Municipal Passenger Shuttles and Rapid Bus Networks:

Environmental Sustainability and Low-cost Rapid Transit

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There is a saying, “simple is best”. Given the choices, the best way to reduce transportation related green house gas emissions is the most inexpensive way. Global warming is a major crisis that we cannot afford to ignore. Fortunately, it is also a simple problem and one we do not need to invest massive amounts of money in new technologies and infrastructure to solve. The necessary components to build a sustainable and inexpensive rapid transit system already exist. Utilizing current combustion engine technology, a municipally owned taxi corporation, used to provide door-to-door passenger service by feeding a concentrated rapid bus network, would provide incredibly fast and inexpensive environmentally sustainable transportation. It costs something like $4000/year to own and operate a passenger vehicle, and there are roughly 150,000 passenger vehicles in the HRM with a combined annual cost of $600 million. Replacing half of these vehicles with rapid public transit could generated a combined annual cost savings of at least $213.5million. This system would have no additional cost to operate because it would actually save money. Many people would not need to own a car. Many people could get by with one car instead of two. Others could choose alternate forms of ownership like car sharing. Gone would be the days of getting wet walking to the bus stop or waiting in the rain. Gone also would be the stress of driving. Commute times would be shortened and time spent behind the wheel replaced with time spent reading the paper, listening to music, or simply looking out the window. Rapid bus networks are a fast and cost-effective solution to our transportation related climate problems.

Introduction

The majority of passenger vehicles used for the daily commute carry only a single occupant.[1] Compared to a single-occupancy vehicle, a vehicle with four passengers uses ¼ the fuel per passenger, or 75% less.[2] A bus carrying up to 80 passengers, while using only 4 times the fuel, will require 1/20 of the fuel per passenger of a single passenger automobile.[3] This is a reduction of 95% in fuel usage and well beyond what is required for green house gas emissions from passenger travel to be reduced to well within sustainable levels. It is, therefore, possible to construct an inexpensive and environmentally sustainable transportation system using existing combustion engine technology. The advantages of combustion engines over all other forms of automotive power systems are that they are reliable and inexpensive. The disadvantage of single passenger vehicles are their expense and inefficient energy usage resulting in excessive green house gas emissions.

Buses, on the other hand, are one of the most efficient forms of public transportation. Their ability to go anywhere accessible by road makes them incredibly cheap to operate in comparison to things like commuter rail that requires massive investments in specialized infrastructure. Roads themselves are

[1] “Commuting to Work”. National Household Survey, Statistics Canada. <http://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-012-x/99-012-x2011003_1-eng.cfm

[2] (Fuel usage=100%Passanger/vehicle)/4passangers,=,1/4Fuel usage/passenger=25%.

[3] 4(Fuel usage=100%Passanger/vehicle)/80passangers,=,(Fuel Usage=(100%Passanger/vehicle)/20passangers),=,Fuel Usage=5%.

cheap to construct and maintain and are incredibly versatile and can be used by many vehicle types serving many purposes. It is unlikely that the roadways will ever disappear but that they will remain vital well into the future. The city of London, England, spent many years investing in new articulated buses, pre-boarding ticket purchasing machines, and intersection by-pass and high occupancy vehicle lanes in order to speed-up and improve public transit. While London has a vast underground rail network, existing pressures on this system meant that it could not provide for the growing demand for public transportation. The result is an incredibly fast and pleasant bus service. In comparison to the underground network, which is often uncomfortably crowded, hot, and stuffy, London's modern double-decker and articulated buses are open and airy and a pleasure to travel on. For shorter distance travel, they are much quicker than the tube network and are cheaper as well. It does not make sense for a small city like Halifax to invest in highly specialized forms of public transportation, but rather to make use of existing infrastructure to its greatest potential. Where railways and waterways exist, it is only logical to investigate their use as public transportation corridors. However, it is only prudent for Halifax to also make use of its existing roadways rather than building expensive new transportation networks.

Like roads, it is hard to replace the versatility and freedom offered by automobile ownership. To this day, a private automobile is a quicker and more pleasant way to get around than almost all forms of transportation. Its greater expense outweighed by its greater convenience. If buses were as fast and convenient as private automobiles, but less expensive, there would be no reason to use private automobiles. However, until this happens, most people will continue to rely on their cars to get to and from work. Carpooling is not always convenient, so it is also likely that single-occupancy vehicles will remain the norm. Electric vehicles can, in some circumstances, reduce green house gas emissions. However, they are even more expensive, lack versatility, and are subject to the same inconveniences of congestion and parking as regular automobiles. Increasing numbers of automobiles will only continue to make our roadways more congested and even less enjoyable. Public transportation offers the benefit of significant cost savings and the pleasure of having someone else do the driving. This may mean more time to read the paper or just look out the window. What is needed is a transportation system that combines the flexibility of private automobiles with the economy and ease of mass transit.

The simplest way to do this would be to use a taxi service that shuttles passengers from their front doors to the nearest bus stop. This would allow sprawling bus routes to be concentrated and their frequencies significantly increased while also making it much easier to access them. No more getting wet walking or waiting in the rain. No more waiting 30 minutes for a bus. By operating buses along major corridors and investing in new buses, departure times could be reduced to every 5 minutes and would, for all intents and purposes, be continuous. There would be no need to arrive early at a bus stop or plan a journey based upon when to leave the house. Simply leave when you are ready to leave, and there will be a bus departing within 5 minutes or less. Passengers would simply purchase a fare from their "passenger shuttle" upon pickup that entitles them to travel any distance within a specified zone that includes a number of bus routes and transportation options. Shuttle passengers can then request a transfer which will allow them passage on any bus, and, upon completion of their journey, on any shuttle to a destination within a specified drop-off zone. Beyond the specified pick-up or drop-off zones, passengers can simply hire the shuttle privately and continue on with their journey for a metered fee.

The shuttles could also be equipped with the latest ride sharing technologies, allowing for the creation of "ad-hoc" bus routes with the convenience of a taxi but at significant savings. Because of the problems of administering a public transit system served by private cabs, the simplest solution would be for the municipal government to own the entire taxi service, breathing new life into a industry under threat.

Global Warming is an urgent problem. We cannot afford to continue to damage the global ecosystem or pollute our local environment with toxic emissions. Every day we breath in and suffer the consequences of our inefficient use of energy in our daily commutes. Nor should we continue to bear the tremendous cost of the current model of privately owned transportation. It is possible to construct a reliable, convenient, and comfortable rapid transit service that would avoid the hassle and expense of the daily commute by automobile. Not only would a rapid bus network fed by a publically owned taxi service help save the environment, it would be cheaper, quicker, and much less stressful.

The Cost of Private Versus Shared Ownership of Passenger Vehicles

Automobile ownership is expensive. Shared ownership is one way to reduce the costs. There is the purchase price, insurance, maintenance, gas, and parking. Assuming that a passenger vehicle costs $15,000 to purchase, lasts 10 years, and retains a re-sell value of $1,500, but costs $3000 to maintain, it will cost a total of $16,500 to own over its lifespan, or $1650/year. Allowing another $100/month for insurance and $100/month for gas, the total yearly cost is at least $4000. According to Statistics Canada, there is roughly one passenger vehicle for every 2 Canadians.[4] In the HRM alone, therefore, there are approximately 150,000 passenger vehicles representing a combined annual expense of $600 million.

Whereas the typical passenger vehicle is in operation for at most 2 hours of the day, a shared taxi cab might be in operation for as much as 18 hours a day or 9 times longer. The average cost of a shared passenger vehicle in terms of its average purchase price per hour of operation is, therefore, 1/9th that of a privately owned vehicle. If half of the 150,000 privately owned passenger vehicles in the HRM were shared, 75,000/9=8,300 could do the work of 75,000. This alone represents a combined purchase cost savings of $110million/year.[5] Because of the greater intensity of publically owned vehicle usage, it is also much more profitable to invest in the latest energy saving technologies for them. If used 9x more, the return on investment of publically owned hybrid or electric cars is 9x greater.

Concentrating Routes and Increasing Frequencies

Increasing the frequency of departures is key to making buses an appealing transportation option. Concentrating routes is one of the most cost effective means of doing this. There is nothing worse than wasting time waiting for a bus to arrive or arriving at your destination too early because of the bus schedule. Sprawling suburban routes provide poor service and cost much more to operate because of their low passenger loads. Rather than using buses, which follow winding routes in an attempt to provide every address in Halifax with at least one bus stop, to serve the function of passenger pickup,

[4] "Motor Vehicle Registrations by Province and Territory", Statistics Canada. <http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/trade14c-eng.htm>.
[5] $16,500/10yearsx75,000-$16,500/10yearsx8300=$1.1billion/10years=$11million/year.

this function would be better served by passenger shuttles that feed concentrated bus routes which follow more direct routes along major corridors. The result would be a much quicker service. Direct routes would take less time. Passengers would no longer have to orient their schedules around the departure times of buses because, with departure times down to five minutes, all buses will, in effect, be departing continuously. Passengers will not have to plan to arrive at a bus stop early because the next bus will be along in five minutes or less. Passenger shuttles can travel faster and further than a person on foot, so the distances between bus stops could also be increased, further decreasing travel times. Bus stops that are removed could be designated "drop-off only" stops. Passengers could depart at these stops. However, the buses will not pick up passengers at them. Because the passenger shuttles will handle all ticket collection and fare payment upon pickup, bus travel times will be further decreased because the drivers will not have to accept tickets or fares or wait for passengers to place them in the fare boxes.

Assuming that reducing the current number of routes by ½ would serve to more or less double the number of buses available for the remaining, concentrated routes, current frequencies could be doubled with no increase in costs. This would increase departure frequencies for 15 minute routes, like the #7 or #1, to 7.5 minutes. Departures on routes with 30 minute service would be decreased to 15 minutes. Doubling the current number of buses could reduce, again, departure times by half down to 3.5 minutes and 7.5 minutes for 15 minute and 30 minute routes, respectively. Averaging the number of buses between these routes would result in a 5 minute departures for all routes within the HRM.

Further steps could be taken to reduce travel times by redesigning roadways to include measures like high occupancy and intersection bypass lanes. These are already in existence in many cities across Canada and can significantly increase the speed of bus travel. They were a major part of the effort by the city of London, England to increase the speed of its bus network. High occupancy-only lanes and intersection bypass lanes can also be used by other vehicles, such as cars with multiple passengers, delivery, and freight vehicles, helping to further reduce the total number of vehicles on the road and thereby greatly reducing travel times for the entire roadway system.

Other measures like "night-time augmented routes" could further reduce costs along with measures like station-to-station express routes. Outside peak travel times, it likely would not make sense to run large passenger buses that are mostly empty every five minutes. In this case, the passenger shuttle pickup and drop-off zones could be increased in size for after hours service. Or, they could serve to augment part of a bus's regular route, providing load-and-go service and connecting passengers to the remaining portion of a shortened night-time route. If large numbers of passengers have a shared destination, there is no reason that they should travel on a bus that will be making multiple stops along the way. Station to station express routes could help provide high-speed passenger service even during peak travel times.

Pickups, Drop-offs, and Zones

Generally speaking, it is in the interests of the HRM to minimize the use of privately owned vehicles as much as possible. Shared transportation ownership can significantly reduce transportation costs while greatly reducing green house gas emissions. While serving bus routes will be a major function of

passenger shuttle vehicles, they can also provide low-cost taxi services, further decreasing the need to rely on privately owned vehicles. Upon boarding, passengers will pay a single charge that includes drop-off at a bus stop and a transfer or passage within a specified "zone". The zone will be determined based upon the passenger pickup point and will include travel within a certain distance from that point. Typically, this will be for passengers to access their preferred bus stop. However, it could also be used for travel to any destination within that zone. Passengers could also carry on with their journey beyond the zone by privately hiring the shuttles for a fee. Included in the initial pickup charge would be a transfer that allows passengers to board any bus within the HRM and receive shuttle service to their destination upon disembarking the bus. Passenger shuttles dropping passengers off at bus stops will need to return to the typical points of collection for more pickups. Therefore, providing passengers with a door-to-door shuttle service won't significantly increase the total cost of the service as the shuttles would have been returning to the typical collection points empty. It would, however, significantly increase the value of the service for passengers by providing inexpensive door-to-door rapid transit.

Ride-sharing and Ad-Hoc Routes

The passenger shuttles could also be equipped with the latest ride sharing technologies. Where multiple pickups are to occur along the same route, the same shuttle can collect 4, 5, 8 passengers depending on the size of the vehicle used in accordance with demand. The latest riding sharing technologies can also be incorporated so that passengers wishing to hire shuttles privately but share the costs can enter their destinations in a computer app which will then automatically calculate a route that will allow multiple people traveling to the same destination (or destination along a route) to share a cab. The initial pickup fees entitling passengers to travel within a zone along these routes could be allowed to overlap so that passengers might receive travel along the entire length of the route for no more than the initial pickup fee. While this represents a tremendous convenience and savings for the passengers, it is also a quick and inexpensive way for the Halifax Transit to respond to developing transportation needs through "ad-hoc routes" at a cost that is probably comparable on a per passenger basis to continuous bus routes. Moreover, these ad-hoc bus routes could provide additional value by helping to indentify new routes. Rather than resorting to complicated forecasting methods, bus routes can be developed simply by responding to the demand for ad-hoc bookings within a certain areas or along certain routes. As a recent article in the Halifax Metro points out, these technologies are already in operation across Canada. In Innisville, Ontario, they are providing cheaper public transportation than expensive bus routes through subsidizing private taxi cabs.[6] The system described in the article is owned by Uber. However, there are likely comparable systems that are commercially available that could be licensed by Halifax Transit. As one of the major goals of the transportation system will be to reduce green house gas emissions, the high occupancy vehicle and intersection by-pass lanes designed for buses should also be open to all high occupancy vehicles to encourage, as much as possible, car-pooling as well as other alternatives to private vehicle usage such as home delivery and courier services.

Total Costs and Total Savings

[6] "Making an Uber-smart Move". Tristan Cleveland, **Metro News, Halifax**. Monday Aug. 14, 2017, Page 3.

According to Statistics Canada, 15.4million workers out of an employed workforce of 16.5million in 2011 commuted to work, roughly 93.3% of all workers.[7] The rest either worked from home or walked or cycled to work. Of the 15.4million who commuted, 74% drove.[8] Only 5.6% travelled as a passenger. According to Statistics Canada, the HRM's employed labour force is 225,400.[9] Assuming 93.3% of the HRM's labour force also commutes to work, 210,300 people commute to work on a daily basis. Out of those, 155,000 drive their car.[10] Many people work at night or in locations that are not accessible by public transit under any circumstances. Assuming, however, that 50% of single passenger vehicles could be replaced by public transit, total daily ridership would be increased by 75,000. According to Halifax Transit, 52,000 "revenue rides" are completed using public transit on a daily basis.[11] Assuming each of these represents one part of a return journey, there are currently 25,000 return passengers using the system daily. Combined, 100,000 return passengers would be using the system on a daily basis.

It is difficult to measure the total cost of implementing this system. According to Halifax Transit's data, many bus routes operate at only 25% capacity.[12] As such, quadrupling the number of passengers would not require any additional expenditure. Assuming that decreasing the current number of bus routes by half would double the number of buses available to other routes, departure frequencies for the remaining routes could be halved at zero cost. Doubling the number of buses in operation would again reduce departure frequencies by half to every 5 minutes. Many of the most expensive routes to operate, because of their low passenger loads, would have their cost effectiveness greatly increased by additional passengers and concentrated routes. Ad-hoc routes might eliminate the need for many high cost rural routes as passengers form their own routes using privately hired passenger shuttles.[13]

A private taxi currently charges $3.33, with the minimum pickup fee, for a journey of 1.7kms. [14] Assuming that a private taxi must cover all of its costs with passenger fees, a municipal taxi service would require no more than this per pickup to cover the total costs of a passenger shuttle service. The current cost of purchasing a ticket on a conventional bus route in Halifax is $2.50. One could take a cab to many bus stops from his or her home now for $3.33. Based upon my estimates, it costs an average of $16.67 for a daily return commute in a private automobile.[15] A rapid transit network could do this for $10.46 or less. A rapid bus network would, therefore, be much cheaper to use than operating a private automobile. Unlike private cabs, passenger shuttles covering a "zone" of 1.7kms or less will not need to

[7] "Commuting to Work". The National Household Survey. Statistics Canada. <http://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-012-x/99-012-x2011003_1-eng.cfm>.
[8] "Commuting to Work", The National Household Survey. Statistics Canada.
[9] "Labour Force Characteristics". Statistics Canada. <http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/lfss03a-eng.htm>
[10] 225,400x74%=155,000.
[11] "2017/18 Multi-year Budget and Business Plan: Halifax Transit". Halifax Regional Municipality. Page E2. <https://www.halifax.ca/sites/default/documents/city-hall/budget-finances/Multi-Year_Business_and-Capital-Plans_book.pdf#page=409>.
[12] "2016/2017 Year End Report". Halifax Transit. Pg. 1. <https://www.halifax.ca/sites/default/files/documents/city-hall/regional-council/170718rcinfo07.pdf>
[13] "Making an Uber-smart Move". Tristan Cleveland, **Metro News, Halifax**. Monday Aug. 14, 2017, Page 3.
[14]< https://www.casinotaxi.ca/rates>
[15]($4000/year)/(48weeksx5days)=$16.67Daily commute in an automobile.

travel nearly as far between passenger drop-offs and their next pickup location. To the extent that concentrated bus routes and increased ridership generate additional cost savings, and to which passenger shuttles are able to carry more than one passenger, the fare required for a basic passenger shuttle pickup and transfer could be reduced so that one-way travel on the system costs much less than $5.83. General tax revenue could also be used so that some of the cost savings of former vehicle owners subsidize the network as well as gas taxes from the remaining drivers who benefit from a far less congested commute with 50% fewer passenger vehicles on the road.

Passenger shuttles would also be a source of additional revenue. Like taxis, through private hires, they will generate revenue. Ad hoc routes will increase ridership and reduce the number of continually operated buses required to serve the system and replacing them with unassigned low-cost multiple passenger vehicles. By removing half the cars from the road or more, a rapid transit system would also greatly ease or reverse the infrastructure burden and the need for further roadway expansion. Over-engineered roadways like the Cogswell Street interchange can simply be rendered redundant.

The since the average cost per passenger of a conventional bus and the minimum fee require to hire a taxi are roughly equal, a basic assumption could be made that doubling the current Halifax Transit budget from $112.5million to $225million would cover the additional costs of providing rapid door-to-door public transit.[16] Increasing current ridership by 4 times would increase fare revenues from $34.6million to $138.3million, requiring only an additional $86.7million in funding to implement the system.[17] Increasing the average fare by 50% would reduce the additional costs to $17.55million.[18] Someone who pays $1300 a year for the increased fare on rapid transit rather than owning an automobile would save more than $2,700 a year.[19] The remaining $17.55million in additional costs could be made up out general tax revenue paid for by the savings generated by former vehicle owners who are able to rely on rapid transit instead.

If the average cost of owning an automobile is $4000/year, and 75,000 automobiles within the HRM are taken off the road as their drivers choose to use rapid transit instead, the combined yearly savings for the local economy would be $300million/year. Subtracting the $86.7million in additional funding that doubling the current Halifax Transit budget would require, the net savings generated on a yearly basis would be at least $213.3million/year. This is equivalent to an increase of $213.3million/year in annual household income that would be reinvested back into the local economy either through increased consumer spending or increased levels of personal savings and investment.

Total GHG Reductions

[16] "2017/18 Multi-year Budget and Business Plan: Halifax Transit". Halifax Regional Municipality. Pg. E2. <https://www.halifax.ca/sites/default/documents/city-hall/budget-finances/Multi-Year_Business_and-Capital-Plans_book.pdf#page=409>. Pg. E5

[17] "2017/18 Multi-year Budget and Business Plan: Halifax Transit". Pg. E5. (Fee revenuesx4=$138., $225million-$138.3million=$86.7million)

[18] $225million-150%($138.3million)=$17.55million.

[19] $4000/yr- $1300/yr=$2700/yr.

According to Statistics Canada, transportation accounted for 24% of total national GHG emissions and was the single largest source of green house gas emissions, by sector, next to oil and gas in 2015.[20] Passenger vehicles accounted for 47% of all transportation related GHGs and freight trucks accounted for 36.5%.[21] Combined, they represent 83.5% of all transportation related green house gas emissions. The remaining portion being shared by aviation, shipping, railways, and heavy equipment.[22]

A rapid transit system will not reduce the number of freight trucks in operation. However, assuming that it could reduce the number of passenger vehicles on the road by at least half, and this results in a 50% decrease in passenger vehicle fuel usage, it could reduce passenger vehicle related green house gas emissions by 50%. By removing half of the passenger vehicles from the road, it could reduce total transportation related green house gas emissions by 23.5%.[23] There are many ways in which freight related green house gas emissions could also be reduced. According to Statistics Canada, total green house gas emissions by freight trucks increased by 125% between 1990 and 2015. This growth alone represents 24.5% of all total present transportation related green house gas emissions.[24] Greater reliance on locally sourced foods and material goods can reduce the current need for freight trucks. Railways can move freight with much lower levels of green house gas emissions. Removing half the passenger vehicles from the road, and allowing high occupancy, delivery, and freight vehicles to use intersection by-pass and high occupancy-only lanes, would also increase the efficiency of freight trucks. If it is also possible for freight trucks to cut their total emissions by 50%, total transportation related green house gas emissions could be reduced by almost 50% with reduction in the passenger vehicle and freight truck sectors alone. If the public transportation system proved popular, and 75% of car owners switched to public transit for their commute to work, total transportation green house gas emissions could be reduced by 35.9% by rapid transit alone.[25] Reducing green house gas emissions due to passenger vehicles is an important component of solving our overall climate problems. While climate change represents a global threat, the toxic fumes produced by automobiles are hazards to basic human health that we breath in on a daily basis. Reducing emissions by at least 50% or even 75% should be a goal for the simple reason of promoting greater human health and longevity.

Municipal Ownership

It would be incredibly difficult to administer a system in which private taxis collected fares and issued transfers for a publically owned transportation company as would providing the appropriate accountability. A simple solution is to make the private taxi drivers employees of Halifax Transit. Their livelihoods would not be dependent on the collection of fares, and there would be little incentive to manipulate the system for person gain at risk to well paying stable jobs. Providing the necessary

[20] "Canadian Environmental Sustainability Indicators: Greenhouse Gas Emissions". Environment and Climate Change Canada. <www.ec.gc.ca/indicateurs-indicators/default.asp?lang=En&n=FBF8455E-1>. Pg. 9.
[21] "Canadian Environmental Sustainability Indicators: Greenhouse Gas Emissions". Pg, 22.
[22] ... Pg. 22.
[23] Passenger vehicles=47% of total emissions. Passenger vehicles/2=47%/2=23.5%.
[24] "Canadian Environmental Sustainability Indicators: Greenhouse Gas Emissions". Pg, 22. Freight truck emissions 2015-Freight truck emissions=1990=42.5MtC02, 42.5MtC02/173MtC02=24.45% total transportation emissions.
[25] "Canadian Environmental Sustainability..". Pg. 22. 83MtC02*(.75)/173=35.9%.

oversight and regulation would also be much easier for transit officials under this form of ownership. Moreover, the taxi business is in trouble. Competition from ride sharing services is a major threat to its existence. As many taxi drivers have argued, government regulations covering the taxi business exist for a reason, and there is a danger in allowing unregulated drivers to compete in unlicensed cabs. However, the industry has also experienced problems relating to violence, both against drivers and by them. The causes of these problems include lack of proper training and oversight and the need for investment in modern safety equipment. Their solution requires investment, something that a shrinking industry cannot provide. To save the taxi industry and the service it provides, while helping to address its problems, municipalities should form their own taxi corporations. There would be benefits for drivers, as well. Rather than relying on uncertain fares for income, taxi drivers would receive stable, well-paying jobs with greater security, regulated benefits, and scheduled working hours and holiday pay.

Commuter Rail, Ferries, and Amenities

As roadways are an existing transportation resource, public transportation networks should make as great a use of them as possible in order to provide the lowest cost service. However, where there are other preexisting transportation resources like waterways or railways, it only makes sense for the HRM to investigate their use as well. Because a railway by its very nature is a fixed resource, the use of passenger shuttles would have as great or greater impact on the ridership for a commuter rail service as a rapid bus network. The use of passenger shuttles would greatly increase the catch basin of any commuter rail service or expanded ferry service, lowering the average cost of providing these services on a per rider basis and greatly increasing their appeal to potential riders.

As concentrating routes and reducing the number of stops along each routes will significantly reduce the total number of stops, the remaining stops, which will be used much more intensively, will justify additional investment to improve both their comfort and appeal as part of the daily commute and to provide additional services beyond what even a major bus station might currently offer. With much higher levels of ridership, major bus stops will become community hubs. Large numbers of people will pass through these locations on a daily basis as part of their commute to work or in the course of their daily lives. Therefore, it only makes sense to turn them into service centers offering things like coffee, snacks, and food, but also services like health care, dentistry, government agents, public libraries, banking, post offices, cultural, recreational, and entertainment spaces. The hubs would also provide attractive locations for retail and office spaces because they will be destinations where large numbers of people will already be travelling to. What better way to reduce commute times than to place employment centers above transportation centers? The various forms of retail and commercial spaces can then be leased and used to generate additional revenue, further reducing the costs of the transit service while returning even greater benefit to passengers and the local economy.

Conclusion

Municipally owned passenger shuttles serving a rapid bus network would provide inexpensive, quick, and stress-free travel. Except for commuters who work outside of areas serviced by public transit or who require a vehicle for their work, there would be little reason not to use public transit. It may be

necessary to continue to own a car, but it would not be necessary to use one to get to work. By removing half of the commuter vehicles from the road, rapid transit would generate at least $213.4million/year in additional household income for the HRM that would compound year after year. Ten years from now, this represents $2.13billion in potential income spent here in our region. We cannot afford to ignore economies like this. It would be cheaper; it would help to reduce by half or more the total green house gas emissions produced by passenger vehicles; it would much healthier, resulting in significantly lower levels of toxic emissions from car exhaust. There is no other single way to improve life in the HRM more or to solve a greater percentage of our climate problems for a lower cost, and it does not require waiting for expensive new technologies to implement.