is to provide a pedestrian friendly environment throughout the Main Campus. Campus Planning identifies features such as bus shelters or crosswalks, which are controlled by the City of Kingston, to be upgraded based on observed need (Participant B).

Additionally, Queen’s University is participating in the City of Kingston transit pass program. The cost of a pass is reduced the more people participate in the program (Participant B), further incentivizing a switch to campus. By offering rates that are below the cost of parking, University commuters are encouraged to make a decision which may encourage transit use for some.

4.5.2.3 Limitations
The direction taken by Queen’s University to partner with the City of Kingston to promote transit and regulate parking on campus is a great foundation to addressing barriers to transit ridership. This foundation, however, provides room for growth and has particular limitations. For instance, parking at Main Campus can be seen as a significant convenience for some, and the policies enable this convenience. Parking permits are paid for generally by payroll reduction (Queen’s University, n.d.), simplifying the process and leaving the cost less visible to the user. Parking costs on Main Campus are identical to costs on West Campus ($100.24), not adequately reflecting the demand for this service. Additionally, Queen’s University policies require an administrative fee of $25 for parking permit holders who wish to decommission their pass prior to expiry (Queen’s University n.d.). This, combined with no discovered opportunity to temporarily suspend parking passes apart from long term leave (Queen’s University, n.d.), act as a barrier to shifting to transit mid-year.
5 **Summary and Recommendations**

This concluding section summarizes the main findings from the analysis for each of the four research questions posed. It then offers recommendations for both the City of Kingston and Queen’s University based on the findings, before offering potential future research directions.

5.1 **Summary of Research Question Findings**

**Question 1: How have the commute patterns of Queen’s University employees changed since 2013 when express transit service was first introduced in Kingston?**

The commute patterns of Queen’s University employees have responded to a major change in transit service in Kingston, Ontario. In 2013, commute patterns of Queen’s University employees were primarily characterized by passive means; over 60% of respondents commuted by primarily automobile, either parking on campus or nearby, and walking the remaining distance. Transit represented the smallest mode by which Queen’s University employees commuted to work with only 3.9% of year round trips. In 2016, commute patterns remain dominated by passive means and the automobile, and transit still represents the least reported commute mode. However, the margin of difference between these different commute modes narrowed during this period.

In the four years since the introduction of express service in 2013, 45 surveyed Queen’s University employees shifted to riding transit on a year round basis. This represents 5% of all respondents, and has primarily been at the reduction of those commuting by somewhat passive means. On a year round basis, commuting by somewhat passive means experienced a statistically significant reduction of 2.9%. Commuters who travel by entirely passive means, as in those who park on campus, appear to be the least likely to adopt other modes of transportation. Indeed, entirely passive commuting decreased by only 0.1% over the four years.

**Question 2: How have the attitudes towards Kingston Transit among Queen’s University employees changed with the redevelopment of Kingston’s transit system?**

Generally, positive perceptions of Kingston Transit have been stimulated since the introduction of express service in 2013. More individuals are reporting an increased willingness to use Kingston transit in 2016 (25.1%) than in 2013 (16.8%).

Queen’s University employees were able to identify a total of 19 barriers and facilitators to taking transit ridership to commute to work in 2013 and 2016. Over time, these variables experienced both increased and decreased prevalence in response. The most prominent primary barriers identified in both years are attributed to access, that is, *living too close to campus* or *service being unavailable*. When filtering out respondents within 3km of Queen’s University, a few barriers change significantly over time, namely *parking permit ownership*, *service unavailable*, and *bus stops too far*. As determined through interviews, Kingston transit has strategically placed express stops at farther walking distances, in anticipation that transit users would walk farther for faster service. Obviously express service cannot be provided
everywhere in the city. But, an increase in service unavailable being identified as a primary barrier may be a good sign, as it suggests that other more important barriers have been removed since 2013.

In regards to facilitators for transit use, after removing individuals residing within 3km of Queen’s University, two variables changed significantly over time: living closer to an express stop increased over time, while high gas prices decreased over time (though this accounted for a very small proportion of the total responses). This finding underscores the notion that access is a significant influencer of transit ridership.

**Question 3: Based on known determinants of transit ridership, what factors best predict who will switch to year-round transit ridership amongst the subject population?**

Using Binary Logistic Regression, seven variables were found to be statistically significant predictors of shifting to transit. The most influential variable to predict transit shifting was physical proximity to various transit stops. Those who reported that an express bus stop was within walking distance of their home were 31 times more likely to shift to transit than those who reported they were not within walking distance of transit. This relationship is not surprising, however the degree of influence is noteworthy. Similarly influenced by built form, those reporting close proximity to non-express bus stops, or reporting being walking distance from multiple bus stops were 11 and 19 times more likely to shift to transit respectively. Thus, this study demonstrates that where people live, and the resulting access to transit, are highly predictive of shifting to public transit following the introduction of express service.

Attitudinally, those who reported sensitivity to fluctuations in parking cost were predictive of transit shifting opposed to those who did not; those who reported parking costs being too high as a facilitator in 2013 were 3.5 times more likely to shift to transit in 2016. The amount of time one is willing to spend on public transit was also a key predictor of transit shifting. Those reporting a maximum transit length to commute to Queen’s between 21 and 30 minutes were almost nine times as likely to shift to transit as those who reported unwilling to take public transit. This finding is particularly interesting because it potentially indicates what a realistic commuting time is for those shifting to transit. Those who reported a maximum travel time between one and 20 minutes, and above 30 minutes were not found to be predictive of transit ridership.

The demographic and transportation characteristics of the population had some degree of influence on shifting to transit. Those who owned a permit to park at Queen’s University, were over five times as likely to shift to transit as those who did not. Interestingly, car ownership was not a significant predictor of shifting to transit. Demographically, females were more likely to shift to transit than males (4.6 times). As noted in Chapter 2, various other demographic characteristics often predict transit ridership, such as income, age, or household characteristics. In the full model, examining these other demographic characteristics were not predictive of transit shifting. Income approached significance and in some models was determined to be a predictor, however with all other variables was not found to be influential.
Question 4: What has the City of Kingston and Queen’s University done, what are these institutions currently doing, and what do they plan to do in the future, to address barriers to transit ridership?

The City of Kingston and Queen’s University were found to be addressing barriers and facilitators through a variety of means. Clear partnerships have been established between the two institutions to better coordinate parking supply and provide efficient transit. The City of Kingston has been addressing barriers to transit ridership over the past 9 years through three transportation demand management focused on parking regulations, enhanced trip characteristics, and targeted marketing strategies to increase awareness. These three overarching strategies target identified barriers to transit ridership of inefficiency, accessibility, comfort, and automobile convenience.

Queen’s University was found to have a more limited capacity toward influencing transit ridership, however has still shown ability to encourage ridership through parking policies and partnerships with Kingston Transit. Parking on campus is the main way in which Queen’s University has, and continues to make driving to campus a decision and not an inevitability. By costing a parking pass greater than a transit pass, employees see transit as a more affordable and accessible option. Main Campus parking is also limited in supply, creating a waiting list for those who wish to pay less for surface lots and offloading additional supply to West Campus approximately 1km away. The University has also partnered with the city on multiple occasions to encourage transit promotion and ridership, and to help make campus a convenient and walkable destination for transit users.

5.2 RECOMMENDATIONS

Upon analysis of the statistical results regarding barriers to transit ridership, and further review of how Kingston Transit and Queen’s University are addressing these identified barriers, recommendations can be made as to how these institutions can further promote transit shifting. Both institutions have been found to be continuously encouraging transit ridership amongst the Queen’s University commuting population. And with the statistically significant shift in transit ridership since the introduction of express service in 2013, current initiatives and policies are clearly having their impact. However, additional steps can be taken to target groups identified within this study. This section offers five recommendations for both the City of Kingston and Queen’s University policymakers.

Recommendation 1: Increased coordination of parking initiatives.

In the regression model, parking was found to have a significant role in predicting who would shift to transit. Those who did not own a parking permit in 2013 were over five times more likely to shift to transit as those who did own a permit. Similarly, those who were sensitive to price increases of parking also were more likely to shift to transit within this model. In their model, Rotaris and Danielis (2014) find that both increased parking cost and decreased availability can have significant influence on bus ridership to a major university. Similar approaches appear to have been implemented by Queen’s University and the City of Kingston, who have cost transit to be below the cost of parking and are actively attempting to replace surface parking lots. However, more can be done in this regard and closer coordination of policies can potentially yield greater results. For instance, the cost of parking on Main Campus and on West Campus
is the same ($100.24/month). The difference in the cost between surface parking and transit, may not be large enough to overcome the perceived inconvenience of transit. Given the demand for surface parking at this location, prices should be adjusted accordingly. Those who wish for this convenience can continue using it as such, however fluctuations in parking cost have been shown to influence transit ridership amongst populations, and Queen’s University employees are likely no exception.

Additionally, it was mentioned by Participant B that multiple faculty will park outside of the pay and display parking areas implemented by the City of Kingston to find free parking, and walk the distance to campus. Again, this slight inconvenience to parking may not be enough to dissuade automobile drivers from using transit or park and ride lots. Rotaris and Danielis (2014) find that when parking supply is moved to a further distance from the destination, bus ridership increases. If the walking distance to express transit is comparable to the walking distance to free parking, very little incentive for modal shift exists and automobile drivers will continue to make the drive to streets adjacent to campus. Queen’s University should similarly continue to reduce the availability of surface parking on Main Campus, always ensuring enough supply is available on West Campus for those who wish to continue to use their automobiles and pricing Main Campus parking accordingly.

The coordination of parking between Queen’s University and City of Kingston needs to therefore find this balance between supply and cost, to appropriately allow those who wish to commute by car to campus to continue doing so, but to make transit a more appealing and realistic alternative to others who may find parking just not worth it in the end. This balancing act will take time and coordination between these institutions, and the fine balance will not be reached overnight. Both institutions have set great foundations within policy for these actions, and continued monitoring and discussion will help to guide this process in the future.

**Recommendation 2:** Provide better connections to express/bus routes for those within shorter and longer commute distances.

Commuters who identified a maximum time willing to commute by transit to Queen’s University between 20 and 30 minutes were found to be almost nine times more likely to shift to transit use than those who did not. This population should remain a target of the Kingston Transit staff, to understand more about who lives within this commuting range and how to retain this likely commuting population. However, those willing to take longer commute times (30+ minutes) and shorter commute times (1-20 minutes) by Kingston Transit were not found to significantly shift to transit ridership. The City of Kingston should therefore explore ways in which to better connect these target populations to routes which efficiently connect them to their destination. Those within walking distance to express service were the most likely to shift to transit within the study population. Those close to bus stops were similarly likely to shift to transit ridership over this period. Clearly, access to transit infrastructure is a primary contributor in determining who switches to transit from automobile. With the addition of express service bus stops naturally become farther for individuals to access – as a result the barrier of the bus stop being too far experienced a statistically significant increase for those outside of 3km.
While Kingston Transit is actively improving infrastructure and intermodal connections based in the policy directions reviewed, more should be done to reduce the perceived distance to accessing transit. Continued work to upgrade transit shelters, bicycle infrastructure, and ensuring sidewalk access throughout the trip duration should be a focus moving forward.

**Recommendation 3: Extend the Queen’s University restrictive parking Zone 3 and modify policies for Zone 2.**

The Main Campus parking at Queen’s University is in short supply, and with the waiting lists the University has introduced three major zones for where people live, and to some extent allocates parking based on this information. The boundaries and policies for these three zones can be adjusted however, to further promote transit ridership amongst populations. It is noted that those in Zone 3 do not have their transit pass automatically renewed upon expiry. This policy should be extended to include those who live in Zone 2. Without automatic renewal of a parking pass, employees may be more inclined to explore alternatives, rather than continuing with the convenient mode. It was found that those holding parking passes in 2013 were unsurprisingly significantly less likely to shift to transit by 2016. Those with a permit clearly do not wish to sacrifice this convenience, and this can act as a barrier to trying alternative modes. It does not make logical sense to give up one’s parking pass to try transit, only to decide to reapply for parking and be placed on a waitlist. It similarly does not make sense to pay for and hold two types of permits – a parking pass and transit pass. If commuting staff are presented with the choice however, some may be more inclined to explore Kingston Transit to commute to work. Consideration should also be given to extending the geographic scope of Zone 3, which has the most restrictive policies toward parking on campus.

**Recommendation 4: Eliminate parking pass decommissioning fee and replace it with an activation deposit.**

Current parking policy identified for Queen’s University indicates that in order to cancel a parking pass before the expiry date, the user will be charged an administrative fee of $25 (Queen’s, n.d.). This fee can discourage staff from cancelling their parking pass in order to try a transit pass, and can potentially act as a barrier for shifting mid-year. Indeed, those who owned a parking permit in 2013 were significantly less likely to shift to transit than those who did, indicating continued reliance on the parking permit. Instead of a cancellation fee, the University can establish a refundable administrative deposit at the time of purchasing a parking pass. It can equal the same $25 fee currently in place, however provide more upfront cost to the user. This would not decrease any revenue generated by the University from this cancellation fee, however will appear to the user as if it has already been paid and will make upfront costs appear greater. Additionally, when an employee considers cancelling their parking pass it will not appear that they have to pay more to do this, as their deposit has already been included in the cost of parking already paid for. While this will not increase the overall cost of parking on campus, it can make it appear as if it is. If the perception of transit is that it is more affordable than parking on campus, it will appear more favourable to the user.
**Recommendation 5:** Continue realizing directions and goals set out in policy.

Both Queen’s University and City of Kingston have been found to exhibit strong policy basis for the continued encouragement of public transit. Through initiatives such as the transit pass program, costing of parking, supply of parking, and infrastructure improvements, both institutions are realizing their policy directions in action. Indeed, the population of transit shifters at Queen’s University experienced a statistically significant increase since the introduction of express service 2013. Both institutions should therefore continue in the direction laid out in policy to achieve a more sustainable community with equitable access provided to all. The directions taken by these institutions are clearly influencing transit ridership to certain extents, and all efforts should be continued which allocate resources to make transit a more efficient and desirable means of commuting.

**5.3 Directions for Future Research**

The wealth of understanding of transit systems is vast and growing; we know the benefits of supplying efficient transit and we know that numerous factors influence who takes transit. Much of the literature on this topic is focused towards large cities where providing transit is much more efficient and development is highly compact. A greater understanding of the challenges experienced providing transit to a less dense, mid-size city was the aim of this research and is argued should receive more attention moving forward.

The surveys used for analysis in this research proved useful to understanding generally what prevents or encourages individuals to ride transit. However human behaviour is complex and future research could benefit from a more detailed examination of people’s perspectives towards transit through more extensive surveys or follow up interviews. Using a triangulated mixed methods approach (Creswell & Plano, 2007) would provide a more detailed and qualitative understanding of why people choose to shift to transit, or alternatively why they do not. This further step can bring the current research from answering the question of what influences transit ridership, to understanding why these factors are influential. With this greater understanding, policymakers can more effectively market and manage transit systems to encourage greater ridership uptake.

The results of this study were not intended to be generalizable to a greater population – the factors predicting transit ridership shifting is not intended to be found in Toronto, Ottawa, or even the rest of Kingston. Studies can, however, employ a similar methodological approach to examine attitudinal variables influencing transit ridership for similar populations. It is encouraged that similar research be conducted on a broader city wide scale in order to gain understanding of different perspectives that exist within the City of Kingston, as opposed to those specifically employed by Queen’s University. Additionally, future research can, and should, be administered in other municipalities across Canada in order to understand how various attitudinal variables predict transit ridership in a variety of jurisdictional contexts.
REFERENCES


References


References


Queen’s University. (2014). *Queen’s University Campus Master Plan*. Retrieved from http://www.queensu.ca/strategicplanning/cmp


GENERAL COMMUTE PATTERNS TO QUEEN’S

1. At which Queen’s campus location do you typically work? (Please circle the appropriate response.) [For the remaining questions in this survey, please refer to the Queen’s location you identify in this question.]
   a. Main campus (including Kingston General Hospital)
   b. West campus
   c. Other (please specify)

   [For the remaining questions in this survey, please refer to the Queen’s location that you identified in Q1.]

2. On average, how many days per week do you commute to Queen’s University campus? _____day(s)

3. In an average week, what percentage of your commute trips would you say involve stops to pick up and/or drop off a passenger at a location different from your place of work (e.g., child, spouse, carpooler)?
   a. All of my commute trips (100%)
   b. The majority of my commute trips (around 75%)
   c. About half of my commute trips (around 50%)
   d. A minority of my commute trips (around 25%)
   e. None of my commute trips (0%)

4. On a typical day, how many minutes does it take you to travel ONE-WAY from your home to Queen's University campus? (Do NOT include time spent making stops along the way for errands.) _____ minute(s)

5. What is the approximate ONE-WAY travel distance between Queen’s University and your home? (Do NOT include any travel distance accrued by making stops along the way for errands.) _____ kilometres

6. How satisfied or dissatisfied are you with your commute? (Please circle the appropriate response.)
   a. Very satisfied
   b. Somewhat satisfied
   c. Neither satisfied nor dissatisfied
   d. Somewhat dissatisfied
   e. Very dissatisfied

7. a) In the FALL months (October, November, December), how do you typically commute to Queen’s University campus? (Please review all options, and circle the most relevant one.)
   a. Drive alone, and park on-campus (i.e., parking structure, surface lot, or metered street parking)
   b. Carpool, and park on-campus (i.e., parking structure, surface lot, or metered street parking)
   c. Drive alone or carpool, park off-campus (i.e., residential street parking), and walk in (Branch to Q8)
   d. Drive alone or carpool, park at west campus, and take shuttle to main campus
   e. Drive alone or carpool, park at west campus, and walk in (Branch to Q8)
   f. Take Kingston Transit
   g. Walk to campus
   h. Cycle to campus
   i. Other (e.g., ferry, taxi, shuttle) _____________________

   b) In the WINTER months (January, February, March), how do you typically commute to Queen’s University campus? (Please review all options, and circle the most relevant one.)
a. Drive alone, and park on-campus (i.e., parking structure, surface lot, or metered street parking)
b. Carpool, and park on-campus (i.e., parking structure, surface lot, or metered street parking)
c. Drive alone or carpool, park off-campus (i.e., residential street parking), and walk in (Branch to Q8)
d. Drive alone or carpool, park at west campus, and take shuttle to main campus
e. Drive alone or carpool, park at west campus, and walk in (Branch to Q8)
f. Take Kingston Transit
g. Walk to campus
h. Cycle to campus
i. Other (e.g., ferry, taxi, shuttle) ________________

c) In the SPRING months (April, May, June), how do you typically commute to Queen’s University campus? (Please review all options, and circle the most relevant one.)
a. Drive alone, and park on-campus (i.e., parking structure, surface lot, or metered street parking)
b. Carpool, and park on-campus (i.e., parking structure, surface lot, or metered street parking)
c. Drive alone or carpool, park off-campus (i.e., residential street parking), and walk in (Branch to Q8)
d. Drive alone or carpool, park at west campus, and take shuttle to main campus
e. Drive alone or carpool, park at west campus, and walk in (Branch to Q8)
f. Take Kingston Transit
g. Walk to campus
h. Cycle to campus
i. Other (e.g., ferry, taxi, shuttle) ________________

d) In the SUMMER months (July, August, September), how do you typically commute to Queen’s University campus? (Please review all options, and circle the most relevant one.)
a. Drive alone, and park on-campus (i.e., parking structure, surface lot, or metered street parking)
b. Carpool, and park on-campus (i.e., parking structure, surface lot, or metered street parking)
c. Drive alone or carpool, park off-campus (i.e., residential street parking), and walk in (Branch to Q8)
d. Drive alone or carpool, park at west campus, and take shuttle to main campus
e. Drive alone or carpool, park at west campus, and walk in (Branch to Q8)
f. Take Kingston Transit
g. Walk to campus
h. Cycle to campus
i. Other (e.g., ferry, taxi, shuttle) ________________

8. For those months in which you park your car and walk in, on average, how many minutes does it take for you to walk on way to campus from the location that you usually park your vehicle? ______ minute(s)

9. Are your work hours flexible?
a. Yes
b. No

10. Do you have a valid driver’s licence?
a. Yes
b. No

11. Do you have regular access to drive, or be driven in, a private vehicle to commute to Queen’s?
a. Yes
b. No

12. How many vehicles does your household own? _______ number of vehicles

13. What type of monthly parking permit do you hold?
   a. I have a permit to park on Queen’s Main Campus
   b. I have a permit to park on Queen’s West Campus
   c. I have a permit to park at a nearby lot (e.g., St. Mary’s Hospital)
   d. I have a commuter permit from the City of Kingston to park on nearby residential streets (BRANCH TO Q14)
   e. I do not have a monthly parking permit

14. Prior to purchasing this commuter permit through the City of Kingston, what type of monthly parking permit did you hold?
   a. I had a permit to park on Queen’s Main Campus
   b. I had a permit to park on Queen’s West Campus
   c. I had a permit to park at a nearby lot (e.g., St. Mary’s Hospital)
   d. I did not have a monthly parking permit

15. Do you have a monthly Kingston Transit pass?
   a. Yes
   b. No

ACCESS AND USE OF KINGSTON TRANSIT

16. What type(s) of bus stop, if any, is within walking distance of your home? (Consider “walking distance” to be within a 15 minute walk of your home.)
   a. There is ONE non-express bus stop.
   b. There is ONE express bus stop.
   c. There are MULTIPLE stops (regular stops ONLY).
   d. There are MULTIPLE stops (regular AND express stops).
   e. There are MULTIPLE stops (express stops ONLY).
   f. There are NO bus stops. (SKIP TO Q18)
   g. Don’t know (SKIP TO Q18)

17. About how many minutes would it take you to walk one way from your home to the NEAREST Kingston Transit bus stop? _______ minutes

18. About how many minutes would it take you to walk one way from your place of work at Queen’s to the NEAREST Kingston Transit bus stop? _______ minutes

19. Have you EVER taken Kingston Transit? (Please circle the most appropriate response.)
   a. Yes
   b. No (SKIP TO Q26)

20. Have you EVER taken Kingston Transit to commute to Queen’s campus? (Please circle the most appropriate response.)
   a. Yes
b. No (SKIP TO Q22)

21. a) In the FALL months (October, November, December), how OFTEN would you say you take Kingston Transit to commute to Queen’s? (Please circle the most appropriate response.)
   a. Every day (5-7 days/week)
   b. A few times a week (2-4 days/week)
   c. Several times a month (5-7 days/month)
   d. A few times a month (2-4 days/month)
   e. A few times a season (2-4 days/season)
   f. Never

b) In the WINTER months (January, February, March), how OFTEN would you say you take Kingston Transit to commute to Queen’s? (Please circle the most appropriate response.)
   a. Every day (5-7 days/week)
   b. A few times a week (2-4 days/week)
   c. Several times a month (5-7 days/month)
   d. A few times a month (2-4 days/month)
   e. A few times a season (2-4 days/season)
   f. Never

c) In the SPRING months (April, May, June), how OFTEN would you say you take Kingston Transit to commute to Queen’s? (Please circle the most appropriate response.)
   a. Every day (5-7 days/week)
   b. A few times a week (2-4 days/week)
   c. Several times a month (5-7 days/month)
   d. A few times a month (2-4 days/month)
   e. A few times a season (2-4 days/season)
   f. Never

d) In the SUMMER months (July, August, September), how OFTEN would you say you take Kingston Transit to commute to Queen’s? (Please circle the most appropriate response.)
   a. Every day (5-7 days/week)
   b. A few times a week (2-4 days/week)
   c. Several times a month (5-7 days/month)
   d. A few times a month (2-4 days/month)
   e. A few times a season (2-4 days/season)
   f. Never

22. Does, or would, your commute to Queen’s by Kingston Transit require a transfer?
   a. Yes
   b. No
   c. Don’t know

KINGSTON TRANSIT EXPRESS SERVICE

23. Which, if any, of the following Kingston Transit express bus routes have you ever used? (Please select all that apply).
a. 501/502 (SKIP to Q24a)
b. 601/602 (SKIP to Q24b)
c. 701/702 (SKIP to Q24c)
d. I have not used any of Kingston Transit’s express bus routes (SKIP TO Q25)

24. a) How satisfied or dissatisfied were you with the 501/502 express route service? (Please circle the most appropriate response.)
   a. Very satisfied
   b. Somewhat satisfied
   c. Neither satisfied nor dissatisfied
   d. Somewhat dissatisfied
   e. Very dissatisfied

24. b) How satisfied or dissatisfied were you with the 601/602 express route service? (Please circle the most appropriate response.)
   f. Very satisfied
   g. Somewhat satisfied
   h. Neither satisfied nor dissatisfied
   i. Somewhat dissatisfied
   j. Very dissatisfied

24. c) How satisfied or dissatisfied were you with the 701/702 express route service? (Please circle the most appropriate response.)
   a. Very satisfied
   b. Somewhat satisfied
   c. Neither satisfied nor dissatisfied
   d. Somewhat dissatisfied
   e. Very dissatisfied

25. Since Kingston Transit introduced express bus service, my use of Kingston Transit to commute to Queen’s has:
   a. Increased
   b. Remained the same
   c. Decreased

26. Since Kingston Transit introduced express bus service, my willingness to use Kingston Transit to commute to Queen’s has:
   a. Increased
   b. Remained the same
   c. Decreased

KINGSTON TRANSIT BUS PASS

27. Since Queen’s introduced its subsidized monthly bus pass program, my use of Kingston Transit to commute to Queen’s has:
   a. Increased
   b. Remained the same
c. Decreased

28. Since Queen’s introduced its subsidized monthly bus pass program, my willingness to use Kingston Transit to commute to Queen’s has:
   a. Increased
   b. Remained the same
   c. Decreased

   CITY OF KINGSTON COMMUTER PERMIT PARKING

29. Since the City of Kingston introduced the commuter permit parking program on residential streets near Queen’s main campus, my use of Kingston Transit to commute to Queen’s has:
   d. Increased
   e. Remained the same
   f. Decreased

30. Since the City of Kingston introduced the commuter permit parking program on residential streets near Queen’s main campus, my willingness to use Kingston Transit to commute to Queen’s has:
   g. Increased
   h. Remained the same
   i. Decreased

   ATTITUDES TOWARDS KINGSTON TRANSIT

31. What is the maximum amount of time that you would be willing to spend taking public transit to get to Queen’s University? *(Please circle the most appropriate response.)*
   a. 1-10mins
   b. 11-20mins
   c. 21-30mins
   d. More than 30mins
   e. I am unwilling to take Kingston Transit

32. I do not use Kingston Transit as often as I could to commute to Queen’s because… *(Please circle all that apply.)*
   a. It is too time consuming
   b. The bus stops are too far away
   c. The transit schedule is inconvenient
   d. It costs too much
   e. I worry about my personal safety
   f. Disability prevents use
   g. I have a monthly parking permit
   h. I am close enough to walk or bike
   i. I need my vehicle in order to drop-off and/or pick-up my children
   j. Service is not available in my area
   k. Other (Please specify) ___________________
   l. Not applicable (I already use Kingston Transit to commute to Queen’s as often as I could) (SKIP to Q36)
33. I do not use Kingston Transit to commute to Queen’s PRIMARILY because… (Please select ONE option from the list in Q32.) __________________________

34. My use of public transit to commute to Queen’s would be increased if… (Please circle all that apply.)
   a. I lived closer to a bus stop
   b. I lived closer to an express bus stop
   c. I could rely on transit to get me to my destination on time
   d. Parking on campus became too expensive
   e. Gas for my vehicle became too expensive
   f. Parking near campus was unavailable
   g. I moved further away from campus
   h. I moved closer to campus
   i. Riding public transit was a more pleasant experience
   j. Other (Please specify) __________________________
   k. Nothing would increase my use of Kingston Transit to commute to Queen’s (SKIP to Q36)
   l. Not applicable (I already use Kingston Transit to commute to Queen’s as often as I could) (SKIP to Q36)

35. My use of Kingston Transit to commute to Queen’s would be increased PRIMARILY if… (Please select ONE option from the list in Q30.)

   HEALTH

36. In general, would you rate your health as…
   a. Excellent
   b. Very Good
   c. Good
   d. Fair
   e. Poor

37. In general, would you rate your mental health as…
   a. Excellent
   b. Very Good
   c. Good
   d. Fair
   e. Poor

38. Thinking about the amount of stress in your life, would you say that most days are…
   a. Not at all stressful
   b. Not very stressful
   c. A bit stressful
   d. Quite a bit stressful
   e. Extremely stressful

39. How physically active would you describe your job at Queen’s?
   a. Very active (I am on my feet and moving all day long, and regularly have to lift and move heavy objects)
   b. Moderately active (I am on my feet and moving all day long)
c. Somewhat active (I spend about half the day on my feet and moving)
d. Sedentary (I spend most of my day sitting at a desk)

40. Thinking about the level of physical activity you do outside of your job every week, do you consider yourself to be…
a. Very physically active
b. Moderately physically active
c. A bit physically active
d. Not physically active

41. Outside of your job and excluding any time that you spend walking/cycling as part of your commute, what is the total number of minutes per week that you spend engaged in physical activity? _______ total number of minutes

42. Does a long-term physical or mental condition limit the amount or the kind of physical activity you can engage in?
a. Sometimes
b. Often
c. Never

DEMOGRAPHICS

43. What is your postal code? (do not include spaces) __________

44. Have you moved within the past three months?
a. Yes
b. No

45. With what gender do you identify?
a. Male
b. Female
c. Other

46. What is your current age? _____ years old

47. What is the age of each member of your household? (If more than 5 members in your household, provide ages for the 5 oldest members.)

Does household member X work full-time outside of the home?
a. Yes
b. No

48. Which of the following captures your current total household income?
a. Less than $60,000
b. $60,000 to $74,999
c. $75,000 to $89,999
d. $90,000 to $104,999
e. $105,000 to $119,999
Appendix A

f. $120,000 to $134,999
g. $135,000 to $149,999
h. $150,000 to $164,999
i. $165,000 to $179,999
j. $180,000 or more

Is there anything else you would like to tell us about your commute to Queen’s?

Thank you for taking the time to complete this survey.
Consent Form

“Attitudinal Variables Influencing Transit Ridership
Measuring the Impact of Express Bus Service in Kingston, Ontario”

Name (please print clearly): ______________________________________

I have read the Letter of Information and have had any questions answered to my satisfaction.

I understand that I will be participating in the study called Attitudinal Variables Influencing Transit Ridership: Measuring the Impact of Express Bus Service in Kingston, Ontario. I understand that this means that I will be asked to participate in a semi-structured interview lasting approximately one hour, which will be audio recorded for transcription at a later period.

I understand that my participation in this study is voluntary and I may withdraw at any time during my participation in the study. If after participating in the study I wish to withdraw my answers from the study I may do so within 4 weeks following the interview.

I understand that every reasonable effort will be made to protect my privacy and maintain the confidentiality of my personal information now and in the future. I understand that my personal information will be removed from the research data and replaced with a participant code so that I cannot be linked to the information without the participant code key. To protect my privacy and confidentiality I understand that only Robert MacFarlane Patricia Collins will have access to the participant code key and any information that can link the research data to me and my answers. I understand that this information will be stored in a secure location and that every reasonable effort will be taken to protect my privacy and confidentiality. I understand that my personal information will be destroyed after it is no longer needed to authenticate the research data. I understand that the research data may also be published in professional journals or presented at scientific conferences, but any such presentations will be of general findings and will never breach individual confidentiality.

I understand that there is no compensation for participation in this research study but that a copy of the findings will be made available to me if I so choose.

I am aware that should I have further questions about the research study that I can contact Robert MacFarlane at 416-801-6140 or r.macfarlane@queensu.ca. Or if I have any ethical concerns or complaints, I may contact the Chair of the Queen’s University General Research Ethics Board at 1-844-535-2988 or chair.GREB@queensu.ca.

I have read the above statements and freely consent to participate in this research:

Signature: ______________________________________ Date: ______________________
"Attitudinal Variables Influencing Transit Ridership: Measuring the Impact of Express Bus Service in Kingston, Ontario"

Letter of Information

This letter is an invitation to participate in a research study regarding transit and transportation behaviour that is being conducted by Dr. Patricia Collins and Robert MacFarlane at Queen’s University and has been granted clearance by the General Research Ethics Board according to Canadian research ethics principles (http://www.ethics.gc.ca/default.aspx) and Queen's University policies (http://www.queensu.ca/urs/research-ethics).

The aim of this research study is to better understand transit use and transportation behaviour in a mid-size Canadian city context. The study will involve a series of semi-structured interview questions. Questions will pertain to Kingston Transit and your involvement with the transition to express service. The interview is building on a series of surveys, previously administered to Queen’s University staff. Questions will focus on (EITHER) broad objectives of express transit service, and the experience of the City of Kingston during the shift to express transit service / broad transportation demand management objectives, and the experience of Queen’s University during the shift to express transit service in the City of Kingston.

The interview session will take less than one hour. You are not required to answer any questions that you do not want to answer. Your participation is voluntary and you can discontinue your participation in the study at any time by informing the researcher present. You can withdraw your answers from the study up to 1 month after your participation in the study by contacting the researcher using the contact information below or on the Consent Form.

The information you provide us with will be de-identified and given a code so that no one will be able to identify you from the information unless they have the participant code key. All personal information will be kept private and confidential and only Dr. Patricia Collins and Robert MacFarlane will have access to the participant code key. Any personal contact information and the participant code key will be destroyed after it is no longer required to authenticate study results. No personal information will ever be made public, for example, in publications or when the de-identified data is shared or archived.

We would also like to share with you our study results when they are ready for publication. If you are interested in receiving a copy please let Robert MacFarlane know at the end of the study or you can contact Robert MacFarlane to request it later.

Should you have further questions about the research study please contact Robert MacFarlane at 416-801-6140 or r.macfarlane@queensu.ca. If you have any ethical concerns or complaints, you may contact
the Chair of the Queen’s University General Research Ethics Board at 1-844-535-2988 or chair.GREB@queensu.ca.