

Impact of the introduction of an express transit service in Waterloo Region

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Proceedings of the ITE Canadian District Annual Conference
held May 6-10, 2007 in Toronto, Canada.

ABSTRACT

This paper describes the motivation for, implementation of and impacts from a new express bus service in the Region of Waterloo in Ontario Canada. The 33km, 13 stop *iXpress* service was introduced in September of 2005 with funding from the Canadian Federal Government's Urban Transportation Showcase Program to provide higher order transit in the rapidly growing Region. The intentions of the project were to improve the quality of service offered through higher-speed travel and improved use of technology, to increase transit ridership and, as a result, to reduce greenhouse gas (GHG) emissions in the Region.

The initial results demonstrate the *iXpress* has been successful in attracting riders. Despite delays in technology implementation, the most recently available data shows that ridership is at 92% of the forecast values. A closer look at the data reveals that while *iXpress* is attracting riders from other transit routes, a significant number of its riders previously commuted by automobile. Further, the evidence suggests that the implementation of *iXpress* has made travel possible for a subset of the population.

The analysis presented here demonstrates that *iXpress* is currently responsible for the reduction of approximately 1.5 million kilometres of personal automobile trips per year, with an associated reduction of approximately 500 tonnes of GHG emissions. Further, we estimate that if predicted ridership levels are achieved, these reductions in personal auto use will result in an annual reduction of 625 tonnes of GHG at the time of technology deployment and as many as 750 tonnes/year of GHG one year later.

1. INTRODUCTION

Similar to many communities across Canada, Waterloo Region is facing a daunting challenge represented by automobile travel in medium-sized urbanized areas. This challenge is characterized by: low to medium density land-use patterns developed over the past three decades; ubiquitous auto ownership; traffic congestion that occurs at relatively few locations in the road network and typically exists for relatively short periods of the day; parking that is free in most locations and relatively inexpensive where there is a charge; and travel times by auto that are generally very favourable. The resulting market share of the “drive alone by auto” option for journey to work trips is over 80%, with resulting damaging environmental impacts, particularly the creation of greenhouse gases (GHG).

This challenge, common to medium sized cities across Canada is further compounded in the case of Waterloo Region as a result of tremendous growth pressures. Population is predicted to grow by more nearly 60%, from 456,000 in 2001 to 729,000 in 2031, greatly intensifying impacts on transportation infrastructure, air quality and greenhouse gases.

To help meet this challenge, Waterloo Region has initiated higher order (express bus) public transit service (called *iXpress*) that is supported by a number of additional initiatives, including advanced technologies, marketing, and active mode integration.

This paper describes: the *iXpress* initiative; the steps taken to measure and monitor the impacts that the *iXpress* initiative has had on travel behaviour in Waterloo Region; the impacts that have been observed to date; and the plans for the future.

2. THE *IXPRESS* INITIATIVE

2.1 PROJECT BACKGROUND

On October 6, 2000, the Government of Canada announced it would establish the Urban Transportation Showcase Program (UTSP), among other initiatives contained in its Action Plan 2000 on Climate Change. The primary objective of the UTSP was to demonstrate, evaluate, and promote effective strategies to reduce greenhouse gas emissions from transportation in urban Canada. The program was formally launched June 11, 2001 and a nation-wide two-stage competitive selection process was initiated to select a number of showcase projects. Stage 1 consisted of submissions of expressions of interest. On the basis of these submissions, a number of projects were short-listed and proponents were invited to submit detailed proposals by May 2003 for the Stage 2 evaluation.

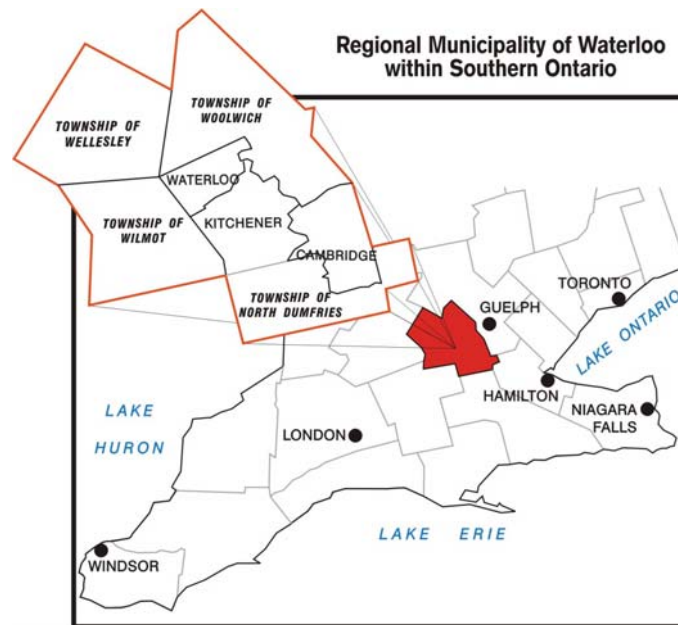
On the basis of this competitive selection process, the Region of Waterloo’s proposal entitled “Central Transit Corridor Express Project” was selected as one of projects for funding under the UTSP. The announcement of the successful proposals was made by the Federal Minister of Transport on Nov. 26, 2003. Formal contractual agreements between

the Region of Waterloo and the Federal Government and between the Region of Waterloo and the University of Waterloo were completed by the end of the summer of 2004.

2.2 WATERLOO REGION

Waterloo Region is one of the most diverse and dynamic economic regions in Canada. With a population of nearly half a million people, Waterloo Region is a significant contributor to the national economy, boasting an annual estimated regional GDP of over \$16 billion. The Region is situated at the fulcrum of the Greater Toronto Area and U.S. Gateways at Windsor, Sarnia and Niagara (Figure 1). This strategic location, along the axis of the North American free trade corridor, affords access to and is connected to many of the major North American markets.

Figure 1: Location of Region of Waterloo



The Region is comprised of the cities of Cambridge, Kitchener, Waterloo, and the townships of North Dumfries, Wellesley, Wilmot and Woolwich. Collectively the municipalities represent the 10th largest census metropolitan area in Canada, the 4th largest in Ontario and the extent of Canada's Technology Triangle. The MacDonell Cartier Freeway (Highway 401), which extends along the Quebec City to Windsor Corridor, bisects Waterloo Region. Several top ranked educational institutions - the University of Waterloo, Wilfred Laurier University and Conestoga College provide talented graduates that ensure the on-going supply of a highly skilled work force and innovation to fuel the success of existing and future enterprises.

The Region of Waterloo has a long history of innovation and proactive sustainable development. The hallmark of integrated transportation and land use planning will be

tested during the next 40 years with the projected growth in population and employment. Recognizing the new physical, social, environmental and economic realities that accompany growth, the Region initiated the development of a Growth Management Strategy to effectively manage these new realities and channel them to the Region's best advantage. A balanced transportation system and demand management initiatives, coupled with intensified land use to support higher order transit, are viewed as critical to addressing the challenges of new growth and reducing greenhouse gas (GHG) emissions. The transit initiative embodied as part of this UTSP project is just one step forward to achieving a balanced transportation system.

2.3 THE PROJECT

The UTSP project consists of the implementation of a higher order transit service supported by advanced technologies, enhanced integration with active access modes such as walking and cycling and novel marketing. The following sections describe each of these components in more detail.

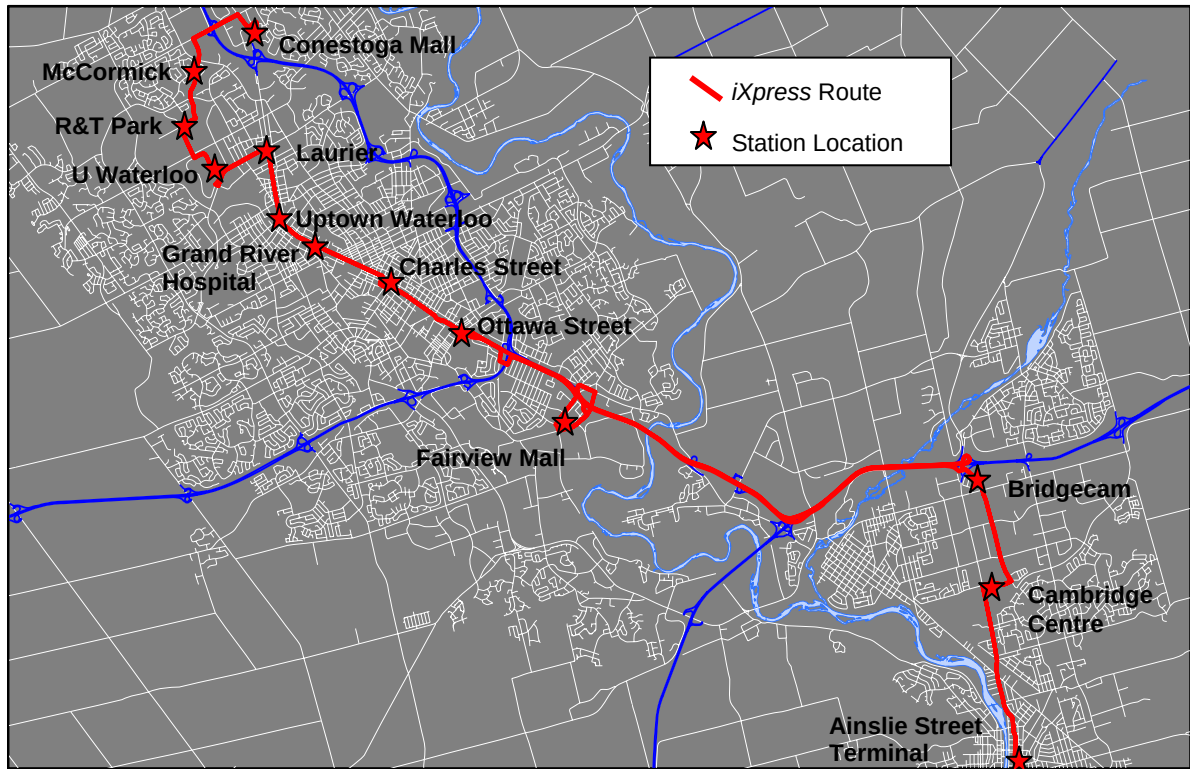
2.3.1 iXpress Service Route

The backbone of the project is a limited-stop express service branded as *iXpress* (Figure 2). The *iXpress* route, which travels from north Waterloo to south Cambridge, is approximately 33 km in length and consists of 13 stops. Along the route there are four downtowns, two universities, office complexes, major hospitals and regional shopping centres. The *iXpress* service, which commenced in September 2005, operates Monday to Friday with 15 minute headways during the morning and afternoon peak periods and with 30 minute headways during the midday.

Local transit routes operate along portions of the *iXpress* route, including Route 7 which currently serves the corridor within the urban municipalities of Kitchener and Waterloo. Local bus service headways on King Street in Kitchener and Waterloo approach 5 minutes during the peak periods.

The *iXpress* service is provided using standard 40 foot Nova low floor buses which are differentiated from buses servicing local routes by unique exterior branding.

Figure 2: *iXpress* route and stations



2.3.2 Advanced Technologies

The goals in developing the *iXpress* service were providing more reliable service (in terms of schedule compliance) and travel times that are more competitive with respect to auto travel times than existing local transit. One of the elements to achieving this goal was the use of advanced technologies, including:

- Transit signal priority (TSP);
- Automatic bus locating system (AVLS);
- Automatic passenger counting system (APCS);
- Real-time traveller information displays at stations;
- Web-based trip planner;
- Interactive Voice Response (IVR) systems which provide information through a touch-tone telephone for all GRT routes.

At the time of the writing of this paper, only TSP had been implemented and was operational. The remaining technologies were undergoing deployment and were expected to be operational late spring of 2007.

The purpose of the technologies was to enhance the travel experience by improving pre-trip planning (i.e. web-based trip planner); improving transit rider knowledge (i.e. real-time traveller information panels which would display the expected arrival time of the next *iXpress* bus); and the speed, comfort and reliability of the service (i.e. TSP).

2.3.3 Intermodal Integration

One of the primary goals of the project in Waterloo Region was the enhancement of non-auto travel modes. The implementation of the *iXpress* service, supported by the advanced technologies, provided an additional transit mode alternative to travellers. However, recognising that unlike auto trips, transit trips are not door-to-door, there was a strong desire to enhance the active modes (e.g. walk and bike) and their integration with the *iXpress* service. Consequently, a number of intermodal integration activities were undertaken, including:

- Installation of bike-racks on all buses within the GRT fleet;
- Installation of bike lockers at several stations;
- Installation of “post and ring” bike stands at several stations;
- Improvements to pedestrian facilities at several stations (e.g. painting ladder striping at intersections, replacement of sidewalks, etc.)
- Designation of bike lanes.

2.3.4 Branding and Community Based Social Marketing

The express bus service was branded as *iXpress* with a tag line of “connecting you” to reflect the fast, limited stop quality of the service, and to reflect the notion that this quality of service provides individuals with travel mode choices (expressions). The graphic design uses contemporary fonts and styling to reflect the advanced technology elements of the service and the high tech nature of the community it serves. The buses servicing the *iXpress* route are differentiated from buses servicing local routes by exterior graphics (Figure 3). Typical marketing campaigns were initiated including radio and print ads to inform and educate the community about the new service.

Figure 3: *iXpress* service branding



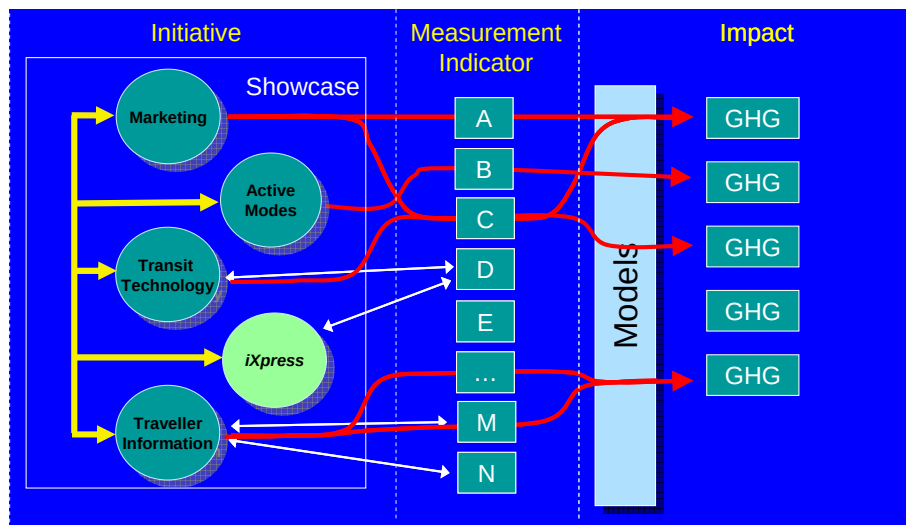
Community based social marketing (CBSM) differs from typical marketing in that it targets and interacts with individual households and trip makers in the community. The objective of CBSM is to target specific residential neighbourhoods within the service catchments area and identify, via surveys, their travel patterns, mode choices, and constraints. On the basis of the survey responses, individual households are approached and offered additional information and assistance in identifying alternate travel choices for their individual travel needs. A follow up survey is conducted to identify and quantify the impact that the CBSM has had on the travel patterns of the participating households.

3. MEASURING THE IMPACTS

Researchers from the University of Waterloo have partnered with the Region of Waterloo on the UTSP project and are responsible for identifying the impacts that the project has had, particularly with respect to greenhouse gas emissions.

An evaluation methodology was developed (Figure 4) under the assumption that each of the project components would be deployed soon after the *iXpress* service commenced in September 2005. The method consisted of identifying a number of measurement indicators, each related to one or more of the project components. These measurement indicators are used as inputs to models to estimate the impacts that the project components have had.

Figure 4: Proposed impact assessment methodology



The impact evaluation is still on-going and therefore this paper examines only a subset of the impact evaluation activities that have taken place. In particular, this paper describes (1) the aggregate impact of the *iXpress* service on transit ridership; (2) the methodology used to estimate the GHG emissions associated with the *iXpress* service and initial results using this methodology; and (3) the baseline results obtained from the CBSM pilot survey.

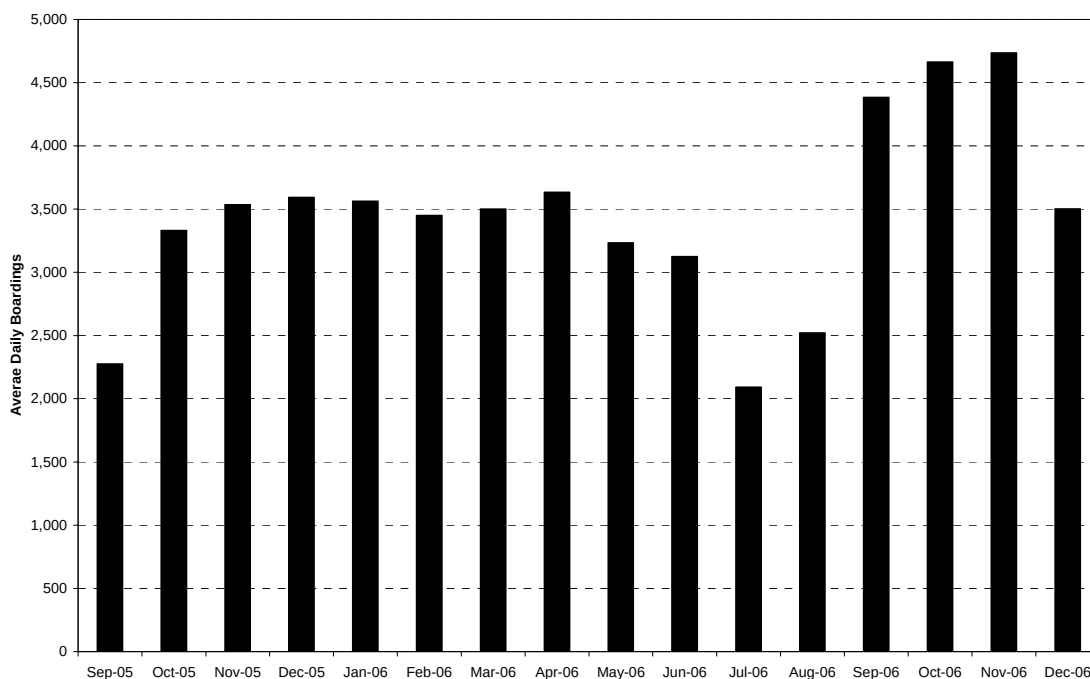
3.1 IMPACT OF *IXPRESS* ON TRANSIT RIDERSHIP

The impact of the introduction of the *iXpress* service can be measured in terms of the use of the service. Figure 5 depicts the average daily boardings for the *iXpress* service for each month from September 2005, when the service commenced, to the end of December 2006.

Several observations can be made on the basis of Figure 5.

1. The average number of daily boardings in October 2005 is approximately 140% of the average daily boardings for September 2005. This rapid increase in service use reflects the lag time between the beginning of service on September 6, 2005 and the change in travellers' behaviour to begin taking this service.
2. Significant seasonal variation is evident in the data. Consistent with general trends in urban transit use, the seasonal variation is strongly correlated with the school (high school and post-secondary school) year.
3. The boardings for September, October, and November 2006 are significantly larger (83%, 47%, and 34%, respectively) than the corresponding months one year earlier. This growth in ridership may reflect an increasing awareness in the community of the service. It is also noted that a student monthly transit pass was introduced at one of the local universities (Wilfred Laurier University) for September 2006. Students are required to pay for the pass as part of their student fees. This may have contributed to the increased ridership.

Figure 5: Average daily boardings on *iXpress* service



It is interesting to note that in the original UTSP project proposal, forecasts were made of daily *iXpress* ridership for three future service deployment scenarios;

2005 Basic Service (<i>iXpress</i> without support technologies):	3,800
2005 Service with supporting technologies:	5,000
Mature Service (1 year after full deployment):	5,700

From Figure 5 it is evident that during the 16 months of operations, daily boardings have averaged approximately 3,500 (92% of forecast). Due to delays in the deployment of the

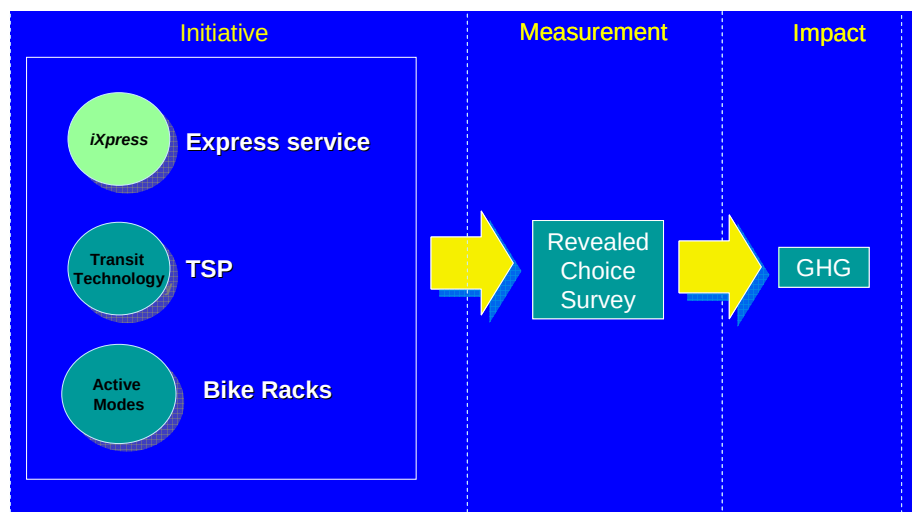
supporting technologies, this time frame most closely matches 2005 Basic Service forecast. Deployment of supporting technology is expected to be completed before the end of the summer of 2007 leading to the second forecast phase (i.e. 5,000 daily boardings).

Two additional observations on ridership can be made from initial surveys (described below) which were conducted by Grand River Transit. First, of the approximately 1146 survey respondents, there were 33 *iXpress* riders (2.9%) who do not have cars available, did not previously make the trip but now make the trip at least 4 times per week, and are traveling to work or school. This is a direct quantification of the *social benefits* of *iXpress* – providing mobility to quality of life enhancing activities for those who do not drive. A second important finding is that of all the survey respondents, 59 persons (5.1%) used to complete their trip as a driver of a private auto and still have a vehicle available to them. This indicates that *iXpress* is effective in capturing *choice riders* – those for whom many travel modes are available, but transit is most desirable.

3.2 IMPACT OF *IXPRESS* ON GREENHOUSE GAS EMISSIONS

The *iXpress* service commenced September 6, 2005. However, significant delays occurred in the deployment of most of the transit technology elements and the traveller information components. Consequently, a revised evaluation method was developed to estimate the GHG impacts that the *iXpress* service has had after approximately 6 months of service (e.g. Feb. 2006). This revised method is illustrated in Figure 6. The method makes use of data obtained from two revealed choice surveys and reflects travellers choices in response to the *iXpress* service conducted as it existed in the fall of 2005 (i.e. with unconditional transit signal priority and bike racks on all *iXpress* buses).

Figure 6: GHG impact assessment method



Two revealed choice intercept surveys were conducted. An intercept survey was conducted on the *iXpress* on Thursday Dec. 6, 2005 and again on Wednesday February 15, 2006. In both surveys, riders were provided with a survey questionnaire when they boarded the bus, asked to complete the survey, and to return the completed survey before leaving the bus. The responses on the returned questionnaire were entered into a database. The database was used to calculate parameter values required for estimating GHG impacts. The following sections describe the two survey methods in more detail.

3.2.1 December 6, 2005 Survey

The survey was scheduled to be conducted on all *iXpress* buses during both the morning and afternoon peak periods. However, as a result of unexpected problems with distribution of the survey cards, data were obtained only for the afternoon period.

A total of 615 surveys were returned by respondents. The actual number of *iXpress* riders during the survey period is not known. However, the average daily number of boardings computed over a three month period beginning October 2005 is approximately 3500.

The survey questionnaire consisted of 22 questions (Appendix A); however, only the following four questions were relevant for the purposes of estimating the impact of *iXpress* on GHG:

Question 6: *I got on this bus at: _____ <iXpress stop name>*

Question 8: *I am getting off this bus at: _____ <iXpress stop name>*

Question 13: *I take this trip: _____ times per week*

Question 17: *Before iXpress, how would you have made this trip? Select from*

- *Local route # _____*
- *Passenger in car*
- *Drove car*
- *Bike*
- *Walk*
- *Taxi*
- *Other*
- *Did not make trip*

Of the 615 returned survey questionnaires, only 484 contained complete answers for these four questions and therefore only these responses constituted the survey sample that was used for further analysis.

3.2.2 February 15, 2006 Survey

Due to a limited number of surveyors available to conduct the survey, the survey was scheduled to be conducted over two consecutive days with surveyors on half of the *iXpress* buses on each day. Unfortunately, on the second day of the survey period (i.e. Feb. 16) a winter storm resulted in the closure of the University of Waterloo, Wilfred Laurier University, and all public and Catholic elementary and high schools in the Region, as well as many day care centres, offices, and other businesses. Obviously, these

closures would have had a significant impact on travel patterns, including the use of the *iXpress* service, and consequently the survey was cancelled.

Nevertheless, data obtained on the first day of the survey (Feb. 15, 2006) captured ridership over the period from 5:30 AM to 6 PM for approximately half of the *iXpress* fleet.

A total of 1146 surveys were returned by respondents. The actual number of *iXpress* riders during the survey period is not known.

The survey questionnaire used on the Feb. 15, 2006 survey was different from the questionnaire used on the Dec. 6, 2005 survey. During the Dec. 6th survey, feedback from the respondents indicated that the questionnaire was too long. Consequently, the questionnaire was revised for the Feb. 15th survey and several questions were omitted. The questionnaire consisted of 15 questions (Appendix B); however, only the following four questions were relevant for the purposes of estimating the impact of *iXpress* on GHG:

- Question 5: *I got on this bus at: _____ <iXpress stop name>*
- Question 7: *I am getting off this bus at: _____ <iXpress stop name>*
- Question 12: *I take this trip: _____ times per week*
- Question 14: *Before iXpress, how would you have made this trip? Select from*
 - *Local route # _____*
 - *Passenger in car*
 - *Drove car*
 - *Bike*
 - *Walk*
 - *Taxi*
 - *Other*
 - *Did not make trip*

Of the 1146 returned survey questionnaires, 995 contained complete answers for these four questions and therefore only these responses constituted the survey sample that was used for further analysis.

3.2.3 Analysis Method

The impact of the new *iXpress* service on GHG emissions arises from three different sources, namely (a) the emissions created by the new service, (b) the elimination of emissions from express route 101 which the *iXpress* service replaced, and (c) elimination of emissions associated with auto trips no longer made because the trip makers have switched from using an auto-based mode to using *iXpress*. This section describes this last impact.

The GHG impact was estimated using the method illustrated in Figure 7. From the survey the previous mode used (M_i) and trip length (d_i) was determined for each respondent i . For each trip previously made using an auto-based mode (e.g. Driver of Car, Passenger in Car, and Passenger in Taxi), the estimated annual fuel savings (in Litres) was calculated

as the trip length $\times$ average fuel consumption rate $\times$ trip frequency. This was summed across all respondents i to find the total fuel (T) saved. Using a constant conversion rate, fuel was converted to mass of GHG emissions saved (E).

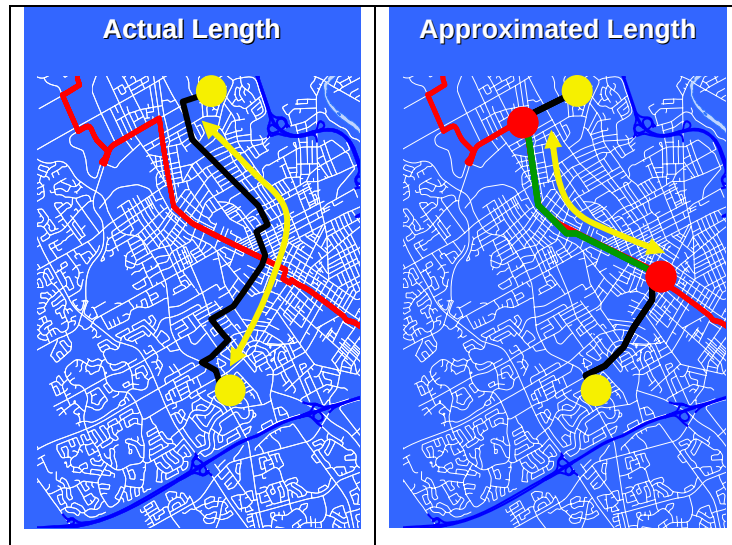
Figure 7: Emission calculation methodology

Survey Responses					Calculations	
Respondent (i)	Origin (O _i)	Destination (D _i)	Mode (M _i)	Frequency (f _i)	Trip Length (d _i)	Fuel (F _i)
1						
2						
⋮						
⋮						
N						
					Total Fuel	T
					Total GHG	E

Trip length was computed on the basis of the origin and destination data provided by the survey respondents. Respondents were asked to provide their trip origin and destination by street address or major intersection and were also asked at which station they boarded the *iXpress* and at which station they planned to depart the *iXpress*. Many respondents provided no or incomplete data for trip origin and trip destination and therefore, trip origin (O_i) was considered to be the *iXpress* station at which the rider boarded the *iXpress* and the trip destination (D_i) the station identified by the respondent at which they would be departing the *iXpress*.

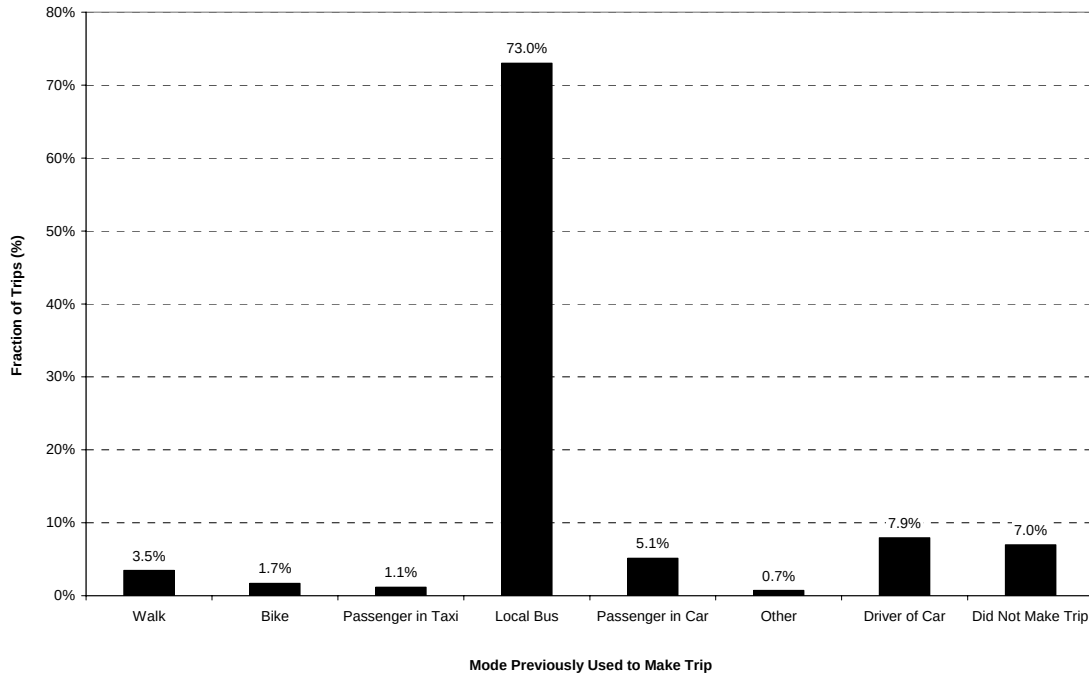
It is recognised that these origins and destinations reflect only the locations at which the rider boarded and departed the *iXpress* and therefore represent only a portion of the total trip. Furthermore, as illustrated in Figure 8, the trip distance (d_i) computed from these origins and destinations likely under-estimates the actual trip length; however the magnitude of this underestimation is not known.

Figure 8: Actual and approximated trip length



Survey respondents were asked to indicate the mode they used prior to the availability of the *iXpress* service and how many times per week they made the trip. Figure 9 illustrates the average fraction of trips previously made using each available mode. These data can be interpreted as the modes from which *iXpress* riders have switched. As expected, a large number (73%) of *iXpress* riders have switched from local bus routes. However, a relatively large proportion of riders (14%) switched from auto-based modes (7.9% driving a personal automobile; 5.1% from being a passenger in an automobile; and 1.1% from using a taxi).

**Figure 9: Mode that was used prior to availability of *iXpress*
(Average of Dec. 6, 2005 and Feb. 15, 2006 surveys))**



It is also interesting that 7.0% of respondents did not previously make the reported trip. Two possibilities can be identified that explain these previously unmade trips.

1. These trips may be new because of a change in the trip makers' travel generation circumstances, such as a change in employment location; employment status (i.e. may not have been employed previously and now is employed); or change in place of residence.
2. The person may not have made the trip previously because the trip was not sufficiently attractive given the travel modes available to the trip maker. However, after *iXpress* became available, the trip time and/or cost were sufficiently reduced to make the trip attractive representing an increase in trip maker mobility. This explanation may be particularly applicable to discretionary trips such as trips made for shopping and entertainment.

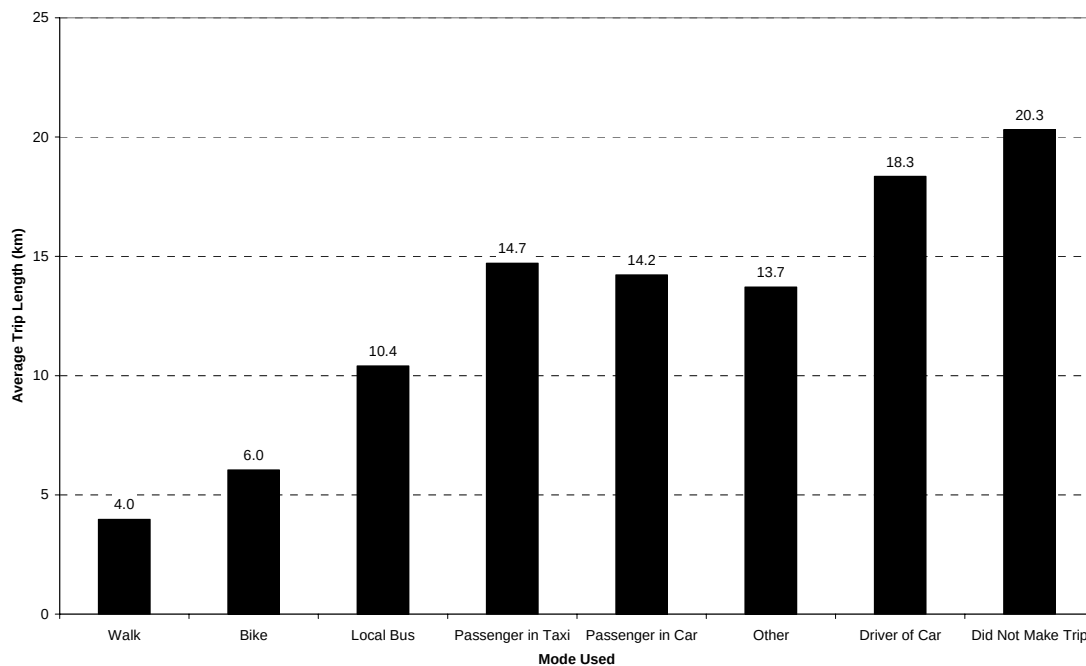
It is difficult to conclude what impact previously unmade trips may have on GHG. If it is assumed that these trips would have been made by some other mode if the *iXpress* had not been available, then these trips should also be considered in the calculation of GHG reductions resulting from the *iXpress*.

In identifying the impact that mode shift from "Passenger in Car" to *iXpress* has on GHG emission, it is speculated that some portion of the total km associated with "Passenger in car" trips likely were still made after the passenger switched mode to take the *iXpress*. However, the survey data do not provide any information from which this proportion can be estimated. Consequently, it has been assumed that 25% of the total kilometres

associated with former “Passenger in car” trips are still made. The validity of this assumption remains to be determined.

Figure 10 illustrates the average trip length by previously used mode. The relationship between average trip length and previous mode used is consistent with expectation. Shorter trips were made via Walk and Bike modes. Longer trips were made via local transit and even longer trips were made by auto mode. Interestingly, trips that previously were not made are on average the longest. This seems to indicate that the presence of the *iXpress* service has provided access to mobility that was previously unavailable.

**Figure 10: Average trip length by mode used prior to availability of *iXpress*
(Average of Dec. 6, 2005 and Feb. 15, 2006 surveys))**



3.2.4 Results

On the basis of these data it is estimated that for ridership levels as experienced during the first 4 months of service, travellers switching from auto mode to *iXpress* has resulted in a annualized reduction of approximately 1.5 million kilometres of auto travel and a corresponding savings of approximately 170,000 litres of gasoline and approximately 450 tonnes of GHG.

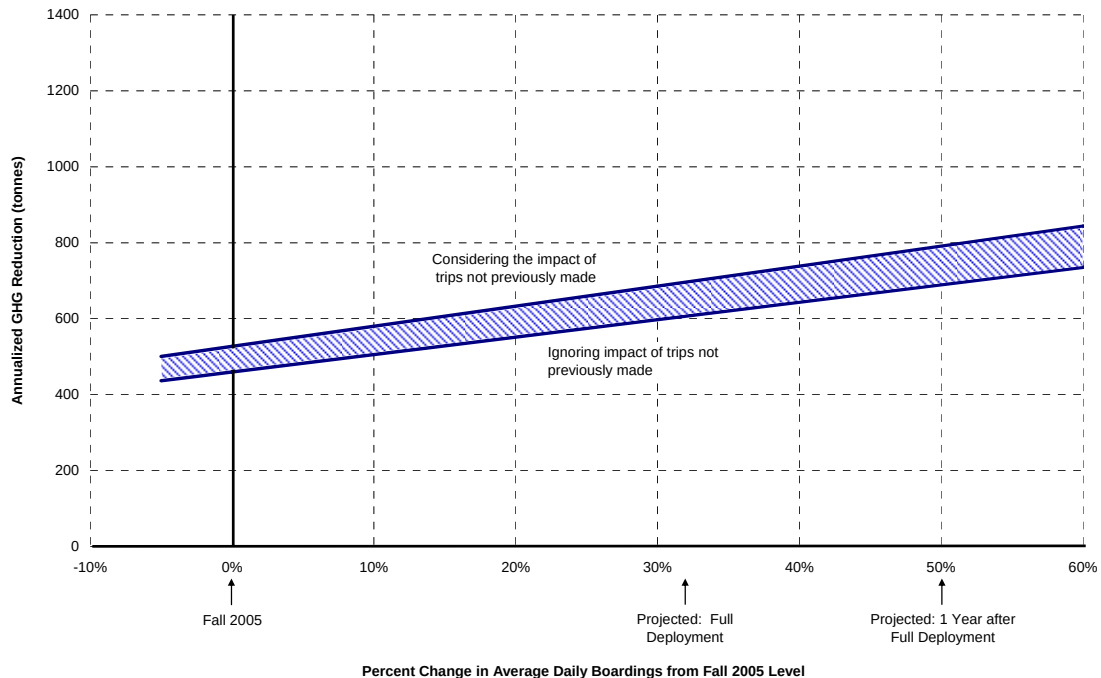
The following constants were used in the GHG estimation calculations:

- Average automobile fuel consumption rate = 11.21 L/100km (Canadian Vehicle Survey, 2001),

- Conversion of gasoline to mass of GHG (Transport Canada): 2,503.86 tonnes/million litres of gasoline

The gross annualized reduction in GHG emissions due to this mode change is a function of the number of riders making use of the *iXpress* service. Figure 11 illustrates the change in GHG reductions as a function of the average number of daily boardings.

Figure 11: Estimate of annualized gross reduction in GHG emissions due to mode shift to *iXpress*



3.3 CBSM – BASELINE SURVEY

Another aspect of the UTSP project is the exploration of whether or not lack of knowledge of transportation alternatives is a barrier to the use of non-auto modes. The CBSM components of the project will help to explore this issue. A pilot CBSM survey was conducted in September, 2006. The purpose of the survey was to collect detailed household travel data to establish a baseline measure for evaluating the impacts that community based social marketing (CBSM) activities have on modifying travel behaviour and to identify suitable candidates to participate in the CBSM activities.

The neighbourhoods within approximately 1500 metres surrounding the Ainslie Street Transit Terminal in Cambridge were selected as the target area. A phone number database of this area was purchased and 1925 households were randomly selected.

Each of the 1925 households were sent a letter of introduction to the project, followed by another letter one week later which included a link to the on-line survey in addition to a paper copy of the survey. Several attempts were made to contact the household by

telephone, to confirm mailing had been received, encourage participation and answer any questions.

The survey consisted of three parts, namely (1) Household profile information; (2) Household member information; and (3) Trip information. A total of 794 surveys were begun¹ of which 174 (22%) households conducted the survey on-line and the remaining 620 (78%) on paper copy. However, a number of survey respondents created duplicate household profiles. Duplicate entries were identified and either merged or deleted as required. This resulted in the removal of 9 records. From the remaining 785 surveys, 28 (3.6%) consisted of household profiles only, as the second part of the survey was not completed (i.e. did not provide information on trip makers). An additional 27 (3.4%) households did not complete part 3 of the survey (i.e. they did not log any trip information). Consequently, 730 (91.9%) of the 794 surveys returned were considered complete and used to establish base-line travel behaviour.

The survey respondents' characteristics and travel behaviour can be summarized as follows:

- Average of 2.4 persons per household.
- Average of 1.5 motorized vehicles per household.
- 12.7% of households had no motorized vehicle.
- 46% of trip makers are employed full time; 11% employed part-time; 26% unemployed and 17% are students.
- 74% of trip makers have a valid driver's license.
- A total of 5,308 trips were reported. For approximately 8.5% of these trips, no personal automobile was available to the trip maker. Fifty-eight percent of these trips were made by walking, 15% by transit, and 9% by bike.
- For those trip for which at least one vehicle was available to the trips maker; 64% were made by driving a car, 24% as a passenger in a car, and 9% by walking. Only 1.2% of these trips were made by transit.
- Approximately 32% of trips were less than 2 km in length. Median trip length was 5 km.
- Average of 7.3 trips reported per household per day.
- Average of 3.2 trips per day per trip maker.

These characteristics define the existing demographics and travel preferences for the surveyed households. It is clear that, similar to many medium-sized communities, personal auto is the dominant mode choice, even for relatively short trips. Furthermore, car ownership is generally understood to be a strong determinant of mode choice. Average car ownership for the survey respondents (1.5 vehicles/household) is on the same order as the average for the Greater Toronto Area and surrounding municipalities

¹ For respondents using the on-line survey, "begun" means that they completed at least one of the three portions of the survey - typically the household profile information portion.

(1.4 vehicles/household), as determined from the 2001 Transportation Tomorrow Survey (TTS, 2001).

Despite the current dominance of auto use, approximately 17.5% of trip makers indicated that they were interested in receiving additional information about non-auto modes of travel. These trip makers will be the target for phase 2 of the CBSM pilot study in which they will be provided with information concerning alternate transportation options, etc. A subsequent survey will be conducted in the late spring of 2007 to determine the impact of the CBSM on trip making behaviour.

4. CONCLUDING REMARKS

This paper has described the central transit corridor project being undertaken in the Region of Waterloo as part of the Urban Transportation Showcase Program. The methods being used to monitor the impacts of this project have been introduced and impacts observed to date were reported. Several important components of the UTSP project have not yet been deployed and consequently, their impacts cannot yet be measured.

On the basis of the impacts that have been quantified it was observed that:

1. Almost 14% of riders using *iXpress* 6 months after service commenced, had previously made their trip using an auto-based mode (either drove a car, were a passenger in a car, or took taxi). This mode change represents an estimated annualized reduction of 1.5 million auto km; 170,000 litres of fuel, and 450 tonnes of greenhouse gas emissions.
2. Almost 7% of riders using *iXpress* 6 months after service commenced reported that they had previously not made that trip. This may indicate that the *iXpress* service has provided increased mobility (e.g. access to jobs, recreation, shopping, etc.).
3. The *iXpress* service has experienced an increase in ridership (measured in number of boardings) of 37% during the period of Sept. through Dec. 2006 compared to the same period in the previous year with no change in the number of hours of service.

ACKNOWLEDGEMENTS

This research was financially supported by Transport Canada (Urban Transportation Showcase Program), the Regional Municipality of Waterloo and the Natural Science and Engineering Research Council of Canada.

REFERENCES

TTS (2001) <http://www.jpint.utoronto.ca/tts01/tts.html>. Accessed March 6, 2007.

Canadian Vehicle Survey (2000) <http://www.tc.gc.ca/pol/en/aca/cvs/menu.htm>. Accessed Feb. 2006.

Transport Canada. GHG Emission factors.

http://www.tc.gc.ca/programs/Environment/climatechange/subgroups1/passenger_urban/study1/final_report/final_report.htm#_Toc454344378. Accessed Feb. 2006.

Appendix A: Dec. 6, 2005 Questionnaire

GRT
GRAND RIVER TRANSIT

Travel Survey 2005 No:

Complete this survey for a chance to win an iPod!

Name: _____

Address: _____ # _____ Street Name _____

Postal Code: _____ Phone #: _____

When finished please hand this survey back to surveyor.

1. I paid for this bus trip using:
☐ Cash ☐ Adult Ticket ☐ Senior/Student Ticket ☐ Adult Pass ☐ College Pass
☐ Laurier OneCard ☐ University Pass ☐ Corporate Pass ☐ Senior/Student Pass

2. My age is: ☐ 16 or less ☐ 17-25 ☐ 26-35 ☐ 36-55 ☐ 56-64 ☐ 65+

3. My gender is: ☐ Female ☐ Male

4. On this bus trip I am coming from:
☐ Home ☐ Work ☐ School ☐ Shopping ☐ Recreation ☐ Other

5. Which is located at:

Address # _____ Street Name _____ Postal Code _____
OR Closest Intersection _____ & _____ Street Name _____
☐ Cambridge ☐ Kitchener ☐ Waterloo ☐ Other _____

GRT
GRAND RIVER TRANSIT

Travel Survey 2005

8. I am getting off this bus at:
☐ Conestoga Mall ☐ McCormick ☐ R & T Park
☐ U Waterloo ☐ Laurier ☐ Uptown Waterloo
☐ Grand River Hospital ☐ Charles Terminal ☐ Ottawa
☐ Fairview ☐ Bridgecam ☐ Cambridge Centre ☐ Ainslie Terminal

9. My FINAL destination for this bus trip is:
☐ Home ☐ Work ☐ School ☐ Shopping ☐ Recreation ☐ Other

10. Which is located at:

Address # _____ Street Name _____ Postal Code _____
OR Closest Intersection _____ & _____ Street Name _____
☐ Cambridge ☐ Kitchener ☐ Waterloo ☐ Other _____

11. I will get to my FINAL destination:
☐ on this bus ☐ by transferring to Route # _____

12. I will arrive at my FINAL destination by:
☐ walking ☐ being picked up ☐ riding my bike ☐ other

13. I take this trip:
☐ _____ times per week ☐ once a month ☐ other

14. For this trip my total travel time is: _____ minutes
(include walking, waiting and riding time).

15. Did you have a vehicle available to use for this trip? ☐ Yes ☐ No

16. Is your iXpress trip today: ☐ one-way ☐ round trip

17. Before iXpress, how would you have made this trip?
☐ Bus (Route # _____) ☐ passenger in car ☐ drove car
☐ bike ☐ walk ☐ taxi ☐ other ☐ did not make trip

18. How do you keep informed about GRT?
☐ Website ☐ Rider alerts ☐ newspaper ☐ terminal poster
☐ shelter posters ☐ Transit Talk ☐ radio
☐ information on bus ☐ friends ☐ other _____

19. There is/are _____ vehicles(s) at my home.

20. There is/are _____ person(s) living at my home.

21. Typically, Mon. through Fri., I make _____ one-way trips on GRT.

22. Typically, on the weekend, I make _____ one-way trips on GRT.

Important! Please Fill Out Back of Form!

FOR ADMINISTRATIVE USE ONLY

Bus #: _____ Run #: _____ Time: _____ Surveyor: _____

Collection Notice: Personal information requested on this form is collected under the authority of the Municipal Act and will be used to assist Region staff and Regional Committees regarding transit service. All information is confidential. Region of Waterloo employees or their families are not eligible to win.

Appendix B: Feb. 15, 2006 Questionnaire



Travel Survey

No:

Complete this survey for a chance to win an iPod!

Name:

Address:

Street Name

Phone #:

Postal Code:

☐ Kitchener

☐ Waterloo

☐ Cambridge

☐ Other

1. My age is: ☐ 16 or less ☐ 17-25 ☐ 26-35 ☐ 36-55 ☐ 56-64 ☐ 65+

2. My gender is: ☐ Female ☐ Male

3. On this bus trip I am coming from:

☐ Home ☐ Work ☐ School ☐ Shopping ☐ Recreation ☐ Other

4. Which is located at (please fill out at least one of the categories below):

Address:

Street Name

Closest Intersection:

Street Name

Postal Code

☐ Cambridge ☐ Kitchener ☐ Waterloo ☐ Other

5. I got on this bus at:

☐ Conestoga Mall ☐ McCormick ☐ R & T Park

☐ U Waterloo ☐ Laurier ☐ Uptown Waterloo

☐ Grand River Hospital ☐ Charles Terminal ☐ Ottawa

☐ Fairview ☐ Bridgecam ☐ Cambridge Centre ☐ Ainslie Terminal

6. I got to this bus by:

☐ transfer from Route #

☐ walking ☐ dropped off ☐ bike ☐ other

7. I am getting off this bus at:

☐ Conestoga Mall ☐ McCormick ☐ R & T Park

☐ U Waterloo ☐ Laurier ☐ Uptown Waterloo

☐ Grand River Hospital ☐ Charles Terminal ☐ Ottawa

☐ Fairview ☐ Bridgecam ☐ Cambridge Centre ☐ Ainslie Terminal

Important! Please Fill Out Back of Form!

Travel Survey

8. My FINAL destination for this bus trip is:

☐ Home ☐ Work ☐ School ☐ Shopping ☐ Recreation ☐ Other

9. Which is located at (please fill out at least one of the categories below):

Address:

Street Name

Closest Intersection:

Street Name

Postal Code

☐ Cambridge ☐ Kitchener ☐ Waterloo ☐ Other

10. I will get to my FINAL destination:

☐ on this bus ☐ by transferring to Route #

11. I will arrive at my FINAL destination by:

☐ walking ☐ being picked up ☐ riding my bike ☐ other

12. I take this trip:

☐ days per week ☐ days per month ☐ other

13. Did you have a vehicle available to use for this trip? ☐ Yes ☐ No

14. Before iXpress, how would you have made this trip?

☐ Bus (Route #) ☐ passenger in car ☐ drove car

☐ bike ☐ walk ☐ taxi ☐ other ☐ did not make trip

15. How many vehicles are at your home? ☐ 1 ☐ 2 ☐ 3 ☐ 4+

Thank you for completing this survey!

Collection Notice: Personal information requested on this form is collected under the authority of the Municipal Act and will be used to assist Region staff and Regional Committees regarding transit service. All information is confidential. Region of Waterloo employees or their families are not eligible to win.

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