

# Impact of Free Transit Passes on Youth Travel Behaviour

by

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## Author's Declaration

I hereby declare that I am the sole author of this thesis. This is the true copy of my thesis, including any required final revisions, as accepted by my examiners. I understand that this thesis may be made electronically available to the public.

## Abstract

Young adults are often restricted in their activity participation and mobility by parental constraints and driving age restrictions. Public transit can, however, be a viable option for youth to accomplish their trips independently without an adult chaperone. To improve transit accessibility and availability, Kingston, Ontario developed a pilot program targeted to high school students. Since 2010, the City of Kingston has provided high school students with a complimentary transit pass to encourage high school students to travel by public transit and to enhance independent travel behaviour.

This thesis investigated how the complimentary transit pass program influenced transit ridership and households' ability to meet their transportation needs. A literature review found very few studies for high school students. The approach utilized ridership data provided by Kingston Transit to identify ridership trends and locations where students are travelling the most. Also, a series of in-person and online surveys were distributed to graduating students, grade 9 students and parents to explore the impact of the transit pass program. By conducting surveys with local high school students and parents, this research examined the individual and household travel patterns and assessed the impacts of the pilot program.

The study found that grade 12 students on average use the transit pass three times more frequently than grade 9 students, which suggested that as students become older and gain experience with transit, they become more frequent transit users. The surveys provided evidence that the transit pass facilitated more independent trips and helped students participate in more activities. Also, parents' perceptions indicated that there are spatial constraints on their children's independent mobility and that age was a determining factor on how far they can travel alone. The research study concluded that the transit pass was an important stimulant for travel independence for high schools students and the program could be applied to other mid-sized North American municipalities.

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# 1.0 INTRODUCTION

Public Transportation, or transit, has always been considered one of the most efficient ways to move the masses in cities. Trams, streetcars and bus networks of the late 1800s and early 1900s covered metropolitan areas all over North America and provided a fast, affordable way to travel to downtown areas. Young people were able to travel safely and comfortably together on transit to major city destinations. In the decades that followed the 1930s, the private automobile gained popularity and major road infrastructure projects, particularly highways, were commissioned by federal governments that promoted driving behaviour. Since the automobile enabled passengers to travel longer distances, it resulted in low-density residential neighbourhoods and land use segregation that eventually became the norm in North American cities. Unfortunately, the personal freedom and choice gained from the private automobile may have invariably led to the loss of independent mobility for today's youth, especially for those who are not old enough to drive.

Independence for young adults is inherently linked to their ability to travel freely. Due to segregated land use patterns in North American cities, youth are restricted in their transportation choices and often rely on their chauffeuring parents in automobiles. However, as children become older, they want to be able to travel independently. Independent mobility is typically defined as a persons' ability to move to places unaccompanied by an adult (Veitch, Salmon, & Ball, 2008). Research has shown a dramatic decrease in children's independent mobility over the past few decades for a variety of reasons including concerns with traffic safety, distance to school, fear of abuse and abduction (Mattsson, 2002; Carver et al., 2013). More often, parents would chaperone their children to their activities, meaning they would accompany their children on a trip to ensure that their children would be safe and behave properly (Carver et al., 2013). In fact, studies have shown that parents often drive their children to/from school and to other location destinations, even if they are within walking distance (Mattsson, 2002; Carver et al.,

2013). Other than active transportation modes such as walking or cycling, public transit can be a viable mode of transportation for these young adults who wish to travel without an adult chaperone.

Encouraging youth to travel via public transit can increase the likelihood that they will continue to be transit users into adulthood and perhaps reduce the possibility of being automobile dependent. The term automobile dependence was first introduced by Newman and Kenworthy (1989) who studied the relationship between urban density and transport energy use in the 1980's. The research found that automobile dependence described the auto-oriented land use patterns and the dominance of private vehicle for urban travel (Newman and Kenworthy, 1989). However, the researchers continued their work and determined some key factors that could end automobile dependence: price of fuel, increasing urban development, changing demographics including elderly who tend to drive less, rising demand to live in cities and the rising popularity of public transit. Young adults will be the voters of the future and if they continue to use public transit, they may support transit-related issues as voting citizens and may become less reliant on automobile transportation. It is important that teenagers have experience using transit first-hand in order to better understand the benefits of public transit.

Providing opportunities to enhance public transit service for young adults will not only improve their travelling opportunities or activities, but also have a direct impact in the community. There are multiple advantages of public transportation, including reduction of carbon emissions, provision of economic opportunities, reduced congestion and improved mobility benefits for community members. In particular, mobility benefits refer to the advantages derived from being able to move freely and easily to different activities (Spinney et al., 2009). For example, mobility benefits can include physical benefits of movement (i.e. exercise), community benefits (i.e. volunteering), access to desired places (i.e. socializing with friends or family), psychological benefits (i.e. time spent outside of home and independent travel), and emotional security benefits of potential travel (i.e. free to travel at will) (Spinney et al., 2009). Public transportation offers a valuable travel alternative for users who choose transit for the convenience, safety, speed, cost or environmental concerns.

However, public transit has to provide a service that is at least competitive to the automobile in terms of service and cost. The automobile is arguably more competitive compared to transit since there is greater control of the route, the ability for multiple stops, and expediency. Also, there is an increasing desire for young adults to attain their drivers' licence and purchase their own vehicle once they become of age. To dissuade young adults in North American cities to become drivers is a significant challenge since societal norms and peer pressure encourage car ownership. However, public transit offers two advantages: cost and safety. Automobile ownership is significantly more expensive compared to a transit fare. Besides the large initial investment to own a vehicle, there are maintenance costs, insurance, parking considerations and potential costs due to mishaps. Moreover, there are safety concerns associated with private vehicles.

According to the most recent report from Transport Canada, over 160,000 people were killed or injured in motor vehicle collisions in Canada in 2015 (Transport Canada, 2017a). That is average rate of 443 vehicle-related incidents per day. In 2015, twenty-five percent of passengers killed in collisions are age 19 or younger and over 23,400 of those young adults were injured in a collision and 193 were killed (Transport Canada, 2017a). Furthermore, 30% of the fatalities from collisions are not the drivers or passengers of cars but are, in fact, pedestrians, bicyclists and motorcyclists (Transport Canada, 2017a). Statistically speaking, however, there is a greater risk of danger travelling inside a private vehicle in comparison to walking or cycling.

In September 2016, the American Public Transportation Association (APTA) argued in their report that transit-supportive policies can provide significant traffic safety benefits that can result in saving lives and injuries. The report revealed that, measured by distance, public transit has less than one-tenth the casualty rate of automobiles per kilometre travelled (APTA, 2016). Measured by per capita, communities that have good public transit are five times less likely to suffer as many deaths as car-oriented communities (APTA, 2016). Although cost-savings from health care and public safety perspective are not factored into the cost-benefit analysis of transit, the reduction in injury and fatality

rates should be considered one of many assets of public transit. Along with the economic benefit of providing jobs and environment benefits around reducing pollution, public transit can be a valuable service that should be promoted.

To encourage public transit, one of the possible solutions has focused on subsidized transit fare programs to make transit more affordable to citizens. Transit fare programs offer reduced fares to particular demographics, such as seniors, students or low-income households, to decrease the burden of transportation expenditures. Although there are multiple examples of discounted fare programs for university students throughout North America, there are very few case studies of free transit fare programs directed to high school students. However, one such program does exist in Kingston, Ontario. Since 2012, the City of Kingston has provided complimentary access to students attending secondary schools within the City of Kingston as part of a pilot program. The purpose of this thesis is to study and report on the impacts of this transit fare program.

The primary motivation for the transit pass program in Kingston was to provide students with transportation to after school activities (City of Kingston, 2012). The goal of the pilot program was to expose high school students to the Kingston Transit system and create the potential for students to continue as regular transit passengers (City of Kingston, 2012). Over time, the community and municipal government recognized the potential of this program and continued to provide the funding and support of the pilot program until it was accessible to all grades in high schools across Kingston (City of Kingston, 2016). Although registration and participation in the program significantly increased over the years, the City did not conduct an in-depth analysis of the collected data to determine the impact on student travel behaviour. Such an analysis is necessary to investigate the effectiveness and performance of the pilot program. Furthermore, a follow up study on the transit use of the students who participated in the pilot program would provide important insight into its long term sustainability.

## 1.1 Motivation

Public transportation provides an essential alternative transportation mode to the automobile and serves a range of economic, environmental and safety benefits. This is especially true for young adults, whose movements are often restricted by their parents' ability to chaperone them to and from their activities. Public transit provides a vital method of travel for those who are not old enough to obtain a driver's licence or able to own a personal vehicle. To encourage youth to use public transit, municipalities collaborate with transit agencies to provide transit fare programs to ease the financial burden of using transit. By providing youth with access to transit, it encourages young adults to travel without a chaperone to their activities and enables the freedom for them to explore their city independently.

The City of Kingston implemented a complimentary transit pass program for students attending high schools in Kingston since 2012. Each year, students were able to register for a transit pass that would enable them to board any Kingston Transit vehicle for free. By registering for this pilot program, students would save \$56.50 each month, \$678 per year, for not having to buy an unlimited rides monthly pass (City of Kingston, 2016). Although registration for the program increased year after year, there was no evidence that the transit passes improved students' travel behaviour or influenced the number of activities they were able to accomplish. To examine the impacts of the transit pass program, the data collected by the city is here studied in conjunct with a set of targeted questionnaires distributed to the students.



## **1.2 Goals and Objectives**

The main goal of this research is to determine how the provision of free transit passes has impacted the independent mobility of the individual high school student in the Kingston case study. To accomplish this goal, the research accomplished the following objectives:

1. Analyze ridership data collected by Kingston Transit to determine if students are using their free transit pass for activities beyond primarily school trips;
2. Design and conduct surveys to evaluate if participants derive mobility benefits from having access to a free transit pass;
3. Assess factors that influence travel independence and travel behaviour; and
4. Identify potential parental or guardian constraints on youth mobility independence.

All of these objectives can collectively help evaluate the impact of youth transit fare programs. Overall, this research not only contributes to academics' understanding of transit in cities, but also provides insight for other public transit fare programs, thereby enabling other similar municipalities to advance evidence-based decision making, and enhancing public engagement.

## **1.3 Scope of Work**

To fulfill objective (1), the data used for the study were provided by Kingston Transit. For objectives (2) to (4), surveys were undertaken using three questionnaires that were developed for target groups and distributed to high school students.

The first questionnaire involved a small study group of graduating grade 12 students from the 2015-2016 academic year. For graduating high school students who were not attending post-secondary education (Non-PSE), Kingston Transit provided them with an adult transit pass that extended their access to transit for an additional six months after they graduated high school. In this study, this group of

participants is referred to as “Non-PSE G12”. With new adult transit passes, Kingston Transit was able to track participant boardings over the six-month trial period. Kingston Transit wanted to know if students would continue using transit after they graduated and if the transit pass was able to facilitate other activities that were non-school related. To address these questions, a customized student survey was developed to inform the City’s understanding of students’ travel behaviour. The survey specifically addressed household travel priorities and how the absence of the transit pass would affect a range of activities. Along with the six-month ridership data collected by Kingston Transit, this information was then used to inform the performance of the extended student pass and how it may have helped students achieve non-school related trips.

The second questionnaire involved both grade 9 and grade 12 students from the 2016-2017 academic year from three separate schools across Kingston. This study explored the travel behaviour of young adults who were benefitting from the transit pass program during their academic year. To investigate the individual and household travel patterns, a different customized survey was developed for each grade. Furthermore, Kingston Transit also provided ridership data for the 2016-2017 academic year to investigate when and where students are most often travelling. Both the surveys and ridership data are used to inform this study and provide supporting evidence that the transit pass program is able to support travel independence.

The third questionnaire involved households, in particular parents or guardians, because guardians are responsible for their child’s whereabouts. Parents usually chaperone their younger children to their activities based on one main reason: safety (Carver et al., 2013). Guardians want to supervise their children to make sure they arrive to their destinations in a safe and timely manner. As a result, the level of travel independence for children is often determined by their parents. Therefore, it is important to understand the level of comfort parents have for allowing their children to travel alone. A tailored survey was developed for guardians and parents to determine possible constraints and their level of comfort with

respect to their child's travel independence. By having a level of understanding about parents' constraints on their child's travel behaviour, it can provide meaning information about their child's travel restrictions.

## **1.4 Thesis Outline**

Chapter 1 provides the research motivation, goals, objectives and scope of study of this thesis. Chapter 2 presents a review of the previous case studies and research in the literature that has been conducted on transit fare programs and travel independence. Chapter 3 introduces the case study of the City of Kingston and describes the proposed methodology. Chapter 4 presents the results for the scope of work conducted. Finally, Chapter 5 summarizes the conclusions of the results, the limitations of the methodology and identifies potential future applications to other municipalities.

## **2.0 LITERATURE REVIEW**

This chapter describes current strategies and performance measures associated with transit fare programs that are available in the open literature. The first section is an overview of the current transit pass programs, both at the university and high school level, and their evaluation methods. The second section investigates travel independence for youth. A summary of findings is provided at the end with a discussion of the limitations to current practices.

### **2.1 Transit Pass Programs**

A review of the literature on recent transit pass programs, evaluation methods and findings is presented in this section. First, studies that have focused on transit pass programs targeted for university student are presented. This is followed by descriptions of transit fare programs for secondary education students.

#### **2.1.1 University Pass Programs**

A review of the literature between 2000-2017 found that a large majority of articles related to transit fare programs were directed towards university students. Since universities are institutions with thousands of students, their major challenges include providing mass transportation and parking when there are expanding enrolments and a growing level of automobile ownership. There is also the competing pressure to deliver quality education with state-of-the-art facilities and provide housing to students who want to drive to school. Most campuses are restricted in land area and financial resources to be able to allocate valuable space and funds to parking lots. Parking lots and structures are expensive to build and the generated revenues rarely make up for their initial costs (Heath & Gifford, 2002). Therefore, in response to these challenges, universities work with transit industries to propose and implement low-cost strategies to riders such as the universal transit pass program (U-Pass). The goals of typical U-Pass programs are to discourage car use and encourage public transit by providing reduced bus fares (Heath &

Gifford, 2002). In North America, more than 60 colleges and universities have universal transit pass programs and in particular, Canada has 12 communities with U-pass programs (Transport Canada, 2017b).

One of the first U-Pass programs in Canada began at the University of Victoria in association with BC Transit, in British Columbia. Launched in the 1999 – 2000 academic year, the U-pass provided unlimited access to all BC Transit services in the Victoria area to all undergraduate and graduate students (Heath & Gifford, 2002). Currently, the cost for the U-pass is \$39.50 per month for all students, which is significantly cheaper than the equivalent three-zone monthly pass of \$170 (TransLink, 2017). In 2002, a study was done by Heath and Gifford to examine the impact of the U-pass on university students and to determine the motivation for using public transit. This section summarizes their approach and results. Identical questionnaires were distributed to students one month before (phase 1) and after (phase 2) the U-pass program was implemented. Phase 1 of the study included 431 voluntary students from different faculties and were notified by email or mail about the second survey. The survey questions had a number of objectives including comparing transit use with other modes over the previous 10 years, assessing reasons for using the bus, collecting attitudes and general preferences about the U-pass, behavioural and control beliefs, and increasing awareness of problems caused by car use. Paired-sample *t*-tests were used to examine changes between phase 1 and phase 2 of the questionnaire. The results indicated that between phase 1 and phase 2, transit ridership increased by 11.1% and driving alone decreased by 6.7%. The researchers also found that behavioural beliefs did not change between phase 1 and phase 2, suggesting that increased ridership was due to improving perceptions of transit, meaning that transit became more desirable. However, the study sampling was limited to university students, which cannot necessarily be generalized to other populations, particularly adults who generally formed their transportation patterns already.

Although U-Pass programs provide a subsidized transit fare for students, some universities invest more into transit programs and offer free transit to pass-holders. For instance, the University of

California, Los Angeles (UCLA) in the United States offered Unlimited Access system in 2001 that provided fare-free transit service for students and in some cases, faculty and staff (Brown et al., 2003). Summarizing Brown's investigation, with the Unlimited Access system, the university would pay the transit agency a reduced fare payment for all transit rides taken within a service area and in exchange, the pass-holders could travel in the service area free of charge. During the first year of the program, the commute to campus by bus increased by 56% and solo driving decreased by 20%. Brown et al. also found that 29% of the student riders were new transit riders and 71% of the new riders were former solo drivers. The study found that ridership increases could be explained by reduced fares, improved service, reduced automobile-ownership and travelling together since transit was more cost-effective than carpooling. In fact, the program also reduced parking demand since more than 1000 commuters stopped driving to campus alone and 1332 student left the wait list for parking permits. Overall, this case study showed that 'free' transit pass programs reported a number of benefits for universities: increased transit ridership, improved transit service, reduced solo driving and alleviated parking demand on campuses. The study suggests that since the program was effective in Los Angeles, "a city famous for its addiction to cars," the program could be successful in other major cities. One of the limitations of this analysis was the assumption that the population would only use transit or automobile to travel to campus and did not consider alternative transportation methods like biking or walking to campus.

In 2006, a study was conducted by De Witte et al. on the free public transport initiative for Flemish college and university students in Brussels. This section summarizes the approach and results of their study. In the academic year 2003-2004, university students under the age of 26 were able to obtain a refunded annual season ticket for Brussels public transport. Student would purchase their annual transit ticket and be refunded for their cost at the end of the year. The ridership data revealed an increase in public transit use for students who received the free pass: 17.55% new tram riders, 11.08% new metro riders and 13.69% new bus riders. The researchers also investigated travel behaviour of students by conducting surveys. Over 3160 Flemish and French students completed a quantitative survey that asked

about their travel behaviour, activity patterns and perception of public transit. Furthermore, the study conducted 40 in-depth interviews that involved a combination of multiple choice and open-ended questions on methods of travel, transportation modes and the cost of travel mode. The study concluded that travel behaviour was linked to where students lived, their access to a vehicle, and that students who were permanent residents of Brussels tend to use public transit more often. Also, the study found that travel patterns did not change significantly with the introduction of the free pass, and that transit use was more related to students' knowledge and perception of public transit and the city itself. However, the authors recognized the limitations of this study did not examine the activities student participants in, where they are located or how accessible they are, which could affect their travel behaviour.

Overall, as reflected by the numerous case studies that evaluate the performance of transit pass programs for university students, it would seem that universities are very much involved in the adoption of such programs. The main assessment methods include analyzing ridership data before and after the program implementation and also engaging with the participants through surveys or interviews. The results of the studies suggested that the main benefits of transit pass programs are a significant increase of transit use and a reduction in driving alone to campus, which reduces the need for parking.

### **2.1.2 Secondary Education Pass Programs**

As compared to universities, there are relatively few studies in the literature that evaluate the performance of transit pass programs for high school students for the period between 2000 and 2017. The period for this review is relevant to the Canadian context since it aligns with the first known U-pass program in Canada which was launched at the University of Victoria in the 1999-2000 academic year. Intuitively, high school students would derive a range of benefits from having access to free public transit as university students. A proposal developed by the Los Angeles County Department of Public Health (LACDPH) in 2013 outlined the costs and benefits of providing free public transportation passes to students of all ages because most student districts in Los Angeles County (LAC) do not provide school

bus services. The free transit pass proposal discussed the potential benefits for students, schools and society, which are outlined in Figure 2-1 (LACDPH, 2013).

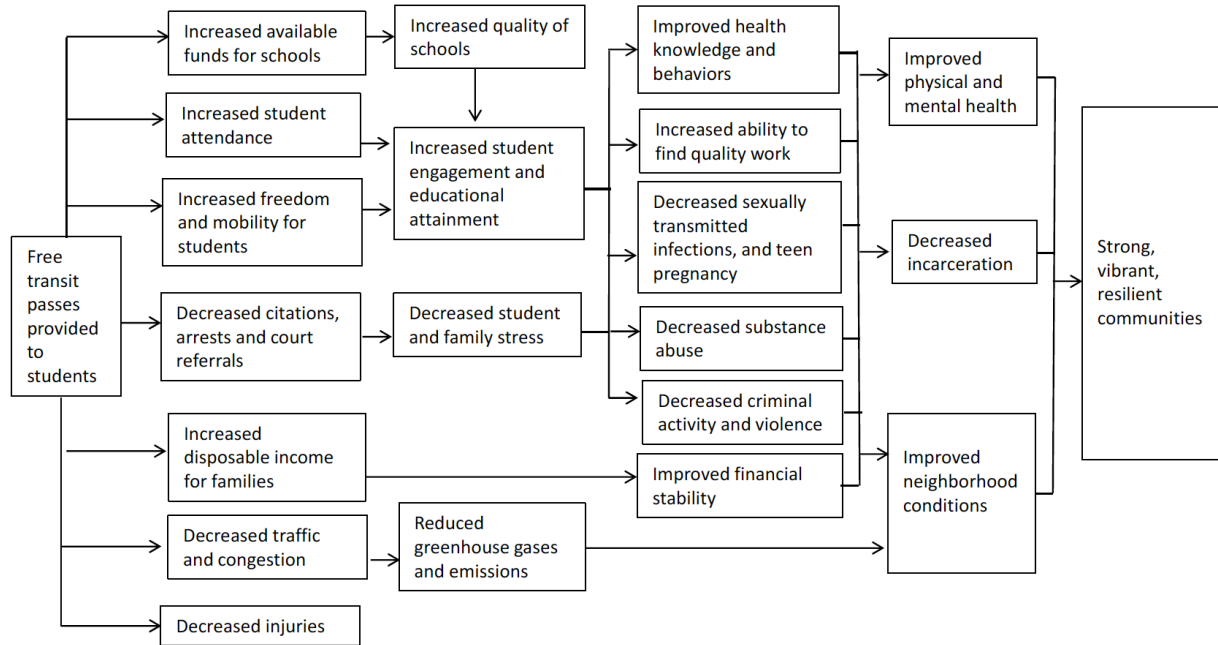


Figure 2-1: Pathway diagram of potential benefits of providing free public transit passes to students (Los Angeles County Department of Public Health, 2013)

The Los Angeles County Department of Public Health 2013 proposal recognized that school attendance can have short- and long-term health effects such as lower rates of chronic disease, teen pregnancy, violence and substance abuse. The lack of affordable transportation was frequently cited as a barrier to regular school attendance in Los Angeles County (SATF, 2012). The LACDPH proposal also found that, 13% of students in LAC live in households without access to a car and 12.7% of transit riders under the age of 18 rely on public transit to get to/from recreational activities outside of school. The proposal suggested that providing free transit passes would likely improve access to schools and after-school activities and as a result, have positive impacts on school attendance. Additional potential benefits included reduced traffic volume and congestion, injuries, increased opportunities for physical activity, disposable income for families and independent mobility for youth.



In the United States, there are multiple examples of cities that have implemented transit pass programs. For instance, in Washington, D.C., the Kids Ride Free Program allows students ages five to 21 who live in the District of Columbia to go to school and school-related activities for free using public transit (District of Department of Transportation, 2017). The Kids Ride Free Program used to provide free transit between 5:30 and 9:00am and from 2:00 to 8:00pm on weekdays, but recently extended their hours to all day, every day including weekends for the 2016-2017 academic year (District of Department of Transportation, 2017). Also, New York City provides free or half-fare transit passes to students depending how far they live from their school, however, the passes are valid only from 5:30am to 8:30pm on weekdays (Office of Pupil Transportation, 2017). In addition, the Tempe Youth Transit Pass Program allows all Tempe, Arizona, youth under the age of 18 to ride regional and local metro and bus routes for free at all times, including weekends (City of Tempe, 2017). However, there has been limited published research that evaluates the performance of free transit pass programs for youth.

Vincent et al. (2014) discussed the Youth Pass program in Portland, Oregon, that provided free transit for high school students in the Portland Public School (PPS) district. The PPS district served approximately 47,000 students in 81 schools, which is the largest school district in the Pacific Northwest. To encourage the next generation of transit riders, the Youth Pass program provided free transit passes to all high school students, regardless of income or distance to school, and was valid all day, every day during the academic school year. Approximately 12,500 students participate in the Youth Pass each year and the ridership estimated 60 trips per month. The majority of the trips used with the transit pass were non-school trips, in fact, 80% of trips were for getting to employment, visiting friends and running errands. Although the Youth Pass program was highly popular with students, the program requires restructuring since the city has cited the inconsistent and unsustainable funding of \$3 million a year required to administer the program.

One study (McDonald et al., 2004) examined the results of a pilot one-year Alameda-Contra Costa (AC) Transit program near San Francisco that offered free bus passes to low-income middle and

high school students. In the AC Transit service area, the cost of school transportation shifted to families and students and, as a result, there were very few school buses in circulation; those that did operate required students to pay to ride them. Concerns about school attendance rates falling and the ability of low-income families to afford the cost of bus passes led to the creation of the pilot program. In 2002, 25,000 free bus passes were distributed to students in the AC Transit service district. Data were collected on school attendance, interviews with stakeholders, financial and ridership information from AC Transit, and focus groups with students and parents. The results revealed several positive outcomes: after-school programs saw an increase in participants; students with the free bus pass used it to commute to school more frequently; low-income students made more weekend trips by transit; and high school students used the pass to access better part-time jobs. Parents were also pleased that their children had a way to get home, particularly when they were unable to pick them up, but some expressed safety concerns during specified circumstances (i.e. after dark or travelling alone on transit). One of the limitations of this study is that the pilot program only lasted for one year due to funding complications, whereas a multiple-year research design would be needed to fully understand the impact of the program.

A similar study was conducted in London, England by Goodman et al. (2013) that interviewed 118 young students aged 12 - 18 to examine how the universal free transit pass impacted youth's independent mobility. In 2005, the free transit pass program extended from under 16-year olds to 17 and 18-year olds to "help young people reach their full potential through continued studies and is a cost-saving measure for thousands of London families" (Transport for London, 2006). Although there was an increase in school commute patterns by transit, the study found that free bus travel had the biggest impacts on travel decisions related to social goals and exploring London (Goodman et al., 2013). Further, the study concluded that children's independent mobility was constrained by a number of factors including financial access, transport skills, the company of peers, parental permission and the security of having a contingency plan if things go wrong. The Goodman study only took into consideration the data collected from discussions with students and did not evaluate the transit ridership or the number of

activities students were able to accomplish. Although the study did not include quantitative data, it provided supportive evidence that the transit pass had positive impacts on children's mobility freedom and social activities.

Although there are about a dozen cities in the United States that have implemented free transit passes for high school students, there was only one other Canadian city besides Kingston: Whitehorse, Yukon. Since 2012, the Department of Education has paid the City of Whitehorse \$4000 a month, which provided students with free transit passes to use public transit at any time (Tukker, 2016). Students who received the transit pass would not be eligible for the regular school bus, however some students argued that taking transit was a quicker commute to school and allowed them to travel to after-school activities, employment and attend social events (Tukker, 2016). Combined with other transit investments such as improved evening schedules and new routes, the number of transit boardings increased by 65% between 2010 and 2014 based on the CUTA Canadian Transit Fact Book. Although the transit pass program improved accessibility to public transit for high school students, there was no published research conducted to investigate the impact on youth independent mobility.

It is evident that there are a number of transit pass programs that have been applied in North America and abroad. Creating future transit riders was a motivating factor for many transit agencies, including Tempe, San Francisco, Portland and San Diego, to implement free student transit programs (LACDPH, 2013). The case studies provide relevant examples to suggest that transit pass programs can improve the commute to school and facilitate social trips. However, there are still limitations when transit pass programs are evaluated for their performance since most of these case studies did not publish their findings or their conclusions were based on short-lived pilot programs. More research is required to link the impact of the transit pass programs and youth's independent mobility.

## 2.2 Independent Travel for Youth

There are a number of published research studies that seek to identify the factors that influence independent mobility. Independent mobility refers to the ability of a person to move to places unaccompanied by an adult (Veitch, Salmon, & Ball, 2008). Free public transit can increase independent mobility for youth, which could have a range of benefits including the potential for strengthening social networks among peers and improved civic participation (Goodman et al., 2013). Providing free transit passes to youth can improve access to school and other essential destinations, including after-school activities, shopping and other discretionary trips. Discretionary trips are defined as trips other than home-based work and home-based school (Dalton, 1999). There have been case studies where jurisdictions, such as Alameda County, have seen increases in students' participation in after-school program and weekend transit ridership due to free transit passes (McDonald et al., 2004). Research demonstrates that it is important for students to have access to extracurricular activities because they can provide social, health and academic benefits (Mahoney et al., 2005). In fact, students who are involved in after-school programs are more likely to perform better in school and to graduate, compared to students who do not (Mahoney et al., 2005).

Increased access to reliable transportation can expand students' ability to seek and maintain employment opportunities (McDonald et al., 2004). Early work experiences for young adults have been linked to improved academic performance, decreased dropout rates, reduced criminal activity and increased likelihood of student enrollment in college after graduation (Schochet, Burghardt & McConnell, 2008). Graduating high school and attending post-secondary education is critical for young people to find jobs in the future. Based on the Canadian Occupational Projection Systems (2015), it estimated that between 2015-2024, 3.95 million (two-thirds) of current job openings will require post-secondary education or management training while 71% of new jobs created by economic expansions are projected to require postsecondary education. Improving independent mobility for students allows them to pursue employment opportunities and increase the likelihood of attaining higher education.

Despite the benefits of independent mobility, many parents continue to drive their children to and from school and other destinations (Carver et al., 2012). This habitual practice of driving children to their activities is often referred to as parents 'chauffeur' children to their destinations (Carver et al., 2012). The common reasons for parents to drive their children include concerns about road safety, getting lost and perceived danger from strangers (Carver et al., 2012). However, the ability to chauffeur children is often limited to households that can afford vehicles to drive their children. Lin & Chang (2010) studied how the built environment and household structure influenced children's independence by collecting survey data in three elementary schools. The study found that higher-income households are generally more attentive to their children and can afford private transportation modes compared to lower-income households. Also, findings indicated that higher income households often depend more on car or motorcycle to take their children to school (Lin & Chang, 2010). These findings suggest that the economic status of households could be determining factor on child independent mobility, in particular, higher-income households are able to chaperone their children to more activities compared to lower-income households.

Nevertheless, parents should not have to chaperone their children to school since governments dedicate massive funds to transport their children to school. In Ontario, the Ministry of Education currently spends approximately \$800 million per year for school bus transportation (Cook, 2010). A study conducted by Bullock et al., (2016) evaluated the costs of school transportation in American since American schools spent \$22.3 billion on school transportation during the 2010-2011 academic year. The authors recognized that almost 50% of American students use private vehicles to get to school, which means there was a financial burden on families in terms of vehicle operation and their value of time. The study found that 6.6 billion auto trips to and from school accounted for 30 billion vehicle miles in 2009. Using data from the American Automobile Association (2013) that estimates the operational costs related vehicle ownership (i.e. 20 cents per mile), the study calculated that the time costs for all school-related mileage was \$8 billion and in particular, the cost for parents to drive their children to school were

approximately \$3 billion for the 2009 year. The same study estimated the collective value of time based on 35% of the average hourly wage rate. Using this assumed value, accompanying grade K-8 children less than one mile to school “cost” parents the equivalent of \$420 million per year (Bullock et al, 2016). It is evident that parents are spending a substantial amount to chaperone their children to school.

Over the past several decades, parents’ willingness to grant children the permission to travel alone or without an adult chaperone has been on the decline (Clifton, 2003). A study by Veitch et al. (2008) revealed that 12% of children were not permitted to walk or cycle anywhere in their neighbourhood without adult supervision, and approximately 32% had an independent mobility range of <100m from home. Parents often feel more comfortable chaperoning, or accompanying, their children to their activities so they are more supervised. Thus, parental permission plays a role in children’s mobility independence.

Parental permission is often varied by gender, age, birth order and household composition (Clifton, 2003; Bjerkan & Nordtomme, 2014). Traditionally, researchers believed that girls have less travel independence compared to boys because parents are more protective of girls (McDonald, 2012). McDonald (2012) also researched whether school travel was gendered for children since previous literature showed strong differences in work commuting patterns between males and females. The study used data from the US National Household Travel Surveys from 1977 to 2009 to investigate gender differences in school travel and the changes over time. The findings indicated that males used active transportation – both walking and cycling – to and from school more often than females, especially biking, where males biked to school two to three times more than females. Another study confirmed previous research stating that young girls are more likely to travel to their leisure activities by car than adolescent males, due to mobility restrictions (Bjerkan & Nordtomme, 2014).

Furthermore, there are significant differences with parental permission with respect to the age of their child. As children become older, parents lessen their restrictions and allow children to travel farther distances unchaperoned (Veitch et al., 2008). A study by Veitch et al. (2008) found that 50% of children

aged 10 to 12 were able to walk or cycle greater than 1000m from home alone compared to only 25% of younger children aged 8 to 9.

Also, there is general notion that parents are stricter with their first child compared to later-born children, which could mean that first-born children have less independent mobility than their younger siblings. Lehmann (2016) and other studies suggest that parents are unable to provide their younger children with the same level of cognitive support as they do with their first-born. In other words, research has supported findings that parents tend to relax their restrictions and household rules for their younger children. As a result, younger children are often provided with more freedom and independence compared to their elder siblings.

Household composition was also considered a factor that influenced independent travel for youth. Bjerkan & Nodtomme (2014) studied how transport mode choices for adolescent leisure activities were influenced by household structures. The researchers used data from the 2009 Norwegian Travel Survey, which included all leisure trips for 1790 adolescents aged 13-17 years, and found that 60% of trips longer than 4 km were made by automobile. Findings showed that there were fewer activities made by adolescents in single-parent households and a shorter distance radius for independent travel compared to adolescents living in dual-parent households. Also, the study concluded that single parent households have a lower probability of using the car on leisure trips among adolescents, which is likely due to the lack of time that single parents have to chauffeur their children to his or her leisure activities. Since single-parent households do not often consider chaperone activities to be a high priority compared to two-parent families, household composition can be also considered as a determining factor on youth's independently mobility.

## **2.3 Chapter Summary**

This chapter presented a review of the previous research in the open literature aimed at transit fare programs and youth travel independence. A variety of transit pass programs for university and high

school students and their evaluation methods have been described together with their limitations. To date, Canadian studies have been limited to only university transit pass programs. To evaluate the performance of the university transit programs, studies analyzed ridership data before and after the program was implemented and engaged with participants through surveys or interviews. Transit fare programs were shown to significantly improve transit use among students and reduce driving alone to campus.

Comprehensive studies on high school education transit pass programs were found for American and British schools, but not for Canadian (Heath & Gifford, 2002; De Witte et al., 2006). The case studies provided recent examples where providing free transit can improve the commute to school or extracurricular activities, increase school attendance and facilitate non-school trips for youth. For both university and high school transit pass programs, the majority of the studies found that the programs led to positive outcomes on transit use (Brown et al, 2003; Vincent et al., 2014).

Finally, factors that influence independent mobility, i.e, the ability of a person to travel unaccompanied by an adult, were described (Veitch et al., 2008). According to reported research, the factors that influenced a young persons' independent mobility included age, birth order, household composition, access to public transit and parental constraints (Lehmann, 2016; Bjerkan & Nodtomme, 2014). By improving independent mobility, families can save costs related to chaperoning children to activities and allocate those funds to other household needs (Bullock et al., 2016).

Since no thorough reported work at the high school level in Canada was found in the literature, this thesis study seeks to determine if a free transit pass program applied in a mid-sized Canadian city can influence independent travel for this cohort of students. The research aims to use ridership data and develop surveys to understand the travel patterns and factors that influence the independent mobility of high school students in Kingston. In the following chapter, details of the research methodology are described.



# 3.0 STUDY BACKGROUND & RESEARCH METHODS

One of the main objectives of this study is to determine if the provision of transit passes has an effect on independent mobility for young adults in urban areas. Independent mobility refers to ability to travel without an adult chaperone and it is important because it can allow youth to attend more activities and reduce household costs related to chaperoning children (Bullock et al, 2016). This work utilizes the Kingston’s pilot transit pass program as a contemporary and relevant case study. The complimentary high school bus program is an unprecedented investment in public transit for Canadian cities and, as such, the results of this study may be relevant to many North American cities exploring new transit programs for young adults. This chapter provides details on the study location, program background, sampling design, research tools, and the data analysis approach.

## 3.1 Study Location

The City of Kingston is located approximately 150km southwest of the City of Ottawa, and north of Lake Ontario as shown in Figure 3-1 and 3-2. It is a mid-sized city of 161,175 residents in its census metropolitan area (Statistics Canada, 2016).



Figure 3-1: Regional context of Kingston, Ontario (City of Kingston, 2015).

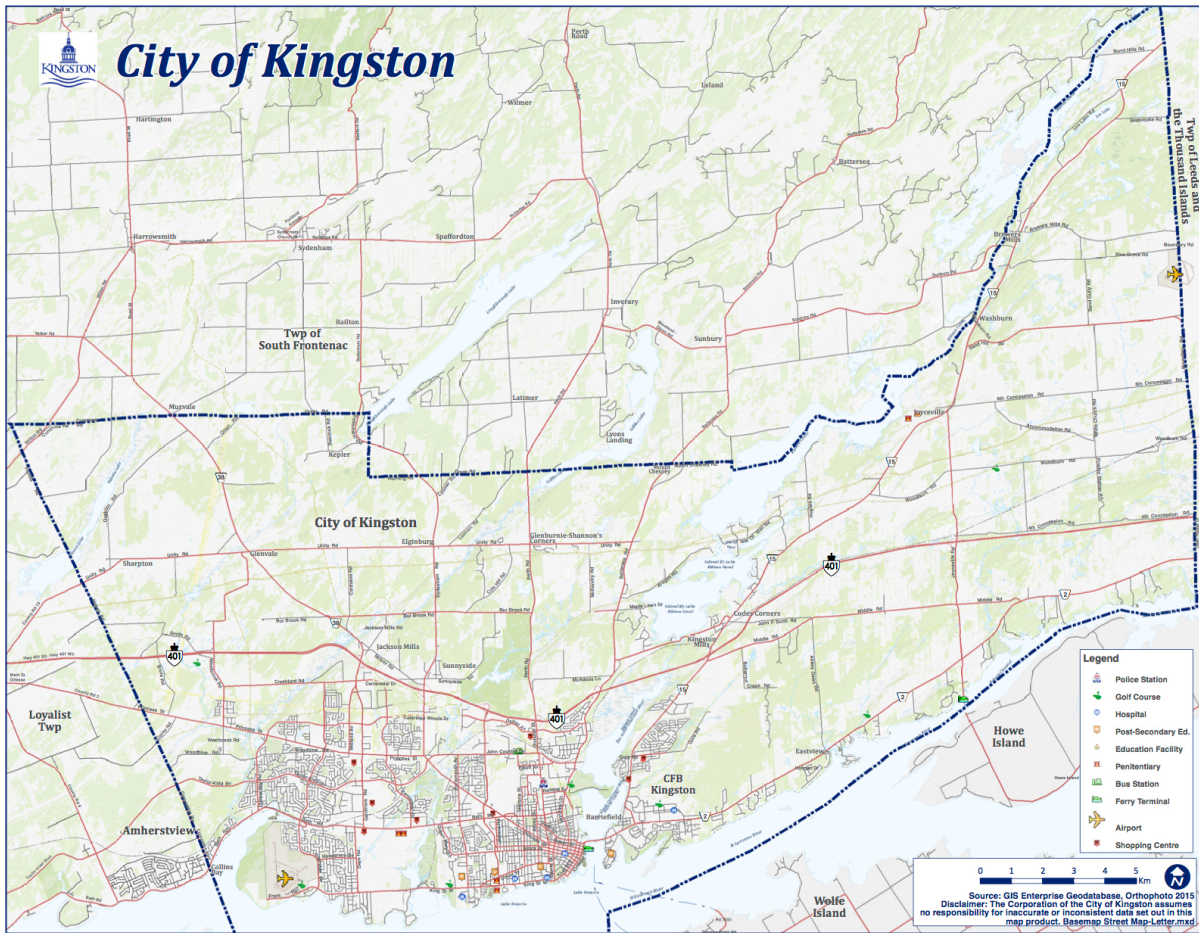


Figure 3-2: Municipal boundary of Kingston, Ontario (City of Kingston, 2015).

The average 2016 total income per person in Kingston was \$49,778 and the average household income was \$92,572 in 2017 (Statistics Canada, 2017). In comparison to other mid-sized cities such as Guelph (CMA population of 139,670 and average family income of \$103,898 in 2011), Kingston’s household income is lower, but higher when compared to Barrie (CMA population of 184,325 and average family income of \$93,579 in 2011) (Statistics Canada, 2013b; Statistics Canada, 2013c). As of April 2017, the city’s labour force was reported to be 90,989 and had an employment rate of 59%, which is slightly lower than the national employment rate of 61% (Statistics Canada, 2013a, Statistics Canada, 2017). The major industries in Kingston are primarily in the public sector as shown in Table 3-1 (Bidnes,

2017). Based on average household income and employment rate, the City of Kingston is representative of an average mid-sized municipality in Canada.

*Table 3-1: Kingston employment by major industry, public sector and private sector (Bidnes, 2017).*

		<b>Number of Employees</b>
<b>Major Industries</b>	Educational Services	12,712
	Health Care and Social Assistance	12,453
	Public Administration	11,712
	Retail / Trade	10,556
<b>Major Public Sector Employers</b>	Canadian Forces Base	8,442
	Queen’s University	8,074
	Kingston General Hospital	4,123
	Limestone District School Board	3,186
<b>Major Private Sector Employers</b>	INVISTA Canada	700
	StarTek Canada	650
	Empire Life Insurance Company	630

In Kingston, there are two French and two English school boards that offer Kindergarten through grade 12 classes. In terms of area coverage, the largest school board is the Conseil des écoles publiques de l’Est de l’Ontario (CEPEO), which is a French language public school board that covers 40,314 km<sup>2</sup> of Eastern Ontario. In Kingston, there is one high school under the CEPEO school board called the école secondaire publique Mille-Iles. The second largest school board is the Conseil des écoles catholiques du Centre-Est (CECCE), also known as the Centre-East French Catholic School Board, which covers an area of 35,615 km<sup>2</sup> in Ontario. The CECCE provides education for over 21,000 students in 41 elementary schools, 10 high schools and an adult school. In Kingston, there is one high school called Marie-Rivier Catholic Secondary School under the CECCE school board.

Covering an area of 16,000 km<sup>2</sup>, one of the English school boards in Kingston is the Algonquin & Lakeshore Catholic District School Board (ALCDSB), educating over 13,200 students in grade school class and special adult programs. Under the ALCDSB, there are two high schools within the Kingston boundary: Holy Cross Catholic Secondary School and Regiopolis-Notre Dame Catholic Secondary

School. The other English school board is the non-denominational Limestone District School Board (LDSB) that covers 7,719 km<sup>2</sup> in Ontario and educates over 23,000 students at 55 elementary and 11 secondary schools. Under the LDSB, there are six high schools within the Kingston boundary: Bayridge, Frontenac, Kingston Collegiate & Vocational Institute, La Salle, Loyalist Collegiate & Vocational Institute, and Secondary School of Community Education. The Figure 3-3 below shows the area coverage of both English school boards that participated in this research.

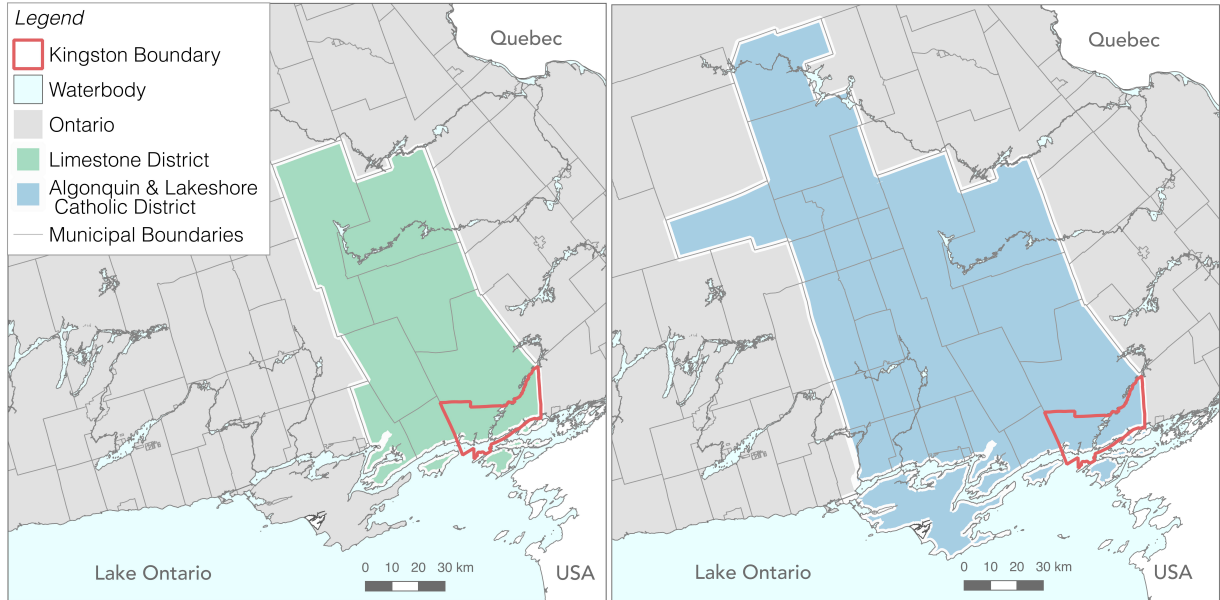


Figure 3-3: Limestone District School board boundary (Left) and Algonquin & Lakeshore Catholic District boundary (right) (City of Kingston, 2017).

### 3.2 Kingston Transit

The city’s sole transit service has been provided by Kingston Transit since 1962, which operates in the urban areas of the city and the neighbouring community of Amherstview. For the past six years, Kingston Transit has made significant improvements and investments to its public transit service. From 2011 to 2015, the revenue service hours increased from 158,000 to 236,000 annually (Kingston Transit, 2015). Kingston Transit operates seven days a week with three express routes and 15 local routes. The

ridership in 2015 reached a record 4.6 million passenger trips, which was an increase of 31% from 2011 (Kingston Transit, 2015). One of the significant changes Kingston Transit experienced was the introduction of Express Routes 501 and 502 in 2013. Since then, there have been four additional express routes implemented; the 601, 602, 701 and 702 implemented in May 2015 (Kingston Transit, 2015). The Express Routes provide a more direct, rapid, reliable and frequent service between major destinations with at least 15-minute service headways during weekday peak periods (Kingston Transit, 2015). Figure 3-4 illustrates the express routes.



Figure 3-4: Kingston Transit Express Routes (Kingston Transit, 2011).

### 3.3 High School Transit Pass Program

In 2012, Limestone District School Board, Mayor Gerretsen and Kingston City staff collaborated to provide more opportunities for grade 9 students. Initially, access to free transit was to complement the

existing grade 9 Community Activity Pass that provided grade 9 students access to free recreational programs, such as public skating and swimming, in Kingston, Frontenac, Lennox and Addington Counties (KFL&A) (City of Kingston, 2012). Unfortunately, the lack of transportation options was reportedly a barrier for students to attend these recreational activities, according to the City of Kingston Recreation Services Staff. In 2012, there were 200-300 uses of the grade 9 Activity Pass each year, even though there were approximately 2,500 grade 9 students in the KFL&A area. To improve program usage, Recreation Services Staff recommended broadening the Community Activity Pass program to include free public transit so that students could have another transportation option available to them. Since the Community Activity Pass was already established, the expansion to include free access to Kingston Transit could be completed without additional city resources.

The city staff recognized that providing free transit service to grade 9 students also gives them a transportation option for other purposes such as traveling to or from school, employment, or for personal reasons. The city hoped that exposure to the Kingston Transit system would create the potential for these students to continue as regular, committed transit passengers when their pass expired at the end of grade 9 (City of Kingston, 2012). After city council approved the pilot program in June 2012, the complimentary access to Kingston Transit for grade 9 students was offered from September 2012 to August 2013. The school boards contributed \$30,000 to cover the program costs and estimated reduction in transit revenues (City of Kingston, 2012).

In the first year of the pilot, grade 9 students had to visit one of the Kingston Transit ticket vendors in order to get a transit pass. At the end of the first year, 648 grade 9 transit pass were issued and more than 28,000 trips were taken (City of Kingston, 2012). The ridership results had shown that in the first year, 85% of all trips were on weekdays between 7am-9am and 2pm-4pm. Based on the participation of the pilot program, the city staff and the local school boards approved to continue the transit pass program for another year and expand it to grade 10 students.

In the second year (2013), grade 9 passes were issued at the schools, but grade 10 students were required to visit City Hall or the Cataraqui Centre to renew or obtain their transit pass. For the second year, there was an increase of 869 grade 9 students and 630 grade 10 transit passes that were issued as part of the pilot program (City of Kingston, 2013). The ridership for the pilot program also increased to 63,606 trips (176%) from the previous year, including both grade 9 and grade 10 students. The data showed that the usage patterns were concentrated around the beginning and ending times of school days, with approximately 61% of all trips occurring on weekdays between 7:00am- 9:00am and 2:00pm-4:00pm. The data revealed that the program was successful in encouraging grade 9 and 10 students to use public transit.

Over time, city staff and both the Limestone District School Board and Algonquin District School Board indicated interest and support in extending the program. In 2014, they expanded the program to grade 9, 10 and 11 students (City of Kingston 2016). In 2015, the pilot program was expanded to all students attending high schools in the City of Kingston. Figure 3-5 provides the overview of ridership as the program was incrementally implemented over the first four years, while Figure 3-6 illustrates the growth in ridership.

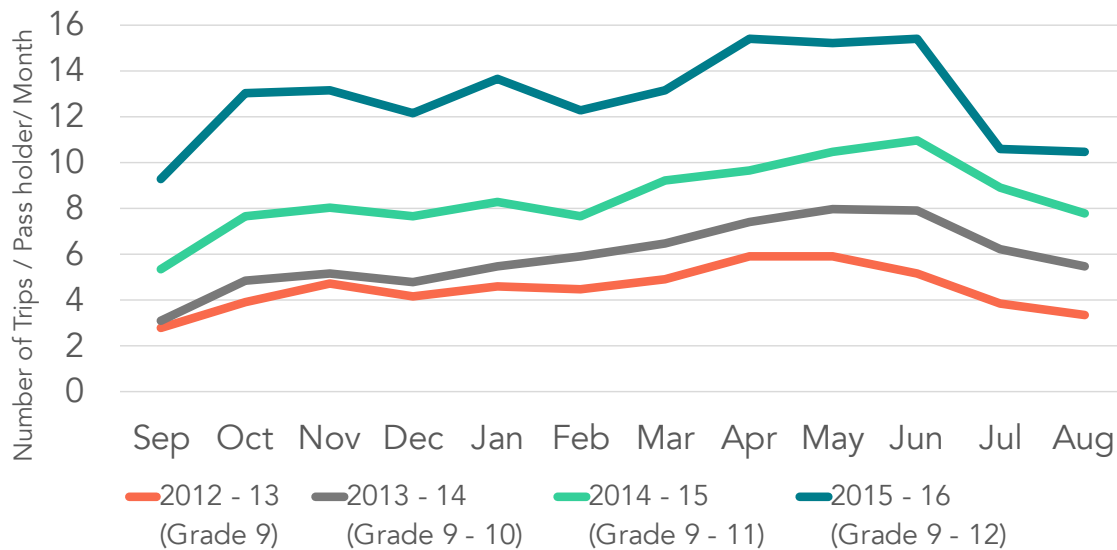


Figure 3-5: Number of transit trips per pass holder from program's inception in 2012 (Kingston Transit, 2016)

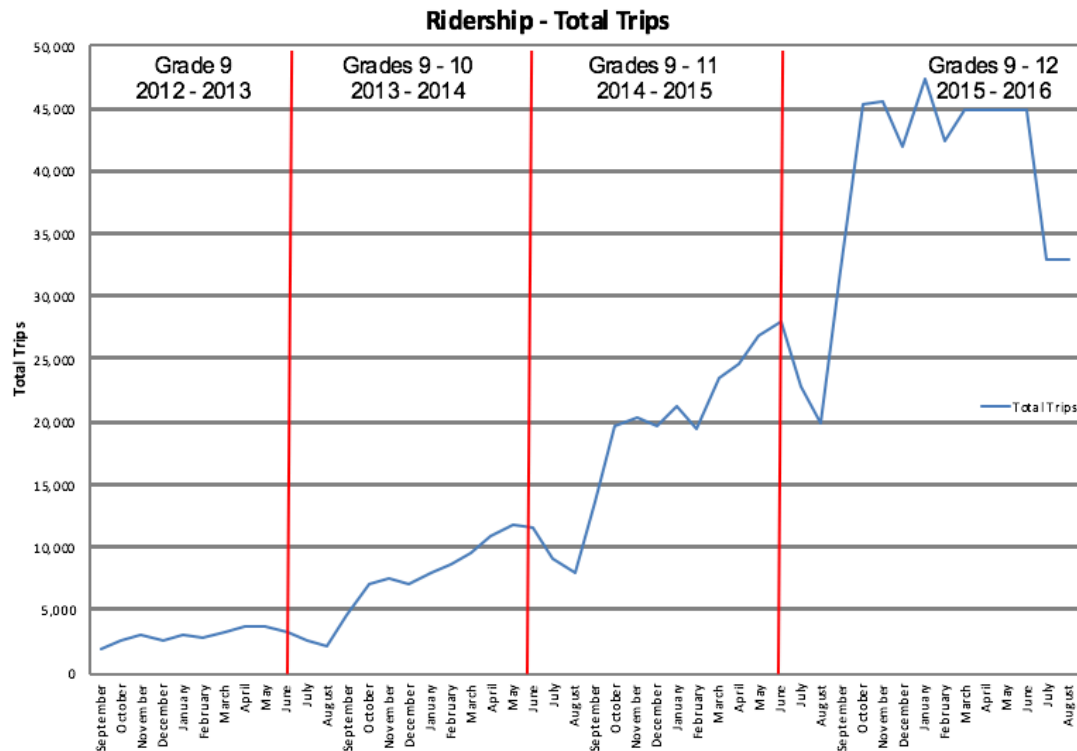


Figure 3-6: Ridership of pilot program since inception (Kingston Transit, 2016)

### 3.4 Research Methods – Data Collection

As discussed in chapter one, the main goal of this study is to determine how the provision of the free transit pass program has impacted the independent mobility of high school students. To achieve this goal, the current study analyzed the Kingston ridership data and undertook a series of surveys to answer the following research questions:

1. Are students using the free transit pass for activities beyond primarily school trips?
2. Do transit pass holders derive mobility benefits by having access to free transit?
3. Do factors (such as birth order, family size and composition, gender, access to free transit or regular transit use) influence students’ travel independence or the number of activities?
4. What are the potential parental constraints on child mobility independence?



To address research question (1), ridership data provided by Kingston Transit was used to analyze ridership trends, which will be discussed in the following section. To address questions (2) to (4), data were collected from three separate questionnaires developed for target groups in Kingston. In order to ensure anonymity of the participants, no photos or student names were collected during the data collection process.

### **3.4.1 Kingston Transit Ridership Data**

To address the first research question, ridership data collected from Kingston Transit were analyzed to investigate if students also used their transit pass for activities beyond school trips. When each student is issued a transit pass, Kingston Transit records their name, grade and provides them with a unique card number with their card. Each time the student boards a transit bus, they have to swipe their card on an electronic fare collection machine and it records their unique card number, date, time and location. Kingston Transit provided the ridership boarding information, without their names, from September 2016 to February 2017. An example of the dataset is shown in Appendix A. The ridership information shared provides the unique card number, date, time and the longitude and latitude of each boarding. Kingston Transit also provided separate lists of grade 9, 10, 11 and 12 unique card numbers so that it would be possible to distinguish ridership trends by grade level. This information provides a useful overview of the actual ridership trends throughout the most recent academic year.

## **3.5 Research Methods – Surveys Administered**

To address the research questions (2) to (4), multiple surveys were developed and distributed to the Kingston community from January 2016 to May 2017. Collecting primary data offers the advantage of collecting specific information related to the research and the new data can be added to the existing

store of social knowledge (Hox & Boeijs, 2005). Collecting data through questionnaires provides direct insight into the participants' views and opinions (Hox & Boeijs, 2005). Details of the study participants, incentives, method of distribution and the questionnaires are provided below.

### **3.5.1 Gathering Data on Recent Graduates**

A survey was distributed to graduating grade 12 students to address the second research question: would participants derive mobility benefits from having access to free transit after high school? At the end of the 2016 academic school year, Kingston Transit visited all the schools in the city to offer an incentive to grade 12 graduates who are not planning to attend post-secondary schools. Usually, the high school transit pass is valid from September to July of the school year. However, Kingston Transit offered grade 12 students the opportunity to extend their free transit from the end of July to December 2016 for those who are not attending post-secondary schools. For the purposes of this study, this participant group is referred to as 'Non-PSE G12'.

In preparation for the data collection process, both the Limestone District School Board and Algonquin District School Board were in communication with the author to recruit students for a survey, the purpose of which was to better understand students' utilization and the potential benefits they derived from having access to the pass after secondary school. A grade 12 survey package was developed that included the survey, recruitment flyer, student information letter, consent form and feedback letter; all survey materials are shown in Appendix B. After receiving University of Waterloo ethics clearance, the documents were shared with the school boards to initiate the recruitment process. The recruitment flyer was sent to schools and posted in the main office. As an incentive for students to complete the survey, each student was entered in a prize draw to win a \$100 Best Buy gift card. At the end of the study, one student was randomly selected as a winner and was notified.

As Kingston Transit representatives distributed the new transit passes to students in schools, the author and a supporting team of researchers accompanied them to conduct in-person surveys. Since it was difficult to attend each school in-person to distribute hard-copy surveys, Kingston Transit representatives collected interested participants' contact information as they distributed the new transit passes on behalf of the author. After the contact information was collected, the hard-copy version of the survey was digitized and students were sent emails to request that they complete the survey online.

The survey asked participants a series of questions to better understand their travel behaviour. Participants were asked "on average, how often do you travel by different modes" to determine their propensity to use transit, walk, bike and drive. Since students from the participant group were not planning to attend post-secondary education, this would suggest that the sub-population were not seeking postsecondary education perhaps because they already had a profession where their high school education was sufficient. The expectation is that these students would use the transit more than other modes since it would enable them to seek and maintain employment opportunities while saving costs on travel (McDonald et al., 2004). To test this, participants were asked "are you employed" to determine if there were any correlations between working status and the propensity to use transit.

Also, research has indicated that higher-income households tend to drive their children to activities since they can afford private transportation modes (Lin & Chang, 2010). The expectation is that students who use transit more frequently are often in lower income households. To test this, participants were asked "what is your estimated annual household income range" to identify correlations between transit use and household income status.

Furthermore, it was evident in literature that chaperoning children to school caused a financial burden on families in terms of time and vehicle related costs (Bullock, 2016). Since chaperoning activities are deemed too costly, it is expected that households would not prioritize chaperoning activities as more important than school or work activities. To test this, participants were asked to rank a list of activities in the order of its priority when their household decisions are made. The list of eight activities (chaperone,

grocery shopping, other shopping, recreational, school/work, service and social) was based on a previous study conducted for a household activity-travel model (Yeung, 2015).

To evaluate if participants derive mobility benefits from the pass, the final question of the survey asked participants “if you did not have a transit pass, indicate...how your travel would be affected for each activity from the previous question”. Participants were asked to choose between ‘not affected at all’, ‘some trips affected’, ‘most trips affected’ and ‘trip no longer possible’ for each of the eight activities. The answer to this question will inform the second research question of this study and determine if the pass enables students to pursue multiple activities beyond school or work activities.

### **3.5.2 Grade 9 and grade 12 Students**

To address the third research question – how different factors influence independent mobility – another questionnaire was developed for grade 9 and 12 students in three separate high schools. As shown in Appendices C and D, two separate surveys were developed for each grade. In addition, the purpose of grade 9 survey was to ask new students if the transit pass has affected their travel independence compared to their previous year when they did not have complimentary access to transit. In other words, the survey investigated if grade 9 students are able to do more activities compared to previous year by having access to transit.

Since both grade 9 and 12 students were invited to participate in this survey, and since grade 9 students were under the age of 18, it was recommended by the School Boards and Ethics Committee to request parental / guardian consent first. After the University of Waterloo granted ethics approval for the study, the draft surveys were shared to both the Limestone District and Algonquin District School Boards for approval. It was important to collaborate with both local school boards and Kingston Transit to strengthen the local partnership and improve awareness about the pilot program.

Each school board had separate research application guidelines. After two separate research application packages were approved by the two boards, the author coordinated with Kingston Transit, the school boards and participating schools to plan the study. The three participating schools that agreed to do this study were Bayridge Secondary School, Loyalist Collegiate & Vocational Institute and Regiopolis-Notre Dame Catholic School.

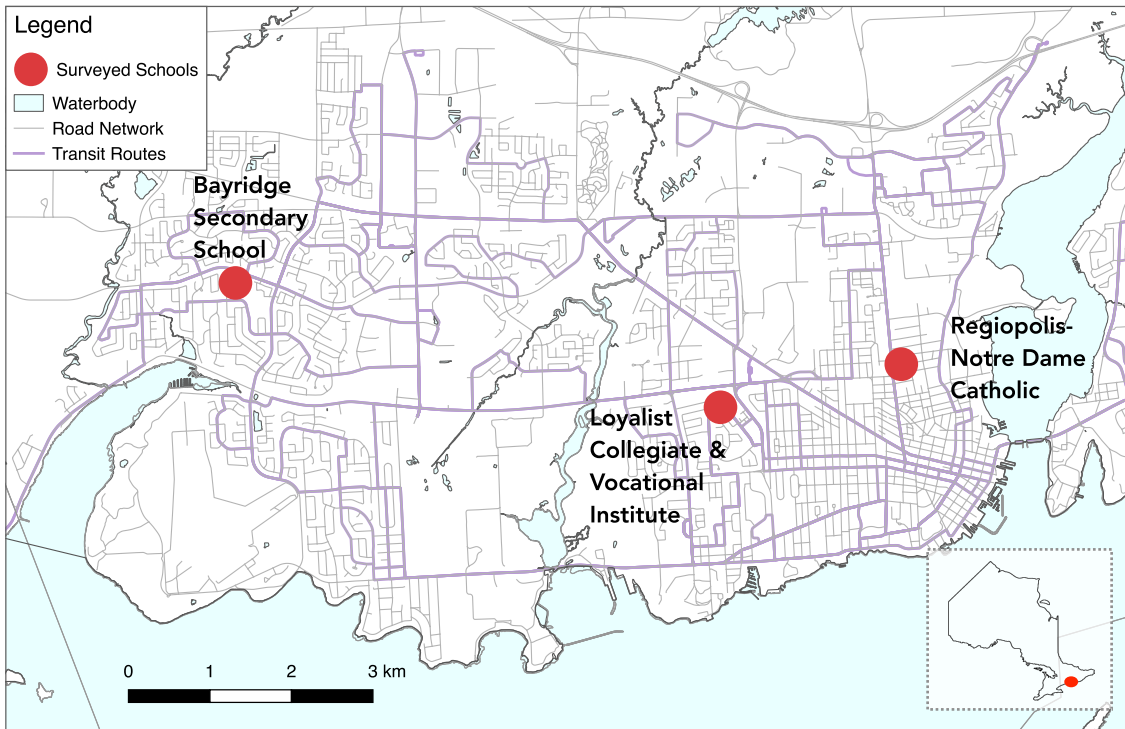


Figure 3-7: Locations of schools surveyed in the City of Kingston.

A representative was assigned by each high school to provide logistical support to the author. The school representative helped share recruitment flyers and school newsletters to promote the awareness for the surveys. Since grade 9 students were under the age of 18, interested participants had to complete parent consent forms before being able to participate in the study. After the parent consent forms were signed, grade 9 students had to submit them to the school representatives prior to the survey date. The majority of grade 12 students were over the age of 18 and did not require parental consent. On the survey

days, announcements were made during lunch hour to recruit grade 12 participants. As an incentive, a \$5 Tim Hortons Gift card was advertised and would be awarded to each student for completing the survey. There was a team of three to seven researchers at each school and the school reserved a classroom to facilitate the questionnaire. Focus groups of five to 10 students would meet with the researchers in case they needed to seek guidance in filling out the survey.

With respect to the survey questions, there were multiple hypotheses that the study was designed to investigate. First, there is a general stereotype that parents are often stricter with their first born children compared to their later-born children, and some studies suggest that parents are unable to provide the same level of support to their younger children (Lehmann et al, 2016). The expectation is that there may be differences in student travel patterns based on their birth order. To test this, participants were asked “if you have siblings, what order are you in the family?” to determine any correlation between birth order and the number of independent trips.

In this study, an independent trip is defined as a trip made without a chaperone. Trips made by walking, transit bus, bicycle, driving alone and taxi are defined as independent trips. In comparison, trips made by school bus, carpool and dropped off by car were assumed to non-independent. To determine the number of independent trips that each student made, participants were asked to fill in a table and list the “activities that you did during the school year. For each activity, indicate the mode that you commonly used” for ‘getting to’ that activity and ‘coming back’ home from that activity. Participants were asked to fill in a table of their activities that they participated in their current year and their previous year. Since there were two years listed, each activity had the potential of four trips recorded for the same individual. For example, if participants wrote under the *previous* year column ‘dropped off by car’ for getting to school as their activity, it counted as one trip, and wrote ‘walked home’ for coming back, it would count as the second trip. If the participant wrote under the *current* school year column ‘school bus’ for getting to school and ‘transit bus’ for coming back, it would be counted as another two trips. By comparing the number of activities between the *previous* year and the *current* school year, it is possible to quantify the

number of activities or independent trips made as children become older and as they gain access to the complementary transit pass.

There is also the expectation that there may be differences in student travel behaviour based on family size and composition. Research by Bjerkan & Nodtomme (2014), suggested that single parent households are more restrictive in the number of leisure activities that their children can participate in compared to dual-parent households. To test this, “how many people live in your household?” was asked in the survey to determine the relationship of the number of activities that students participated in with household size and composition.

Furthermore, studies have reported that young females tend to have higher mobility restrictions compared to boys, and as a result have less mobility freedom and independence than males (McDonald et al., 2012; Bjerkan & Nodtomme, 2014). As a result, there is an expectation that there may be differences in independent travel behaviour based on the students’ gender. To test this, participants were asked “what is your gender?” to determine correlations between gender and the number of independent trips.

### **3.5.3 Research Methods – Parents’ Survey**

To address the fourth research question that sought to identify potential parental constraints, another questionnaire was developed for parents and guardians in Kingston. The recruitment process was conducted during the same time period as the grade 9 and 12 student surveys. When grade 9 students had to sign their parental consent forms, the parents of grade 9 students were invited to follow a link to an online survey. To increase the participation rate, the local school boards also provided the link in the school newsletters and parent councils for recruitment. As an incentive, a \$50 prize draw winner was randomly selected at the end of April 2017. The survey, presented in Appendix E, was developed to determine under what circumstances parents would allow their child to travel independently and their opinions regarding the transit pass program.

The literature has identified multiple reasons for parents to restrict their children from travelling alone, including concerns related to traffic safety and the fear of abuse from strangers (Carver et al., 2012). However, parental restrictions on child independence often vary based on the age of the child since older children tend to be more responsible than younger children (Veitch et al., 2008). To test this, the survey asked parents at what age they would feel comfortable allowing their children to travel alone, or with a friend, to different areas in Kingston.

An earlier study have suggested that higher income households are generally more attentive to their children and thereby are more likely to chaperone their children to more activities compared to low-income households (Lin & Chang, 2010). To test this, the survey asked “what is your household income range” to determine any correlations between household economic status and their propensity to allow their children to travel alone.

Also, there was a list of open-ended questions to provide parents the opportunity to explain reasons for allowing their children to travel alone and ask them how it would affect their household trips if their child did not have a transit pass. Overall, this survey provides valuable insight regarding what guardians perceive as an acceptable level of independence for their children.

## **3.6 Chapter Summary**

This chapter discussed the study location, background of transit pass program, data collection efforts and research tools used. Ridership data provided by Kingston Transit were used to determine if students are using their free transit pass for activities beyond school trips. Three separate surveys were developed to evaluate if the transit pass program enables participants to accomplish independent trips. Based on the literature, questionnaires were developed to test a variety of hypotheses related to independent mobility. Chapter 4 presents the results of the study.



## **4.0 RESULTS**

This chapter presents the results of this research in four main sections. The first examines the Kingston Transit ridership data while the second describes the results of the graduating grade 12 students survey. The 2016-2017 grade 9 and 12 student surveys are then evaluated, followed by the results of the parent surveys. In each of the sections below, at least one hypothesis is evaluated and tested using a variety of different approaches.

### **4.1 Kingston Transit Data**

As described in Chapter 3, Kingston Transit ridership data were used to determine if the availability of the transit pass allowed students the opportunity to complete travel beyond school-related trips. The expectation is that high school students board transit outside of the regular school hours, such as weekends and evenings, and that they use the pass to travel to destinations across the city. To test this, the author analyzed the proportion of trips that occur outside of the time periods when school is in session and conducted a spatial analysis using Geographic Information Systems (GIS) to reveal areas where boardings occurred within the Kingston municipal boundary.

Kingston Transit provided high school transit ridership data for six months: September 2016 to February 2017. Based on these records, there were over 340,000 recorded boardings for students with high school transit passes. In terms of free transit pass distribution, there were a reported 1562 grade 9 students, 1131 grade 10 students, 1229 grade 11 students and 1305 grade 12 students who participated in the complimentary transit program. This section describes the usage patterns and boarding locations of these four groups of students who participated in the transit program and discusses the trends in the ridership data.

Based on literature, independent mobility of youth increases as children become older (Veitch et al., 2008). The expectation is that older students are able to make more independent trips outside of regular school hours compared to younger students. To test this, the overall ridership data are first compared between the youngest grade level and the graduating grade level. In total, grade 9 students contributed to 54,089 boardings compared to 122,508 boardings for grade 12 transit passes. Figure 4-1 shows the difference in frequency for the two grades.

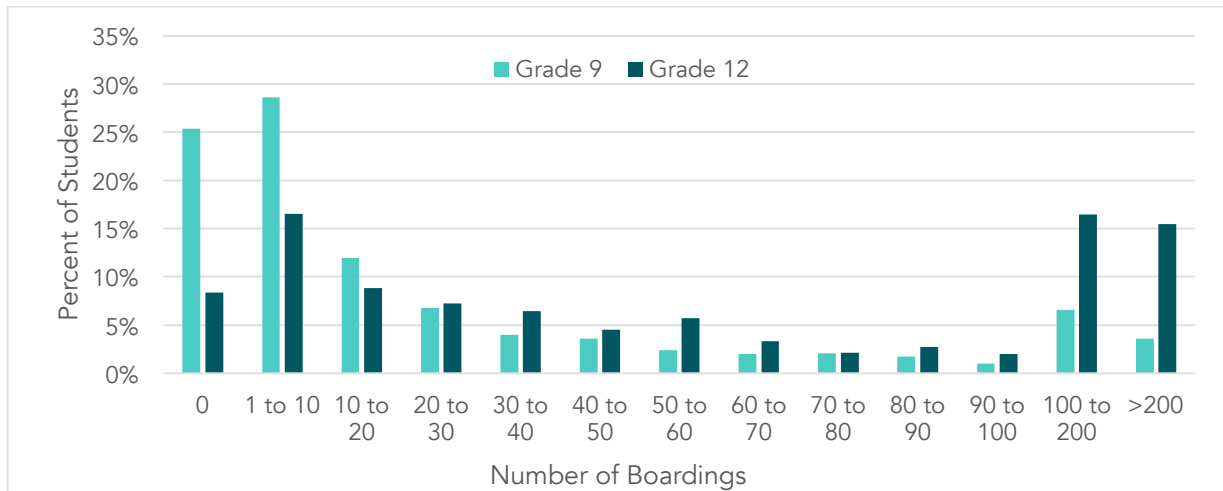


Figure 4-1: Distribution of grade 9 and 12 ridership for the period of January 2016 – February 2017.

The distribution of Figure 4-1 is shown above, revealing the highest peaks located on the far left and far right of the distribution. The left side of the distribution indicates that there are more grade 9 students who use the program occasionally, where 29% of students made between 0 and 10 trips. On the other hand, there are more grade 12 students who use the transit pass very frequently, where 31% of students made more than 100 trips. This indicates that on average, grade 12 students used the pass more frequently than grade 9 students.

However, there are grade 9 students using the transit pass on a regular pass. The ridership data revealed that over 50 grade 9 students made over 14,000 boardings, which is approximately 46 trips per month per student. In other words, about 4% of the grade 9 pass holders rely heavily on the transit pass

program to meet their transportation needs. In comparison, grade 12 students made over 64,000 trips which averages to 56 trips per month per student or about 14.5% of the pass holders are heavy users. Overall, the results showed that grade 12 students use the transit pass more frequently than grade 9 students, which is expected since grade 12 students are older and research has shown that independent mobility increases with age (Bierkam & Nordtomme, 2014).

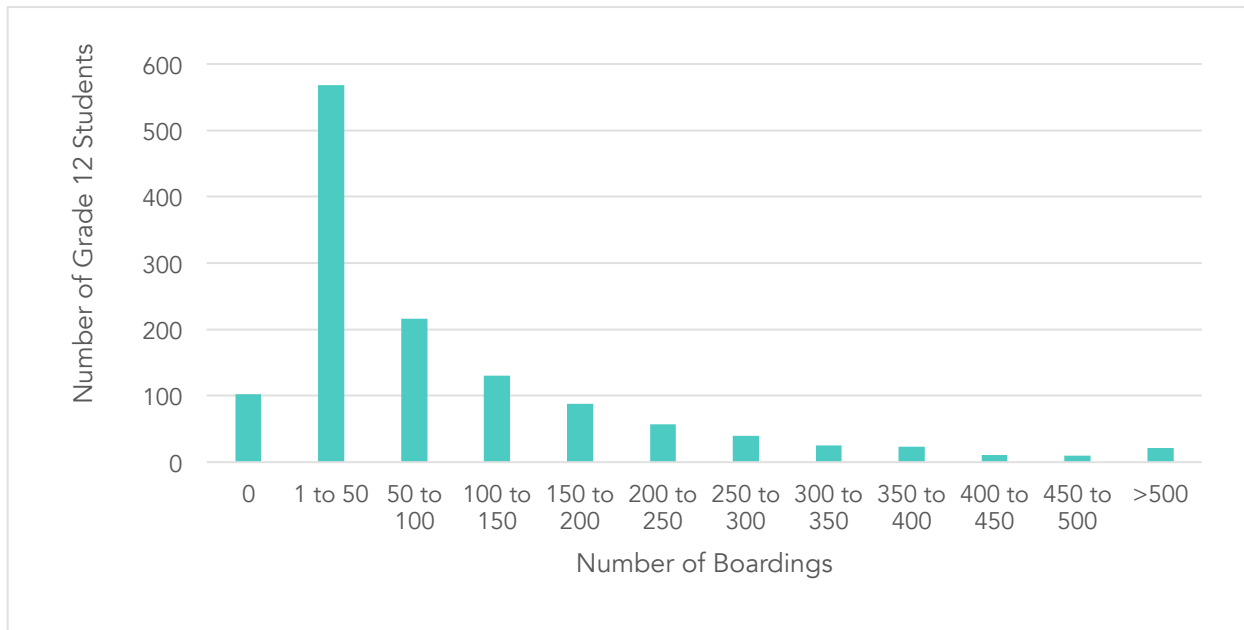


Figure 4-2: Distribution of grade 12 boardings for the period of January 2016 – February 2017.

To determine if there was a statistical difference in the number of boardings per student between grade 9 and grade 12 groups, a Wilcoxon-Mann-Whitney test was conducted. Based on Figure 4-2, the distribution of boardings was skewed to the left and requires a nonparametric test. The Wilcoxon-Mann-Whitney test is a non-parametric test that can be used to compare two independent samples and does not require the assumption of a normal distribution (De Veaux et al., 2012). In order to apply the Wilcoxon-Mann-Whitney test, the data should be verified to meet the following assumptions and conditions (De Veaux et al., 2012):

- a) Independence Assumption: The data in each group must be collected independently. To the best of the author’s knowledge, the participants in each grade had no interaction with each other and were independent with regards to their travel choices, therefore the assumption of independence is reasonable.
- b) Randomization Condition: The data collected from Kingston Transit should be a representative random sample of that group. In our case, students volunteered at random to register for the free transit pass program and their number of boardings were recorded for the data set, therefore this assumption is reasonable.
- c) Independent Groups Assumption: The two groups must be independent of each other. Since the grade 9 students were likely to have different travel patterns compared to grade 12 students and that all students volunteered at random for the pass program, this assumption is reasonable.
- d) Ordinal Data Condition: The data should be ordinal in nature. In this case, the number of boardings was quantitative data, which was ranked and reduced to an ordinal scale.

Based on the assumptions and conditions mentioned previously, the data were analyzed using a Wilcoxon-Mann-Whitney test based on an alpha of 0.05. The data analysis software module provided by Microsoft Excel was used. The results are shown in Table 4-1 below.

*Table 4-1: Results of the Wilcoxon-Mann-Whitney test between the grade 9 and grade 12 boardings.*

	<b>Grade 12</b>	<b>Grade 9</b>
<b>N = Sample Size</b>	N1 = 1204	N2 = 1187
<b>R = Sum of Ranks</b>	R1=1,678,418	R2 =1,145,627
<b>U Stat = <math>N1*N2 + [(N1* (N1 +1)) / 2] - R1</math></b>	476,140	
<b>Mean = <math>N1 * N2 / 2</math></b>	714,574	
<b>Standard Deviation</b>	16878.29	
<b>Z Score (0.05 alpha)</b>	- 14.12	
<b>Z Critical</b>	- 1.64	

Based on the results, the Z Score of -14.12 is less than the Z Critical value of -1.64, meaning that the result is statistically significant. There is a 95% confidence level that there is a difference in the number of boardings between the two groups for a one-tailed test.

Another analysis was conducted to understand how the ridership trends changed with seasons, since it is less desirable to wait for transit in winter months. The expectation is that students will be affected by colder weather and ridership will decline in the winter months of the academic year. In Figure 4-3, the monthly ridership for all four groups is shown from September to February.

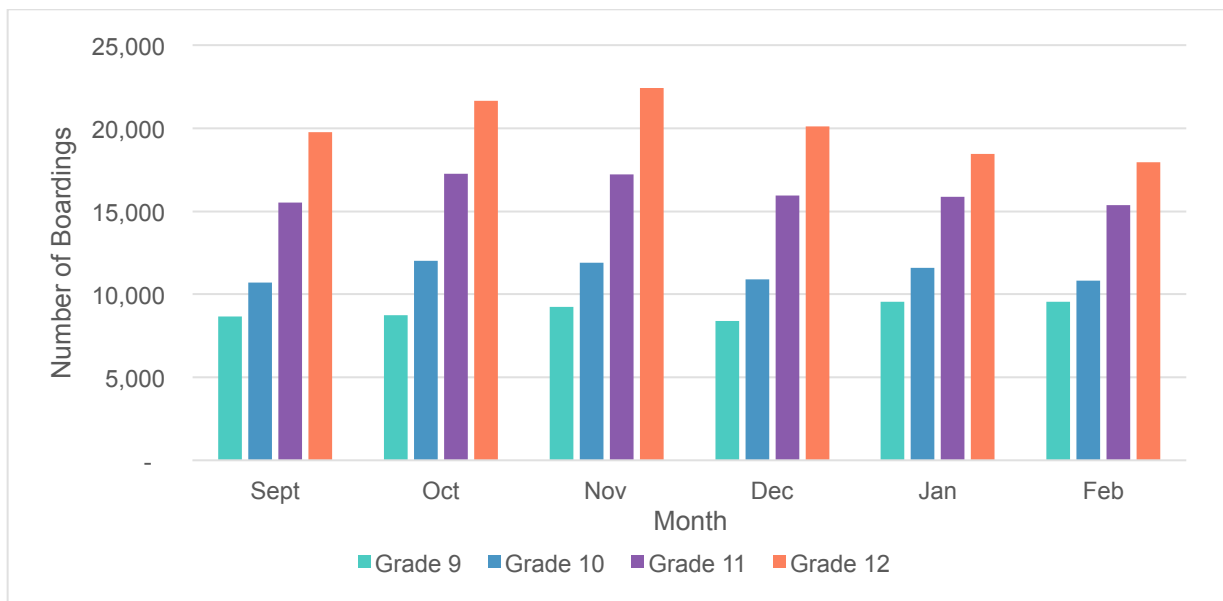


Figure 4-3: Transit Boardings over a monthly trend from September 2016 to February 2017.

For grade 9 students, there were a reported 8,663 trips made in September 2016 and it grew approximately 10% by February 2017. The gradual increase in ridership suggests that the travel behaviour for grade 9 students were unaffected by the colder winter months. In other words, as young students become more comfortable with using transit, they tend to use public transit even when the weather became colder. In comparison, the grade 12 students began with 19,750 trips made in September, peaked at 18% in November and then gradually declined to 17,964 trips in February. One possible explanation

for this 20% decline is grade 12 students are more affected by the cold weather in the winter months. Although grade 12 students made 57% more trips than grade 9 students in September 2016, the data suggest that grade 12 students tend to be less inclined to take transit as the weather got colder from December to February.

Nevertheless, it is clear that grade 12 students are the heaviest transit users at about three times as many total boardings as compared to grade 9 students on any given month of the year. For instance, during the month of November, a grade 12 transit pass holder averaged 17 trips while a grade 9 transit pass holder made six trips. Moreover, the trend shows an increase in the number of boardings among the grades, which implies that as students get older, their independent mobility improves and they become more frequent users of public transit.

## **4.2 Understanding Transit Trip Purpose**

Based on previous free transit pass programs, there is evidence that access to free transit enables pass holders to accomplish more than school trips (Tukker, 2016). Therefore, the question this section addresses is whether or not the availability of the transit pass allows students to complete trips by transit other than school trips. To test this, an analysis was conducted to determine the proportion of trips that occur in travel periods consistent with the start and end times of school, and comparing that activity to other periods, including weekends. School trips refer to the journeys between home and school, during hours that coincide with the beginning and end of the scheduled school day. The Kingston Transit ridership data were used to count the number of trips meeting these criteria. The average start time for school is between 7:00am and 8:00am, and the end time for school is around 2:00pm and 3:00pm. Figure 4-4 presents the percent of total trips over each hour of the day.

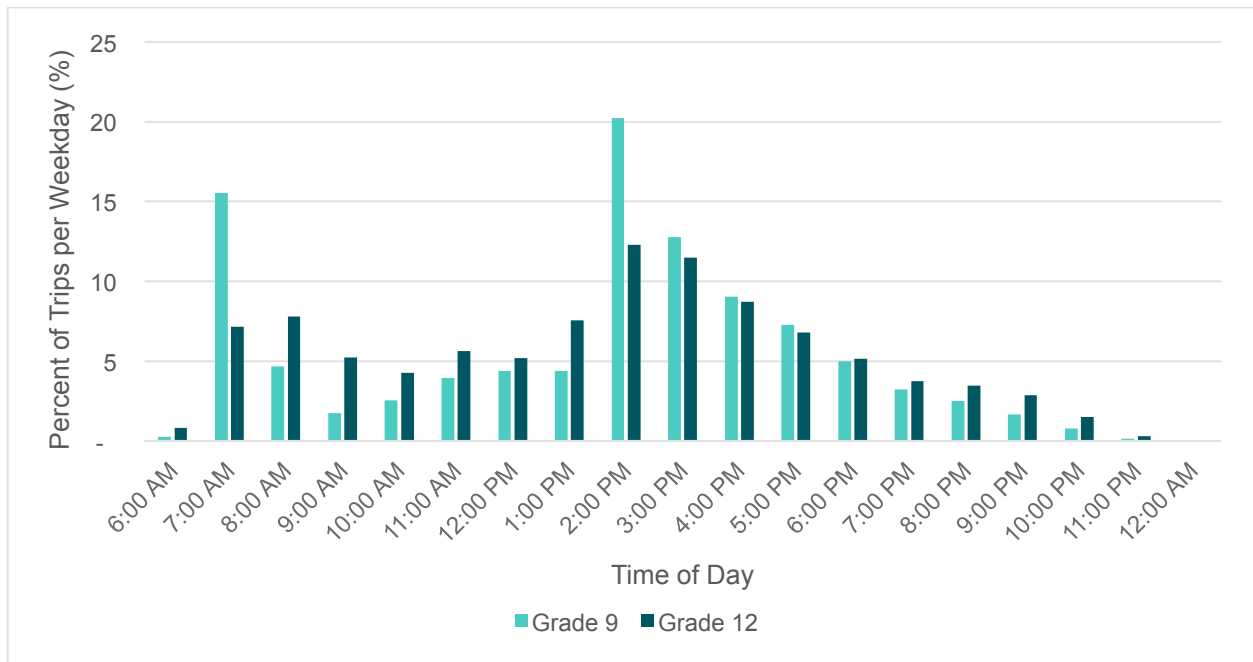


Figure 4-4: Distribution of grade 9 and 12 ridership for the period of January 2016 – February 2017.

Figure 4-4 above revealed that 16% of grade 9 student trips were made between 7:00am and 8:00pm, and 20% were made from 2:00pm to 3:00pm. This would suggest that approximately 36% of trips were made for school trips during weekdays. The data indicate that 64% of observed grade 9 trips are not school trips. Collectively, 22% of trips are made between 8:00am and 2:00pm, which is during school hours. This could occur because it includes weekdays that are non-school days such as holidays or professional activity days during the six-month span. It is seen that the number of trips after 3 pm declines, suggesting that students may have extra-curricular events after school and use their transit pass to go home since there are no school buses after 3:00pm.

It is clear that both the grade 9 and grade 12 student data showed two significant ridership peaks during the weekday. The morning ridership peak is split between 7:00am and 9:00am, with 14% of trips combined, which could be caused by a free period, known as a ‘spear’, in their morning schedule. The highest ridership peak of 12% was also from 2:00pm to 3:00pm during the day and gradually decreases for the remainder of the day. However, the results showed more activity for grade 12 than grade 9

students after 6:00 pm, which is consistent with grade 12 students having more flexibility to travel by transit after school hours.

When the data for the entire week are analyzed, approximately 15% of all trips or over 67,000 boardings made between September to February occurred on weekends as shown in Figure 4-5. This further supports the hypothesis that the transit pass program is used for more than just school trips. It is evident that students are using their transit pass for a diverse set of activities on weekends when school is not in session. The travel pass clearly offers utility benefits that are beyond traveling to and from school.

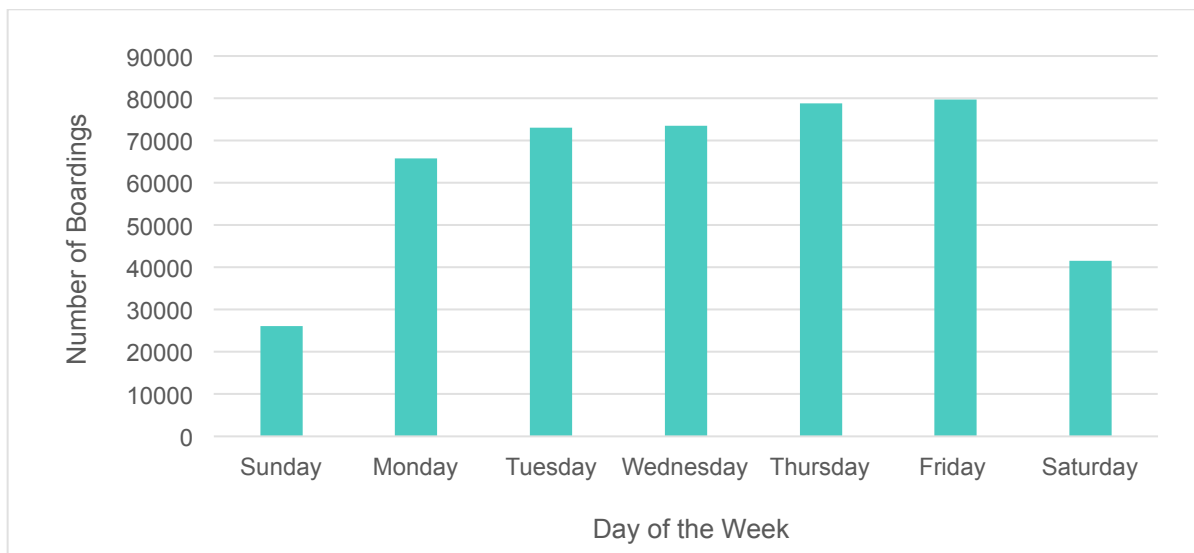


Figure 4-5: Distribution of grade 9 and 12 ridership for the period of January 2016 – February 2017.

### 4.3 GIS Visualization of Trip Origins and Destinations

The purpose of this section is to take a spatial approach to determine if the transit pass allows students to complete more than just school trips. The expectation is that the transit pass program allows students to travel to locations other than school or residential areas, using the pass for leisure activities (Bjerkkan & Nordtomme, 2014). To test this notion, geographic information systems were used to visualize the students' main boarding points within the city. Geographic information systems (GIS) are a



tool often used in to support decision-making for transit route planning because it allows users to identify spatial relationships (Horner & Grubestic, 2001). If the spatial analysis shows boarding locations away from high schools, then there is spatial evidence that the pass is being used for more purposes than primarily school trips.

To develop this visualization, a base map was created using publicly shared information from the City of Kingston Data Catalogue (2017). The base map included the transit routes, road network, Kingston municipal boundary, high school locations and Ontario water-bodies obtained from the Data Catalogue (City of Kingston, 2017). Furthermore, all Kingston high school locations were manually imported as geographical points layered on top of the base map and identified as red markings in Figure 4-6. In the next step, the same aggregated ridership data were imported into GIS. The total boardings in the six month period (September 2016 – February 2017) were aggregated into a 200 metre by 200 metre grid and displayed as a heat map using graduated classes 0-30, 30-60, 60-120 of total boardings in the study period. Figure 4-5 provides the output of the GIS mapping as well as a 1000 metre buffer around high school locations within Kingston. The 1000 metre buffer represents a 10 to 15-minute walking radius from each high school.

Surprisingly, two of the three largest boarding points were Cataraqui Centre and downtown Princess Street, which are major points of interest but not near the high schools. These locations are very prominent destinations for students. At the same time, the third largest boarding is the Kingston Centre, which is located at the center of Kingston near one of the high schools, the Loyalist Collegiate and Vocational Institute.

To further understand trip purpose, the total boardings were disaggregated into weekend and weekday boardings. These data are shown in Figures 4-7 and 4-8. The weekend boardings further emphasize the importance of retail shopping areas as origins for student travel. It is evident that students are traveling by transit to shopping destinations.

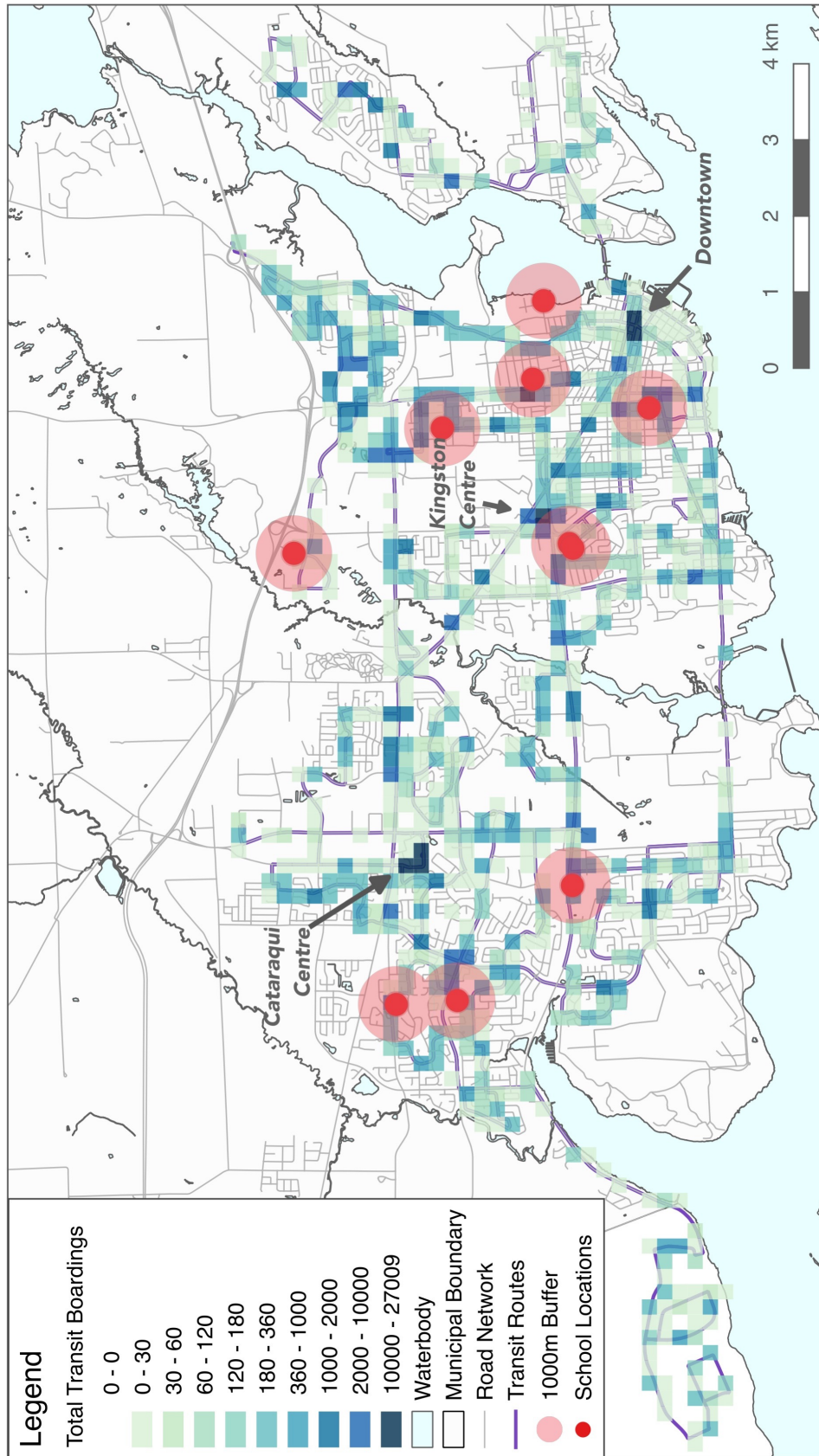


Figure 4-6. GIS Visualization of total transit boarding from September 2016 to February 2017.

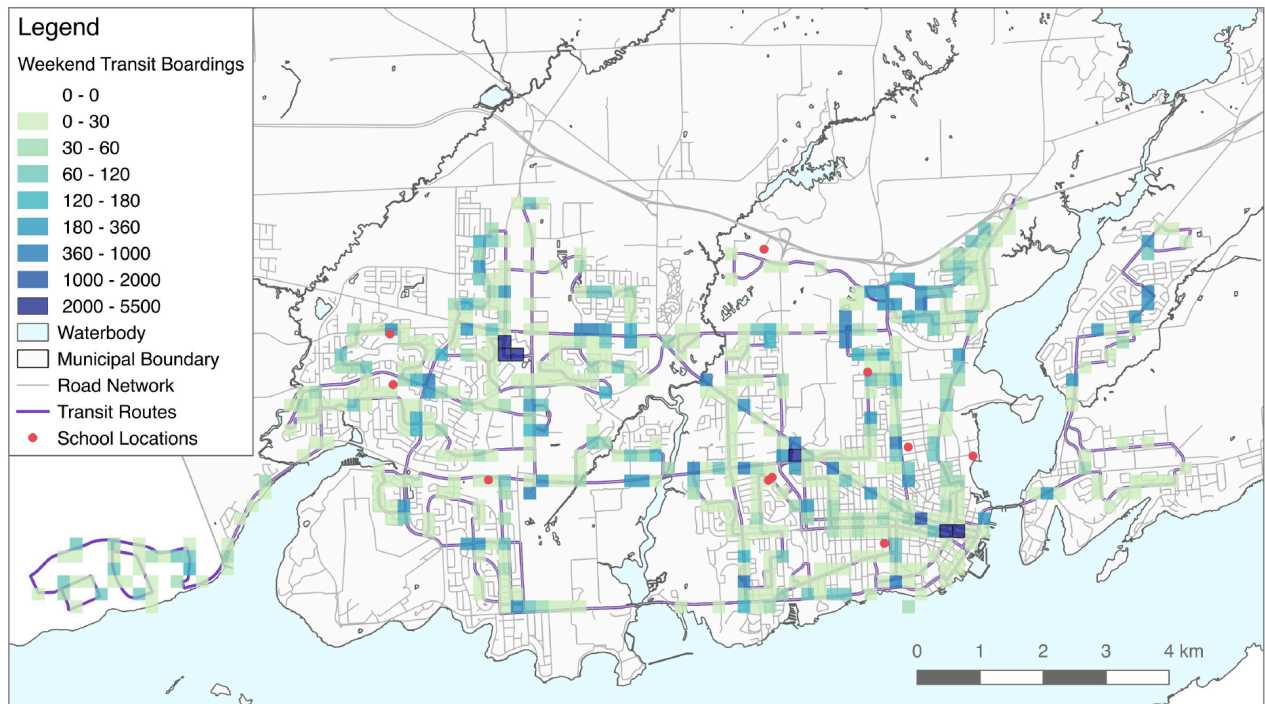


Figure 4-7: GIS Visualization of total transit boardings on weekends (only Saturday & Sunday).

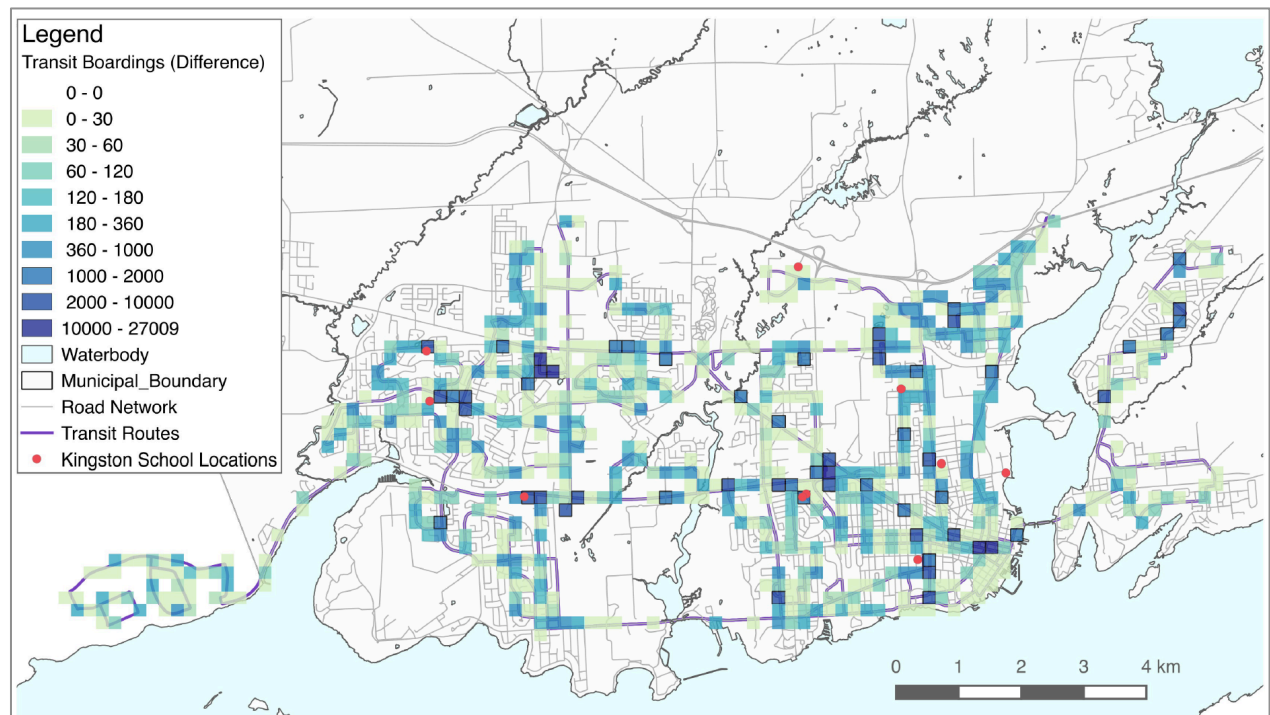


Figure 4-8: GIS Visualization of total transit boardings on weekdays (Monday – Friday).

For improved resolution, the 2D graphic image was converted into a 3D image using a plugin tool in GIS. Figure 4-9 displays a relative projection of the number of boardings within each 200 metre square grid. This figure provides a perspective projection looking northward from Lake Ontario and visually shows the distribution of boardings throughout the city. It is evident that there are three major boarding centres coloured in dark navy that surpass beyond other areas; Cataraqui Centre, downtown along Princess Street and Kingston Centre. There are also a relatively large number of boardings arising from a location on Division Street and Stephen Street next to Regiopolis-Notre Dame Catholic High School near Downtown. Other prominent locations are Queen’s University, Kingston Frontenac Public Library, Gardiners Town Centre and the intersection of Taylor Kidd Blvd and Bayridge Dr where two schools are located. With visualization images such as Figure 4-9, local municipalities will be better able to target transit improvements for students. Overall, this spatial analysis indicates that the majority of student boardings were not location near high schools and provides evidence that students are using their transit pass for other non-school related activities.

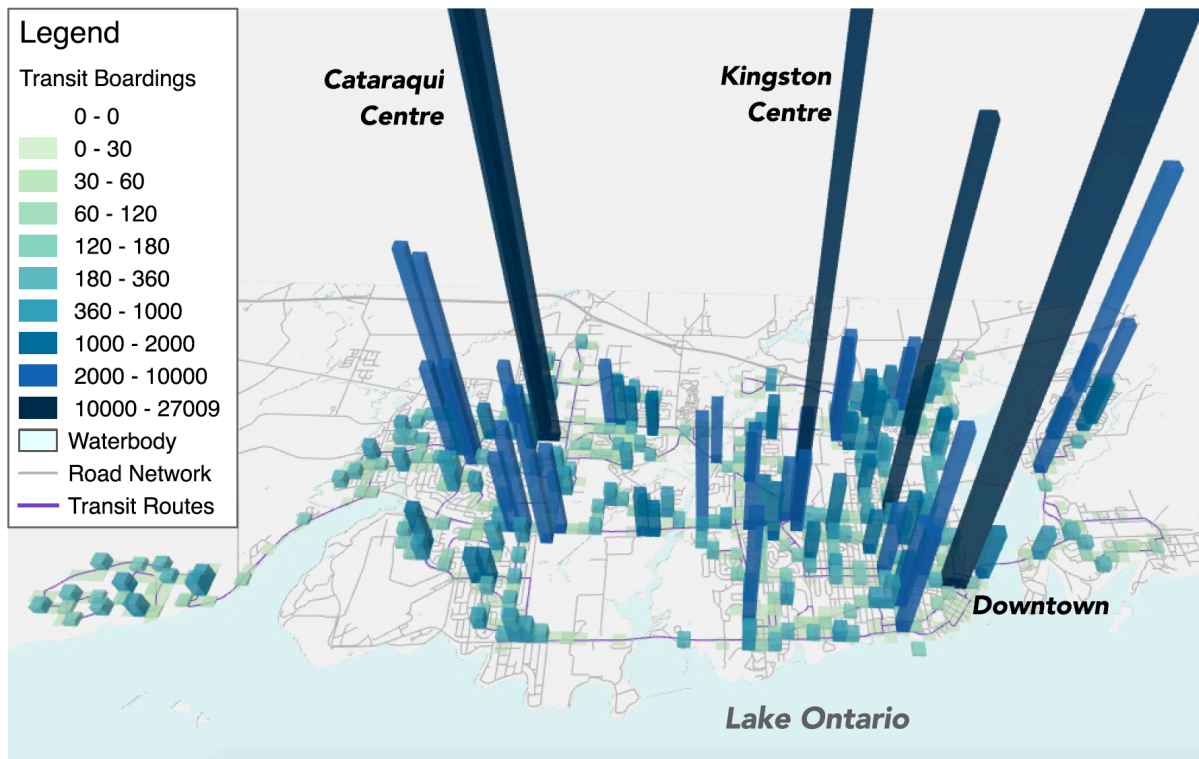


Figure 4-9: Three-dimensional GIS visualization of transit boardings.

## **4.4 Grade 12 Non-PSE Graduate Survey**

In 2015, Kingston provided free transit passes to graduating grade 12 students not pursuing post-secondary education. To avoid confusion, this small group of students will be referred to as “Non-PSE G12” in the following discussion. These new transit passes had a unique identifier which allowed the city to track ridership for the period between July and December 2016. In this section, the results of the Non-PSE G12 student survey will be presented together with their ridership data. Although this is recognized as a small, limited sample, it can still provide some insight on economic mobility. Since this sample self-reported as not attending post-secondary education, the focus of this survey is to understand if public transit has a positive impact on providing employment opportunities.

This study aims to test three hypotheses:

- (1) Grade 12 students will continue to use public transit after they graduate when they have access to free public transit.
- (2) Graduating high school students derive mobility benefits from having access to a free transit pass.
- (3) The complimentary transit pass enables students to pursue multiple activities that are beyond school related.

### **4.4.1 Ridership Data**

To address the first hypothesis, anonymous ridership data were collected and shared by Kingston Transit on the transit passes issued to the Non-PSE G12 participants. Appendix A.2 provides a set of typical data for this group. The expectation is that students would continue to use public transit after they graduate because they have had four years of prior experience with the system to make them more accustomed and familiar to using public transit.

At the end of the 2015-2016 academic year, a total of 201 transit passes were issued with unique identification card numbers and a total of 4926 boardings were recorded between July and December 2016. Although 201 transit passes were distributed to Non-PSE G12 participants, only 52 passes had boardings recorded. The remainder of this section will focus on the results of those 52 participants.

The data revealed that approximately 40% of those Non-PSE G12 participants made over 100 transit boardings during the program time period, as shown in Figure 4-10. Surprisingly, there were some students who made more than 400 individual transit trips during the six-month period. The average ridership level for Non-PSE G12 participants was 95 trips per person. In comparison, the average ridership level for Non-PSE G12 participants was 95 trips per person. In comparison, the average ridership for grade 12 students during the 2015-2016 academic year was 102 trips per person that had recorded boardings. Also, the grade 12 students during high school participated in 7% more trips on average compared to graduated grade 12 students. Overall, the ridership trends showed that the Non-PSE G12 students continued to use transit after they graduated high school and their travel patterns remained consistent with those students during the academic year.

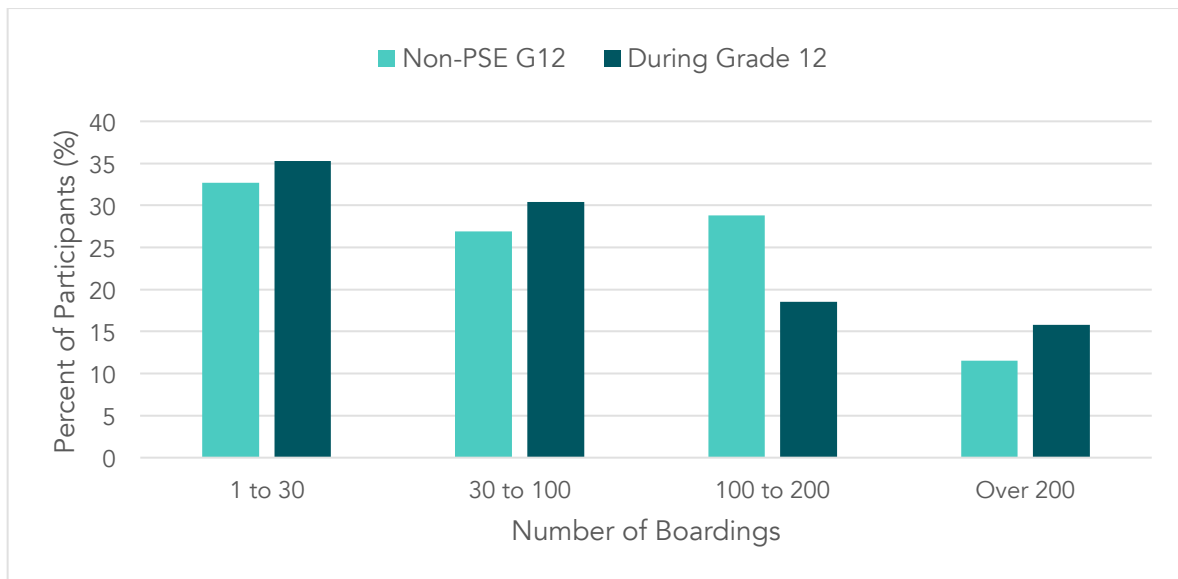


Figure 4-10: The percent of transit boardings made by 52 Non-PSE G12 participants from July to December 2016 and grade 12 students during the school year from September 2016 to February 2017.

Figure 4-11 presents the percent of boardings made for each weekday between the Non-PSE G12 participants and grade 12 students during the school year. The ridership trends for Non-PSE G12 show an increase during the weekdays compared to the weekends. The highest percent of boardings were made on Tuesdays with 18.47%. However, the average weekday boardings on Saturdays was a reported 50%, which suggests that the transit pass is also being used for non-work related activities. In comparison, during the school year, the grade 12 students have a fairly equal distribution of ridership throughout the week, including weekends.

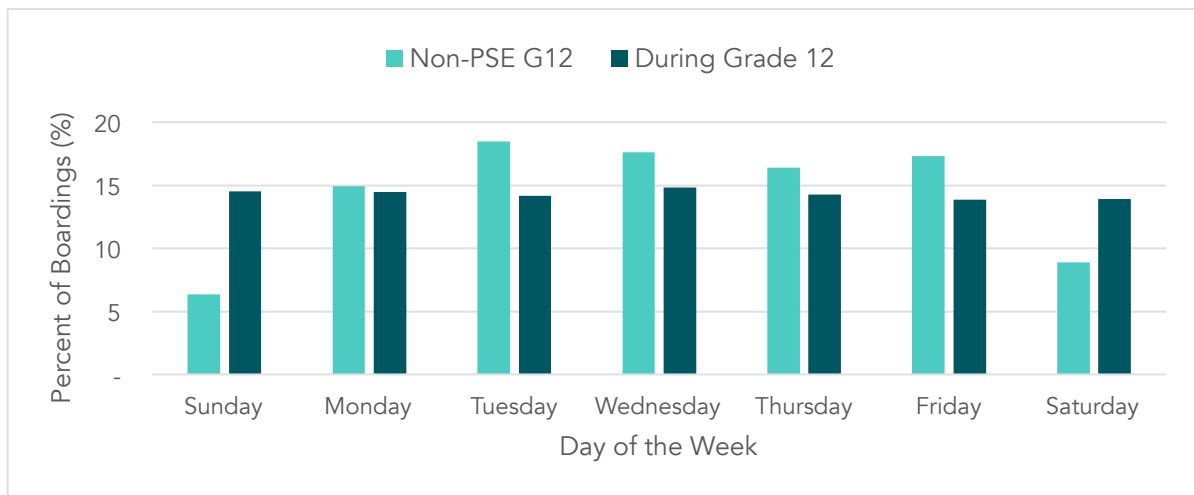


Figure 4-11: Percent of boardings during the weekday made by Non-PSE G12 participants from July to December 2016 and grade 12 students during the school year from September 2016 to February 2017.

Figure 4-12 shows the percent of boardings by month from the start of the Non-PSE G12 program (1<sup>st</sup> month was July 2016) and the start of the grade 12 academic year (1<sup>st</sup> month was September 2016). For Non-PSE G12 participants, a total of 976 boardings were recorded in the month of July, which is approximately 18 trips per participant. By December 2016, the numbers decline slightly by 6%. In comparison, grade 12 students while in school recorded over 19,700 boardings in month of September, which translates to approximately 16 trips per participant. By February 2017, the grade 12 student ridership declined by 11%, which is almost twice the amount compared to Non-PSE G12.

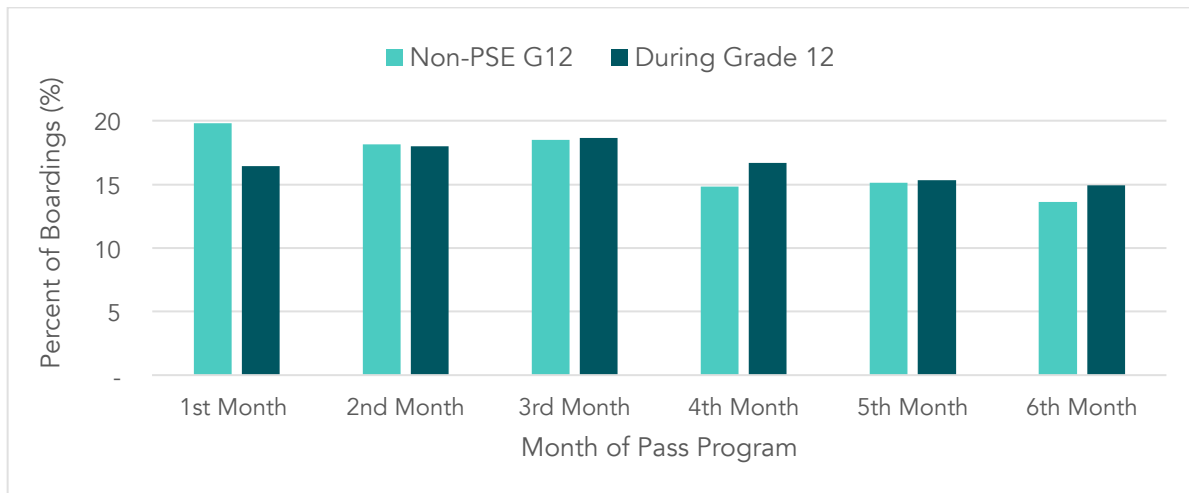


Figure 4-12: Percent of boardings by month made by Non-PSE G12 participants from July to December 2016 and grade 12 students during the academic school year from September 2016 to February 2017.

In summary, the data revealed that students continue to use the transit pass well after they graduate high school, provided they are given the opportunity to extend their complimentary access. Therefore, the results here support the first hypothesis that grade 12 students will continue to use transit after they graduate when provided with a free transit pass. The next section will explore the sample survey results of this participant group to better understand the motivations for using the pass.

#### 4.4.2 Sample Demographics

Since the “Non-PSE G12” participant group were not planning to attend post-secondary education, this would suggest that the sub-population is not as strong academically or perhaps, already in an occupation. The expectation is that students in “Non-PSE G12” would likely be employed or seeking employment (as opposed to education), have lower than average income, live in households with fewer drivers than the population as whole, and generally have less access to vehicles than others in their age group. To test this, participants were asked a series of questions to better understand the demographics of this sample group.



A total of 29 surveys were collected from the Non-PSE G12 group but only 20 were complete. The survey sample consisted of 11 females and nine males from eight different high schools in Kingston. Furthermore, 21% of the sample self-report with disabilities. With respect to employment status, 40% were looking for work, 35% worked part-time, 15% were unemployed and 10% reported full time employment. In Figure 4-13, the proportion of their estimated annual household income range is presented, which are at relatively low incomes. In terms of driver's licence ownership, half of the sample reported they did not have a licence, 30% had a G1 licence and 20% had a class G2 licence. According to Figure 4-14, the proportion of students with frequent access to their household's automobile almost equals to those with limited access. Overall, these observations support the previous expectation that this subpopulation are mainly employed or looking for employment and are from lower-income households that generally have less access to an automobile. Therefore, these observations suggest that the Non-PSE G12 group would likely have a higher propensity to use transit than the average student population.

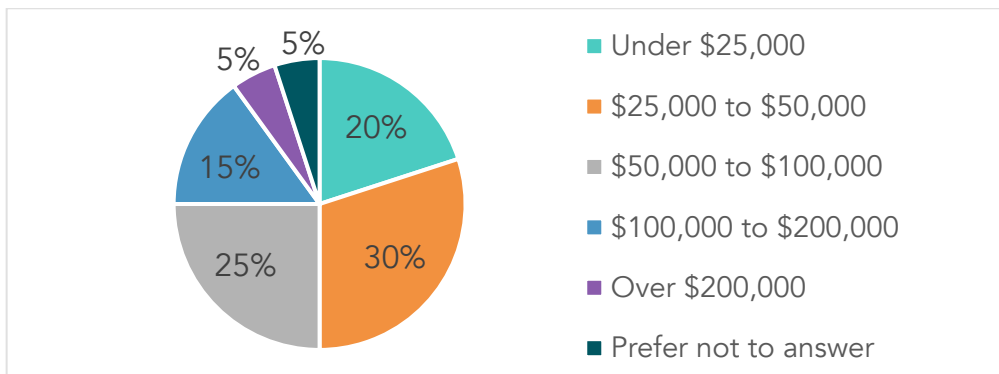


Figure 4-13: Estimated annual household income range.

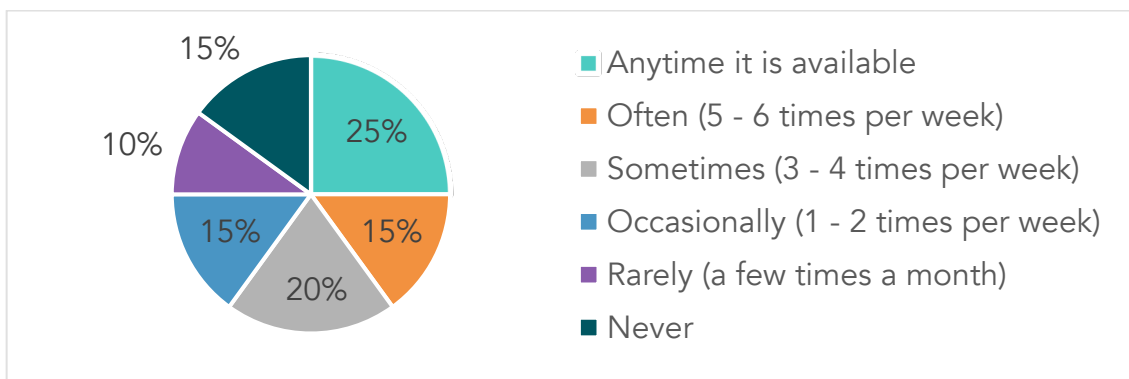


Figure 4-14: Distribution of how often the sample has access to an automobile.

### 4.4.3 Transportation Options

The survey asked participants a series of questions to better understand their travel behaviour. The expectation is that students would use transit more often than other modes because it helps maintain employment opportunities that are farther away, while saving costs on travel (McDonald et al., 2004). To evaluate the validity of this assumption, participants were asked, “on average, how often do you travel by different modes?” to determine their frequency to use transit, walk, bike and drive. The responses available were ‘everyday’, ‘often: 5 to 6 times a week’, ‘sometimes: 3 to 4 times a week’, ‘occasionally: 1 to 2 times a week’, ‘rarely: few times a month’, ‘never’ and ‘weather dependent’.

As shown in Table 4-2, the predominant modes of transportation for ‘everyday’ were reported walking, followed by transit then biking. Some students ‘never’ travel by bike or automobile. The two students who responded that they never travel by automobile also reported that they did not have a licence and often use transit or bike every day. The ‘other’ mode provided by the surveys included school bus and skateboard.

*Table 4-2: Frequency of travel mode based on the number of respondents.*

<b>Mode</b>	Everyday	Often	Sometimes	Occasionally	Rarely	Never	Weather Dependent
Walk	6	1	4	4	3	0	0
Bike	4	0	1	2	4	7	0
Automobile	1	7	5	2	1	2	2
Transit	5	2	7	0	4	1	0
Other	1	0	1	0	3	1	1

An interesting characteristic of the transit users in Table 4-3 was also found in the survey results where all respondents who use transit ‘everyday’ tend to be employed and have household income levels in all categories except over \$200,000. This suggests that the transit pass is able to support the transportation needs for the employed, regardless of their income levels. Furthermore, over 71% of respondents who reported they use transit at least 3 times a week have a driver license. These students

have the ability to drive to their activities but continue to use public transit regardless. Under the “everyday” column, 4 out of 5 students use transit in spite of having other transportation options.

*Table 4-3: Number of participants that reported their employment status and transit ridership.*

<b>Transit Usage</b>	Employed	Looking for Work	Not Employed
Everyday	5	-	-
Often (5-6 times per week)	2	-	-
Sometimes (3 - 4 times per week)	2	4	1
Rarely (few times a month)	-	2	2
Never	-	1	-

#### **4.4.4 Household Activity Prioritization**

According to research, chauffeuring children to their destinations causes a financial burden on households in terms of time and vehicle related costs (Bullock, 2016). Households would likely save transportation costs if parents did not have to chauffeur their children to their activities, especially for the Non-PSE G12 group who have already graduated high school and are old enough to travel alone. Therefore, it is expected that households would not prioritize chauffeuring, or chaperoning, activities as more important than school or work activities due to the costs involved. To test this, participants were asked to rank a list of seven activities in order of their priority in their families’ travel schedule. Rank ‘1’ would be deemed highest priority, meaning that the activity would be the most important to accomplish; the activity ranked ‘7’ would be deemed the lowest priority activity that could be deferred to another day with more flexibility (Yeung, 2015).

In Figure 4-15, the distribution of ranks is presented for each activity type in the form of boxplots. A boxplot is a standardized way to display the distribution of data based on a five number summary: minimum, first quartile, median, third quartile, and maximum (De Veaux et al., 2012). The central rectangle spans the interquartile range from the first quartile to the third quartile. The segment

inside the rectangle shows the median and “whiskers” above and below the box show the locations of the minimum and maximum values (De Veaux et al, 2012).

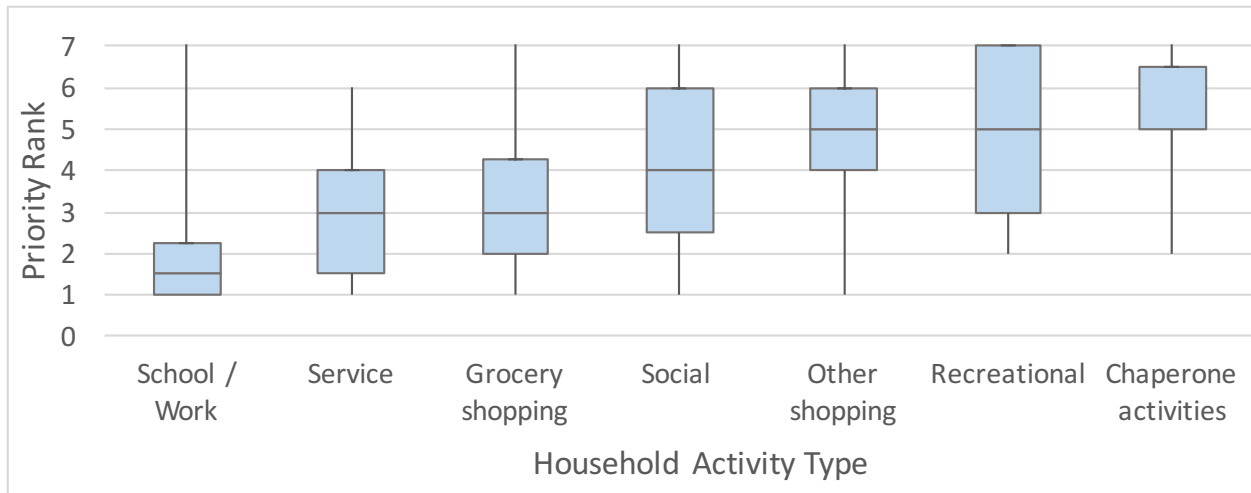


Figure 4-15: Priority of activity types boxplot.

From the diagram above, households consider school or work activities their first priority. Chaperone activities, in contrast, were ranked very low and as a result, considered as one of the least important activities. This suggests that household adults prefer not to spend time chaperoning their children to their activities as compared to other household activities.

Of the remaining activities, there was a wide range of priority ranks that reflects a variation of household preferences for different activity types. Although there were wide distributions and in some cases with similar medians, the box plots indicate that households tend to prioritize these activities in this order: school or work (being the highest), service, grocery shopping, social, other shopping, recreational and chaperone (being the lowest). With chaperoning being the lowest priority, this supports the expectation that the high school transit pass is highly important for students needing to travel independently.

### 4.4.5 Students' Activity

To test the second and third hypothesis for this section requires an exploration of how students can derive utility and benefit from the transit pass. The previous subsection highlighted the importance for young adults to travel independently since chaperone activities are not a high priority for households. The study conducted by Bullock et al. (2016), concluded that the estimated costs for parents chaperoning their children to school were approximately \$3 billion per year for vehicle-related expenses and \$240 million per year in terms of value of time lost. It is evident that chaperoning activities come at a cost, in both the value of time spent travelling and the expenses related to driving.

In this subsection, the focus is on how students' travel would be affected for each activity if they did not have a transit pass. A Likert scale is used with four options: not affected at all, some trips affected, most trips affects and trip no longer possible. Figure 4-16 provides results for one trip purpose; the data show the proportion of students' responses for how their travel would affect recreational activities. The results indicate that without the transit pass, about 75% of their trips would be negatively affected in some way. This is a significant portion of students' ability to have access to recreational activities.

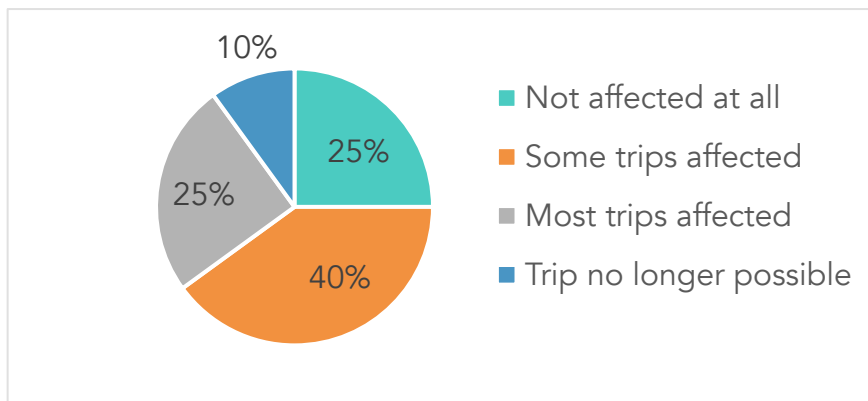


Figure 4-16: Results of how students' travel would be affected for recreational activities without a transit pass.

To minimize redundancy, Table 4-4 provides the summary of results for each activity for question #15. When summarized, the survey results reveal that 86% of social trips and 65% of school or work related trips would be affected if students did not have access to the transit pass. Clearly, the transit pass facilitates students’ activities across multiple domains such social, school, service, shopping, recreation and employment. Therefore, this supports the second and third hypotheses that the transit pass program provides a range of benefits and activity opportunities for young adults.

*Table 4-4: Percent of trips affected for each activity without access to a transit pass.*

<b>Activity</b>	<b>Trips Not Affected at All</b>	<b>Some Trips Affected</b>	<b>Most Trips Affected</b>	<b>Trip No Longer Possible</b>
Social	16%	53%	31%	0%
Recreation	25%	40%	25%	10%
School / Work	35%	35%	10%	20%
Grocery Shopping	40%	45%	15%	0%
Other Shopping	40%	35%	25%	0%
Service	50%	22%	28%	0%
Chaperone	55%	30%	10%	5%

#### **4.4.6 Summary of Non-PSE G12 Study**

At the end of the survey, students were asked if they would continue using public transit after their pass expired. Forty two percent responded yes. Some students responded ‘maybe depending on’ reasons such as cost and their location of residence at that time. This survey provided valuable insight into the ridership trends and priorities that the transit pass enabled for graduating high school students for the 2015-2016 academic year. As a result, the pilot program encouraged students to continue to use public transit after they graduate. It is evident that if there was another opportunity to provide complimentary access to young adults after secondary school, this would encourage regular ridership.

## **4.5 Grade 9 and 12 Student Survey**

To understand how different factors influence independent mobility, another questionnaire was developed for grade 9 and 12 students, one for each grade. This section presents the results of the grade 9 and 12 surveys that were administered in the 2016-2017 academic year. In total, 53 grade 9 students and 71 grade 12 students were surveyed from three different schools in Kingston. In particular, the results of the survey provide insights into the relationship between:

- (1) The student's birth order and the average number of independent trips.
- (2) Family size and composition and the number of activities the students participate in.
- (3) Gender and the propensity to make independent trips.
- (4) The number of activities completed by students in grade 9 (with the pass) and the number of activities completed in grade 8 (without the pass).
- (5) The total number of activities completed by students who identify as transit users and those students who identify as non-transit users and transit users.

The following subsections will address each of these factors in corresponding order and be summarized at the end.

### **4.5.1 Birth Order**

Prior research (Lehmann et al., 2016) indicates that parents are stricter with their child household rules with their first-born child, which consequently constrains their independent mobility. Further, Lehmann argues that parents are unable to provide their later-born children with the same level of cognitive support as they do with their first-born such that parents are more relaxed on what they might deem as non-essential rearing needs for their later-born children. As a result, younger children are often provided with more freedom or flexibility compared to their elder siblings (Lehmann et al., 2016). Hypothesis (1) suggests that student's birth order would likely influence the average number of trips of a

transit pass holder. The expectation is that first-born children would experience greater restrictions on independent travel than their younger siblings. In the current study, the activity rates of first-born and later-born children are compared.

To test hypothesis (1), question #7 of the survey (Appendix C) asked participants what their birth order was in their family. The purpose of this question was to identify the respondent's birth order that could then be linked travel activity. The results of birth order question, as shown in Figure 4-17, revealed that the largest group of respondents were first born, 39 participants, while the smallest group sample were middle children. The sample provides reasonable diversity of birth orders to allow further comparisons.

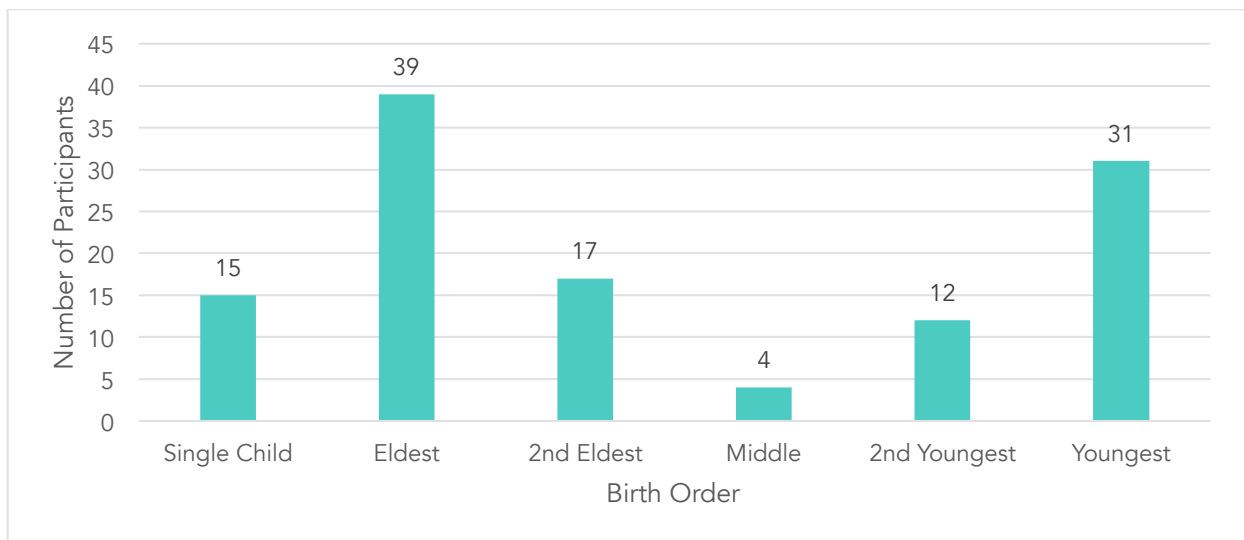


Figure 4-17: Participants categorized by birth order.

To compare the number of activities between each birth order group, the results of the previous question were linked to question #11, which asked participants to list different the activities in which they are engaged currently and were engaged in the previous year. (The latter data are analyzed in section 4.5.4.) The question also asked students to indicate their regular mode of travel for all of the activities reported. Eight possible modes of transportation were identified: school bus, walking, transit bus,



bicycle, carpool, dropped off by car, drove themselves and taxi. Assumptions were made regarding whether each mode identified by the students represented independent travel (i.e. without chaperone). Trips made by walking, transit bus, bicycle, driving themselves and taxi were defined as independent trips; trips made by school bus, carpool and dropped off by car were assumed to be non-independent trips, i.e., with a chaperone.

Using these data, it was possible to analyze both the total number and the number of activities accessed by independent travel as a function of birth order. Figure 4-18 illustrates the average number of activities and the average number of independent trips by birth order group. As expected, the first born and single child groups participate in fewer activities and fewer independent trips on average compared to later-born children in all cases except with middle children. This result could be due to the low sample rate of four participants in the middle child group. On average, the eldest group participates in 3.07 activities and 2.8 independent trips. In comparison, the second eldest group participates on average 3.80 activities and 4.3 independent trips. Furthermore, the single and eldest child groups have a fewer amount of independent trips compared to their number of activities, which suggests that they often travel chaperoned to activities.

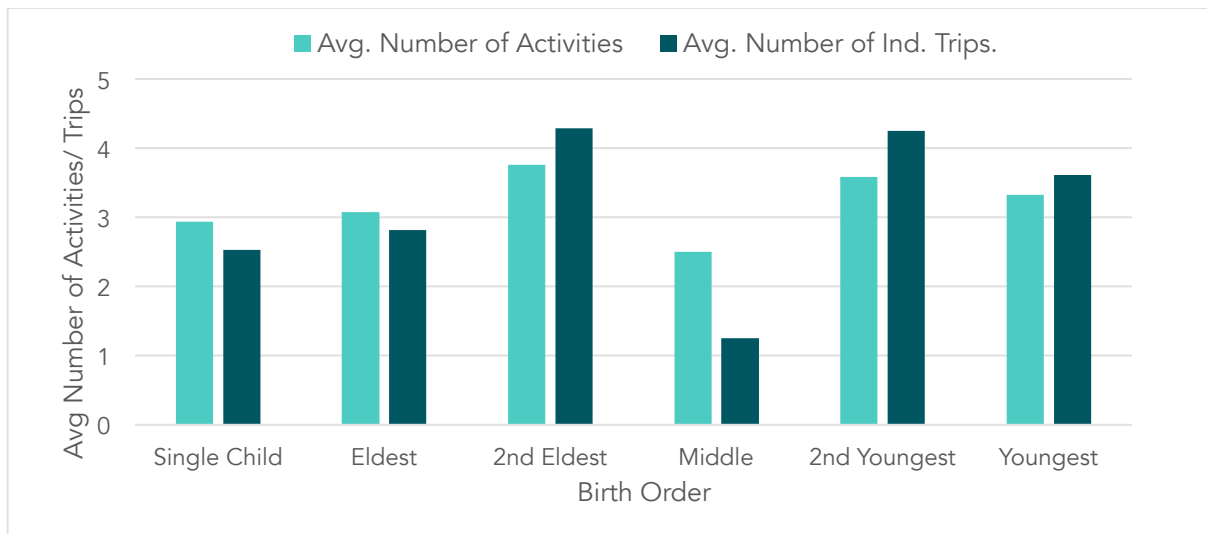


Figure 4-18: Average number of activities and independent trips according to birth order.

An analysis was conducted to determine if there was a statistical difference in the average number of activities between the birth order groups. Since there are more than two groups being compared, implementing multiple *t*-tests on multiple pairs of means would be inappropriate because the repetition of *t*-tests may repeatedly add multiple chance of error, which may result in a larger alpha error level (Kim, 2014). To compare more than two group means, the more appropriate method would be to conduct the one-way analysis of variance (ANOVA) (Kim, 2014). The ANOVA method “assesses the relative size of the variance among group means (between group variance) compared to the average variance within groups (within group variance)” (Kim, 2014, p.74). A single factor ANOVA test was conducted on the number of activities between each birth order group using Microsoft Excel and based on an alpha of 0.05. The results shown in Table 4-5 below indicate that the differences between numbers of activities between birth order groups are not statistically significant. A possible explanation for this is the small sample size for some of the groups including: middle (4), second youngest (12) and single child (15) groups. A larger sample size, by conducting more surveys, may improve the results of the ANOVA test.

Table 4-5: Results of a single-factor ANOVA test on the number of activities between birth order groups.

### SUMMARY

<b>Groups</b>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
<b>Single Child</b>	15	44	2.933	1.924
<b>Eldest</b>	39	120	3.077	1.652
<b>Second Eldest</b>	17	64	3.765	2.191
<b>Middle</b>	4	10	2.500	5.667
<b>Second Youngest</b>	12	43	3.583	2.629
<b>Youngest</b>	31	103	3.323	1.759

### ANOVA

<b>Source of Variation</b>	<i>SS</i>	<i>Degrees of Freedom</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
<b>Between Groups</b>	10.921	5.000	2.184	1.095	0.367	2.295
<b>Within Groups</b>	223.452	112.000	1.995			

Although it may not be statistically significant, the data does not refute the hypothesis that birth order is a related factor that influences travel behaviour. This study supports previous literature that first-born children are more likely to be chaperoned to activities compared to later-born children on average. Also, later-born children would tend to travel independently using various modes including walking, transit bus, bicycle, driving themselves and taxi as compared to first-born children due to increased mobility freedom.

### 4.5.2 Family Size and Composition

Based on literature, findings have suggested that children living in single-parent households participate in a lower amount of activities compared to dual-parent households (Bjerkan & Nodtomme, 2014). One explanation is that two-parent households are able to split household duties and child supervision between two people versus one person to uphold all the family responsibilities in one-parent households. Therefore, it is expected that children in single-parent households, especially large sized households, would participate in fewer activities compared to two-parent households with small family sizes. Hypothesis (2) suggests that family size and composition is an influencing factor on the number of independent trips.

To test hypothesis (2), question #4 of the grade 9 survey was used, which asked participants how many people lived within the same household and their relationship to the participant. Table 4-6 is a pivot table of the number of participants based on household size and number of guardians. From the survey sample, approximately 74% of households had at least two guardians at home and 26% of households had one guardian at home.

Table 4-6: Number of participants based on Household size and Number of Guardians.

		Household Size				
		1	2	3	4	5
Number of Guardians	1 Guardian	0	18	6	4	2
	2+Guardians	0	0	19	40	30

For all participants in each category, the number of independent trips was calculated and then averaged using the same methodology as the previous subsection. To summarize, the number of trips made by walking, transit bus, bicycle, self-driving and taxi during their current year of school (grade 9 and 12) was averaged for each household category. The results are shown in Figure 4-19, which shows that single children of single parent households make more independent trips on average. In contrast, the number of independent trips made by single children of two parent households is below the average of the entire sample. The data suggests that single parent households allow their children to make more trips unaccompanied by a parent. As a result of this analysis, the data support the hypothesis (2) that household composition is a factor that influences travel behaviour. However, these findings go against the expectation that children of single-parent households make fewer independent trips (Bjerkhan & Nodtomme, 2014). A possible reason for this occurrence is that single-parent households arguably do not have enough time to accompany their children to their activities, and as a result, children are left to travel by themselves more often.

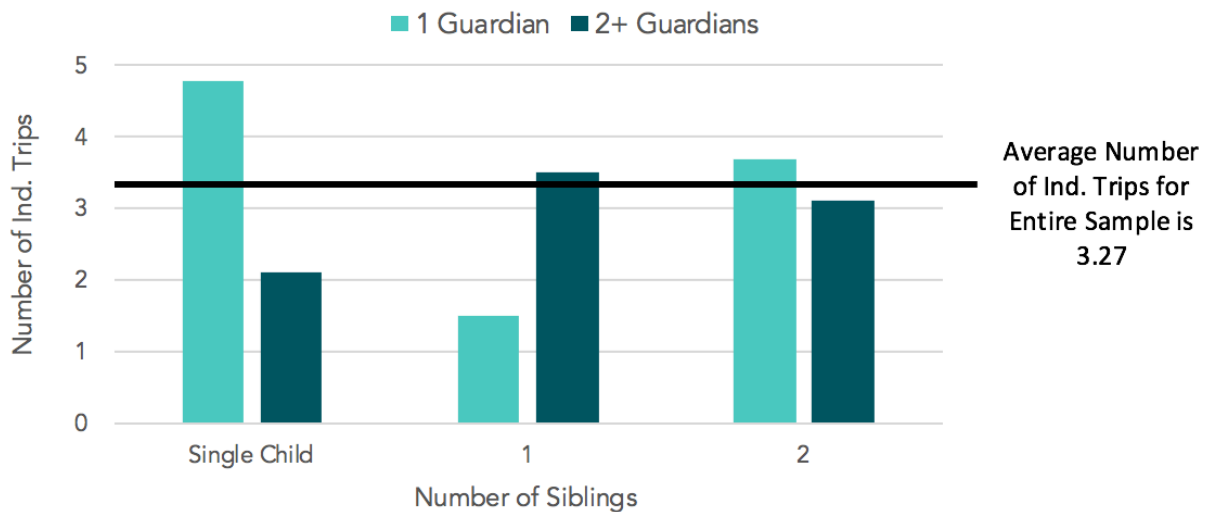


Figure 4-19: Average number of independent trips based on household size and number of guardians.

### 4.5.3 Gender

Previous research by McDonald (2012) indicated that young females have less travel independence compared to young males, since males are often perceived as less vulnerable to crime. Studies have found that boys cycle to and from school independently three times more than females (McDonald, 2012). The expectation in this research is that males will likely participate in more independent trips than females.

To address the hypothesis (3), gender was explored as factor that may influence independent travel. To test this hypothesis, the question “what is your gender” was asked to participants. The results of the question showed that the survey consisted of 56% female, 42% male and 2% reported other. Table 4-7 provides the counts for gender, activities and independent trips. The results revealed that female students participate in 3.3 activities on average compared to male students with 3.1 activities. Furthermore, female students participate on average 3.1 independent trips, while male students’ participant on average 3.2 independent trips. The ‘other’ sample was too small to be used for comparison.

*Table 4-7: Number of activities and independent trips by gender.*

<b>GENDER</b>	<b>MALE</b>	<b>FEMALE</b>	<b>OTHER</b>
<b>Count</b>	52	68	3
<b>Number of Activities</b>	160	223	11
<b>Number of Independent Trips</b>	168	211	16

To determine if there is a difference between the means for males and females, a one-way analysis of variance (ANOVA) was performed. The ANOVA test is usually used to determine if there are any statistically significant differences between the means of two or more independent groups (De Veaux et al., 2012). In order to be allowed to apply an ANOVA, the data should be verified to meet the following assumptions and conditions (De Veaux et al., 2012):

- a) Independence Assumption: The groups must be independent of each other. In this case, the participants did not have interaction with each other and the sample was selected at random in each school, therefore the assumption of independence is reasonable.
- b) Randomization Condition: The data collected from the surveys from each group should be a representative random sample of that group. Since the data came from a random sample of students, this assumption is reasonable.
- c) Similar Variance Condition: The variances of the treatment groups should be equal, due to the dependence of the  $F$ -test on within-group variances. The  $F$ -test compares the differences between the means of the groups with the variation within the groups (De Veaux et al., 2012). To compare the variation between the groups, side-by-side boxplots were created and shown in Figure 4-20. For the number of activities, the boxplots show very similar spreads between genders, which satisfies this condition. For the number of independent trips, the boxplots show a similar spread, however the average amount of activities for females' students is slightly higher compared to males. Since box heights are quite similar and the range is similar, neither plot shows a violation of the condition.

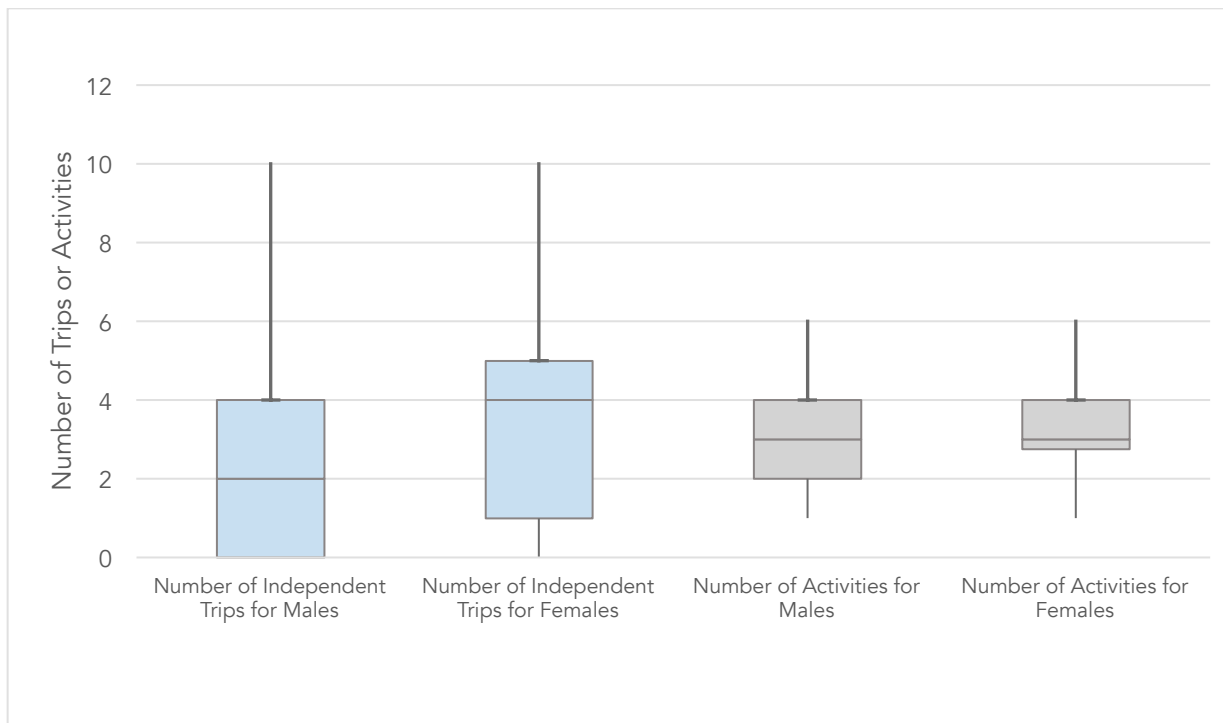


Figure 4-20: Boxplots of the number of independent trips and activities for each gender.

Based on the assumptions and conditions mentioned previously, the data were analyzed using a single-factor ANOVA test between males and females based on an alpha of 0.05. The data analysis software module provided by Microsoft Excel was used and the results are shown in Table 4-8 for independent trips, and Table 4-9 for the number of activities between genders.

*Table 4-8: Results of a Single ANOVA test for independent trips between males and females.*

### SUMMARY

<b>Groups</b>	<b>Count</b>	<b>Sum</b>	<b>Average</b>	<b>Variance</b>
<b>Number of Activities for Males</b>	52	160	3.08	2.43
<b>Number of activities for Females</b>	68	223	3.28	1.76

### ANOVA

<b>Source of Variation</b>	<b>SS</b>	<b>df</b>	<b>MS</b>	<b>F</b>	<b>P-value</b>	<b>F crit</b>
<b>Between Groups</b>	1.21	1	1.21	0.59	0.44	3.92
<b>Within Groups</b>	241.38	118	2.05			

*Table 4-9: Results of a Single ANOVA test for the number of activities between males and females.*

### SUMMARY

<b>Groups</b>	<b>Count</b>	<b>Sum</b>	<b>Average</b>	<b>Variance</b>
<b>Number of Activities for Males</b>	52	168	3.23	10.06
<b>Number of activities for Females</b>	68	211	3.10	6.00

### ANOVA

<b>Source of Variation</b>	<b>SS</b>	<b>df</b>	<b>MS</b>	<b>F</b>	<b>P-value</b>	<b>F crit</b>
<b>Between Groups</b>	0.48	1	0.48	0.06	0.80	3.92
<b>Within Groups</b>	915.51	118	7.76			

The results of the ANOVA test reveal that there was no statistical difference between males and females in terms of the number of independent trips or the number of activities because the  $p$ -value is greater than 0.05 in both cases. This finding did not support previous research that gender influenced independent travel behaviour and therefore, hypothesis (4) was rejected. There was no conclusive evidence from this set of data that gender played a role in the student's ability to take independent trips. Further tests should be conducted with a higher sampling population to confirm this finding.

#### **4.5.4 Grade 9 Student Survey**

The majority of Canadian cities do not offer free transit pass programs to high school student due to the investment costs (Vincent et al., 2014). However, providing free transit passes to students can have a multitude of benefits including social activities, participate in extracurricular activities and opportunities to seek employment without having to rely on their parents as chaperones (Goodman et al., 2013). The expectation is that providing free transit passes will encourage students to participate in more activities because it enables them to travel independently. To evaluate if the transit pass enables pass-holders to conduct more activities, it is possible to compare the number of activities of grade 9 students to their previous year activities when they did not have access to the transit pass. Hypothesis (4) states that there will be a difference between the number of activities conducted grade 9 compared to grade 8. The expectation is that grade 9 students would have a higher amount of activities compared to grade 8 students due to the introduction of the transit pass program.

To test hypothesis (4), the grade 9 survey was used to compare the students' current level of activities with their grade 8 year. Specifically, question #10 of the grade 9 survey, shown in Appendix B, was used to count each activity listed under the grade 8 column and compared with the responses under the grade 9 column. If the activity had a mode listed under the grade 8 column, it was assumed that the student participated in that activity for that year. If the activity did not have mode, then it was assumed



that the student did not participate in that activity. The same approach was applied to the grade 9 column. Figure 4-21 provides the overall student responses showing clearly that they were involved in a wide range of activities.

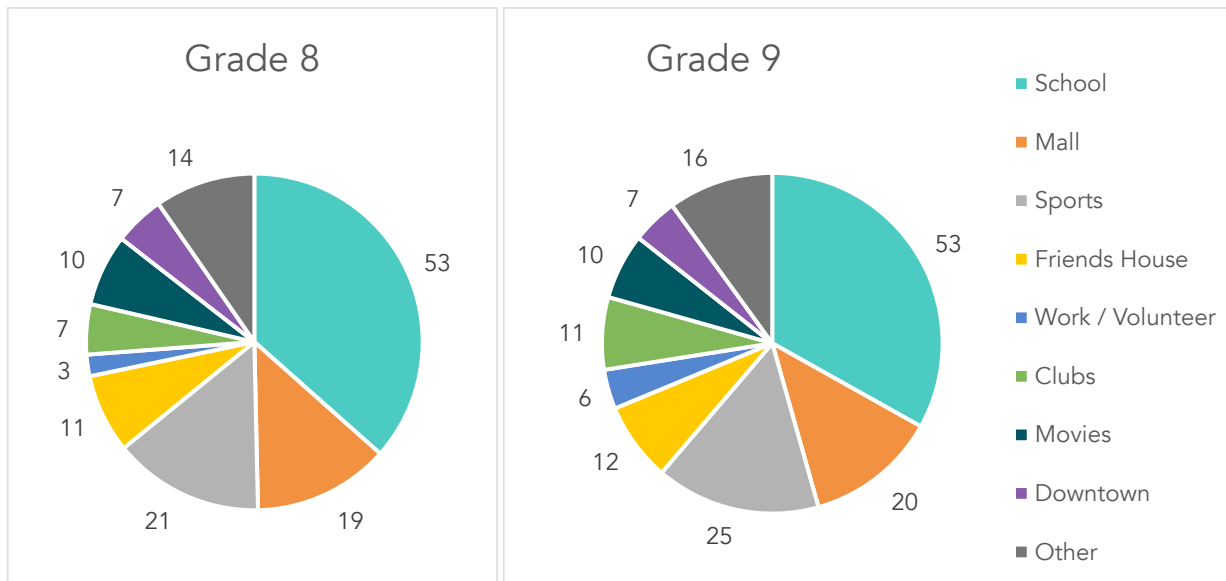


Figure 4-21: Frequency of activities indicated by participants between grade 8 and grade 9.

The results of question #10 revealed that 53 students participated in 145 activities in grade 8 and 160 activities in grade 9, which averaged 2.7 and 3.02 activities, respectively. This provides evidence that on average, grade 9 students are able to participate in 10% more activities than the previous year, which supports the fourth hypothesis. Furthermore, the survey data also revealed that the diversity of activities increased from grade 8 to grade 9. There were eight additional types of activities that grade 9 students attended in high school compared to grade 8: basketball, bowling club, field hockey, ‘improv’ / comedy club, Queens University, rowing, swimming and tutoring. It is possible that the transit pass program not only enables students to participate in more activities, but also allows them to join new activities not previously possible.

### 4.5.5 Transit and Non-Transit Users

For the majority of high school students, independent transportation mode choices are limited to walking, cycling and riding transit. Of those three options, transit often provides a much more convenient and rapid means of travel. Hypothesis (5) states that there is a difference in the number of activities between non-transit users and transit users who have access to free public transit. The expectation is that there would be a higher number of activities for high school transit users compared non-transit users.

To test hypothesis (5), the number of activities completed by students who self-identified as transit users and non-transit users was compared. It is important to note again that while all the grade 9 students were provided with free transit passes, the grade 8 students had to purchase them. Accordingly, the survey was only offered to grade 9 students to compare their current activities with the previous school year. To distinguish between the transit and non-transit user groups, question #10 in the grade 9 survey was used. If the participant wrote “a transit mode” as a method of transport under the grade 9 column for any activity listed, they were counted as a transit-user. The purpose was to determine if there was a difference in the number of activities from grade 8 to grade 9 for the two groups. For example, if a student participated in two activities in grade 8, but then three activities in grade 9, the number of activities increased by one. Figure 4-22 below provides the results of all 53 grade 9 participants.

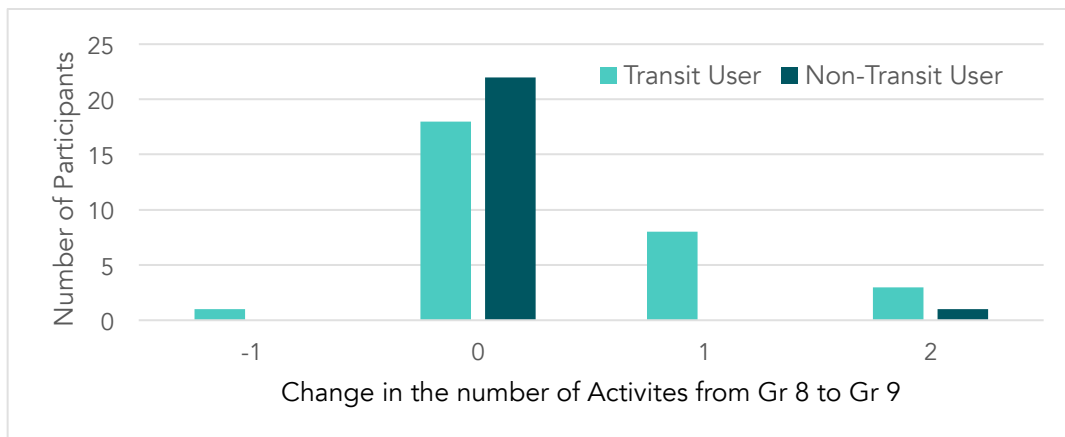


Figure 4-22: The change in activities from grade 8 to grade 9 between transit users and non-transit users.

The results indicate that on average, transit users tend to participate in more new activities compared to non-transit users for both grades. Moreover, 22% of grade 9 students participated in more activities compared to their previous year and 66% of those participants were transit users. It is possible that the transit pass facilitated new activities.

The next set of analysis was to determine if there was a statistical difference in the number of activities between non-transit and transit users when they transitioned from grade 8 to grade 9. An ANOVA test was conducted, using data in Figure 4-22 and an alpha value of 0.05, and results are shown in Tables 4-10 and 4-11, for grade 8 and 9, respectively.

Table 4-10: Results of a Single ANOVA test for the number of activities between non-transit and transit uses in grade 8.

### SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
<b>Non-Transit Users in Grade 8</b>	23	53	2.30	2.04
<b>Transit Users in Grade 8</b>	30	94	3.13	2.40

### ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
<b>Between Groups</b>	8.95	1	8.95	3.991	0.051	4.030
<b>Within Groups</b>	114.34	51	2.24			

Table 4-11: Results of a Single ANOVA test for the number of activities between Non-Transit Users and Transit Users in grade 9.

### SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
<b>Non-Transit in Grade 9</b>	22	55	2.50	2.36
<b>Transit User in Grade 9</b>	30	107	3.57	1.77

### ANOVA

<b>ANOVA</b>						
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
<b>Between Groups</b>	14.44	1	14.44	7.16	0.01	4.03

At grade 10, as shown in Table 4-8, the  $p$ -value of greater than 0.05, which implied that there is no statistical difference between transit users and non-transit users in the number of activities made. At grade 9, however, Table 4-11 shows that the  $p$ -value for the ANOVA test was 0.01 at a 95% confidence level. This indicates that there is a statistical difference in the number of activities between transit users and non-transit users. Meaning, for the transit user group, the transit pass program could be an influencing factor causing the pass holders to participate in more activities. Based on these results, hypothesis (5) is supported.

#### **4.5.6 Grade 9 & 12 Survey Qualitative Questions**

At the end of the survey, all 124 participants were asked if they would continue to use the high school transit pass after it expires. Surprisingly, 66% of this sample responded yes. Here is a subset of responses of their reasons why they would continue using transit:

*“It gives me the freedom to travel whenever and wherever without a car”*

*“It gives me an opportunity to travel quickly without my parents”*

*“My parents are not always free to drive me and I really enjoy public transit”*

*“It’s convenient in unplanned situations”*

*“I have no other way to get to places quickly”*

*“Now I know how the system works. It is better for the environment and easier”*

*“In the winter months, it’s too cold to walk”*

*“It’s the only way I usually can get around”*

It is clear that the transit pass program has provided a range of benefits for high school students and enables their ability to travel independently without their parents. In some cases, public transit is the only method of convenient, affordable transportation available to the students. Furthermore, question #19 in the survey asks if there are trips that students are unable to make without transit and the majority of responses are “school, mall, downtown area and friends’ house”. It is evident that many students rely on the transit pass program for many activities and continue to use it for their independent trips.

## 4.6 Parent Survey

In the above analysis, several assumptions have been made and tested regarding parental willingness to allow children to travel independently. In this section, empirical responses are used to understand whether parental restrictions have an impact on youth independent mobility. Based on the literature, parents often restrict their children from travelling alone due to fears related to road safety and potential harm from strangers (Carver et al., 2012). However, parental constraints often are varied in terms of their child's age and travel mode (Veitch et al., 2008). The purpose of this section is to provide insight regarding what parents perceive as acceptable level of independence for their children and the common constraints for independent travel in the case of Kingston. The parental / guardian survey, shown in Appendix E, provides another perspective about the impact of the transit pass program. A total of 29 households completed the survey with 90% of the respondents employed.

First, it is important to identify the reasons why guardians do not feel comfortable allowing their child to travel alone on transit. Here is a subset of answers from the open-ended question (#13) that specifically asks guardians what they are most concerned about when allowing their child to travel on transit alone:

*“Chance of getting lost, missing bus, having to wait alone at bus stop with strangers, [and] traffic dangers in busy areas.”*

*“Unless they have done it before, they are not familiar with the route.”*

*“I am comfortable with her travelling alone, as long as it is not later at night.”*

*“I would allow my oldest child to travel alone on city transit but would prefer to have her travel with a friend. I am not comfortable allowing my younger children to travel alone yet.”*

*“Comfortable for my son who is 14 but not for my daughter who is 12. Would be ok if she was with a friend who was savvy. Safety in numbers.”*

Understandably, guardians are protective for their children's safety when they are travelling alone, especially for their younger children. The potential danger of children getting lost on transit routes or approaching strangers are identified and commonly expressed amongst the respondents. However,

there are some circumstances where guardians feel more comfortable to allow their children to travel independently, such as the age of their child and with whom they are travelling. Question #7 asked guardians under what circumstances would they allow their child to travel alone and the results are shown in Figure 4-23.

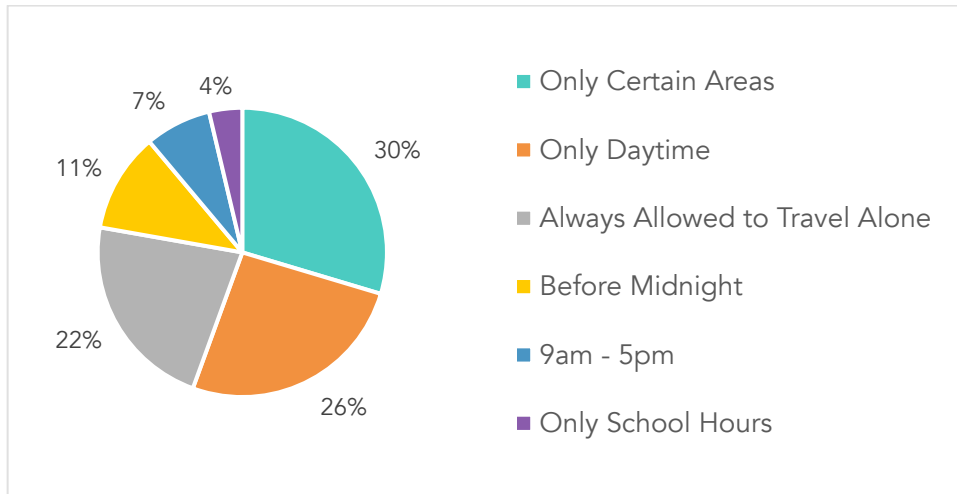


Figure 4-23: Circumstances when guardians feel comfortable allowing child to travel alone.

The purpose of question #7 was to understand if guardians had spatial or temporal constraints for their child's travel independence. The results reveal that 30% of parents have spatial constraints. Half of the responses included shopping centers and the other 50% of responses included only the neighbourhood, school or friends house.

Furthermore, 22% of respondents reported that they always allowed their children to travel alone. Of those respondents, 50% had children in high school. Whereas, 26% of guardians responded that their children were only allowed to travel during the daytime. Of those respondents, all had children only between grades 7 and 9. This suggests that age is a possible constraint placed by parents. As expected, as children grow older, parents are more willing to allow them to travel independently with fewer constraints.

## 4.6.1 Age Constraint

As mentioned previously, age is often a barrier for students to be allowed to travel alone, since parents tend to be more protective of their younger children (Veitch et al., 2008). A study conducted in Australia reported that 50% of children aged 10 to 12 were able to travel greater than 1000m from home, compared to 25% of children aged 8 to 9. The expectation is that as students become older, parents are more willing to allow their child to travel farther distances (Veitch et al. 2008). To test the theory that age is a constraint on travel independence, results from questions #7, #8, #9 and #10 from the survey were explored. These questions asked guardians at what age would they feel comfortable allowing their child to make an independent trip in their neighbourhood (Question #7), to downtown Kingston (Question #8), to Queen’s University (Question #9) and to Kingston Centre (Question #10). The results of these questions were averaged and shown in Table 4-12.

*Table 4-12: Average age that guardian would allow child to travel independently based on location.*

	<b>Your Neighbourhood</b>	<b>Downtown Kingston</b>	<b>Queen's University</b>	<b>Kingston Centre</b>
<b>Total Sample (29)</b>	9.85	12.93	13.07	12.93
<b>Household Income Over \$100,000</b>	9.80	13.21	13.20	13.27
<b>Household Income Under \$100,000</b>	11.33	12.83	13.17	12.75
<b>Household with 2 Vehicles</b>	10.16	13.17	13.21	13.16
<b>Household with 1 Vehicle</b>	12.25	13.88	14.25	13.88

Amongst the entire sample of respondents, the average age that guardians felt comfortable allowing their child to travel independently is approximately 9.85 years old within their neighbourhood and 12.93 to Downtown Kingston. In fact, the data reveal that guardians will usually allow their children to travel alone within their neighbourhood at a much younger age than other locations in Kingston. This is possibly because of their familiarity within their neighbourhood and the reduced likelihood of their children getting lost.

Furthermore, the 29 respondents were divided into categories based on their household income level and the number of vehicles. On the basis of households with a higher income level, there was approximately a three-year difference between the neighbourhood level and downtown area. Whereas, for lower-income households, there was approximately a one-year difference in average age. This difference could be a result of a higher sense of better security in higher-income neighbourhoods that allow guardians to feel more comfortable to let their children travel alone. A similar pattern was shown between households with 2-vehicles in comparison with households with 1-vehicle. Regardless of household type, the evidence clearly supports the theory that age is a constraint for children to make independent trips around the city.

#### 4.6.2 Travelling Options

To explore other possible constraints on travel independence for children, question #12 of the survey asked respondents to rate their comfort level based on different travel options. The comfort level was selected based on a Likert scale where ‘very comfortable’ was considered a rank of ‘1’, ‘somewhat comfortable’ considered a rank of ‘3’ and ‘not comfortable’ was considered a rank of ‘5’. The results of question #12 are shown in Figure 4-24 below.

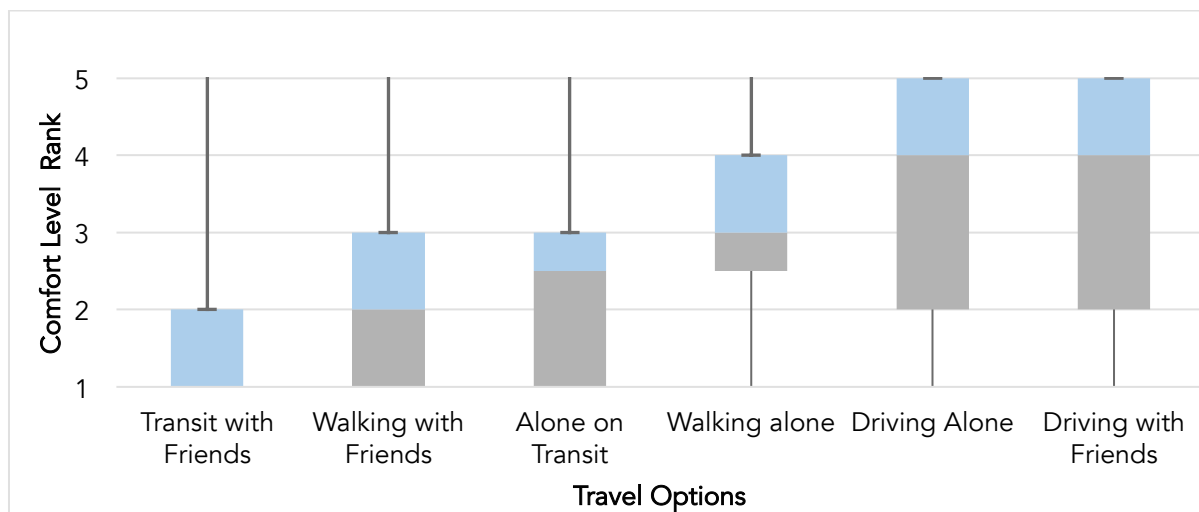


Figure 4-24: Result of question #12 of parent/guardian survey.



The results of the boxplots in Figure 4-24 reveal a large spread amongst respondents for all types of travel options. However, guardians typically felt more comfortable allowing their children to use public transit with their friends in comparison to the other travel options available. Interestingly, guardians on average ranked 1.9 for ‘transit with friends, while ‘driving with friends’ was ranked an average of 3.4. This suggests that guardians do not feel very comfortable having their children in a vehicle unchaperoned compared to riding transit unchaperoned.

Another interesting finding is that the average rank is lower when their child is travelling with a friend in any of the travel options. Although ‘driving alone’ and ‘driving with friends’ do not appear to be ranked differently, the average rank is slightly lower for ‘driving with friends’. This suggests that parents prefer to have their children travelling with others they know.

Table 4-13: Average rank for different travel options where rank ‘1’ is very comfortable and rank ‘5’ is not comfortable.

	<b>Walking alone</b>	<b>Walking with Friends</b>	<b>Alone on Transit</b>	<b>Transit with Friends</b>	<b>Driving Alone</b>	<b>Driving with Friends</b>
Average of Total Sample	2.89	2.16	2.35	1.87	3.43	3.41
Household Income Over \$100,000	3.23	2.38	2.69	<b>2.25</b>	3.11	3.50
Household Income Under \$100,000	2.75	2.00	2.09	<b>1.50</b>	3.55	3.18
Guardian is a Transit User	2.80	1.80	2.00	<b>1.20</b>	3.33	3.33
Guardian is a Non-Transit User	2.81	2.29	2.40	<b>2.08</b>	3.36	3.27

Table 4-13 above compares the average ranks amongst different household characteristics. Overall, there is does not appear to be a significant difference in comfort level between household incomes. All parents have equal concerns when on matters related to their children’s safety. Thus,

households feel ‘somewhat comfortable’ of allowing their child to travel alone or with friends, regardless of household income status.

However, it was also important to consider if the guardian himself / herself is a transit user, and if that factor would influence their comfort level in allowing their child to use transit independently. Question #11 asks if the respondent regularly uses public transit. If they selected ‘all weekdays’ or ‘everyday’, then the guardian would be considered a regular transit user. The results in Table 4-13 suggest that if the household guardian is a regular transit user, they tend to be ‘very comfortable’ allowing their children to travel with friends compared to non-transit guardian households.

### **4.6.3 Parent Survey Qualitative Questions**

The parent survey provided an insightful perspective to possible constraints and their level of comfort with respect to their child’s travel independence. Overall, parents had positive feedback with regards to the transit pass program. The following is list of quotes shared from the parents and guardians from an open-ended question that asked for their comments:

*“I think that the free transit pass for high school students is a wonderful idea! I do not mind my property tax dollars supporting this!”*

*“My other daughter is looking forward to getting to high school to get a bus pass and have more independence.”*

*“Our family schedule is difficult at times with 6 busy people, 2 vehicles and 4 jobs. We use public transit regularly.”*

*“I think it has been a great experience. My daughter has gained much independence and knowledge of her city and how to get places. It has helped our family, as there are times we didn't need to drive her places. She doesn't have a job but I feel now that she knows the bus system there aren't as many limitations on where to apply to a job, as she could find her way there using public transit. I think it is also great as it promotes public transit as an option these teens could use later in life.”*

*“The student transit pass is very helpful for our family. All of the kids use their transit pass to get around Kingston with their friends.”*

*“My 14 year old uses it ALL the time. It's WONDERFUL. Gives him more freedom and independence and takes the load off of us to "chauffeur" him around all the time.”*

*“The majority of public transit travel is for social reasons. I feel it's important that they learn the routes. Travel with friends makes it easier and safer. The pressure is off if the bus is late as compared to them having to make a practice at a certain time.”*

*“It's opened the opportunity for my children to be more independent without having to rely on us or our vehicles. It's a learning opportunity for them, and it means they have to be more responsible and attentive to the world around them. Both my children have taken the bus many times to locations with friends and alone. I'm entirely comfortable with them doing this. I used the bus at a much younger age than when mine started. As parents we need to trust a bit more, in our children their abilities and in our community to watch over them.”*

From the predominantly positive feedback on their experiences by the families, it is clear that the transit pass has encouraged young adults to travel independently and explore their city. The transit pass is allowing families to feel more reassured and confident that their children are able to travel in the city without being chaperoned. Although, parents and guardians may have some constraints on their children's travel behaviour, the majority are very pleased and highly supportive the transit pass program.

## 5.0 CONCLUSIONS

The focus of the current research is to determine how the provision of free transit passes has influenced the independent mobility of high school students. A review of literature demonstrated that there were various cities that have already implemented free transit pass programs; however, multiple limitations were identified and few had published their studies on how the pass program impacted independent mobility. Although Canadian universities have implemented transit pass programs for university students, there was only one other Canadian city that is known to have implemented free transit, Whitehorse, Yukon. In comparison, Kingston Transit has implemented a widespread transit program for the past five years, which can provide a valuable case study to other mid-sized municipalities.

To understand how the provision of free transit passes influenced independent mobility, this research undertook a number of analyses to answer the following research questions:

### **1. Are students using their free transit pass for activities beyond primarily school trips?**

Based on the Kingston Transit ridership data, the findings suggest that the travel pass clearly offers mobility benefits that are beyond traveling to and from school. The data indicated approximately 15% of all trips between September 2016 to February 2017 occurred on weekends, which provides evidence that students use the pass for discretionary trips. A GIS spatial analysis was conducted and confirmed that the majority of boardings were made in key city destinations and not near high schools: Cataraqui Centre, downtown along Princess Street and Kingston Centre. It was evident that retail-shopping areas were prominent origins for student travel. In other words, students are using their pass to travel by transit to shopping destinations.

## **2. Do transit pass holders derive mobility benefits from having access to a free transit pass?**

Yes, based on ridership data and survey information collected on the “Non-PSE G12” participant group, the findings indicated that access to the free transit pass enables mobility benefits that are non-school and non-work related. The survey results indicated that without access to the transit pass program, a significant proportion of trips would be impacted. The current data set shows 84% of social, 75% of recreational, 60% of shopping and 50% of service trips would be affected. Ten percent of participants reported that their recreational trips would no longer be possible without access to their transit pass. It was evident that the free transit pass facilitated student’s activities across multiple domains and that students would continue to use transit for a diverse range of activities after they graduate.

## **3. Do factors such as birth order, family size and composition, gender, access to free transit or regular transit use, influence travel independence and travel behaviour?**

Survey data supported previous research that that birth order is a factor that influences the propensity of making independent trips. First-born children are more likely to be chaperoned to activities compared to younger siblings.

Survey data indicated family size and composition are factors that influence the number of independent trips for youth. Contrary to the literature, children of single parent households in this study had a higher average number of independent trips compared to two-parent households. A speculative reason for this finding is that single-parent households do not have the resources to accompany their children to all of their activities, so children have to travel independently more often.

Based on an ANOVA test comparing differences in independent travel for males and females, the findings do not support that gender has any influence on independent travel behaviour. Although the literature indicates that males tend to have more independent mobility than females, this present survey work found no statistical difference in the number of independent trips or activities between genders. It is, however, noted that a larger sample size would provide more certainty.

For grade 9 students, the analysis conducted in this research compared the number of activities before and after they received the pass. Findings suggest that grade 9 students are able to participate in 10% more activities than the previous year, which indicates that the transit pass may have been a factor in improving independent mobility.

Similarly, this research compared the number of activities between transit users and non-transit users and found that the number of activities made for transit users was greater compared to non-transit users. An ANOVA test confirmed the finding at a 95% confidence level.

#### **4. What are the potential parental/guardian constraints on child mobility independence?**

Based on survey data, the findings suggest that age and travelling methods are potential constraints on child mobility independence. Regardless of household type, it is evident that parents have spatial constraints on their children and that the average age to travel independently in the neighbourhood was around 10 years old, but to travel father to Downtown Kingston, the average age reported was 13. Also, findings indicated that guardians typically felt more comfortable allowing their children to travel with a friend, especially on transit compared to other modes.

## **5.1 Limitations**

One of the main limitations of the research is related to the sampling process. All the participants in this research had access to the free transit pass in Kingston. No data were available for students who did not have the free transit pass, which could have been used as a control group. Therefore, the benefits of introducing a free transit pass program are difficult to quantify definitively. In order to accurately determine these benefits, a comprehensive before and after study would be required, or data from a control group. Despite this, a limited comparison was made using data provided by grade 9 students on their travel behaviour prior to obtaining the free transit pass in grade 8. The results of this analysis

showed that grade 9 students who use transit participate in more activities on average. This suggests that the free transit pass enables independent mobility. However, these effects could have also been influenced by other factors such as age (i.e. the students are older in grade 9) and memory recall (e.g. forgetting activities they participated in grade 8 but no longer participate in grade 9).

Another limitation comes from the sample size. During the analysis, some of the factors, such as gender, previously identified in literature were found not to be significant in this study. A more extensive study involving more participants would be beneficial. In particular, the Non-PSE G12 survey included 20 participants, which was inadequate to draw statistically significant conclusions.

Although the Non-PSE G12 survey and parent survey included income related questions, this information was not collected on the grade 9 and 12 survey due to policy restrictions imposed by the school boards. This limited the ability to study income related factors to independent mobility, which are commonly cited in literature as significant.

## **5.2 Future Research**

In addition to expanding the scope to address the limitations discussed previously, there are opportunities to expand this research to other communities. The research conducted in this study focused on a mid-sized Canadian city with only bus public transit. However, there are data available from a number of other cities that have implemented similar free transit pass programs including small-, mid-, and large-sized cities. By expanding the scope of this research to other locations, the effects of different transit modes (e.g. subways or light rail), location or population size could also be studied. An expanded scope would also allow other municipalities to better understand the implications of transit pass programs to their situation.

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## **APPENDIX A: Kingston Transit Ridership Data**

A.1 Boardings for grade 9, 10, 11 and 12 students from September 2016 to February 2017.

Date-Time	Date	Time	Weekday	Card	Class	Operation	Route	Latitude	Longitude
2016-09-01 5:49	2016-09-01 0:00	1900-01-01 5:49	4	2038192	Student	Pass (Multi-ride card )	1	44.26394333	-76.4786717
2016-09-01 6:14	2016-09-01 0:00	1900-01-01 6:14	4	2018214	Student	Pass (Multi-ride card )	15	44.25694667	-76.5731167
2016-09-01 6:14	2016-09-01 0:00	1900-01-01 6:14	4	2038192	Student	Transfer - Pass (Multi-ride card )	701	44.262185	-76.5046067
2016-09-01 6:19	2016-09-01 0:00	1900-01-01 6:19	4	2028663	Student	Pass (Multi-ride card )	501	44.25072167	-76.5894317
2016-09-01 6:21	2016-09-01 0:00	1900-01-01 6:21	4	2022822	Student	Pass (Multi-ride card )	7	44.26582333	-76.4876967
2016-09-01 6:36	2016-09-01 0:00	1900-01-01 6:36	4	2036102	Student	Pass (Multi-ride card )	2	44.23763667	-76.4941917
2016-09-01 6:37	2016-09-01 0:00	1900-01-01 6:37	4	2040883	Student	Pass (Multi-ride card )	701	44.23112	-76.48554
2016-09-01 6:42	2016-09-01 0:00	1900-01-01 6:42	4	2042743	Student	Pass (Multi-ride card )	7	44.22380333	-76.5264433
2016-09-01 6:45	2016-09-01 0:00	1900-01-01 6:45	4	2036102	Student	Transfer - Pass (Multi-ride card )	7	44.258835	-76.5061117
2016-09-01 6:47	2016-09-01 0:00	1900-01-01 6:47	4	2040715	Student	Pass (Multi-ride card )	2	44.22739333	-76.518065
2016-09-01 6:55	2016-09-01 0:00	1900-01-01 6:55	4	2029998	Student	Transfer - Pass (Multi-ride card )	601	44.23103167	-76.4842383
2016-09-01 6:59	2016-09-01 0:00	1900-01-01 6:59	4	2032528	Student	Pass (Multi-ride card )	15	44.23768833	-76.5773667
2016-09-01 7:00	2016-09-01 0:00	1900-01-01 7:00	4	2041480	Student	Pass (Multi-ride card )	601	44.26388167	-76.446681
2016-09-01 7:07	2016-09-01 0:00	1900-01-01 7:07	4	2035134	Student	Pass (Multi-ride card )	14	44.26431667	-76.5550483
2016-09-01 7:10	2016-09-01 0:00	1900-01-01 7:10	4	2040715	Student	Transfer - Pass (Multi-ride card )	11	0	0
2016-09-01 7:14	2016-09-01 0:00	1900-01-01 7:14	4	2034052	Student	Pass (Multi-ride card )	701	44.25315667	-76.4967567
2016-09-01 7:16	2016-09-01 0:00	1900-01-01 7:16	4	2035134	Student	Transfer - Pass (Multi-ride card )	501	44.25803167	-76.5481333
2016-09-01 7:16	2016-09-01 0:00	1900-01-01 7:16	4	2035688	Student	Pass (Multi-ride card )	15	44.25356	-76.60624
2016-09-01 7:17	2016-09-01 0:00	1900-01-01 7:17	4	2037320	Student	Pass (Multi-ride card )	14	44.25289167	-76.5644717
2016-09-01 7:18	2016-09-01 0:00	1900-01-01 7:18	4	2034204	Student	Pass (Multi-ride card )	1	44.26263	-76.4814833
2016-09-01 7:19	2016-09-01 0:00	1900-01-01 7:19	4	2021823	Student	Pass (Multi-ride card )	502	44.25012333	-76.589915
2016-09-01 7:19	2016-09-01 0:00	1900-01-01 7:19	4	2030385	Student	Pass (Multi-ride card )	502	44.25012333	-76.589915
2016-09-01 7:20	2016-09-01 0:00	1900-01-01 7:20	4	2040694	Student	Pass (Multi-ride card )	601	44.253035	-76.46073
2016-09-01 7:25	2016-09-01 0:00	1900-01-01 7:25	4	2034827	Student	Pass (Multi-ride card )	502	44.22811	-76.5793283
2016-09-01 7:25	2016-09-01 0:00	1900-01-01 7:25	4	2027755	Student	Pass (Multi-ride card )	601	44.25369833	-76.4604683
2016-09-01 7:28	2016-09-01 0:00	1900-01-01 7:28	4	2041480	Student	Transfer - Pass (Multi-ride card )	2	44.23111333	-76.48524
2016-09-01 7:29	2016-09-01 0:00	1900-01-01 7:29	4	2040694	Student	Transfer - Pass (Multi-ride card )	502	44.23095167	-76.48458

A. 2 Boardings for Graduating grade 12 participants from July 2016 to December 2016.

Date-Time	Date	Time	Weekday	Card	Class	Operation	Route	Latitude	Longitude
2016-07-03 16:09	2016-07-03 0:00	1900-01-01 16:09		7	2041055	ADULT	Pass (Multi-ride card )	11	44.24187667 -76.51684
2016-07-03 17:39	2016-07-03 0:00	1900-01-01 17:39		7	2041025	ADULT	Pass (Multi-ride card )	701	44.257165 -76.57318
2016-07-03 19:50	2016-07-03 0:00	1900-01-01 19:50		7	2041065	ADULT	Pass (Multi-ride card )	2	44.22219667 -76.51754667
2016-07-03 20:20	2016-07-03 0:00	1900-01-01 20:20		7	2041025	ADULT	Pass (Multi-ride card )	2	44.26627 -76.49494
2016-07-04 8:30	2016-07-04 0:00	1900-01-01 8:30		1	2041018	ADULT	Pass (Multi-ride card )	1	44.26101333 -76.48155
2016-07-04 8:59	2016-07-04 0:00	1900-01-01 8:59		1	2041018	ADULT	Transfer - Pass (Multi-ride card)	12	44.23094333 -76.48419
2016-07-04 10:39	2016-07-04 0:00	1900-01-01 10:39		1	2041024	ADULT	Pass (Multi-ride card )	6	44.23544333 -76.57432333
2016-07-04 11:16	2016-07-04 0:00	1900-01-01 11:16		1	2041036	ADULT	Pass (Multi-ride card )	14	44.25159333 -76.55633
2016-07-04 11:27	2016-07-04 0:00	1900-01-01 11:27		1	2041037	ADULT	Pass (Multi-ride card )	701	44.23795167 -76.54555667
2016-07-04 11:53	2016-07-04 0:00	1900-01-01 11:53		1	2041036	ADULT	Transfer - Pass (Multi-ride card)	501	44.25712667 -76.57319333
2016-07-04 13:05	2016-07-04 0:00	1900-01-01 13:05		1	2041025	ADULT	Pass (Multi-ride card )	2	44.26852 -76.48509333
2016-07-04 13:16	2016-07-04 0:00	1900-01-01 13:16		1	2041008	ADULT	Pass (Multi-ride card )	16	44.25613167 -76.50121
2016-07-04 13:16	2016-07-04 0:00	1900-01-01 13:16		1	2041025	ADULT	Transfer - Pass (Multi-ride card)	7	44.25866833 -76.506115
2016-07-04 13:25	2016-07-04 0:00	1900-01-01 13:25		1	2041036	ADULT	Pass (Multi-ride card )	601	44.23111833 -76.48446167
2016-07-04 14:10	2016-07-04 0:00	1900-01-01 14:10		1	2041062	ADULT	Pass (Multi-ride card )	2	44.26427833 -76.49857167
2016-07-04 14:27	2016-07-04 0:00	1900-01-01 14:27		1	2041055	ADULT	Pass (Multi-ride card )	11	44.23584667 -76.56807
2016-07-04 15:42	2016-07-04 0:00	1900-01-01 15:42		1	2041036	ADULT	Pass (Multi-ride card )	601	44.25958833 -76.45625667
2016-07-04 15:56	2016-07-04 0:00	1900-01-01 15:56		1	2041036	ADULT	Transfer - Pass (Multi-ride card)	502	44.23107333 -76.48488167
2016-07-04 15:59	2016-07-04 0:00	1900-01-01 15:59		1	2041062	ADULT	Pass (Multi-ride card )	15	44.23103667 -76.484185
2016-07-04 16:30	2016-07-04 0:00	1900-01-01 16:30		1	2041036	ADULT	Transfer - Pass (Multi-ride card)	14	44.25738167 -76.57318333
2016-07-04 16:53	2016-07-04 0:00	1900-01-01 16:53		1	2041024	ADULT	Pass (Multi-ride card )	11	44.241645 -76.54750833
2016-07-04 17:38	2016-07-04 0:00	1900-01-01 17:38		1	2041037	ADULT	Pass (Multi-ride card )	701	44.25720167 -76.57322833
2016-07-04 18:20	2016-07-04 0:00	1900-01-01 18:20		1	2041025	ADULT	Pass (Multi-ride card )	2	44.26626333 -76.494785
2016-07-04 18:34	2016-07-04 0:00	1900-01-01 18:34		1	2041037	ADULT	Transfer - Pass (Multi-ride card)	11	44.238985 -76.54222167
2016-07-04 18:35	2016-07-04 0:00	1900-01-01 18:35		1	2041062	ADULT	Pass (Multi-ride card )	12	44.25308667 -76.46071167
2016-07-04 19:19	2016-07-04 0:00	1900-01-01 19:19		1	2041037	ADULT	Pass (Multi-ride card )	3	44.23586 -76.53494
2016-07-04 20:47	2016-07-04 0:00	1900-01-01 20:47		1	2041065	ADULT	Pass (Multi-ride card )	2	44.222235 -76.51739333

APPENDIX B: Graduating Students Survey Package



**Exploring Travel Behaviour of Graduating High School Students in Kingston Survey**

1. Name \_\_\_\_\_
2. Email Address \_\_\_\_\_
3. What is your current street address? Unit \_\_\_\_\_ Street \_\_\_\_\_  
Postal Code \_\_\_\_\_
4. What is your gender?  Male  Female
5. What is your driver's licence level?  None/ Not Applicable  G1  G2  G
6. How often do you have access to an automobile?
  - Never
  - Occasionally (1 – 2 times per week)
  - Sometimes (3 – 4 times per week)
  - Often (5 – 6 times per week)
  - Anytime it is available
  - Always
7. How long does it take for you to reach the nearest transit stop? \_\_\_\_\_ minutes
8. What modes of travel do you often use?

Travel Mode	How Frequently? (every day, 2-3 times a week, 2-3 times a month, weather-dependent, never)
Walk	
Bike	
Automobile (car, truck)	
Transit	
Other _____	

9. Are you employed?
  - No, not working
  - No, but looking for work
  - Yes, working full time
  - Yes, working part time
  - Yes, self-employed
10. If you are employed, what is your employment address? (please fill out as much as you can)
  - Employer \_\_\_\_\_
  - Street Address \_\_\_\_\_
  - City \_\_\_\_\_
  - Postal Code \_\_\_\_\_

11. Do you have any mobility challenges?

- No
- Sight impairment not corrected by glasses or contact lenses
- Hearing impairment
- Speech impairment
- Difficulty walking or climbing steps
- Other \_\_\_\_\_

12. How many people live in your household?

- I live alone
- I live with others: (fill in all that apply)

Others	Relationship to you (i.e. mother, father, grandparent, spouse, sibling, friend, other)
Person #1	
Person #2	
Person #3	
Person #4	
Person #5	
Person #6	

13. What is your estimated annual household income range?

- |   |   |
|---|---|
| <input type="checkbox"/> Under \$10,000       | <input type="checkbox"/> \$70,000 to \$89,999   |
| <input type="checkbox"/> \$10,000 to \$29,999 | <input type="checkbox"/> \$90,000 to \$119,999  |
| <input type="checkbox"/> \$30,000 to \$49,999 | <input type="checkbox"/> \$120,000 to \$150,000 |
| <input type="checkbox"/> \$50,000 to \$69,999 | <input type="checkbox"/> over \$150,000         |

14. Please rank the following types of activities in terms of its **priority** when you and your family make decisions on household travel schedule. Rank items in order of importance from 1 to 7, with 1 being highest priority.

- \_\_\_\_\_ Chaperone Activities (e.g. accompanying others to their own activities)
- \_\_\_\_\_ Grocery Shopping Activities
- \_\_\_\_\_ Other Shopping Activities (e.g. shopping for housewares, clothing or other personal items)
- \_\_\_\_\_ Recreational Activities (e.g. exercising, playing team sports, or visiting parks)
- \_\_\_\_\_ School / Work Activities
- \_\_\_\_\_ Service Activities (e.g. attending medical appointments, visiting banks or other services)
- \_\_\_\_\_ Social Activities (e.g. meeting with friends or family, attending events, or helping others)
- \_\_\_\_\_ Other; please specify \_\_\_\_\_

15. If you **did not** have a transit pass, indicate on the scale below how your travel would be affected for each activity from the previous question.

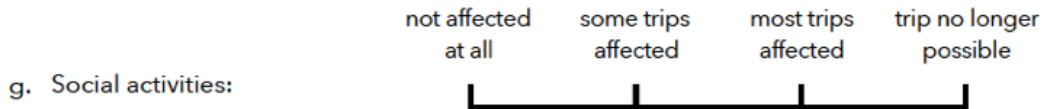
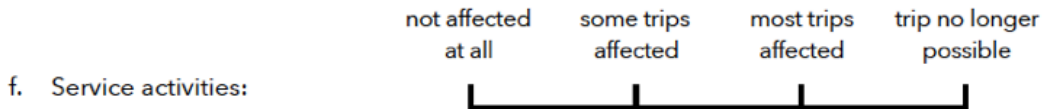
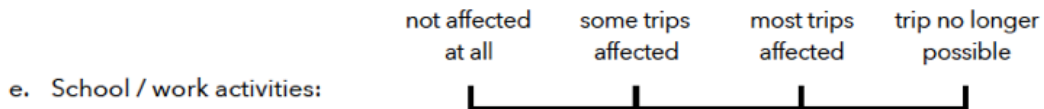
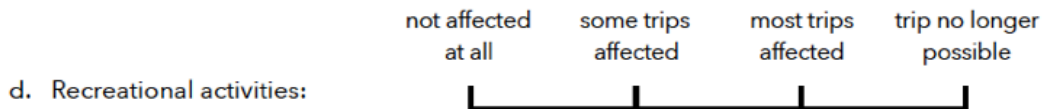
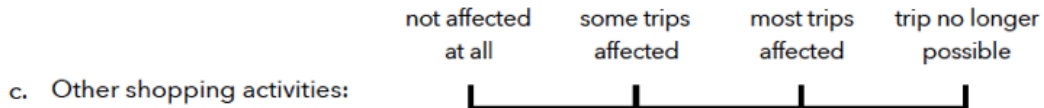
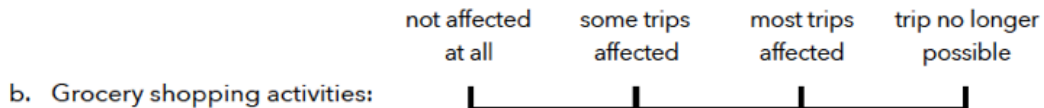
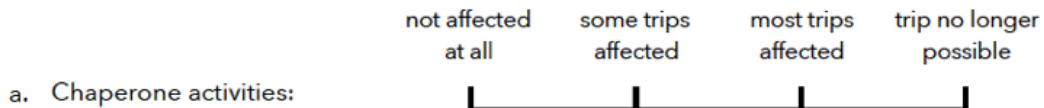
For each activity, your choices are:

**Not affected at all:** If I did not have a transit pass, it would not affect my travel in any way.

**Some trips affected:** If I did not have a transit pass, the trip would be longer, more expensive, or some trips would need to be cancelled.

**Most trips affected:** If I did not have a transit pass, the trip would be significantly longer, much more expensive, less convenient, and many trips would be cancelled.

**Trip no longer possible:** If I did not have a transit pass, I would not be able to make these trips.



16. Did you have a high school transit pass before you received your new adult pass?
- Yes
  - No
17. What grade did you first receive the free high school transit pass?
- Grade 9
  - Grade 10
  - Grade 11
  - Grade 12
18. How often did you use your high school transit pass?
- Everyday
  - Often (5-6 times per week)
  - Sometimes (3-4 times per week)
  - Rarely (only when I have to)
  - Never
19. With your new adult transit pass, how often are you planning to use transit?
- Everyday
  - Often (5-6 times per week)
  - Sometimes (3-4 times per week)
  - Rarely (only when I have to)
  - Never
20. After your free new adult pass expires on December 31, 2016; do you plan to continue using Kingston Transit?
- Yes
  - No
  - Maybe, depending on (please specify): \_\_\_\_\_
21. Currently, Sunday service on Kingston Transit runs from 8AM to 8:45PM. Does this limit your travel opportunities?
- No, it does not affect my travel in any way
  - Yes, sometimes I have to reschedule my activities
  - Yes, I always have to use another mode of transportation on Sunday
  - Other: \_\_\_\_\_
22. Would you like to receive further updates about the study?
- Yes
  - No

Thank you very much for your participation!

**Department of Civil Engineering  
University of Waterloo**

**PARTICIPANTS NEEDED FOR  
RESEARCH IN KINGSTON TRANSIT PASS STUDY**

We are looking for volunteers to take part in a study of Kingston's High School Transit Pass.

As a participant in this study, you would be asked to: complete an anonymous questionnaire through a computer-based survey and a travel diary that documents the trips that you make over 4 days. Eligible participants include students attending Grade 12 in Kingston, Ontario.

Your participation would involve 2 sessions,  
each of which is approximately 10 minutes.

**In appreciation for your time, you will receive  
a chance to win a \$100 Best Buy Gift card.**

For more information about this study, or to volunteer for this study,  
please contact:

*Veronica Sullivan*  
*Civil Engineering*  
at  
519-888-4567 Ext. 37538 or  
Email: [vsulliv@uwaterloo.ca](mailto:vsulliv@uwaterloo.ca)

**This study has been reviewed by, and received ethics clearance  
through a University of Waterloo Research Ethics Committee.**



## Kingston High School Student Survey

### Information Letter

Dear Reader,

You are invited to participate in the research study conducted for the City of Kingston. This study is interested in understanding how the transit pass has influenced the ability for both the individual and the households to be able to accomplish their transportation activities more conveniently and at a lower cost. We believe that our research will contribute to the City of Kingston by providing insightful travel information and assist in determining what improvements should be made to its transportation system. This study will be conducted under the supervision of Professor Jeffrey Casello, Civil Engineering of the University of Waterloo, and the data will be used for Veronica Sullivan's master's degree in the department of Civil Engineering.

It is important for you to know that all the information you provide is completely confidential. You are requested to complete an electronic survey and travel diary by the end of 2016. No individual-level information from any survey response will be reported in publications, other than quotes that are used with permission. We will keep the data for a minimum of 7 years stored in a locked office at the University of Waterloo. The City of Kingston will have access to the final reports and papers and any data shared by the UW researchers will be de-identified. When information is transmitted over the internet privacy cannot be guaranteed. There is always a risk your responses may be intercepted by a third party (e.g., government agencies, hackers). University of Waterloo researchers will not collect or use internet protocol (IP) addresses or other information which could link your participation to your computer or electronic device without first informing you. You can withdraw consent to participate and have your data destroyed by contacting us within this time period. Only those associated with this study will have access to these records which are password protected. You can withdraw consent to participate and have your data destroyed by contacting us. However, it is not possible to withdraw your consent once papers and publications have been submitted to publishers. All records will be destroyed according to University of Waterloo policy. If you prefer not to participate using this online method, please contact one of the researchers so you can participate using an alternative method such as a telephone call. The alternate method may decrease anonymity but confidentiality will be maintained. This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee. However, the final decision about participation is yours. If you have any comments or concerns resulting from your participation in this study, please contact the Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567, ext. 36005 or [ore-ceo@uwaterloo.ca](mailto:ore-ceo@uwaterloo.ca).





If you agree to participate, please read and indicate your consent before you start the questionnaire. In appreciation of your time commitment, you will be automatically entered into a prize draw for a \$100 Best Buy gift card. Your odds of winning are based on the number of individuals who participate in the study. We expect that approximately 50 individuals will take part in the study. Information collected to draw for the prizes will not be linked to the study data in any way, and this identifying information will be stored separately, then destroyed after the prizes have been provided. The amount received is taxable. It is your responsibility to report this amount for income tax purposes.

If you have any questions regarding this study or would like additional information, please do not hesitate to contact Veronica Sullivan or Dr. Jeff Casello.

Thank you for your consideration in participating in this important study.

Yours Sincerely,

Veronica Sullivan, MSc student, Civil Engineering, University of Waterloo  
[vsulliv@uwaterloo.ca](mailto:vsulliv@uwaterloo.ca), 519-888-4567

Jeff Casello, Professor, Civil Engineering, University of Waterloo  
[jcasello@uwaterloo.ca](mailto:jcasello@uwaterloo.ca), 519-888-4567 x37538





**Consent Form**

By signing this consent form, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

I have read the information presented in the information letter about a study being conducted by Dr. Jeff Casello, and Veronica Sullivan of Civil Engineering at the University of Waterloo. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

All information that could identify me will be stored separately from the survey data. They will keep all the survey data for a minimum of 7 years stored in a locked office at the University of Waterloo. I can withdraw consent to participate and have my data destroyed by contacting them within this time period. Only those associated with this study will have access to these records which are password protected. It is not possible to withdraw my consent once papers and publications have been submitted to publishers. All records will be destroyed according to University of Waterloo policy.

I am also aware that excerpts from the survey may be included in the thesis and/or publications to come from this research, with the understanding that the quotations will be anonymous. I am aware that data collected from this survey will not be linked to my name, and will not appear in any publication resulting from this study.

I am informed that I may withdraw my consent at any time without penalty by advising the researcher.

This project has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee. I was informed that if I have any comments or concerns resulting from my participation in this study, I may contact the Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or ore-ceo@uwaterloo.ca.

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

YES  NO

I agree to the use of anonymous quotations in any thesis, reports or publication that comes of this research.

YES  NO

Participant Name: \_\_\_\_\_

Date: \_\_\_\_\_

Witness Name: \_\_\_\_\_

Date: \_\_\_\_\_





## Email Recruitment Letter

Dear [Student's name],

As part of the Kingston High School Pilot Pass Program, we hope that you are enjoying your new free adult pass you received a few weeks ago. Thank you for considering to sign up as a participant in our on-going research! Our goal is to ensure the long term success of the free transit pass program – to make sure the program meets your and all travelers' needs and to help Kingston Transit deliver this service effectively.

To understand how well the system is working, we – the University of Waterloo – is undertaking this research in partnership with Kingston Transit.

If you can help us by filling a quick 10-minute survey, we would greatly appreciate it! It will automatically enroll you in a draw to win a \$100 Best Buy gift card!

Here's the link to the survey and more information about the research:

[survey link]

Thank you in advance for your help in this project. This project has been reviewed and received ethics clearance through the University of Waterloo Research Ethics Committee. However the final decision about participation is yours.

Sincerely,

Professor Jeffrey Casello and Veronica Sullivan  
University of Waterloo  
Department of Civil and Environmental Engineering

Please contact Veronica with any questions or concerns:

[veronica.sullivan@uwaterloo.ca](mailto:veronica.sullivan@uwaterloo.ca)

About your privacy:

All information you provide will be considered confidential and will be grouped with responses from other participants. You will not be identified by name in any thesis, report or publication resulting from this study. The data collected will be kept for a minimum of 7 years in a secured office at the University of Waterloo. This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee. However, the final decision about participation is yours. If you have any comments or concerns resulting from your participation in this study, please contact the Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567, ext. 36005 or [ore-ceo@uwaterloo.ca](mailto:ore-ceo@uwaterloo.ca).



### Feedback Letter

Dear Participant,

We would like to thank you for your participation in our study "Exploring Travel Behaviour of Graduating High School Students in Kingston". As a reminder, the purpose of this study is to investigate how the transit pass has influenced the ability for both the individual and the households to be able to accomplish their transportation activities more conveniently and at a lower cost. Your participation has been essential to the success of our research project. In appreciation of your participation, **you have been entered into a prize draw for a \$100 Best Buy Gift Card. We would like to inform you that you are the winner of \$100 Best Buy Gift Card (OR: unfortunately, you did not win in the prize draw, but your contribution to this study is greatly appreciated.)**.

As a reminder, any data pertaining to you as an individual participant will be kept confidential. Once all the data are collected and analyzed for this project, a summary of the study's results will be made available to participants via email. We will share our analysis with the City of Kingston and interested communities through seminars, conferences, presentations, and journal articles. No additional data will be gathered at that time. If you are interested in receiving more information regarding the results of this study, please let us know. In the meantime, if you have any questions about the study and the prize draw, please do not hesitate to contact myself ([veronica.sullivan@uwaterloo.ca](mailto:veronica.sullivan@uwaterloo.ca)) or Prof. Jeff Casello ([jcasello@uwaterloo.ca](mailto:jcasello@uwaterloo.ca)), 519-888-4567 x37538 at the University of Waterloo.

As with all University of Waterloo projects involving human participants, this project has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee. Should you have any comments or concerns resulting from your participation in this study, please contact the Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or [ore-ceo@uwaterloo.ca](mailto:ore-ceo@uwaterloo.ca).

Yours Sincerely,

Veronica Sullivan, MSc Student, Civil Engineering, University of Waterloo  
[veronica.sullivan@uwaterloo.ca](mailto:veronica.sullivan@uwaterloo.ca), 519-888-4567

Jeff Casello, Professor, Civil Engineering, University of Waterloo  
[jcasello@uwaterloo.ca](mailto:jcasello@uwaterloo.ca), 519-888-4567 x37538



## APPENDIX C: Grade 9 Survey Package

Survey ID: \_\_\_\_\_

**Kingston Grade 9 Transit Survey**

1. I am in Grade \_\_\_\_\_ at High School \_\_\_\_\_

2. What is your current street address?

Unit \_\_\_\_\_ Street \_\_\_\_\_

And/ or Postal Code \_\_\_\_\_

3. What is your gender?  Male  Female  \_\_\_\_\_

4. How many people live in your household?

I live alone

I live with others: (fill in all that apply)

Others	Relationship to you (i.e. mother, father, grandparent, brother, sister, friend, other)	Check if this person has a licence
Person #1		<input type="checkbox"/> Yes
Person #2		<input type="checkbox"/> Yes
Person #3		<input type="checkbox"/> Yes
Person #4		<input type="checkbox"/> Yes
Person #5		<input type="checkbox"/> Yes
Person #6		<input type="checkbox"/> Yes
Person #7		<input type="checkbox"/> Yes

5. If you have siblings, what order are you in the family? (Check one)

I'm the oldest child  2<sup>nd</sup> oldest  2<sup>nd</sup> youngest  The youngest  Other \_\_\_\_\_

6. How many vehicles are in your household?  0  1  2  3  4  5  6+

7. How do you get to your most commonly used transit stop?

Walk  Get dropped off by car  Other \_\_\_\_\_

Bike  Drive there myself

8. How long does it take to get to the transit stop from your starting point? \_\_\_\_\_ minutes

9. If you did not have the transit pass, would you still be using public transit?  Yes  No

10. In the table below, fill in activities that you do during the school year. For each activity, indicate the mode that you commonly used to make the trip in each grade (i.e. walk, bike, school bus, transit bus, someone drives me, drive myself). If there is an activity (e.g. sports, mall) that you only did in one grade, please put (N/A) in the other grade.

Type of Activity (Sports, Clubs, Volunteer, Part time job, movies)	Grade 8		Grade 9	
	Getting there	Coming Back	Getting There	Coming Back
<i>Example</i>	<i>Dropped off by car</i>	<i>Walk home</i>	<i>School Bus</i>	<i>Transit Bus</i>
School				

11. In your **previous** school year, how often did you travel independently, without a parent or guardian?  
(Check one)

- Never
- Occasionally (1 – 2 times per week)
- Sometimes (3 – 4 times per week)
- Often (5 – 6 times per week)
- Always

12. Your **current** school year, how often do you travel independently, without a parent or guardian?  
(Check one)

- Never
- Occasionally (1 – 2 times per week)
- Sometimes (3 – 4 times per week)
- Often (5 – 6 times per week)
- Always

13. Is there a level of distance that you **are not allowed** to travel by yourself from home? (Check all that apply)

- School
- Within my neighbourhood
- Downtown
- Shopping mall
- Activities such as sports, clubs or volunteering
- I can travel anywhere by myself, except \_\_\_\_\_
- N/A, I can always travel by myself

14. Is there a time that you **are not allowed** to travel by yourself from home? (Check all that apply)

- 6:00 am to 8:00 am (Before School)
- 8:00 am to 3:00 pm (During School)
- 3:00 pm to 8:00 pm (After School)
- 8:00 pm to 10:00 pm
- After 10:00 pm
- Never, N/A

15. If you use transit, think back to the last trip that you made **by yourself on transit**. Answer the following questions based on that trip. Please skip this question if you do not use transit.

- a. Do you make this trip regularly (i.e. do you make this trip 2-3 times a week)?  Yes  No
- b. What was the purpose of this trip? \_\_\_\_\_
- c. Trip starting location: \_\_\_\_\_
- d. What time did you leave? \_\_\_\_\_
- e. Trip destination location: \_\_\_\_\_
- f. What time did you arrive? \_\_\_\_\_
- g. Would you be able to make this trip without transit?  
 Yes  No

16. Think back to the last trip that you made with a **parent or guardian by any mode**. Answer the following questions based on that trip.

- a. Do you make this trip regularly (i.e. do you make this trip 2-3 times a week)?  Yes  No
- b. What was the purpose of this trip? \_\_\_\_\_
- c. Trip starting location: \_\_\_\_\_
- d. What time did you leave? \_\_\_\_\_
- e. How did you get to your destination?  
 Walk  Bike  Car  Transit  Other: \_\_\_\_\_
- f. Trip destination location: \_\_\_\_\_
- g. What time did you arrive? \_\_\_\_\_

17. Complete the following table:

Travel Mode	On any given week, how many trips do you make where the majority of the trip is by one of these modes? Consider each trip individually, for example, going to school is 1 trip and coming home is another trip (2 trips total).
Walk	<input type="checkbox"/> 0 <input type="checkbox"/> 1-2 <input type="checkbox"/> 3-4 <input type="checkbox"/> 5-6 <input type="checkbox"/> 7-8 <input type="checkbox"/> other _____
Bike	<input type="checkbox"/> 0 <input type="checkbox"/> 1-2 <input type="checkbox"/> 3-4 <input type="checkbox"/> 5-6 <input type="checkbox"/> 7-8 <input type="checkbox"/> other _____
Automobile (car, truck)	<input type="checkbox"/> 0 <input type="checkbox"/> 1-2 <input type="checkbox"/> 3-4 <input type="checkbox"/> 5-6 <input type="checkbox"/> 7-8 <input type="checkbox"/> other _____
Transit	<input type="checkbox"/> 0 <input type="checkbox"/> 1-2 <input type="checkbox"/> 3-4 <input type="checkbox"/> 5-6 <input type="checkbox"/> 7-8 <input type="checkbox"/> other _____
Other _____	<input type="checkbox"/> 0 <input type="checkbox"/> 1-2 <input type="checkbox"/> 3-4 <input type="checkbox"/> 5-6 <input type="checkbox"/> 7-8 <input type="checkbox"/> other _____

18. After your high school transit pass expires, do you plan on continuing using public transit?

- No  
 Yes, because:

\_\_\_\_\_

19. Are there any trips that you would be **unable** to make without transit?

- No  
 Yes, in these cases I would not be able to travel to (places):

\_\_\_\_\_

20. Is there anywhere you would like to go within the city that you are **not allowed** to go to? (i.e. my parents do not allow me to go)

\_\_\_\_\_

21. Is there anywhere you would like to go within the city that you **cannot get to**? (i.e. there is no way for me to get to this location)

\_\_\_\_\_

22. Do you have any mobility challenges?

- No  
 Sight impairment not corrected by glasses or contact lenses  
 Hearing impairment  
 Speech impairment  
 Difficulty walking or climbing steps  
 Other \_\_\_\_\_

23. Would you like to receive further updates about the study?

- Yes, my email is \_\_\_\_\_  
 No

Thank you for your participation!

# ENJOY YOUR FREE TRANSIT PASS?

## TELL US WHY!

### **PARTICIPANTS NEEDED FOR RESEARCH IN KINGSTON TRANSIT PASS STUDY**

As a participant in this study, you would be asked to:  
complete a questionnaire about how you use your transit pass and travel in  
Kingston. Eligible participants include  
students attending Grade 9 or Grade 12 in Kingston, Ontario and their parents.

Your participation would involve one 30-minute session at your school during school hours.

**In appreciation for your time, you will receive  
a \$5 Tim Hortons Gift card!**

This study will help understand how your free transit pass has  
influenced transit ridership and student independence.

For more information about this study, or to volunteer for this study,  
please contact:

Veronica Sullivan, Civil Engineering at  
519-888-4567 Ext. 30455 or  
Email: [vlsulliv@uwaterloo.ca](mailto:vlsulliv@uwaterloo.ca)

This study has been reviewed by, and received ethics clearance  
through a University of Waterloo Research Ethics Committee.



**UNIVERSITY OF WATERLOO**  
FACULTY OF ENGINEERING



**Page 1: To Parent(s) or Guardian(s)**  
**Information Letter Regarding Student Survey**

Dear Parent(s) or Guardian(s):

I am writing to ask your permission for your child to participate in a University of Waterloo research project conducted for the City of Kingston about the free high school transit pass program. This project will be conducted at your child's school on [insert date and time]. We are also interested in parental feedback and **invite you** to be part of this valuable study. Please turn to the page 2 for more information regarding your participation in a 'Household Survey'.

This study is interested in understanding how the transit pass has influenced the ability for both the individual and the households to be able to accomplish their transportation activities more conveniently and at a lower cost. We believe that our research will contribute to the City of Kingston by providing insightful travel information and assist in determining what improvements should be made to its transportation system. This study is being conducted by Veronica Sullivan as part of her Master's thesis/studies for the department of Civil and Environmental Engineering.

The project in which your child has been invited to participate is expected to be an enjoyable experience and will require less than 30 minutes of time out-of-class. However, the decision about participation is yours. To help you in this decision, a brief description of the project is provided. Children will meet with the researchers in small groups on one occasion only. In this one session, they will be asked to complete a 4-page questionnaire (multiple choice, fill in the blank, ranking and descriptive questions) about how they use their transit pass and if it has improved their ability to travel independently in Kingston. Students will receive a \$5 Tim Horton's gift card for participating in the survey and this amount is taxable. If your child submits tax returns, it is his/her responsibility to report this amount for income tax purposes.

Participation in this survey is voluntary and there are no known or anticipated risks involved. Whether or not your child takes part in the study will not affect his or her participation in the high school transit pass program. All children's answers are considered confidential and individual children's results will not be shared with school staff. However, information based on the results of the group of participants will be provided. Once the data is entered on a secured computer, the identifying data will be kept separate from the rest of the survey data. The collected data for this study will be kept for a period of 7 years in a locked cabinet in my supervisors locked office at the University of Waterloo. Only children in Grade 9 or under the age of 18 who have parental permission, and who themselves agree to participate, will be involved in the study. Also, children or parents may withdraw their permission at any time during the study without penalty by indicating this decision to the researcher. However, the data cannot be withdrawn once papers have been submitted for publication. There are no known or anticipated risks to participation in this study.

If you have any questions regarding the study, please contact Veronica Sullivan at [vsulliv@uwaterloo.ca](mailto:vsulliv@uwaterloo.ca) or feel free to call me at the University of Waterloo, 519-888-4567, Ext. 30455.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#21837). If you have questions for the Committee contact the Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or [ore-ceo@uwaterloo.ca](mailto:ore-ceo@uwaterloo.ca). In addition, it has been approved by the Research Committee at the Algonquin and Lakeshore Catholic District School Board and Limestone District School Board and has the support of the principal at your child's school.

We would appreciate if you would permit your child to participate in this project, as we believe it will contribute valuable information about the free high school transit pass program. Please complete the attached permission form, and return it to the school by February 10, 2017.

Thank you in advance for your interest and support of this project.  
**Yours sincerely,**  
**Prof. Jeffrey Casello, Ph.D. Electrical and Systems Engineering**  
**Veronica Sullivan, Civil Engineering**

**Page 2: To Parent(s) or Guardian(s)**  
**Information Letter Regarding Household Survey**

Dear Parent(s) and/or Guardian(s),

You are invited to participate in the research study conducted by the University of Waterloo for the City of Kingston. This study seeks to understand how the free high school transit pass program has influenced the household's ability to accomplish their transportation activities more conveniently and at a lower cost. We want you to be part of this study by completing short 2-page survey which will provide valuable information about household travel behaviour and assist in potential improvements to the transportation system. This study is being conducted by Veronica Sullivan as part of her Master's thesis/studies for the department of Civil and Environmental Engineering.

There are 3 options for you to complete the survey:

- 1) We invite you come in-person to your child's school on: [insert date and time same as page 1]
- 2) This survey will be available online: [insert URL link]
- 3) We can provide your child a written copy of the survey where you can complete it at your leisure and return it to us using the postage paid envelope that will be provided.

Completion of the 2-page survey is expected to take about 10-20 minutes of your time. The questions are quite general (for example, how many times have you used public transport to accomplish a trip?). You may omit any question you prefer not to answer. There are no known or anticipated risks to participation in this study. Participation in this project is voluntary. Further, all information you provide will be considered confidential. If you choose option 2) or 3) to complete the survey, we request that you complete the survey by the end of February 2017. No individual-level information from any survey response will be reported in publications, other than quotes that are used with permission. We will keep the data for a minimum of 7 years stored in a locked office at the University of Waterloo. Once data entered on a computer, the identifying data will be kept from the rest of the survey data. When information is transmitted over the internet privacy cannot be guaranteed. There is always a risk your responses may be intercepted by a third party (e.g., government agencies, hackers). University of Waterloo researchers will not collect or use internet protocol (IP) addresses or other information which could link your participation to your computer or electronic device without first informing you.

Only those associated with this study will have access to these records which are password protected. You can withdraw consent to participate and have your data destroyed by contacting us. However, it is not possible to withdraw your consent once papers and publications have been submitted to publishers. All records will be destroyed according to University of Waterloo policy

If you have any questions regarding the study, please contact Veronica Sullivan at [vsulliv@uwaterloo.ca](mailto:vsulliv@uwaterloo.ca)

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#21837). If you have questions for the Committee contact the Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or [ore-ceo@uwaterloo.ca](mailto:ore-ceo@uwaterloo.ca).

Thank you for your consideration in participating in this important study.

**Yours Sincerely,**

Veronica Sullivan, MASc student, Civil Engineering, University of Waterloo  
[vsulliv@uwaterloo.ca](mailto:vsulliv@uwaterloo.ca), 519-888-4567

Jeffrey Casello, Professor, Civil Engineering, University of Waterloo  
[icasello@uwaterloo.ca](mailto:icasello@uwaterloo.ca), 519-888-4567 x37538



### Parent(s) or Guardian(s) Consent Form for 'Student Survey'

By providing this consent, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

I have read the information presented in the information letter about a study being conducted by Dr. Jeff Casello, and Veronica Sullivan of Civil Engineering at the University of Waterloo. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

I acknowledge that all information gathered on this project will be used for research purposes only and will be considered confidential. I am aware that permission may be withdrawn at any time without penalty by advising the researchers.

This project has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#21837). If you have questions for the Committee contact the Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or [ore-ceo@uwaterloo.ca](mailto:ore-ceo@uwaterloo.ca).

Child's Name: \_\_\_\_\_

Child's Birth Date: \_\_\_\_\_

Permission Decision: \_\_\_\_ Yes - I would like my child to participate in this study

Signature of Parent or Guardian: \_\_\_\_\_

Date: \_\_\_\_\_

Please note: If you do not want to your child to participate in the survey, then simply do not return this form and discard.



## APPENDIX D: Grade 12 Survey Package

Survey ID: \_\_\_\_\_

**Kingston Grade 12 Transit Survey**

1. I am in Grade \_\_\_\_\_ at High School \_\_\_\_\_

2. What is your current street address?

Unit \_\_\_\_\_ Street \_\_\_\_\_

And/ or Postal Code \_\_\_\_\_

3. What is your gender?  Male  Female  \_\_\_\_\_

4. How many people live in your household?

I live alone

I live with others: (fill in all that apply)

Others	Relationship to you (i.e. mother, father, grandparent, brother, sister, friend, other)	Check if this person has a licence
Person #1		<input type="checkbox"/> Yes
Person #2		<input type="checkbox"/> Yes
Person #3		<input type="checkbox"/> Yes
Person #4		<input type="checkbox"/> Yes
Person #5		<input type="checkbox"/> Yes
Person #6		<input type="checkbox"/> Yes
Person #7		<input type="checkbox"/> Yes

5. If you have siblings, what order are you in the family? (Check one)

I'm the oldest child  2<sup>nd</sup> oldest  2<sup>nd</sup> youngest  The youngest  Other \_\_\_\_\_

6. How many vehicles are in your household?  0  1  2  3  4  5  6+

7. What is your driver's licence level?  None/ Not Applicable  G1  G2  G

8. How often do you have access to an automobile?

Never

Occasionally (1 – 2 times per week)

Sometimes (3 – 4 times per week)

Often (5 – 6 times per week)

Anytime it is available

Always, I have my own car

9. How do you get to your most commonly used transit stop?

Walk

Get dropped off by car

Other \_\_\_\_\_

Bike

Drive there myself

10. How long does it take to get to the transit stop from your starting point? \_\_\_\_\_ minutes

11. If you did not have the transit pass, would you still be using public transit?  Yes  No

12. In the table below, fill in activities that you do during the school year. For each activity, indicate the mode that you commonly used to make the trip in each grade (i.e. walk, bike, school bus, transit bus, someone drives me, drive myself). If there is an activity (e.g. sports, mall) that you only did in one grade, please put (N/A) in the other grade.

Type of Activity (Sports, Clubs, Volunteer, Part time job, movies)	Grade 11		Grade 12	
	Getting there	Coming Back	Getting There	Coming Back
<i>Example</i>	<i>Dropped off by car</i>	<i>Walk home</i>	<i>School Bus</i>	<i>Transit Bus</i>
School				

13. In your **previous** school year, how often did you travel independently, without a parent or guardian?  
(Check one)

- Never
- Occasionally (1 – 2 times per week)
- Sometimes (3 – 4 times per week)
- Often (5 – 6 times per week)
- Always

14. Your **current** school year, how often do you travel independently, without a parent or guardian?  
(Check one)

- Never
- Occasionally (1 – 2 times per week)
- Sometimes (3 – 4 times per week)
- Often (5 – 6 times per week)
- Always

15. Is there a level of distance that you **are not allowed** to travel by yourself from home? (Check all that apply)

- School
- Within my neighbourhood
- Downtown
- Shopping mall
- Activities such as sports, clubs or volunteering
- I can travel anywhere by myself, except \_\_\_\_\_
- N/A, I can always travel by myself

16. Is there a time that you **are not allowed** to travel by yourself from home? (Check all that apply)

- 6:00 am to 8:00 am (Before School)
- 8:00 am to 3:00 pm (During School)
- 3:00 pm to 8:00 pm (After School)
- 8:00 pm to 10:00 pm
- After 10:00 pm
- Never, N/A

17. If you use transit, think back to the last trip that you made **by yourself on transit**. Answer the following questions based on that trip. Please skip this question if you do not use transit.

- a. Do you make this trip regularly (i.e. do you make this trip 2-3 times a week)?  Yes  No
- b. What was the purpose of this trip? \_\_\_\_\_
- c. Trip starting location: \_\_\_\_\_
- d. What time did you leave? \_\_\_\_\_
- e. Trip destination location: \_\_\_\_\_
- f. What time did you arrive? \_\_\_\_\_
- g. Would you be able to make this trip without transit?  
 Yes  No

18. Think back to the last trip that you made with **a parent or guardian by any mode**. Answer the following questions based on that trip.

- a. Do you make this trip regularly (i.e. do you make this trip 2-3 times a week)?  Yes  No
- b. What was the purpose of this trip? \_\_\_\_\_
- c. Trip starting location: \_\_\_\_\_
- d. What time did you leave? \_\_\_\_\_
- e. How did you get to your destination?  
 Walk  Bike  Car  Transit  Other: \_\_\_\_\_
- f. Trip destination location: \_\_\_\_\_
- g. What time did you arrive? \_\_\_\_\_

19. Complete the following table:

Travel Mode	On any given week, how many trips do you make where the majority of the trip is by one of these modes? Consider each trip individually, for example, going to school is 1 trip and coming home is another trip (2 trips total).
Walk	<input type="checkbox"/> 0 <input type="checkbox"/> 1-2 <input type="checkbox"/> 3-4 <input type="checkbox"/> 5-6 <input type="checkbox"/> 7-8 <input type="checkbox"/> other _____
Bike	<input type="checkbox"/> 0 <input type="checkbox"/> 1-2 <input type="checkbox"/> 3-4 <input type="checkbox"/> 5-6 <input type="checkbox"/> 7-8 <input type="checkbox"/> other _____
Automobile (car, truck)	<input type="checkbox"/> 0 <input type="checkbox"/> 1-2 <input type="checkbox"/> 3-4 <input type="checkbox"/> 5-6 <input type="checkbox"/> 7-8 <input type="checkbox"/> other _____
Transit	<input type="checkbox"/> 0 <input type="checkbox"/> 1-2 <input type="checkbox"/> 3-4 <input type="checkbox"/> 5-6 <input type="checkbox"/> 7-8 <input type="checkbox"/> other _____
Other _____	<input type="checkbox"/> 0 <input type="checkbox"/> 1-2 <input type="checkbox"/> 3-4 <input type="checkbox"/> 5-6 <input type="checkbox"/> 7-8 <input type="checkbox"/> other _____

20. After your high school transit pass expires, do you plan on continuing using public transit?

- No  
 Yes, because:

\_\_\_\_\_

21. Are there any trips that you would be **unable** to make without transit?

- No  
 Yes, in these cases I would not be able to travel to (places):

\_\_\_\_\_

22. Is there anywhere you would like to go within the city that you are **not allowed** to go to? (i.e. my parents do not allow me to go)

\_\_\_\_\_

23. Is there anywhere you would like to go within the city that you **cannot get to**? (i.e. there is no way for me to get to this location)

\_\_\_\_\_

24. Do you have any mobility challenges?

- No  
 Sight impairment not corrected by glasses or contact lenses  
 Hearing impairment  
 Speech impairment  
 Difficulty walking or climbing steps  
 Other \_\_\_\_\_

25. Would you like to receive further updates about the study?

- Yes, my email is \_\_\_\_\_  
 No

Thank you for your participation!



**To Students [that require no parental consent]**  
**Information Letter Regarding Student Survey**

Dear Student:

I am writing to ask your permission to participate in a University of Waterloo research project conducted for the City of Kingston about the free high school transit pass program. This project will be conducted at your school in February 2017. We are interested in understanding how the transit pass has influenced the ability for both the individual and the households to be able to accomplish their transportation activities more conveniently and at a lower cost. We believe that our research will contribute to the City of Kingston by providing insightful travel information and assist in determining what improvements should be made to its transportation system. This study is being conducted by Veronica Sullivan as part of her Master's thesis/studies for the department of Civil and Environmental Engineering.

The project in which you have been invited to participate is expected to be an enjoyable experience and will require less than 30 minutes of time out-of-class. To help you in this decision, a brief description of the project is provided. You will meet with the researchers in small groups on one occasion only. In this one session, they will be asked to complete a 4-page questionnaire (multiple choice, fill in the blank, ranking and descriptive questions) about how you use their transit pass and if it has improved their ability to travel independently in Kingston. You will receive a \$5 Tim Horton's gift card for participating in the survey and this amount is taxable. If you submit tax returns, it is your responsibility to report this amount for income tax purposes.

Participation in this survey is voluntary and there are no known or anticipated risks involved. Whether or not you take part in the study will not affect your participation in the high school transit pass program. All of your answers are considered confidential and individual results will not be shared with school staff. However, information based on the results of the group of participants will be provided. Once the data is entered on a secured computer, the identifying data will be kept separate from the rest of the survey data. The collected data for this study will be kept for a period of 7 years in a locked cabinet in my supervisors locked office at the University of Waterloo. Also, you may withdraw your permission at any time during the study without penalty by indicating this decision to the researcher. However, the data cannot be withdrawn once papers have been submitted for publication. There are no known or anticipated risks to participation in this study.

If you have any questions regarding the study, please contact Veronica Sullivan at [vsulliv@uwaterloo.ca](mailto:vsulliv@uwaterloo.ca) or call me at the University of Waterloo, 519-888-4567, Ext. 30455.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#21837). If you have questions for the Committee contact the Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or [ore-ceo@uwaterloo.ca](mailto:ore-ceo@uwaterloo.ca). In addition, it has been approved by the Research Committee at the Algonquin and Lakeshore Catholic District School Board and Limestone District School Board and has the support of the principal at your child's school.

Thank you in advance for your interest and support of this project.

**Yours sincerely,**

**Prof. Jeffrey Casello, Ph.D. Electrical and Systems Engineering**  
**Veronica Sullivan, Civil Engineering**

### Student Consent Form

By providing this consent, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

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I have read the information presented in the information letter about a study being conducted by Dr. Jeff Casello, and Veronica Sullivan of Civil Engineering at the University of Waterloo. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted. I am aware that I may withdraw from the study without penalty at any time by advising the researchers of this decision.

I am also aware that excerpts from the survey may be included in the thesis and/or publications to come from this research, with the understanding that the quotations will be anonymous. I am aware that data collected from this survey will not be linked to my name, and my name (or other identifying information) will not appear in any publication resulting from this study.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#21837). If you have questions for the Committee contact the Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or [ore-ceo@uwaterloo.ca](mailto:ore-ceo@uwaterloo.ca)

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

YES

I agree to the use of anonymous quotations in any thesis, reports or publication that comes of this research.

YES

Participant Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Please note: If you do not want to participate in the survey, then simply do not return this form and discard.

APPENDIX E: Parent Survey Package

Survey ID: \_\_\_\_\_

**Kingston Parent/Guardian Survey**

1. Including yourself, how many individuals in your household have a driver's licence?  
0 1 2 3 4 5 6+
2. How many vehicles are in your household? 0 1 2 3 4+
3. Do you have children? Yes No
4. What grade and school is your child in? (Fill in all that apply)

	Grade	School Name
Child 1		
Child 2		
Child 3		
Child 4		
Child 5		
Child 6		

5. Are you employed? No Yes, Full-time Yes, Part-time Employed from home
6. If you are employed, what are your normal working hours?  
 \_\_\_\_\_ am to \_\_\_\_\_ pm on weekdays  
 \_\_\_\_\_ am to \_\_\_\_\_ pm on weekends  
 Flexible / Irregular working hours
7. What is your household (total of all workers at home) income range?  
 Less than \$20,000  \$20,000 to \$39,999  \$40,000 to 59,999  
 \$60,000 to \$79,999  \$80,000 to \$100,000  over \$100,000
8. What circumstances do you allow your child to **travel alone by themselves**? (Check all that apply)  
 I always allow my children to travel alone  
 They **can only travel alone** between the time \_\_\_\_\_ (am/pm) and \_\_\_\_\_ (am/pm)  
 They **can only travel alone in certain areas**:  
 Our neighbourhood  
 Their school and back home  
 Downtown Kingston  
 Queen's University  
 Kingston Centre  
 Nearby Shopping Centre  
 Other \_\_\_\_\_

7. a. Consider that your child makes a trip from your home to a friend's house in **your neighbourhood**. At what age would you feel comfortable allowing your child to make this trip independently? \_\_\_\_\_ years old
- b. At what age would you allow your child to make the same trip while travelling **with a friend**? \_\_\_\_\_ years old
8. a. Consider that your child makes a trip from your home to **downtown Kingston (near City Hall)**. At what age would you feel comfortable allowing your child to make this trip independently? \_\_\_\_\_ years old
- b. At what age would you allow your child to make the same trip while travelling **with a friend**? \_\_\_\_\_ years old
9. a. Consider that your child makes a trip from your home to **Queen's University**. At what age would you feel comfortable allowing your child to make this trip independently? \_\_\_\_\_ years old
- b. At what age would you allow your child to make the same trip while travelling **with a friend**? \_\_\_\_\_ years old
10. a. Consider that your child makes a trip from your home to **Kingston Centre (Princess St & Bath Rd)**. At what age would you feel comfortable allowing your child to make this trip independently? \_\_\_\_\_ years old
- b. At what age would you allow your child to make the same trip while travelling **with a friend**? \_\_\_\_\_ years old
11. In the last month, how many times have **you** used public transport to accomplish a trip?  
 Consider each trip individually, for example, going to the mall is 1 trip and coming home is another trip (2 trips total)
- 0    1-2    3-4    4-5    6-7    8-9    10+    All weekdays    Everyday
12. Your child wants to make a trip to another neighbourhood to visit a friend. Please rate your comfort level with each of the travel options below circling a point on the line:

Travel Options	Very comfortable (1)	Somewhat comfortable (3)	Not comfortable (5)
Walking alone	1	3	5
Walking with friends	1	3	5
Alone on public transit	1	3	5
With friends on public transit	1	3	5
Driving alone	1	3	5
Driving with friends	1	3	5

13. If you do not feel comfortable having your child travel on transit alone, please explain why:

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14. What are your observations about the student transit pass? (i.e. Do you think it is helping your family and/or community? Do you think students are travelling more or less? Are you seeing that students are conducting more activities or less? What is your personal experience? Are students able to work after school?)

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15. If your **child did not have a transit pass**, are there any trips that your child is making now that you would not be able to take them to?

No

Yes, in these cases I would not be able to take them to (example: take them to sport practice):

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16. Since your child started high school, are there any activities that you used to take your children to, that they now go to by themselves?

No

Yes, they travel by:

Transit

Walk/ Cycle

Drive Themselves / Carpool with others

Other / Combination \_\_\_\_\_

17. If you have any additional comments, please write them here:

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18. Would you like to receive further updates about the study?

No

Yes, my email is \_\_\_\_\_

*Thank you for your participation!*

**Page 2: To Parent(s) or Guardian(s)**  
**Information Letter Regarding Household Survey**

Dear Parent(s) and/or Guardian(s),

You are invited to participate in the research study conducted by the University of Waterloo for the City of Kingston. This study seeks to understand how the free high school transit pass program has influenced the household's ability to accomplish their transportation activities more conveniently and at a lower cost. We want you to be part of this study by completing short 2-page survey which will provide valuable information about household travel behaviour and assist in potential improvements to the transportation system. This study is being conducted by Veronica Sullivan as part of her Master's thesis/studies for the department of Civil and Environmental Engineering.

There are 3 options for you to complete the survey:

- 1) We invite you come in-person to your child's school on: [insert date and time same as page 1]
- 2) This survey will be available online: [insert URL link]
- 3) We can provide your child a written copy of the survey where you can complete it at your leisure and return it to us using the postage paid envelope that will be provided.

Completion of the 2-page survey is expected to take about 10-20 minutes of your time. The questions are quite general (for example, how many times have you used public transport to accomplish a trip?). You may omit any question you prefer not to answer. There are no known or anticipated risks to participation in this study. Participation in this project is voluntary. Further, all information you provide will be considered confidential. If you choose option 2) or 3) to complete the survey, we request that you complete the survey by the end of February 2017. No individual-level information from any survey response will be reported in publications, other than quotes that are used with permission. We will keep the data for a minimum of 7 years stored in a locked office at the University of Waterloo. Once data entered on a computer, the identifying data will be kept from the rest of the survey data. When information is transmitted over the internet privacy cannot be guaranteed. There is always a risk your responses may be intercepted by a third party (e.g., government agencies, hackers). University of Waterloo researchers will not collect or use internet protocol (IP) addresses or other information which could link your participation to your computer or electronic device without first informing you.

Only those associated with this study will have access to these records which are password protected. You can withdraw consent to participate and have your data destroyed by contacting us. However, it is not possible to withdraw your consent once papers and publications have been submitted to publishers. All records will be destroyed according to University of Waterloo policy

If you have any questions regarding the study, please contact Veronica Sullivan at [vsulliv@uwaterloo.ca](mailto:vsulliv@uwaterloo.ca)

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#21837). If you have questions for the Committee contact the Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or [ore-ceo@uwaterloo.ca](mailto:ore-ceo@uwaterloo.ca).

Thank you for your consideration in participating in this important study.

**Yours Sincerely,**

Veronica Sullivan, MASC student, Civil Engineering, University of Waterloo  
[vsulliv@uwaterloo.ca](mailto:vsulliv@uwaterloo.ca), 519-888-4567

Jeffrey Casello, Professor, Civil Engineering, University of Waterloo  
[jcasello@uwaterloo.ca](mailto:jcasello@uwaterloo.ca), 519-888-4567 x37538|



**Parent(s) or Guardian(s) Consent Form for 'Household Survey'**

By providing consent, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

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I have read the information presented in the information letter about a study being conducted by Dr. Jeff Casello, and Veronica Sullivan of Civil Engineering at the University of Waterloo. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted. I am aware that I may withdraw from the study without penalty at any time by advising the researchers of this decision.

I am also aware that excerpts from the survey may be included in the thesis and/or publications to come from this research, with the understanding that the quotations will be anonymous. I am aware that data collected from this survey will not be linked to my name, and my name (or other identifying information) will not appear in any publication resulting from this study.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#21837). If you have questions for the Committee contact the Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or [ore-ceo@uwaterloo.ca](mailto:ore-ceo@uwaterloo.ca)

By completing and returning this survey to the researchers I provide my consent to participate in this study.

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

YES

I agree to the use of anonymous quotations in any thesis, reports or publication that comes of this research.

YES

Please note: If you do not want to participate in the survey, then simply do not return this form and discard.

