The Feasibility of a Community U-Pass (ComPASS) in Kelowna, British Columbia

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Abstract. A ComPASS (Community U-Pass) is a universal community transportation pass that would be applied to households in neighbourhoods rather than students in universities. A ComPASS would provide unlimited access transit passes and other possible components including recreation centre passes, bike tune-ups, merchant incentives, and emergency taxi rides home. The goal of providing a ComPASS to neighbourhoods is to provide an attractive alternative to decrease personal vehicle use in favour of active transportation (e.g. walking, cycling, and transit) modes. The ComPASS concept has already been successfully proven through Boulder, Colorado's Neighbourhood Eco (NECO) Pass for over 20 years. However, this research explores the possibility of a ComPASS in Kelowna, BC, specifically for the residents of the Glenmore neighbourhood. The objectives of this research were to design a ComPASS that would compete with personal vehicle use and implement a ComPASS pilot program to test the potential of the program in Kelowna. Thirty-two households participated in the pilot study (18 treatment and 14 control households), and were surveyed before, during, and after the pilot study. Results of the pilot study suggest that ComPASS could significantly reduce personal vehicle use at a 93.7% confidence level and significantly increase transit use at an 85.7% confidence level. Personal vehicle use could decrease between 6% and 12% amongst ComPASS holders which would translate to a reduction in vehicle kilometres travelled (VKT) per household, resulting in several community-wide benefits. According to an estimated participation rate of 59%, 19 of the 32 piloted households would participate in a potential permanent ComPASS program. Over a three year trial period assuming 19 participating households, there could be 6,052 kg to 12,103 kg reduced greenhouse gas (GHG) emissions, 15 to 30 reduced road injuries, 0.06 to 0.11 reduced road fatalities, and social and government savings of $20,552.26 to $41,104.51. Due to the potential benefits, ComPASS is a recommended tool to help Kelowna achieve sustainable community goals.

INTRODUCTION

There are many examples of ComPASS related programs across North America, known by several different names. In British Columbia, common related programs are the U-Pass (for university students) and BC Transit's Pro-Pass (for employers/employees). Both programs differ in their structure, but they have one main component in common: unlimited transit access at a discounted price. ComPASS differs from these existing related programs in the following ways:

- It is applied to households rather than individuals; and,
- In addition to an unlimited transit pass, ComPASS also provides other components such as recreation centre passes, bike tune-ups, merchant incentives, and emergency taxi rides home for households.

The pass is discounted through implementing the Community Revenue Neutral (CRN) model, which follows three main principles:

1. Transit authorities and other component providers do not lose existing revenue;
2. Participants subsidize fellow participants by collectively paying the existing revenue of component providers; and,
3. The existing revenue is determined by usage of components within a defined geographic boundary, with adjustments as needed for program administration and overhead costs.

ComPASS is intended to be a proactive strategy to help alleviate community sustainability issues by encouraging reduced personal vehicle use in favour of walking, cycling, and transit. ComPASS-style

programs have proven to be successful elsewhere in North America, but the most notable example is Boulder, Colorado's Neighbourhood Eco (NECO) Pass.

Boulder, Colorado's Neighbourhood ECO (NECO) Pass

Boulder, Colorado's NECO Pass, has been operating for over 20 years. Like the ComPASS, the NECO Pass program:

- Targets neighbourhoods instead of university students or employers/employees;
- Includes transit passes;
- Includes merchant incentives (the "Eco Pass Extra");
- Is priced per household rather than for individuals.

Unlike the ComPASS, a NECO Pass does not include other components such as emergency taxi rides home, recreation centre passes, or bike tune-ups. Boulder has been tracking transportation habits in the City every two to three years since 1990 to understand how habits are changing in the community. Figure 1 shows the percent mode split from 1990 to 2012 in Boulder.

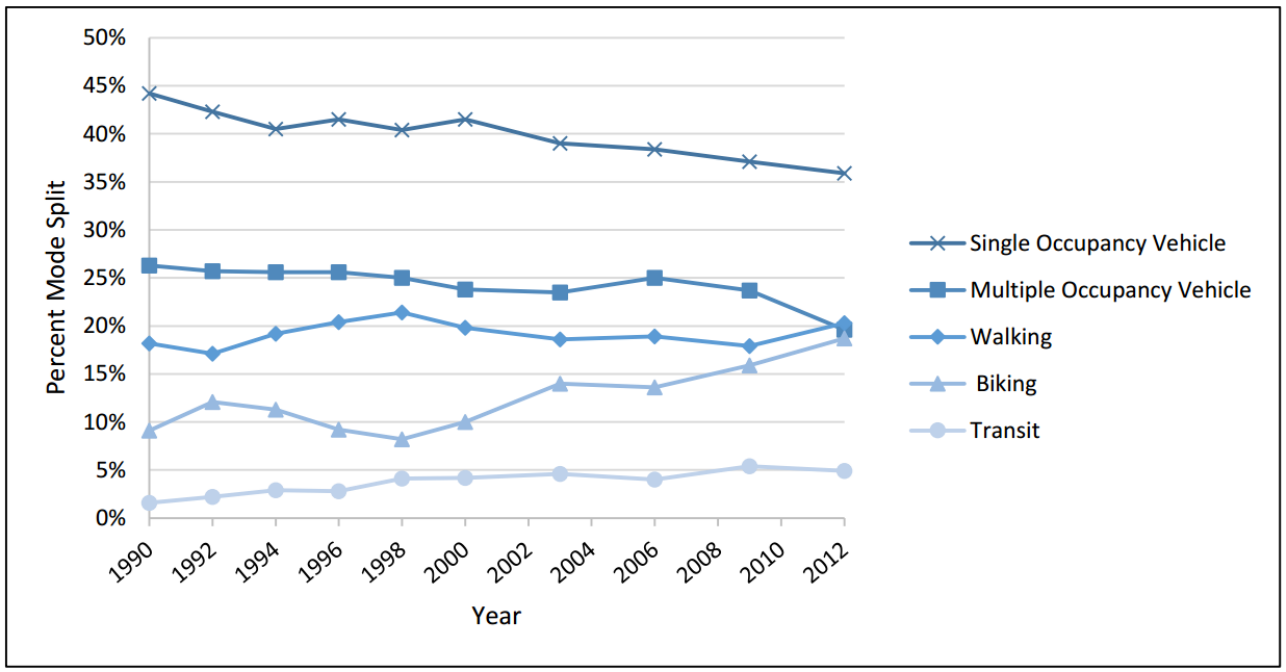

Figure 1 – Changes in transportation mode from 1990 to 2012 in Boulder, Colorado (National Research Center 2013)

Despite a 22% population increase from 1990 to 2012, the single occupancy vehicle mode share significantly decreased from 1990 to 2012, while multiple occupancy vehicle use, transit use, and cycling significantly increased. Walking trips remained fairly constant from 1990 to 2012.

These significant shifts away from single occupancy vehicle use towards carpooling, transit, and cycling are attributed to the City of Boulder's innovative transportation solutions, including their Eco Pass programs (for businesses, students, and neighbourhoods), transit service improvements, parking management, and cycling infrastructure improvements. While this success was a system of many parts, the Eco Pass programs are an important contributor to these mode shifts (City of Boulder 2006):

- Eco Pass holders travel 4,252 VKT less each year than non-Eco Pass holders; and,
- The average NECO Pass holder reduces their CO_2 outputs by 1.2 metric tons each year, compared to non-Eco Pass holders.

Boulder is comparable to Kelowna in many ways, including population size, terrain, climate, and sustainability goals. The two communities are different in some ways; Kelowna has an older median age and

a lower population density. These differences mean that a "cookie cutter" ComPASS design that applies to all situations is not possible, and that there is a need for a "made in Kelowna" ComPASS design.

COMPASS PILOT STUDY

To test whether a ComPASS could be successful in the Glenmore neighbourhood, a pilot study was implemented in 2011, and participating households were surveyed before, during, and after the pilot study to determine how ComPASS may have impacted transportation behaviours. The pilot study focussed on a 55-household study area within the Glenmore community in Kelowna, along Van Street, Lambert Avenue, and Pinehurst Crescent. Figure 2 shows the ComPASS pilot study area.

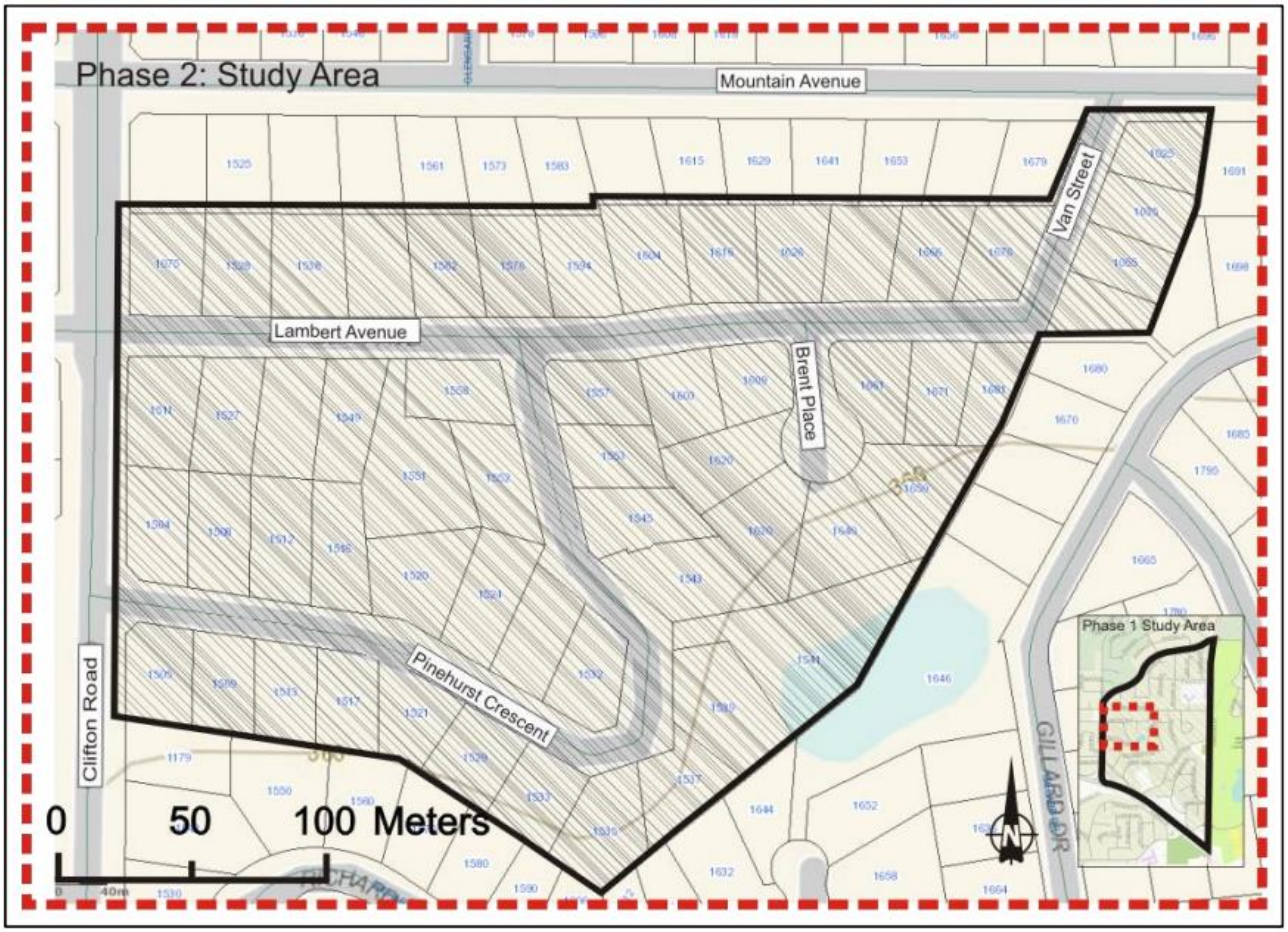

Figure 2 – ComPASS pilot study location

Although a longer duration was desired, available time and budget allowed for a three month pilot study duration. To encourage a higher sample size, the research team attempted to contact all 55 households within the pilot study boundary. However, the sample size ultimately depended on households' willingness to participate. Through extensive canvassing within the study area, 32 households were recruited to participate in the study. Of these 32 households, 18 households were placed in the treatment group (received a ComPASS package for the duration of the pilot study), and 14 households were placed in the control group (did not receive a ComPASS package for the duration of the pilot study).

ComPASS Package

ComPASS components included in the pilot study were selected using results from a previous community survey conducted in the Glenmore neighbourhood. Based on the community survey results, the most popular ComPASS components were (in addition to an unlimited transit pass):

- Local merchant discounts;
- Recreation centre pass;
- Bike tune-ups; and,
- Emergency taxi rides home.

Based on community preferences, these components were combined into the piloted ComPASS package.

Data Collection

The ComPASS pilot study operated from May 1, 2012 to July 31, 2012 (three months). The 18 households in the treatment group were given a ComPASS package for the three month duration, while the 14 households in the control group were not provided with any intervention. Three surveys and travel diaries were distributed to households at three time points throughout the pilot study; before the pilot study began (mid-April), during the pilot study (mid-June), and after the pilot study concluded (mid-September). Hardcopy surveys were distributed to households and collected for data synthesis.

Data Analysis

Survey

Several questions were asked in the pre, mid, and post pilot study surveys, however; this paper focuses on the following survey questions relating to travel behaviours:

- How many car trips as the driver trips did each member of your household make in the past week?
- How many car trips as the passenger trips did each member of your household make in the past week?
- How many transit trips did each member of your household make in the past week?
- How many cycling trips did each member of your household make in the past week?
- How many walking trips did each member of your household make in the past week?

Detecting differences in reported trips for each transportation mode between each group (treatment and control) and each survey (pre, mid, and post) helped determine whether the ComPASS intervention may have influenced travel behaviours. To analyze this data, the generalized linear mixed model (GLMM) tool was applied using IBM® SPSS® Version 22 (2013) software.

Travel Diary

The travel diary asked households to fill out trips each household member took on a specified date. This date was the same for all households (both treatment and control groups). Specific information filled out in the travel diaries included:

- Trip origin and destination;
- The transportation mode used for the trip (e.g. car trip as the driver, car trip as the passenger, transit, cycling, or walking); and,
- The name of the household member that took the trip.

The travel diary information was primarily used to determine the average vehicle kilometres travelled (VKT) by each household during the pre, mid, and post surveys to determine if there were any potential changes in behaviours. To determine the VKTs travelled, the origin and destination of each documented trip was inputted into Google Maps (2015), and the distance in kilometres for the trip was documented and analyzed.

RESULTS AND DISCUSSION

Household Characteristics

It is important to note the demographical differences between the control and treatment groups. Compared to the control group, the treatment group households tended to have:

- A lower average age;
- More full time employed household members;
- More students (UBC and grade 12 & under);
- More bikes per household;
- More vehicles per household; and,
- A higher household income.

These differences between groups may have resulted from the experimental design, where households were given the opportunity to select whether they were in the control or treatment group. While the differences between the treatment and control group may be considered a limitation to the research, the division in groups also demonstrates what type of residents would choose to participate in a ComPASS program. Understanding these differences help to understand pilot study results.

Transportation Mode Split

Table 1 shows the control and treatment groups' percent mode split for the week leading up to each survey.

Table 1 – Transportation mode split

Group	Survey	Car Trips as Driver	Car Trips as Passenger	Transit Trips	Cycling Trips	Walking Trips
Control	**Pre**	49%	22%	4%	4%	22%
	Mid	53%	20%	1%	5%	21%
	Post	44%	21%	3%	4%	28%
Treatment	**Pre**	41%	23%	4%	11%	20%
	Mid	36%	22%	6%	14%	22%
	Post	42%	22%	4%	12%	19%

- During all three surveys, the control households tended to take more car trips as the driver compared to the treatment group.
- Control and treatment households took similar amounts of car trips as the passenger.
- Both groups took similar amount of transit trips during the pre- and post-surveys, but the treatment group took transit much more than the control households during the mid-survey (when ComPASS was in effect).
- During all three surveys, the treatment group tended to cycle more than the control households. This could be due to the younger average age of the treatment households, and more bikes per household.
- Walking trips were fairly similar between both groups and between all three surveys.

The control group's behaviours generally represent the transportation behaviours expected from the treatment group had they not received a ComPASS. Table 2 shows the percent change in each transportation mode for each group between surveys.

Table 2 – Transportation mode split percent change between surveys

Group	Survey	Car Trips as Driver	Car Trips as Passenger	Transit Trips	Cycling Trips	Walking Trips
Control	**Pre to Mid**	+8%	-9%	-75%	+25%	-5%
	Mid to Post	-17%	+5%	+200%	-20%	+33%
	Pre to Post	-10%	-5%	-25%	0%	+27%

Treatment	**Pre to Mid**	-12%	-4%	+50%	+27%	+10%
	Mid to Post	+17%	0%	-33%	-14%	-14%
	Pre to Post	+2%	-4%	0%	+9%	-5%

Without a ComPASS, control households increased their car trips as a driver by 8% between the pre and mid surveys. This increase could have been related to more precipitation during the mid-survey, along with typical increases in traffic in Kelowna in June (mid survey) compared to April (pre survey). However, during the same time period the treatment group reduced their car trips as the driver by 12%. By the post survey, the treatment group's car trips as the driver reverted back to pre survey results, suggesting that a long term ComPASS intervention is required to change behaviours.

Between the pre and mid surveys, the control group decreased their transit use by 75%, while the treatment group increased their transit use by 50%. These changes suggest that ComPASS increased transit use among treatment households, when normally they may have reduced their transit use like the control group. The following subsection outlines the results of the statistical analysis comparisons of transportation behaviours between groups (control and treatment) and surveys (pre, mid, and post).

Transportation Behaviour Changes

After conducting several statistical comparisons between the groups (treatment and control) and the three surveys (pre, mid, and post), the main findings on the reported trips made in the past week were:

- During the mid survey (when ComPASS was in effect), at a 93.9% confidence level, the treatment households' car trips as the driver were significantly less than the control households.
- Between the pre and mid surveys, treatment households reduced their car trips as the driver at a 90.9% confidence level. Between the mid and post surveys, treatment households then increased their car trips as the driver.
- During the mid survey (when ComPASS was in effect), treatment households used transit more than control households at an 85.7% confidence level.
- During all three surveys, treatment households cycled more than control households, at a 98.6% confidence level.
- Between all three surveys and between both groups (treatment and control), there were no significant differences found for the car trips as the passenger and walking trips.

Ultimately, the pilot study revealed that ComPASS:

- Helped reduce car trips as the driver;
- Contributed to increased transit trips; and,
- Had no effect on cycling, walking, and car trips as the passenger.

Compared to a short term intervention, a permanent ComPASS program would be necessary to impact car trips as the driver and transit trips. The piloted short term intervention of three months did not have lasting effects on behaviours as shown in the post survey results.

Trip Distance

Table 3 shows the average trip distance for car trips as the driver for the control and treatment groups, during the pre, mid, and post surveys.

Table 3 – Travel diary average trip distance for car trips as the driver

Group	**Average Trip Distance (km)**		
	Pre	**Mid**	**Post**
Control	4.3	6.0	6.2
Treatment	10.3	7.0	9.3

The control group tended to have shorter trip distances than the treatment group. For determining changes in VKTs, the pre-survey was considered the most accurate, as there had been no ComPASS intervention at this time.

SAVINGS FOR THE CITY OF KELOWNA

As demonstrated, ComPASS plays a role in significantly reducing car trips as the driver and increasing transit trips. By reducing households' car trips as the driver, households are also reducing their vehicle kilometres travelled (VKT). Reductions in VKT can result in many benefits that help create more sustainable communities.

Through the ComPASS pilot study, treatment households reduced their car trips as the driver by 12% between the pre survey and mid survey. The average trip distance reported in the pre survey was 10.3 kilometres for treatment households, with an average of 33 car trips as the driver taken per household per week. With a 12% reduction in trips, this means with ComPASS in effect, each household would make 29 car trips as the driver per week, which equates to a 40.8 VKT reduction per household per week (or 5.8 VKT reduction per day). Assuming a more conservative estimate that ComPASS could reduce car trips as the driver by 6%, each household would make 31 car trips as the driver per week, which equates to a 20.6 VKT reduction per household per week (or 2.9 VKT reduction per day).

Greenhouse Gas Savings

Table 4 shows the estimated reductions in CO_2 equivalent (CO_2e) kilograms resulting from the estimated reductions in VKTs.

Table 4 – Reduced CO2 equivalent (CO2e) emissions due to reduced driving

	Baseline	**ComPASS (-12% driver trips)**	**ComPASS (-6% driver trips)**
Average trip distance for participating households in survey 1	10.3 km	10.3 km	10.3 km
Average daily trips per participating household in survey 1 (car trips per driver)	x 4.7	x 4.1	x 4.4
Daily vehicle kilometres travelled (VKT) per household	48.6 km	42.7 km	45.6 km
Greenhouse gas emissions per VKT (kilograms of CO_2e)	x 0.3 kg/km	x 0.3 kg/km	x 0.3 kg/km
Daily emissions per household	14.5 kg	12.8 kg	13.7 kg
Reduction due to ComPASS (per household):			
• Daily greenhouse gas emission reduction (kg of CO_2e)		1.7 kg	0.9 kg
• Annual greenhouse gas emission reduction (kg of CO_2e)		637.0 kg	318.5 kg

Assuming 0.3 kg of CO_2e is emitted per VKT (Province of BC 2010), then a ComPASS holder could reduce their CO_2e emissions 637 kg per ComPASS household per year (assuming a 12% reduction in car trips as the driver).

Collision Reductions

About 96% of collisions involve driver-related factors (Sayed et al. 1995), suggesting that reducing drivers and VKTs can help reduce road collisions. Table 5 shows the potential reduction in road injuries and fatalities due to reduced VKT through ComPASS.

Table 5 – Reduced road injuries and fatalities due to reduced driving

	Baseline	ComPASS (-12% driver trips)	ComPASS (-6% driver trips)
Average trip distance for participating households in survey 1	10.3 km	10.3 km	10.3 km
Average yearly trips per participating household in survey 1 (car trips per driver)	x 1,716	x 1,510	x 1,613
Yearly vehicle kilometres travelled (VKT) per household	17,676 km	15,554 km	16,614 km
Injuries per 1,000 VKT	x 0.75	x 0.75	x 0.75
Fatalities per 1 million VKT	x 2.75	x 2.75	x 2.75
Average number of injuries per household per year	13.3	11.7	12.5
Average number of fatalities per household per year	0.049	0.043	0.046
Reduction due to ComPASS (per household):			
• Annual average reduced injuries per household per year		1.6	0.8
• Annual average reduced fatalities per household per year		0.006	0.003

In 2006, there were about 2.75 road fatalities per 1 million VKT and 0.75 road injuries per 1,000 VKT in Kelowna (TAC 2010). Using these rates, each ComPASS household could reduce road injuries by 1.6 per year and road fatalities by 0.006 per year, assuming a 12% reduction in car trips as the driver.

Economic Savings

Reducing VKTs also translates to community-wide economic benefits. Using Todd Litman's (2015) estimated social and government cost savings per reduced VKT, about $0.34 can be saved per reduced VKT through:

- Reduced traffic congestion;
- Improved conditions for active transportation use;
- Reduced road construction, maintenance, and operations;
- Reduced parking issues and related costs;
- Reduced energy consumption; and,
- Reduced air, noise, and water pollution.

Table 6 shows the social and governmental economic savings anticipated from each participating ComPASS household.

Table 6 – Economic savings due to reduced driving

	Baseline	ComPASS (-12% driver trips)	ComPASS (-6% driver trips)
Yearly vehicle kilometres travelled (VKT) per household.	17,676 km	15,554 km	16,614 km
Reduced VKT per household.	-	2,121 km	1,060 km
Cost savings per reduced VKT ($ per VKT).		$0.34	$0.34
Cost savings per household per year.		$721.13	$360.57

Assuming a savings of $0.34 per reduced VKT, there could be an economic savings of $721.13 (assuming a 12% reduction in vehicle trips) per ComPASS household per year.

ComPASS Participation Rates

The surveys also asked whether households (in both control and treatment groups) would be willing to participate and contribute financially to a ComPASS program. Fifty-nine percent (59%) suggested that they would be willing to contribute financially to a permanent ComPASS program. This participation rate was expected, as it aligns with the NECO Pass' average participation rate of 55% (Hagelin 2011).

Of those households that indicated they would contribute financially, the average willingness to pay was $62.13 per household per month. The estimated price of ComPASS ($45/household/month) is lower than the

average willingness to pay, which suggests that the ComPASS could be financially feasible in the piloted study neighbourhood.

CONCLUSIONS

The ComPASS pilot study results revealed that ComPASS has potential to reduce personal vehicle use and increase transit use. Car trips as the driver for ComPASS households could be reduced by 12%, which results in greenhouse gas reduction, road injury and fatality reductions, and economic savings. If a ComPASS was implemented permanently in the City of Kelowna, and participating households reduced their car trips as the driver by 12%, each household would:

- Reduce CO_2e emissions by 637 kg;
- Reduce 1.6 road injuries;
- Reduce 0.006 road fatalities; and,
- Save $721.13 for the City of Kelowna.

Under a more conservative scenario where participating ComPASS households would reduce their car trips as the driver by only 6%, these benefits would halve, but are still positive improvements for the City of Kelowna.

If a three-year permanent ComPASS program was implemented in the piloted study neighbourhood alone, with a 59% participation rate of the total 32 participating households (e.g. 19 households), Table 7 shows the potential savings over the three year period.

Table 7 – Savings for the City of Kelowna over a three year permanent ComPASS program

		ComPASS (-12% driver trips)	ComPASS (-6% driver trips)
3-year Permanent ComPASS Program Savings	Reduced CO_2 equivalent (CO_2e) emissions	12,103 kg	6,052 kg
	Reduced road injuries per household	30	15
	Reduced road fatalities per household	0.11	0.06
	Economic savings	$41,104.51	$20,552.26

Ultimately, a three-year permanent ComPASS program is recommended as a tool for the City of Kelowna to implement to achieve their sustainability goals. The piloted study neighbourhood is already familiar with the program, and would be an excellent neighbourhood to initially implement the program, with future expansion throughout the City of Kelowna.

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