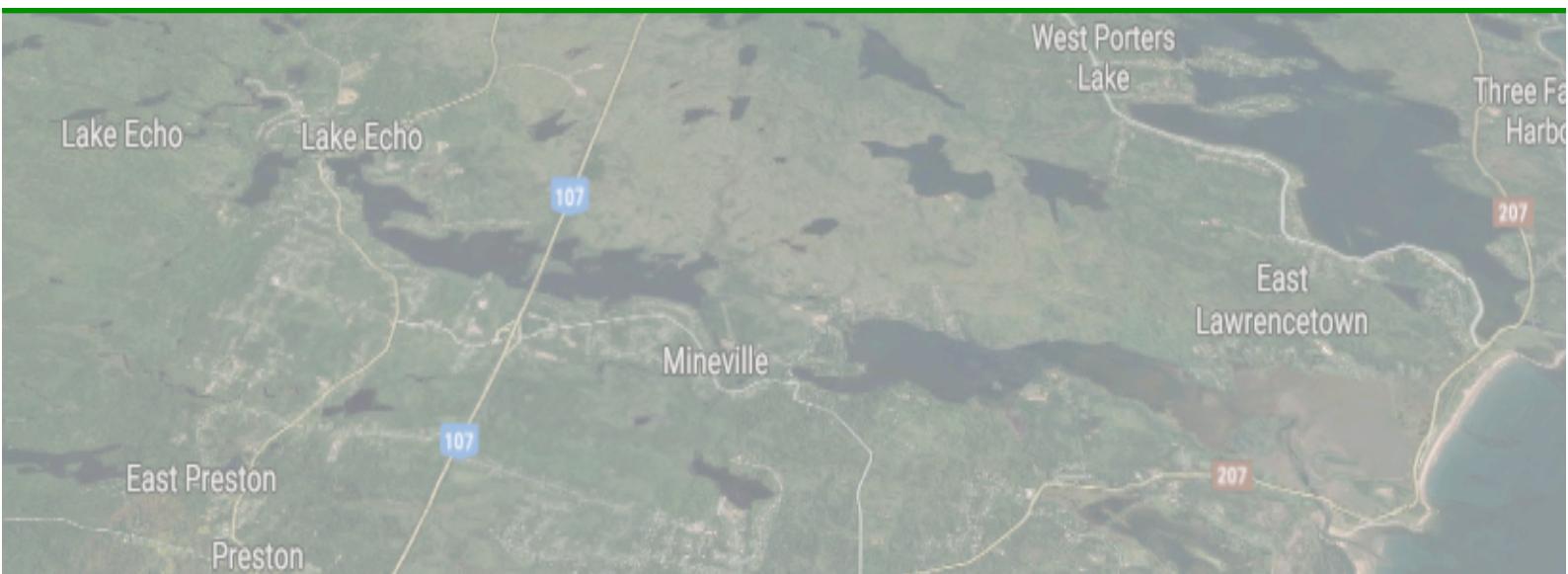
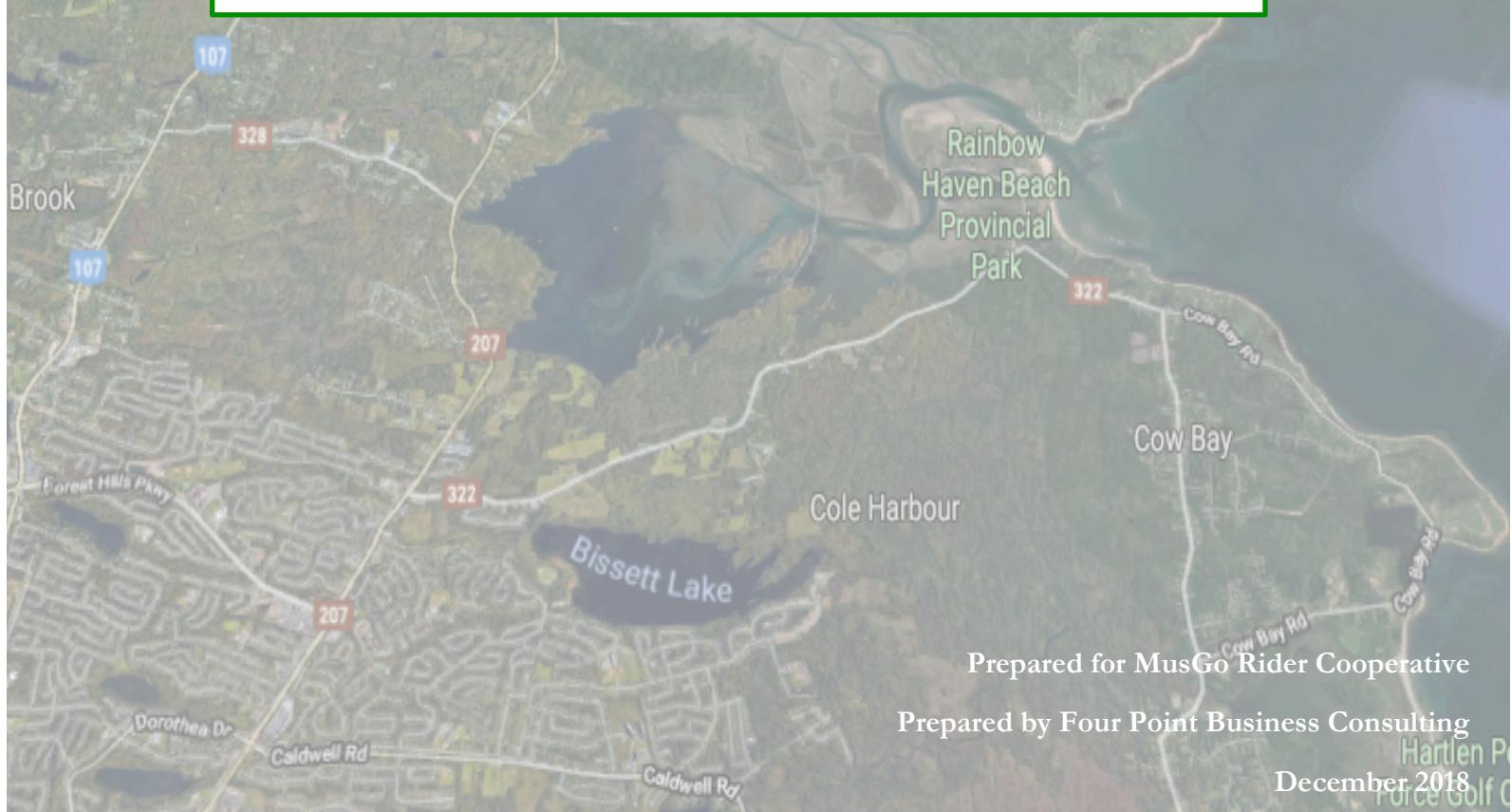




# Feasibility Study



Investigating fixed route community transportation  
options for Highway 207



Prepared for MusGo Rider Cooperative

Prepared by Four Point Business Consulting

December 2018

## EXECUTIVE SUMMARY

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Nova Scotia is fortunate to be one of the leaders in the country when it comes to community-based transportation. Affordable and accessible community transportation helps Nova Scotians get to work, school, important appointments, stay connected with friends and neighbours, and maintain active and independent lifestyles. Despite having an extensive urban and rural transportation network gaps still exist throughout the province.

There remains an opportunity along Highway 207 on the Eastern Shore to establish a fixed route transit service that will provide a significant benefit to residents within an area that is currently not serviced by Halifax Transit.

Given the dispersed population and large geographical area designing a fixed route public transportation system for any rural environment can be particularly challenging. However similar models exist that have the same challenges as route 207 and they have grown to operate in a financially sustainable manner with government support. The proposed system takes the best practices of these systems into consideration.

The transit model recommended for Highway 207 is a slight variation of a fixed route system. The proposed system will have transit operators following a daily scheduled route between Halifax Transit's Portland Hills and the Porters Lake terminals, but will provide the opportunity to pick up passengers between identified stopping locations at convenient and safe locations. This option provides a more efficient use of resources within the rural environment where there may be large intervals between defined stopping locations.

This study recommends the securing of financial resources for a minimum of two years, upon which a business plan should be developed that would detail the implementation of a fixed route pilot project under the MusGo Rider Cooperative organizational umbrella. The pilot project would require the purchase of two new non-accessible Ford Transit body-build chassis' and utilizing the existing MusGo Rider administration to oversee the new system.

This pilot project, through data collection and analysis, will allow the MusGo Rider board of directors to evaluate the transit system on an ongoing basis allowing it to grow organically so that it best meets the needs of its client base moving forward.

A public transit system will be economically, socially and environmentally beneficial to the communities that can be found along Highway 207. This new route will help improve the overall well being and health of the citizens living along the route by allowing them to access medical facilities, increase access to employment opportunities, stimulate economic development by providing opportunities for businesses to access more workers, save people financial resources so they can buy necessity items like medication and groceries, decrease traffic possibly creating a less congested Portland Hills terminal and allow many people living in HRM to have access to recreational assets such the TransCanada Trail and Lawrencetown Beach.

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## 1. INTRODUCTION

MusGo Rider Cooperative (MusGo Rider) offers pre-booked door-to-door transportation services within Halifax Regional Municipality (HRM), along the Eastern Shore, from East Ship Harbour to Lawrencetown. As with the other community transportation organizations throughout Nova Scotia MusGo Rider provides an important community service for those who are transportationally disadvantaged, especially seniors and the physically disabled.

MusGo Rider is investigating the opportunity to expand its door-to-door services to include a small scale fixed route transportation system. The proposed route would connect Halifax Transit's Porter's Lake terminal with the Portland Hills terminal through Highway 207, a piece of highway within HRM not fully serviced by Halifax Transit.

The development of the new fixed route system is based on these guiding principals:

- To make the transit service convenient
- To not interfere with existing services
- To be financially sustainable in the long-term

### 1.1. Methodology

The development of this feasibility study follows a logical work plan that assisted in meeting the overall purpose of the study. The project began with the collection of background information, including a review of other community based transit systems within Nova Scotia and analysis of census data.

An evaluation of current service offerings within the area was conducted including Halifax Transit's



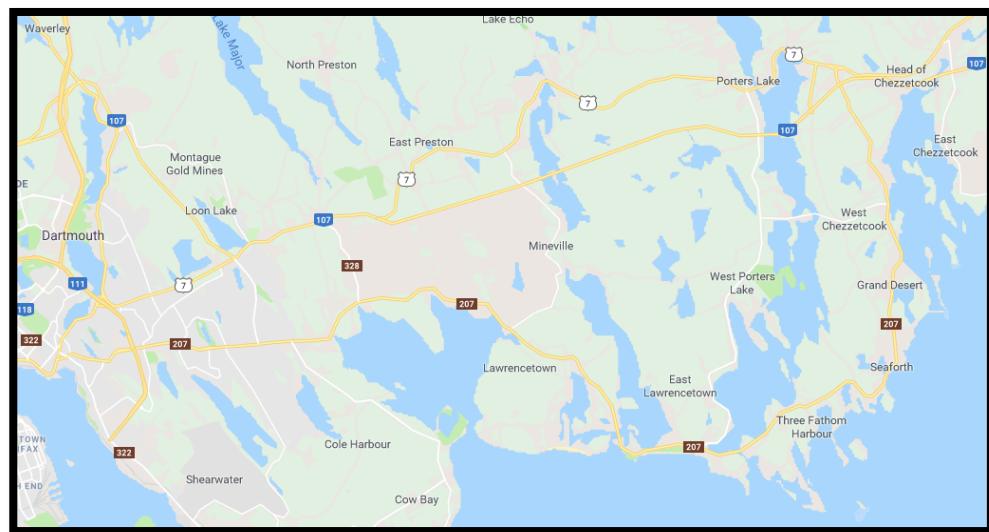
route 401, which services Highway 207 as far as Seaforth to determine potential ridership levels, service gaps and potential opportunities.

Public input greatly contributed to the feasibility study, including two community consultation sessions held in West Chezzetcook and Lawrencetown. An online survey was made available from October 1<sup>st</sup> to November 30<sup>th</sup> and gathered responses from 122 individuals from each of the communities within the proposed service area.

The service design process included several preliminary routing and scheduling options and took into consideration public engagement, projected ridership levels and Halifax Transit property access.

## 2. COMMUNITY PROFILE

The proposed service area will encompass a group of communities along the Eastern Shore from Porter's Lake to Upper Lawrencetown. These communities found within Halifax Regional Municipality stretch in a U-shaped pattern with dispersed communities and subdivisions clustered around and along Highway 207. It takes approximately 45 minutes to drive from the Halifax Transit terminal in Porter's Lake to the Halifax Transit terminal in Portland Hills.



Porter's Lake is the most urbanized community within the proposed service area having a small shopping district (grocery, retail, financial and medical services) that is currently serviced by Halifax Transit's Route 401 and will be easily accessible with this proposed service.

The coastal communities of West Chezzetcook, Grand Desert, Seaforth and Three Fathom Harbour all have small population bases and make up the Eastern section of the proposed route. There are active community centres in West Chezzetcook and Seaforth and a limited number of small businesses along the route.

The communities of Lawrencetown and Upper Lawrencetown make up the Western section of the proposed route. Lawrencetown Beach Provincial Park is a popular destination for beachcombers, sunbathers and known as one of the best surfing locations in North America. The community has a community centre and several surf shops where would be surfers can rent a surfboard for the day or engage in surfing lessons.

Ross Road, on the edge of Upper Lawrencetown, will serve as the Western boundary for the transit service (excluding a stop at Cole Harbour Place) as this falls within Halifax Transit's current service area.

## 2.1. Current Transportation Services

### 2.1.1. MusGo Rider Cooperative (MusGo Rider)

MusGo Rider (MusGo) is a community based transportation service that offers door-to-door pre-booked transportation services from East Ship Harbour to Lawrencetown. MusGo offers its clients both accessible and non-accessible vehicle options depending on the needs of the client.

MusGo Rider's services are more suitable and targeted towards persons requiring "one-of" trips such as medical appointments and running errands such as grocery shopping and banking and not targeted towards clients requiring daily commutes to work or school.

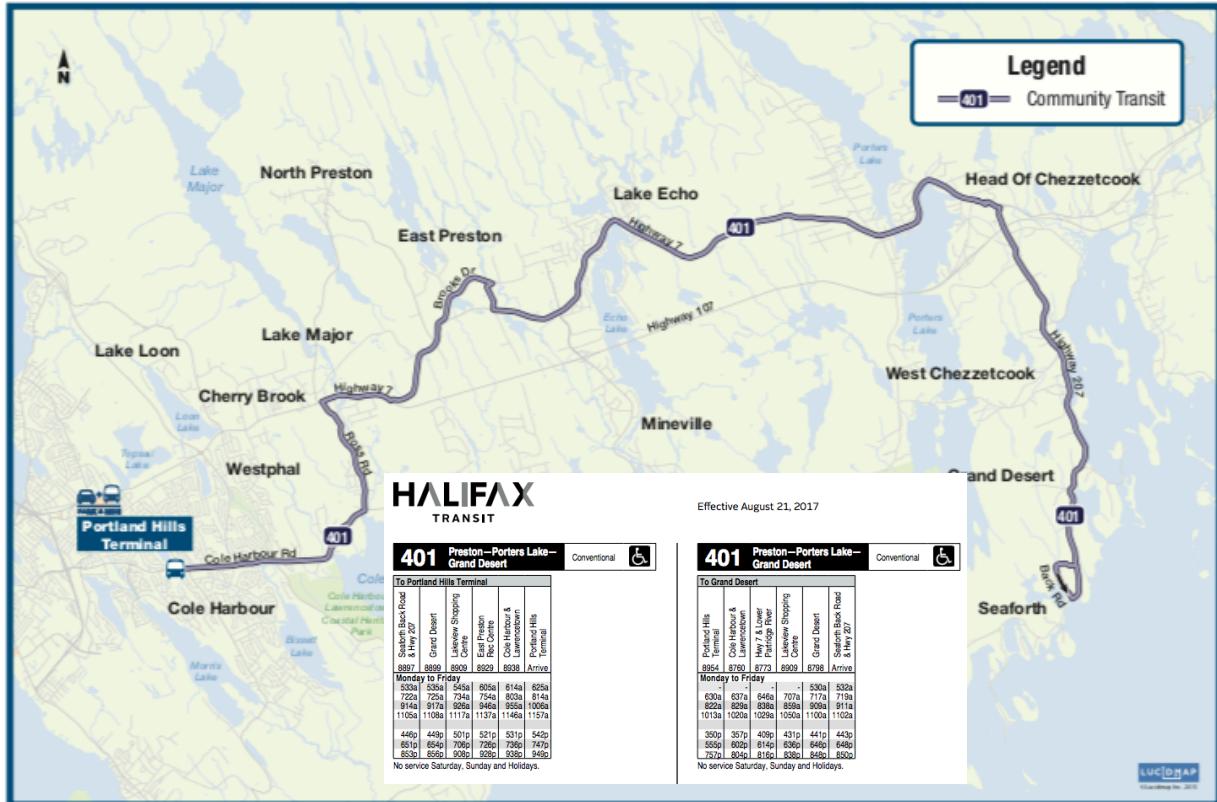
#### 2.1.2. Halifax Transit Route 401

Halifax Transit is currently operating a route that provides service to some of the communities in the proposed service area. Halifax Transit's Route 401 initiates at the Portland Hills terminal and provides service to Westphal, East Preston, Lake Echo, Head of Chezzetcook, Grand Desert and Seaforth. The service does a loop in Seaforth on Back Road and backtracks its route to the Portland Hills terminal. Due to low ridership numbers Halifax Transit has a proposed termination date for this route of September 2020.

The service operates only during weekdays and consists of seven runs per day, beginning in Seaforth at 5:30am with the last bus leaving Seaforth at 8:50pm terminating at the Portland Hills terminal at 9:49pm.

# 401 Porters Lake

**HALIFAX**  
TRANSIT



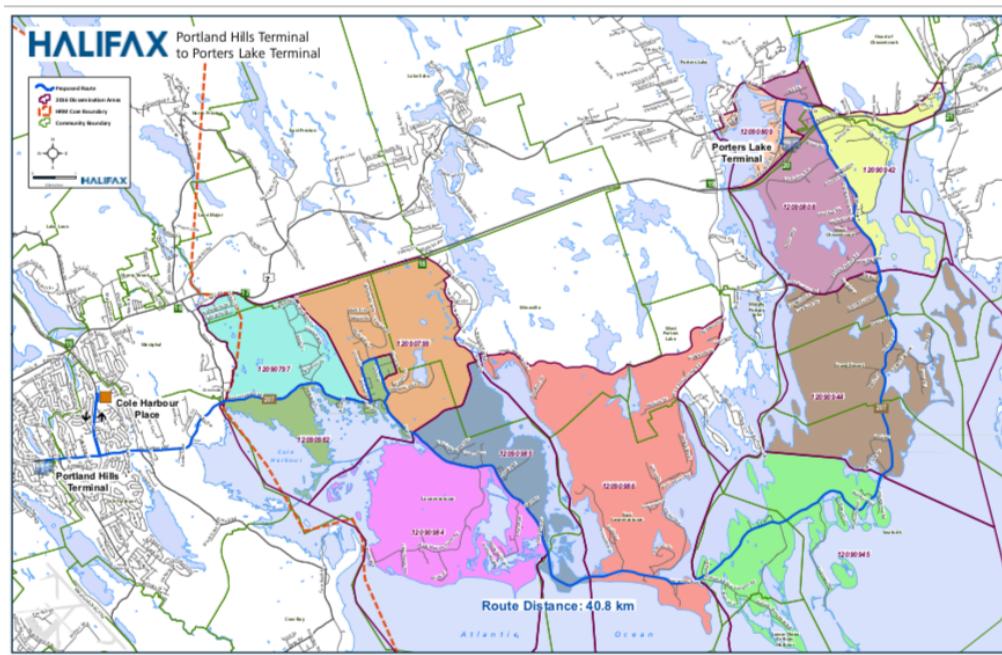
This route is highly criticized by locals for turning around in Seaforth and not continuing along route 207 to service the communities of East Lawrencetown, Lawrencetown and Three Fathom Harbour.

Route 401 Average Bus Stop Activity Hwy 207/Back Road											
2017/18								2018/19			
Q1		Q2		Q3		Q4		Q1		Q2	
Boardings	Alightings	Boardings	Alightings	Boardings	Alightings	Boardings	Alightings	Boardings	Alightings	Boardings	Alightings
12	11	14	14	10	10	12	11	12	11	14	13
23		28		20		23		23		27	

Halifax Transit has provided a year and a half of ridership data for Route 401 from the intersection of Stella Drive and route 207 to the Back Road in Seaforth. For the year and a half of data there were an average of 24 riders per day either boarding or alighting the bus in this short nine-kilometer section.

## 2.2. Demographics Analysis

When planning public transportation, particularly a fixed route system, identifying areas that have high population densities, high rates of single-parent households and low-income families can help assist in determining routing and scheduling options.



Demographic information from the service area has been broken down into dissemination areas – the smallest geographic area used by Statistics Canada to present census data. The proposed service area covers 11 dissemination areas (highlighted in different colors on the map) from Porter's Lake to Lawrencetown.

### 2.2.1. Population Density

Based on 2016 Census data the service area possesses a relatively high population density when compared to both HRM and the provincial averages. The overall average population density for the service area is 90.1 persons per square kilometer compared to the HRM average of 73.4 and the provincial average of 17.4. The highest population concentration occurs at each end of the service route, the Carter/Roman subdivision and Porter's Lake with the lowest concentrations through Grand Desert and Seaforth.

<b>Dissemination Area</b>	<b>Geographic Area</b>	<b>Population (2016)</b>	<b>Land (sq km)</b>	<b>Population (per sq. km)</b>	<b>Households</b>
12090797	Carter/Roman Subdivision	861	5.8	147.7	330
12090982	Opposite side of Carter/Roman	612	2.9	213.2	205
12090799	Gammon Lake	1,044	9.3	111.8	340
12090984	Lawrencetown	495	9.4	52.6	215
12090985	Lawrencetown	511	5.4	94.3	195
12090986	East Lawrencetown	1,071	14.9	71.8	430
12090945	Seaforth	414	8.1	50.9	185
12090944	Grand Desert	658	11.9	55.4	205
12090808	West Chezzetcook	792	7.7	103.5	335
12090942	West Chezzetcook	376	4.1	91.5	120
12090809	Porter's Lake Terminal	457	1.4	333.6	205
	Service Area	7,291	81	90.1	2,765
	Halifax Regional Municipality	403,131	5,490	73.4	173,325
	Nova Scotia	923,598	52,942	17.4	401,990

### 2.2.2. Age distribution

The age distribution for service area is relatively in-line with both HRM and provincial statistics. The median age, as an average, for the service area is 46 which is slightly higher than the HRM median age of 41 and on par with the provincial average of 45.5. There are slightly lower rates of seniors living in the service area than both the HRM and provincial averages with higher concentrations near the Porter's Lake terminal and Lawrencetown. The youth demographic is fairly consistent across the service area with the highest concentration around the Gammon Lake area.

<b>Geographic Area</b>	<b>Median Age</b>	<b>Seniors 65+</b>	<b>Youth (10 - 19)</b>
Carter/Roman Subdivision	43.9	14%	12%
Opposite side of Carter/Roman	49.0	16%	9%
Gammon Lake	42.0	8%	16%
Lawrencetown	52.5	24%	8%
Lawrencetown	44.8	13%	11%
East Lawrencetown	42.9	13%	9%
Seaforth	48.8	21%	8%
Grand Desert	43.0	17%	12%
West Chezzetcook	44.2	21%	10%
West Chezzetcook	41.2	16%	12%
Porter's Lake Terminal	53.3	30%	9%
Service Area	46.0	17%	11%
Halifax Regional Municipality	41.0	18%	11%
Nova Scotia	45.5	22%	11%

### 2.2.3.Income for individuals and households

The likelihood of a person using a transit system is highly dependent on their personal and household income level. Those with lower incomes (students, retirees, those employed in minimum wage jobs and the unemployed) tend to own fewer automobiles and have fewer transportation options. Many of these individuals turn to alternative forms of transportation such as walking, bicycling, rides from others and taxis. These are the most likely users of community transportation system.

Geographic Area	Household Median Income	Household Individual income	LIM-AT	LICO-AT	Lone Parent Households
Carter/Roman Subdivision	96,000	45,440	6.4%	2.3%	8%
Opposite side of Carter/Roman	89,344	43,520	7.4%	2.0%	12%
Gammon Lake	117,931	55,680	4.3%	1.4%	9%
Lawrencetown	70,144	34,176	8.1%	4.0%	9%
Lawrencetown	97,536	42,368	7.8%	2.9%	3%
East Lawrencetown	86,784	47,744	8.0%	3.3%	4%
Seaforth	75,008	33,315	14.5%	7.2%	8%
Grand Desert	64,896	28,288	15.2%	5.3%	17%
West Chezzetcook	61,248	23,616	15.1%	4.4%	6%
West Chezzetcook	61,824	26,560	13.2%	3.9%	21%
Porter's Lake Terminal	79,616	35,840	7.6%	2.2%	7%
Service Area (average)	81,848	37,868	9.8%	3.5%	9%
Halifax Regional Municipality	69,553	36,087	14.8%	9.6%	17%
Nova Scotia	60,764	30,377	17.2%	7.9%	17%

For household income, rates of low-income and lone-parent households the service area outperforms each statistical category analyzed. The median household income is over \$12,000 higher than HRM and \$19,000 than the province, likewise with individual household income being almost \$2,000 and \$8,000 higher than HRM and the province respectively. Incidents of low-income are also lower than HRM and provincial averages, with the highest rates of low-income occurring between Seaforth and West Chezzetcook. Similarly the highest rates of lone-parent households occur in West Chezzetcook and Grand Desert.

### 2.2.4.Transportation

As with the province and the rest of HRM the predominant means of transportation to work is within a vehicle as a driver. The service area exceeds both the provincial and HRM average in this means of transportation.

Dissemination Area		Geographic Area	Car - driver	Car - Passenger	Public Transit	Walked	Bicycle	Other
12090797	Carter/Roman Subdivision		425	45	10	10	-	10
12090982	Opposite side of Carter/Roman		290	40	15	-	-	10
12090799	Gammon Lake		490	30	25	-	-	10
12090984	Lawrencetown		205	10	10	-	-	-
12090985	Lawrencetown		240	30	-	10	-	-
12090986	East Lawrencetown		445	15	10	-	-	-
12090945	Seaforth		180	15	10	10	-	10
12090944	Grand Desert		315	40	10	25	-	10
12090808	West Chezzetcook		370	15	20	-	-	10
12090942	West Chezzetcook		170	15	-	-	-	-
12090809	Porter's Lake Terminal		175	15	-	15	-	20
	Service Area		86%	7%	3%	2%	0%	2%
	Halifax Regional Municipality		70%	7%	12%	8%	1%	1%
	Nova Scotia		78%	7%	6%	6%	0%	1%

A total of 110 persons (3% of population base) within the service area are currently using public transportation. This is well below the 12% average for HRM and even below the provincial average of 6%. There are three dissemination areas where no one reported using public transit including Lawrencetown, West Chezzetcook and surprisingly the area around the Porter's Lake terminal.

### 2.2.5. Time Leaving for Work

The majority of persons (58%) within the service area left for work between 6am and 8am, this will assist in developing route schedules and projected ridership demand.

Geographic Area	5am - 5:59am	6am - 6:59am	7am - 7:59am	8am - 8:59am	9am - 11:59am	12pm - 4:59pm
Carter/Roman Subdivision	26	160	110	100	15	75
Opposite side of Carter/Roman	30	80	115	45	30	50
Gammon Lake	45	105	195	90	30	80
Lawrencetown	20	40	90	35	-	30
Lawrencetown	15	95	110	15	25	30
East Lawrencetown	25	150	190	25	40	55
Seaforth	10	40	90	35	10	30
Grand Desert	50	125	95	60	20	45
West Chezzetcook	45	90	135	70	30	50
Porter's Lake Terminal	25	50	40	30	35	40
West Chezzetcook	20	50	45	30	20	15
Service Area	8%	26%	32%	14%	7%	13%
Halifax Regional Municipality	5%	20%	30%	21%	10%	14%
Nova Scotia	6%	19%	30%	21%	9%	15%

### **3. NEEDS ASSESSMENT**

The need for safe, affordable means of transportation to get from place to place is fundamental to the vibrant, healthy lives of both an individual and the community as a whole. The absence of a transit system that provides service to all of Highway 207 can be a major obstacle to access training, education, employment opportunities, as well as everyday necessities such as groceries and medical appointments.

#### **3.1. Online community survey**

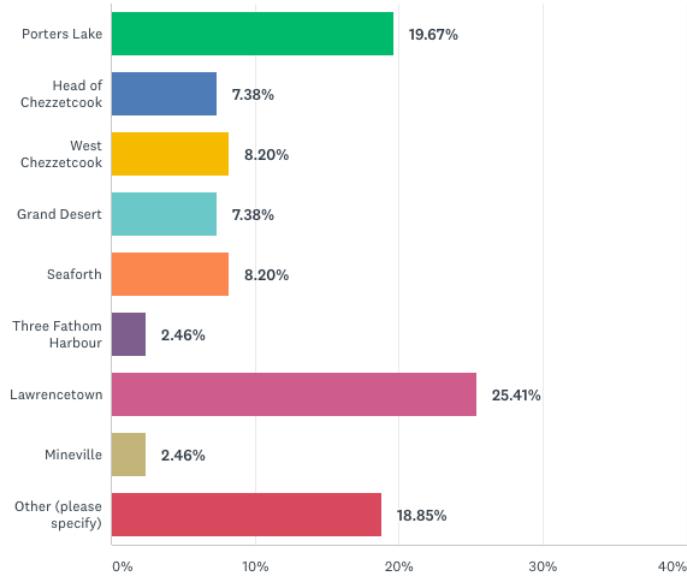
As a part of the needs assessment stage of this project, a survey was developed to help assess the level of public support and demand for a community transportation system within the area surrounding Highway 207. The survey helped provide an understanding of the community's support for a fixed route transportation system along with travel patterns, potential need for the service, willingness to pay and major destinations.

The survey was available online and was advertised on the MusGo Rider website, within the local community paper The Eastern Shore Cooperator, local Facebook pages and was made available in paper form at public consultation sessions.

The survey was online from September 19, 2018 to November 30, 2018. A total of 123 responses were received with 122 of respondents completing the required questions of the survey. Due to people self-selecting to participate in the survey – that is they are not a random sample of the population –the results of the survey are subject to certain limitations and must be interpreted with these considerations in mind.

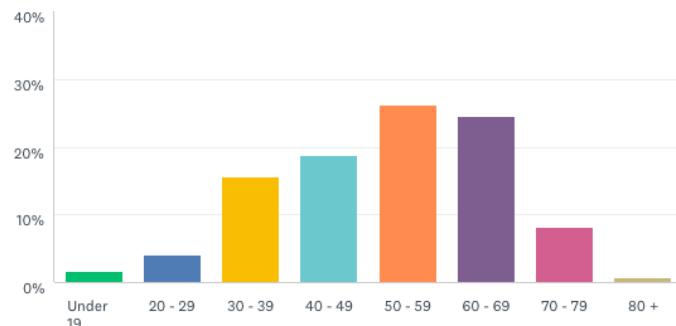
##### **3.1.1. Community**

Responses were received from each of the communities across the proposed service area, with the highest response rates coming from Lawrencetown and Porter's Lake. Of the respondents that selected Other, Musquodoboit Harbour had the highest response rate with almost 50% of the “other” selection.



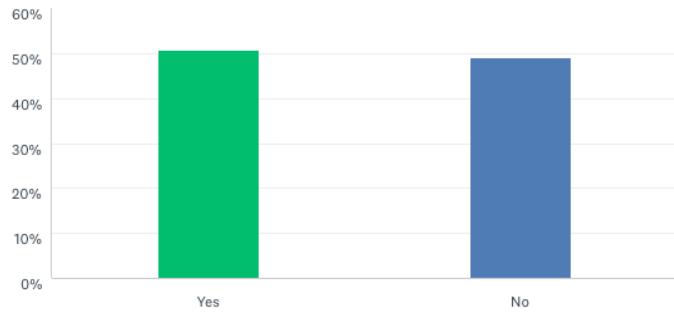
### 3.1.2. Age groups

The highest response rate was from the 50-59 and 60-69 age brackets with a combined 50% of total responses. Response rates were low in the under 29 age groups with only 5% of total responses. In an effort to gather a higher response rate from youth, an attempt was made to get the survey into Cole Harbour High School, however the survey was not approved for email distribution within the school by the Regional Centre for Education.



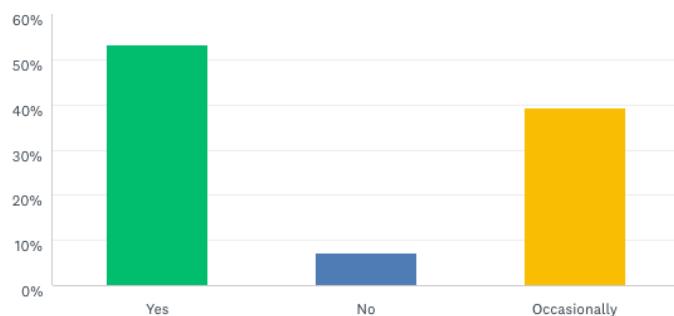
### 3.1.3. Vehicle access

Respondents were asked if all members of their households had fulltime access to a vehicle, responses were basically even split at 51% answering yes and 49% answered no.



### 3.1.4.Fixed route service

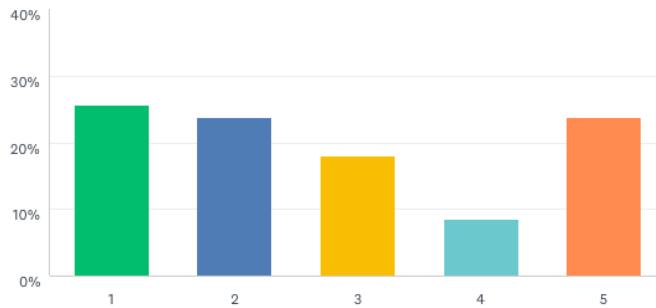
Respondents were asked if a fixed route community transit service from the Metro X terminal in Porters Lake through Highway 207 to Portland Hills Terminal was made available would they use it? The majority of respondents (53.2%) indicated that they would use it, with another 39.3 indicated that they would use it occasionally. Only 7.3% said they would not use the service.



If respondents answered “no” to this question they were excluded from the remaining questions so data from respondents that would use the service was collected providing more accurate user data.

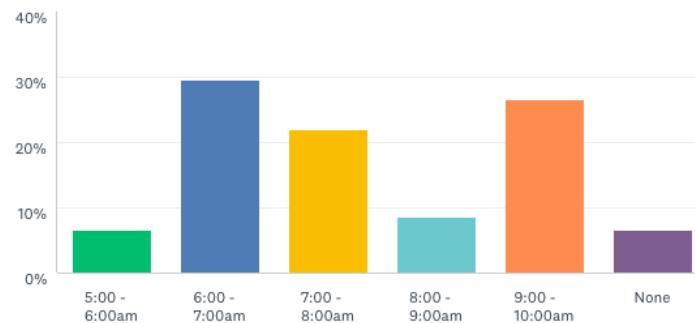
### 3.1.5.Fixed route usage frequency

Respondents that indicated they would use the service were asked at what frequency they would use the service, 24% indicated they would use it 5 times per week while a combined 49% said either once or twice a week.

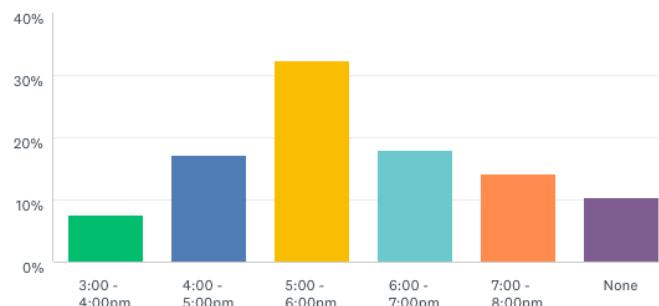


### 3.1.6.Fixed route usage timing

To determine peak service times respondents were asked what time periods they would most likely use the service for a morning departure. Over 51% of respondents indicated they would leave between 6:00am and 8:00am suggesting that potential users of the service would be using it for commuting to work.

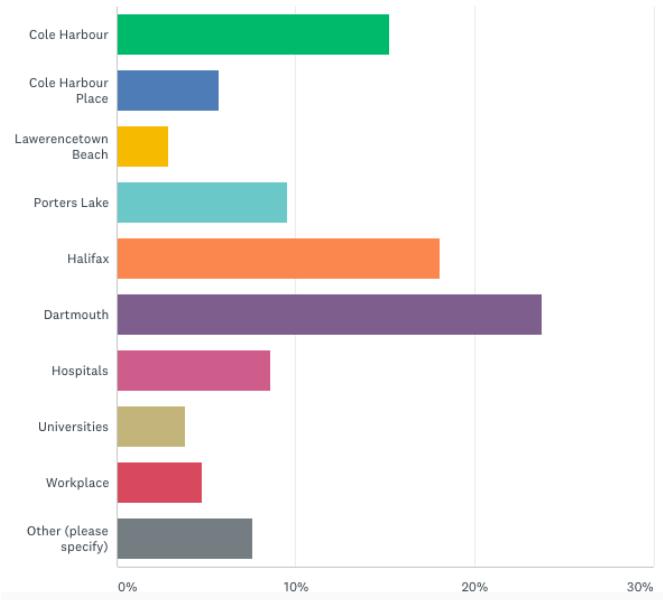


Respondents were also asked when they would use the service for a return trip in the evening. The results were similar to the morning departure in that over 51% indicated between 5:00pm and 7:00pm once again suggesting that the service will be used for commuting to and from work places.



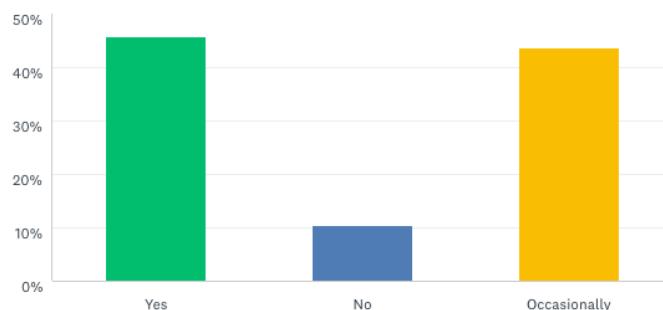
### 3.1.7.Destinations

Survey respondents were asked what their primary destinations would be if they were to use the fixed route transit service, Dartmouth and Halifax were the most common responses with 23.8% and 23.1% respectively.



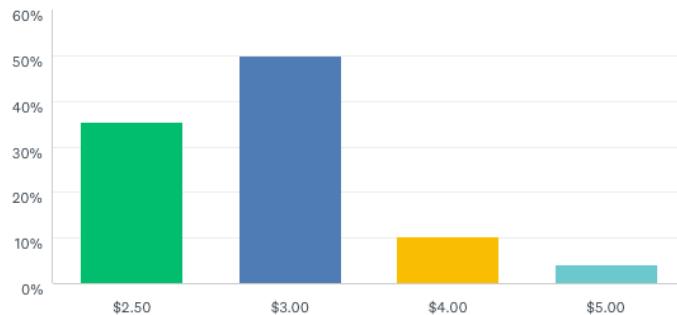
### 3.1.8.Weekend usage

To determine if there was community interest in using the service on weekends, respondents were asked if they would use the service on weekends. The majority of respondents, 45%, indicated that they would with another 44% indicating that they would occasionally use the service on weekends.



### 3.1.9. Reasonable fare

Respondents were asked what a reasonable one-way fare for the service should be, the highest response rate, 50% indicated that \$3.00 was reasonable.



### 3.1.10. Survey comments

Respondents were encouraged to leave comments about the project, some of their comments are found below:

- Have 2 teenagers at home, 20 & 17. One graduated high-school but unless he gets a full time job and can commute with us he can not work part time. Other child has PTSD and is out of school and needs transportation to get him to mental health appointments or just out into the community. No transportation is not good for your mental health, it makes you feel isolated.
- There is a huge need to allow the public to access our beautiful beaches, allow youth to access Cole Harbour Place and part-time work.
- My interest in this service is primarily in my ability to hire folks from 'town' to work at my business. My pool is quite small locally & every time I am searching for a new at least one future possible employee who relies on access to public transit to go to work recuses themselves when they realize that getting to work in Grand Desert will be impossible. This is a huge challenge for my business.
- If there were a bus route available, People could start planning around it.
- I have teenagers looking for part time jobs while attending high school in Cole Harbour currently there is no opportunity for them to get in town unless I drive them, this should be a HRM issue to deal with but Hendsbee doesn't seem to see it

- as an issue, a bus route has been asked for on many occasions, to no avail, it should be run through Halifax Transit and not a independent company trying to make profit
- Wondering about bus stops along the 207, which is a long, narrow, twisty 2-lane road with an incredible and steadily increasing amount of traffic esp. in the summer.
  - I work in Halifax and travel to the city 5 days a week because there is no reliable transit in my area. I would welcome public transportation in my area.
  - We've been waiting a long time to have bus service in Lawrencetown; it's really frustrating to see the bus come as far as Seaforth from the Porters Lake side but not have service here. I think that the MusGo Rider has the right size vehicle for this area (and other areas like this).
  - Accessibility for a fast growing community. Many teens have no access to parks and facilities in HRM because of the rural setting. Bus service would be a no brainer along the route.
  - This area needs better transportation for those without.

### 3.1.11. Survey Summary

A number of insights and findings were gathered from the needs assessment survey about the need for public transit and potential service delivery along Highway 207:

- The majority of respondents, 92.5% of respondents indicated that they either would, or would occasionally use the fixed route system.
- A total of 89% indicated they either would or occasionally would use the service on the weekends.
- Most respondents indicated that they would use the service between four and five times per week.
- Most popular times for departure were between 6:00 and 8:00am, with a return between 5:00 and 7:00pm.
- The majority of people indicated that \$3 was a reasonable fare rate.
- The most popular destinations are Dartmouth, Halifax and Cole Harbour.

### **3.2. Public Meetings**

Two public consultation meetings were held to gain public perspective on the proposed transit service.

- West Chezzetcook, St. Anselm's Hall – October 18<sup>th</sup>
- Lawrencetown, Lawrencetown Community Centre – October 21<sup>st</sup>

Public turnout to the events was quite low with approximately two-dozen people, in total, attending the two consultations. Halifax Transit attended both meetings to answer questions and discuss the project from their perspective. Despite the low turnout there was good dialogue and feedback from the participants. The following is a summary of the feedback received:

- Are electric vehicles an option?
- The Lawrencetown Beach area is prone to washouts and flooding during big storms, which could serve as a service issue in the future.
- Is there an opportunity for GPS tracking on the bus so people know when to meet it?
- Getting feedback from local students through the school system could be beneficial to the project.
- Will bus transfer to Halifax Transit be an option?
- Highly needed in the area, no current way for residents without a vehicle to get to bus terminals to use existing transit services.

### **3.3. Petition**

In 2014 a petition was started on change.org titled “Prevent proposed changes to transit that exclude Highway 207 (on Route 401)”. The description of the petition reads “The communities of West Chezzetcook, Grand Desert and Seaforth have been experiencing challenges with public transit for years. In the past, there has been limited community transit routes offered and these routes have still not been linked to the Xpress 370 in Porters Lake. Halifax Transits proposals for smarter, simpler and more efficient transit do not improve service to our communities. In fact, they have proposed to eliminate the public

transit from Highway 207 all together. This petition is to let Halifax Transit know that we may be small communities but we pay our taxes and wish to keep our transit services.”

The petition has 398 signatures; here are some of the comments made as a reason for signing the petition.

- As a senior I have taken the MetroX to Halifax and have found it an easy way to get to medical appointments. I think it is important to keep the 207 route but connect it to the MetroX and advertise to the senior community this inexpensive easy transportation option
- I live in downtown Halifax and use Halifax transit daily. Losing access to smaller communities in a region full of small communities damages the integrity of the entire system. When I first moved here, the thing that impressed me most about the current transit system was that I could take a bus and visit my friends in Seaforth and West Chezzetcook in a reasonable amount of time. Losing bus service to areas like the 207 is a detriment both to 207 residents who commute, and to urban transit users who lose access to places outside popular corridors.
- It's my access to the most beautiful beach and one of the most vibrant and creative communities around.
- I'm signing because I use this bus a lot and it is needed, do not take it away. I cannot drive and depend on the bus to get to town
- I'm signing because my daughter uses the bus to go back and forth to NSCC and to work. My Son has a disability and he used to get to town as he cannot drive. When I need the family vehicle my husband will also take the bus to and from work. It would really add more expense, wear and tear on our already aging vehicle, not to mention the gas that we would be going through.
- Rural communities need accessible public transportation!
- I am signing because my family often uses the bus to get from Dartmouth to Porters lake. My cousin is going to college and uses the bus everyday to get to school. She has learning disabilities and cannot drive so the bus is very important!
- I take route 401 often because I have no other mode of transportation!!

- Because of living out in a rural town, we depend on transit as a means of reliable transportation and we all deserve access to it!. For myself personally it's the ONLY way I have to travel places with my infant son, for appointments and back and forth to work.
- Not everybody can afford vehicles and some want to stay in the country.
- My family uses this service everyday.
- It's important for us to keep this service. Resources on the Eastern Shore are very limited already; taking this route away is a huge disservice to the community.

## 4. SERVICE ANALYSIS

### 4.1. Fixed route service

A fixed route transit system is the most conventional method of transporting people and can be found in most major cities around the world, whereby buses operate along fixed routes stopping at pre-determined locations on a defined schedule.

Service on a fixed route system is generally provided along main roadways and they tend to serve highly populated residential areas and prime destinations such as universities, hospitals and shopping districts. Buses range in size from 30-foot light duty vehicles to heavy-duty 40 to 60 foot articulated buses; the most common being a 40-foot bus. Fixed routes tend to be more direct in an attempt to attract passengers during peak travel times in the morning and afternoon, when travel times are most important.

Nova Scotia has five fixed route transit systems:

1. Halifax Transit, serving the urban core and immediate vicinity of the Halifax area.
2. Transit Cape Breton, serving the urban core of Cape Breton Regional Municipality.
3. Kings Transit, serving 12 municipalities in the Annapolis Valley.
4. Yarmouth Transit, serving the downtown area of the Town of Yarmouth.
5. Antigonish Community Transit, servicing the Town of Antigonish.

Fixed route transit systems are most popular in urban environments and offer a greater chance of success within high-density populations due to their high operating and capital budgets. Other than for capital purchases, fixed route transit systems are not eligible for any operational transit funding through the Nova Scotia government.

To assist in evaluating the opportunities and challenges of operating a fixed route transit system, two transit services of similar size have been reviewed to determine what the expectations would be for a fixed route system for Highway 207. These reviews should be carefully interpreted as demographics and cultures can vary significantly from municipality to municipality.

## 4.2. Antigonish Community Transit

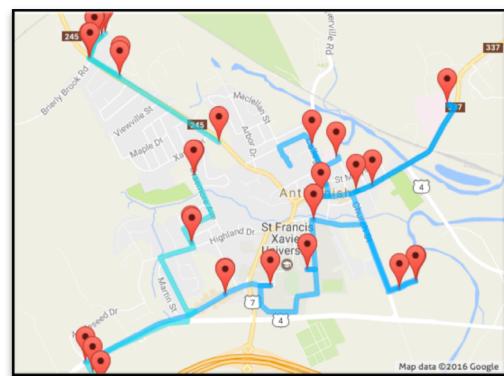
The Antigonish Community Transit (ACT) system began in 2014 and is operated by the Antigonish Community Transit Society. The ACT system consists two services: a dial-a-ride service that operates within the County of Antigonish and a fixed route service that operates within the Town of Antigonish Monday to Friday.

For the purposes of this feasibility study, only the Town of Antigonish fixed-route service has been examined.

### 4.2.1. ACT scheduled town route service

To service the Town of Antigonish a 13 kilometer system was designed to service each of the major shopping areas within the Town of Antigonish; the downtown core, Post Road and the Antigonish Mall.

With stops the Town of Antigonish route takes approximately one-hour to complete. This allows the bus to be at certain points along the route at a certain time each hour. For example; Antigonish Mall 8:00 a.m., 9:00 a.m. etc. and



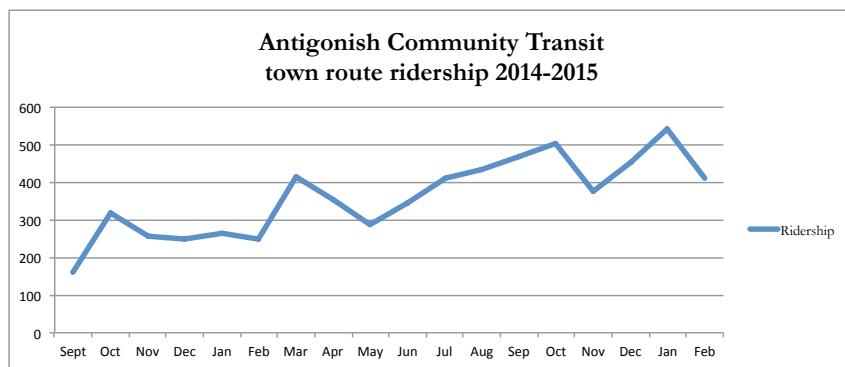
People's Place Library at 8:44 a.m., 9:44 a.m. etc. making it easier for passengers to remember what time the bus will be at a certain stop at a certain time.

**Town Route Monday to Friday:**  
**Antigonish Community Transit Town Schedule 1-902-867-0411**

Bus Stop	1	2	3	4	5	6	7	8
Antigonish Mall	9:00	10:00	11:00	12:00	1:00	2:00	3:00	4:00
Highland Housing Co-op	9:03	10:03	11:03	12:03	1:03	2:03	3:03	4:03
Bloomfield Centre	9:05	10:05	11:05	12:05	1:05	2:05	3:05	4:05
Keating Centre	9:08	10:08	11:08	12:08	1:08	2:08	3:08	4:08
Atlantic Superstore	9:13	10:13	11:13	12:13	1:13	2:13	3:13	4:13
Wal-Mart	9:14	10:14	11:14	12:14	1:14	2:14	3:14	4:14
Shamrock Acres	9:23	10:23	11:23	12:23	1:23	2:23	3:23	4:23
J.J. Carroll House	9:28	10:28	11:28	12:28	1:28	2:28	3:28	4:28
Antigonish Manor	9:30	10:30	11:30	12:30	1:30	2:30	3:30	4:30
People's Place Library	9:35	10:35	11:35	12:35	1:35	2:35	3:35	4:35
Canadian Tire (Main Str)	9:36	10:36	11:36	12:36	1:36	2:36	3:36	4:36
The Maples	9:43	10:43	11:43	12:43	1:43	2:43	3:43	4:43
Parkland (Shannex)	9:46	10:46	11:46	12:46	1:46	2:46	3:46	4:46
St. Martha's Hospital	9:50	10:50	11:50	12:50	1:50	2:50	3:50	4:50
The Sunflower	9:53	10:53	11:53	12:53	1:53	2:53	3:53	4:53
Sobeys	9:57	10:57	11:57	12:57	1:57	2:57	3:57	4:57

#### 4.2.2. Antigonish Community Transit ridership

The ACT system initially experienced ridership challenges during its implementation. Changes in routes, service delivery and the public becoming more familiar with using the service have subsequently lead to significant increases in ridership since its first month of operation in September of 2014.



The town fixed route service has grown fairly consistently since the inception of the service. In its first month of operation the town route had ridership of 161 persons, 15 months later the service experienced a service high ridership of 542 persons in January 2016.

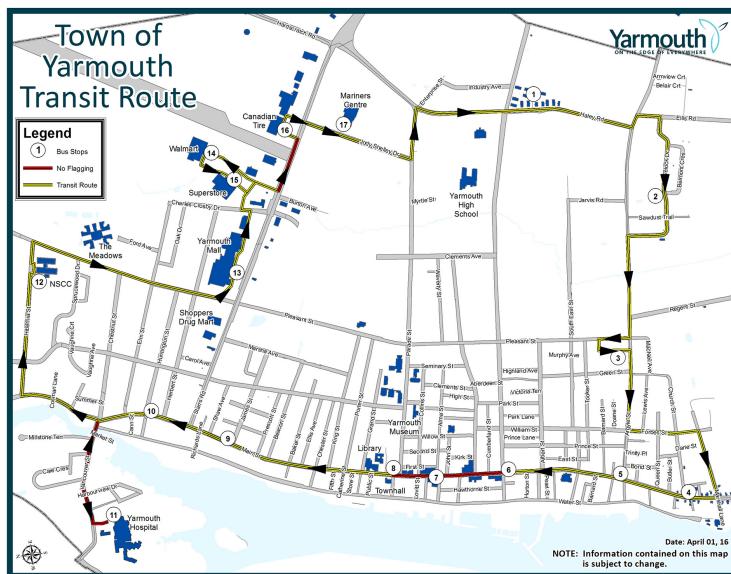
Annual ridership totals for the first two years in operation:

- 2015 4,563 passengers
- 2016 8,357 passengers (projected from 11 months of data)

### 4.3. Yarmouth Transit

In February 2016 the Town of Yarmouth on the Southwestern end of Nova Scotia launched its own fixed route public transit system. The system is owned and operated by the Town of Yarmouth with municipal staff from different departments responsible for its operation.

The system targets both commercial and residential areas though a series of seventeen designated stopping points. The Yarmouth Transit system also uses a flagging system where customers may choose to board and depart the bus in safe stopping areas. With the exception of three areas on the route that are deemed “no flagging areas” customers can wave down the bus anywhere on the route. These areas are highlighted in red on the route map and are considered to be areas of high congestion and challenging areas to stop safely.



With its route planning the Town of Yarmouth Transit system is able to put 80% of the town population within 1 kilometer of the route.

The Yarmouth Transit system operates on a 45-minute schedule:

Stop #	Location	Monday to Friday 7:00 AM to 7:00 PM														
1	Sara Corning Way	7:00	7:45	8:30	9:15	10:30	11:15	12:00	1:00	1:45	2:30	3:15	4:30	5:15	6:00	6:45
2	38 Havelock Drive	7:03	7:48	8:33	9:18	10:33	11:18	12:03	1:03	1:48	2:33	3:18	4:33	5:18	6:03	6:46
3	Grantham Street	7:06	7:51	8:36	9:21	10:36	11:21	12:06	1:06	1:51	2:36	3:21	4:36	5:21	6:06	6:49
4	41 Main Street	7:09	7:54	8:39	9:24	10:39	11:24	12:09	1:09	1:54	2:39	3:24	4:39	5:24	6:09	6:52
5	Main Street At Red & White	7:10	7:55	8:40	9:25	10:40	11:25	12:10	1:10	1:55	2:40	3:25	4:40	5:25	6:10	6:53
6	Main Street At Forest Street	7:12	7:57	8:42	9:27	10:42	11:27	12:12	1:12	1:57	2:42	3:27	4:42	5:27	6:12	6:55
7	Main Street At Alma Street	7:14	7:59	8:44	9:29	10:44	11:29	12:14	1:14	1:59	2:44	3:29	4:44	5:29	6:14	6:57
8	Main Street At Royal Bank	7:16	8:01	8:46	9:31	10:46	11:31	12:16	1:16	2:01	2:46	3:31	4:46	5:31	6:16	6:59
9	Main Street At James Street	7:17	8:02	8:47	9:32	10:47	11:32	12:17	1:17	2:02	2:47	3:32	4:47	5:32	6:17	-
10	Main Street At Coronation Park	7:19	8:04	8:49	9:34	10:49	11:34	12:19	1:19	2:04	2:49	3:34	4:49	5:34	6:19	-
11	Hospital	7:22	8:07	8:52	9:37	10:52	11:37	12:22	1:22	2:07	2:52	3:37	4:52	5:37	6:22	-
12	Hibernia Street AT NSCC	7:26	8:11	8:56	9:41	10:56	11:41	12:26	1:26	2:11	2:56	3:41	4:56	5:41	6:26	-
13	Yarmouth Mall	7:30	8:15	9:00	9:45	11:00	11:45	12:30	1:30	2:15	3:00	3:45	5:00	5:45	6:30	-
14	Walmart	7:34	8:19	9:04	9:49	11:04	11:49	12:34	1:34	2:19	3:04	3:49	5:04	5:49	6:34	-
15	Superstore	7:36	8:21	9:06	9:51	11:06	11:51	12:36	1:36	2:21	3:06	3:51	5:06	5:51	6:36	-
16	Canadian Tire	7:39	8:24	9:09	9:54	11:09	11:54	12:39	1:39	2:24	3:09	3:54	5:09	5:54	6:39	-
17	Mariners Centre	7:41	8:26	9:11	9:56	11:11	11:56	12:41	1:41	2:26	3:11	3:56	5:11	5:56	6:41	-

The hours of operation are:

- Monday to Friday                                    7:00am – 7:00pm
- Saturday    8:00am – 6:00pm
- Sunday/holidays                                      No service

The fare structure is broken down as follows:

- Per ride    \$2.00 (cash)

Unlimited ride tickets:

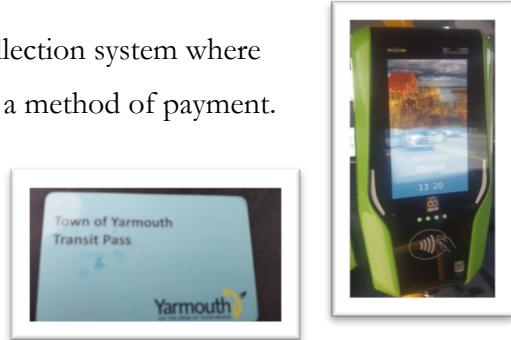
- Day    \$3.00
- Week    \$15.00

Reloadable passes:

- Day    \$3.00
- Month    \$50.00
- Year    \$500.00

Yarmouth Transit is using several methods for fare collection:

- Cash – payable in exact change to the driver
- Pre-purchased tickets – can be purchased at any of the ten participating retail outlets or town hall
- Reloadable cards – an automated fare collection system where passengers use preloaded smart cards as a method of payment. The cards are reloadable at town hall or by calling town hall.



#### 4.3.1. Town of Yarmouth ridership

Since its inception ridership for the Town of Yarmouth has been strong and grew fairly consistently through its first three years of operation beginning with 724 riders in February and peaking at 1,900 riders in October 2018. Since its inception the system has averaged 15,473 riders per year.

	Yarmouth Transit Ridership												Rides per capita	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
2016	-	724	867	1,115	1,007	1,136	1,212	1,271	1,115	1,286	516	966	11,215	1.66
2017	1,251	1,106	1,477	1,412	1,482	1,516	1,738	1,703	979	1,778	1,484	1,429	17,355	2.57
2018	1,483	1,202	1,283	1,096	1,386	1,379	1,684	1,734	1,790	1,900	1,484	1,429	17,850	2.64
Growth 2016 to 2018 (2017-2018)	16%	40%	32%	-2%	27%	18%	28%	27%	38%	32%	65%	32%	37%	2018 projected

Based on the Town of Yarmouth population of 6,761 and a service area (within 1 kilometer of the route) that covers 80% of the population, the population served is 5,408. With this as a population base the Yarmouth Transit has averaged a rides per capita of 2.86 since its inception with a 2018 rides per capita of 3.3.

## **5. MUSGO RIDER – FIXED ROUTE CONCEPT**

The best practices of other community transportation systems, direction from MusGo Rider's Executive Director, input from the community, Halifax Transit and HRM councillor David Hendsbee have all provided a basis for developing this proposed concept for the Highway 207 fixed route service.

### **Target markets**

- Commuters
- Seniors
- Youth

### **Transit Fares**

- Must be affordable
- Must have transfer ability with Halifax Transit

### **Span of Service**

- Connect the communities along Highway 207
- Focus of service on work commuting times

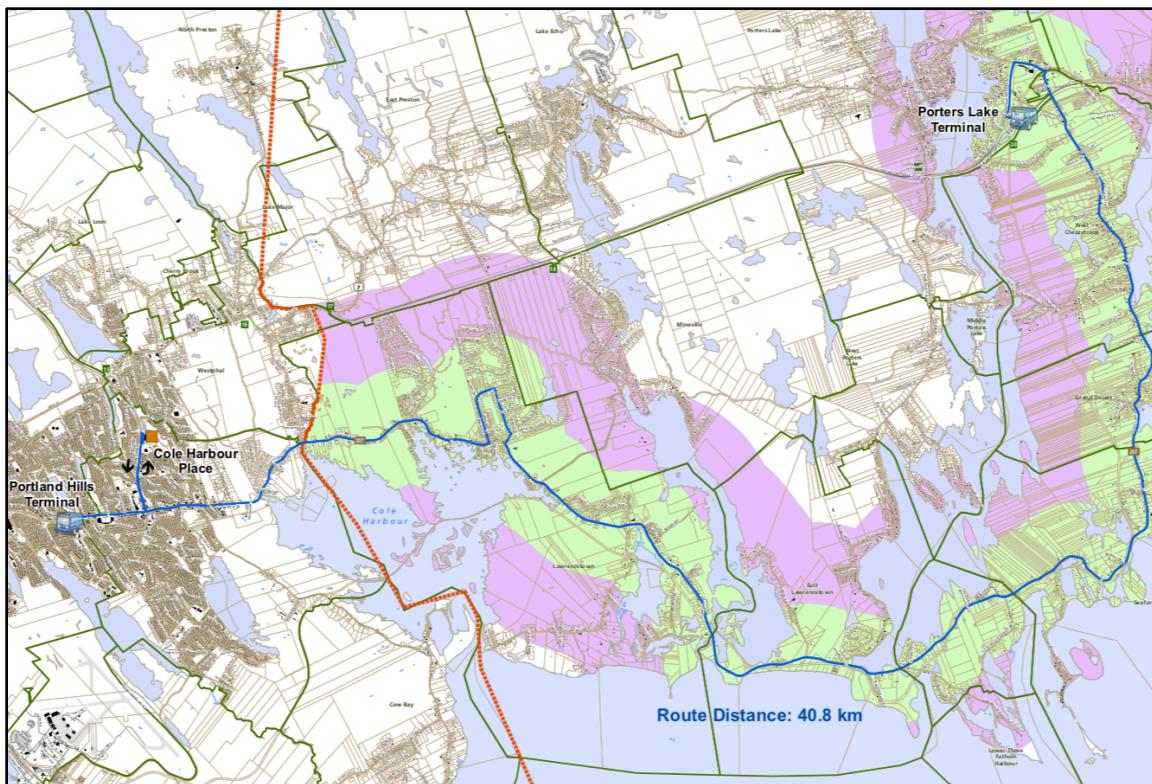
With this proposed expansion MusGo Rider will become a more diversified transportation organization that continues to address even more of the unmet needs for those having both a transportation disadvantage and those looking for alternative methods of transportation. The new fixed route system will focus on increasing the well being and quality of life of many residents living along Highway 207 by providing an affordable way to meet their transportation needs on a regular and consistent basis.

The transit system is designed specifically to target individuals, living in close proximity to Highway 207, that need to travel to either Halifax Transit's Portland Hills terminal, Cole Harbour Place or the Porters Lake terminal. From these terminals passengers will be able to

connect to existing Halifax Transit services. With 51% of survey respondents indicating they would use the bus for a morning departure between 6:00am and 8:00am, suggesting that potential passengers would primarily be using the service for commuting to work, with a smaller percentage using the service for appointments, shopping, education, recreation and other personal activities.

### 5.1. Route

The proposed transit route will be 40.8 kilometers in length, initiating and terminating at Halifax Transit's Portland Hills and Porters Lake terminals.



With this route configuration service is provided to the communities of Porters Lake, West Chezzetcook, Grand Desert, Seaforth, East Lawrencetown and Lawrencetown. With the exception of Cole Harbour Place on outbound service, there will be no service offered between the Ross Road in Lawrencetown and the Portland Hills terminal as this is an existing service area for Halifax Transit.

The service is able to capture a population of 4,279 individuals within a one-kilometer radius of the route and a total population of 9,060 within 2.5km of the route.

	Within 1 km	Within 2.5 km
Population	4,279	9,060
Households	1,699	3,592

This fixed route system will have six to seven identified bus stops along the route - a minimum of one stop for each community. However, in a rural setting a purely fixed route system does not make the most efficient use of transit resources. This transit system will have the flexibility to stop between defined stopping locations to pick up additional passengers, in safe locations, and can be critical to the sustainability and usefulness of the system. This becomes more effective when there could be opportunities to pick up passengers, but no practical location for an identified bus stop.

#### 5.1.1. Halifax Transit terminals

The system will access both Halifax Transit's Porter's Lake and Portland Hills terminals. A request was made to Halifax Transit for the MusGo Rider fixed route vehicle to have access to the bus loops at each terminal to provide an efficient and safe way to load and unload passengers. Halifax Transit denied this request for their safety reasons; primarily the mixing bus traffic with non-bus traffic does not work well.

By working in partnership with Halifax Transit officials, a compromise in using the Halifax Transit terminal facilities was achieved that still provides an opportunity for MusGo Rider to load and unload passengers safely and efficiently and allows Halifax Transit buses to maintain their dedicated bus loops. The MusGo Rider fixed route system will utilize dedicated and marked parking spots located within the public parking area located at each terminal.

#### 5.1.1.1. Porter's Lake terminal

The Halifax Transit terminal in Porter's lake is fairly uncongested even during peak travel times. A parking spot located close to the parking lot entrance and in close proximity to the terminal makes unloading and loading passengers safe and efficient.



#### 5.1.1.2. Portland Hills terminal

The Portland Hills terminal has a very highly used and congested public parking lot. Many options were discussed in regard to this terminal area. Anything located within the large public parking area was considered not feasible primarily due to safety and having to deal with congestion during peak times. Even utilizing the “kiss and ride” area located at the back of the public parking area was not considered feasible due to having to travel through the public parking lot.

A location was chosen within a secondary public parking lot that is within close proximity to the public entrance and exit. This location will provide the opportunity to load and unload passengers safely, however passengers will need to walk a short distance (along a sidewalk and across a bus lane) to access the Halifax Transit terminal.



Even though this location will provide the opportunity to unload and load passengers safely, the drawback of using this location is that the vehicle must use the public traffic lights to access the parking lot. This could cause service delays due to congestion at the lights. Ideally in the future the transit vehicle would have some, even minimal, access to the Halifax Transit bus loop and priority traffic signals to assist in avoiding congestion.

## 5.2. Scheduling

To accommodate both work commuters and the needs of other residents the service will operate from 5:30am to 9:25pm. To provide maximum service during peak times in the morning and afternoon two buses will operate in opposite directions and be in service from 5:30am - 9:15am and 4:05pm – 6:45pm.

The proposed routing requires approximately 45 minutes of travel time, with an extra 20 minutes built into the schedule for stops, traffic and downtime at each terminal.

Bus #1		Bus #2	
Portland Hills	Porters Lake	Porters Lake	Portland Hills
5:30	6:45 - MX	5:30	6:45
8:05	6:50	8:05	6:50
8:10	9:15	8:10	9:25
Break		10:45	9:30
4:05	2:50	10:50	12:05
4:10	5:25 -	1:25	12:10
6:45	5:35 - MX	1:30	2:45
		4:05 - MX	2:50
		4:10	5:25
		6:45 - MX	5:30
		6:50	8:05
		8:10	9:25

MX – Metro X connection

With the proposed schedule service is provided to the route 18 times per day, with service being provided to the route 12 times during peak periods from 5:30am – 9:25am and 4:05pm – 5:35pm. The service also provides connections to the Metro X service in Porters Lake four times daily.

### 5.3. Operational requirements

#### 5.3.1. Organizational

The new fixed route system should be operated by the existing MusGo Rider Cooperative organization. Operating the two systems through one organization will allow the

organization to reduce the amount of administration expenses required in operating two separate organizations.

### 5.3.2. Branding

Although it is recommended that the new service be operated under the existing MusGo Rider organization, it is recommended that the new service be given a new identity to create some separation between the two services.

The recommended new service should be branded MusGo Rider Transit. Local residents already have an established relationship with the name MusGo Rider, many mentioning it in the comment section of the survey. Adding Transit to the MusGo Rider namesake will assist with the marketability of the new fixed route service and allow it to be distinguishable from the current MusGo Rider door-to-door service.



### 5.3.3. Administration

#### 5.3.3.1. Executive director

An executive director role will be required to manage the overall operation of the transit service. It is recommended that this duty should be fulfilled through the existing Executive Director position within the MusGo Rider organization.

Some duties for this position, as they relate to the fixed route system include, but are not limited to:

- Overseeing the operations manager for the fixed route service
- Submit funding applications to funding programs/organizations
- Submit financial reports, ridership statistics to funders
- Monitor and evaluate ridership levels, work with operation manager to adjust schedules and routes when necessary (UARB submission required)

- Communicate with stakeholders to continually build ridership for the fixed route service

Once operational it is anticipated that the executive director will conduct work on behalf of MusGo Rider Transit for an estimated 5 hours per week.

#### **5.3.3.2. Operations Manager**

The MusGo Rider Transit service will require an operations manager to oversee the day-to-day operation of the fixed route service. It is recommended that the operations manager position be shared with the existing MusGo Rider service.

Operations manager duties as they relate to the MusGo Rider Transit service will include, but are not limited to:

- Schedule drivers
- Schedule vehicle maintenance
- Monitor vehicles for cleanliness, fluids etc.
- Maintain maintenance records
- Backup vehicle operator – in emergency basis
- Balance fares to daily rides, oversee bus transfers, bus passes etc.
- Communicate with Executive Director when dealing with drivers and passengers on inter-personal issues, disputes etc.

#### **5.3.3.3. Drivers**

It is anticipated that in the development years of the fixed route system that there will be enough demand to warrant the hiring of three full-time drivers, or two full-time and two part-time drivers.

Drivers are the heart of a community transportation organization and more often than not they are more than just a driver. MusGo Rider Transit needs to ensure that its drivers have the necessary experience, competency, and skillset required for dealing with and transporting

the public in a safe and professional manner. Drivers will need to meet a specific set of criteria to be considered for the position, similar to those required for the MusGo Rider door-to-door system, including:

- Driver's abstract (class 1 or 2)
- Criminal record check
- Vulnerable records check
- Assessment of personality characteristics

Fulltime fixed route drivers are paid a starting wage of \$17 per hour, have access to the MusGo Rider medical plan and are given an allowance of \$25.00 per month as a stipend for using their personal cellphone while on duty.

#### 5.3.4. Vehicle

A community transit system has many vehicle options to choose from in delivering its services to the public, from 60 foot articulating buses to an everyday passenger car choosing the right vehicle can determine the overall financial viability of the project. There are two viable options to consider for this fixed route service, a minibus or a large van.

##### 5.3.4.1. Minibus

Minibuses can hold 20 – 30 passengers, and offer a wide variety of floor plan configurations to accommodate wheelchair passengers and ambulatory passengers.

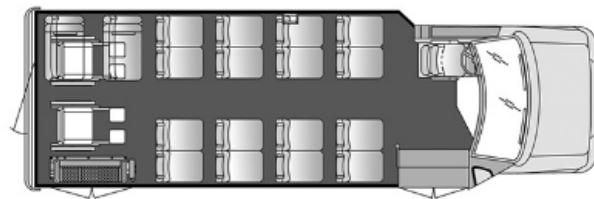
A typical minibus is a body build where a cabin body is fabricated onto a truck chassis. The body-on-chassis approach gives the advantage of higher seating capacity, or more room for passenger comfort through a larger cabin area. There is also the advantage of



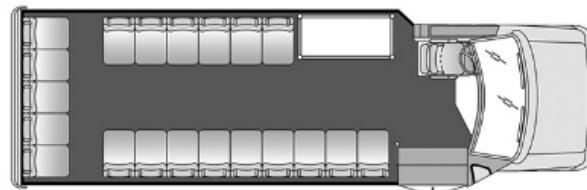
being able to have the drivers seat positioned in a small cubicle, next to the main passenger entrance, allowing the driver to collect fares as passengers enter the vehicle.

A body-on-chassis approach also allows for a wide range of seating arrangements, along with an option for wheelchair accessibility. Some sample seating arrangements that include combinations of fixed seats and fixed seats and wheelchair accessibility are:

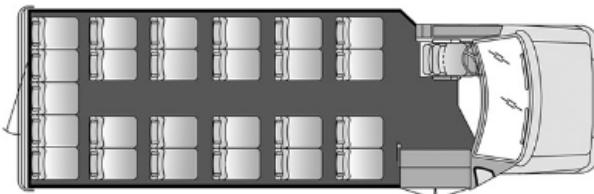
- 16 seats, 2 wheelchairs – 4 foldaway seats
- 20 seats, no wheelchairs and luggage area
- 25 seats, no wheelchair – no luggage area



**16 Passenger 2 Wheelchair  
4 Passenger Foldaway Seats Plus Driver**



**20 Passenger with Interior Luggage Plus Driver**



**25 Passenger Plus Driver**

The seating arrangements provided are general in nature, more customized seating arrangements would be available when ordering the vehicle.

The body-on-chassis minibus configurations are only available in a Ford chassis and there are multiple manufacturers in Canada that produce these vehicles; Crestline in Saskatchewan, Girardin in Quebec and Malley industries in New Brunswick.

Typical pricing of mini buses can range from \$85,000 to \$160,000 depending on the configuration of the vehicle, engine and whether it is a high floor or low floor vehicle, with low-floor being the more expensive option.

#### 5.3.4.2. Van chassis

Another configuration that is gaining popularity due to their lower capital and operating costs is a van chassis. A van chassis is available in two configurations: a body-on-chassis (similar to a minibus) and as a pre-build from the factory. Both options provide the ability to have wheelchair accessibility and/or just ambulatory seating.

##### 5.3.4.2.1. Ford Transit van body

The Ford Transit has the ability to be ordered straight from the factory and customized to the ordered specifications if there are no wheelchair accessibility requirements. If wheelchair accessibility is required than the vehicle must be purchased and built by a manufacturer that specializes in wheelchair accessibility.

The Ford Transit comes in two models an XL or XLT model; the XLT and XL are functionally the same with the exception that the XLT has upgraded features. There are three engine options available:

- 3.7L V6 gasoline engine
- 3.5 EcoBoost V6 gasoline engine
- 3.2L Power Stroke I-5 Diesel engine



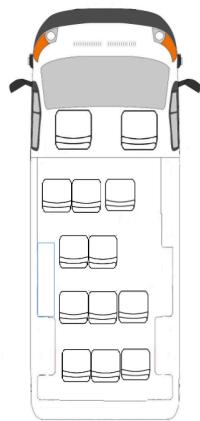
The Ford Transit is built on the F350 heavy-duty chassis and has dual wheels on the rear axle providing greater traction in the winter and added ride comfort.

Pricing for the Ford Transit XL with a high roof, heavy-duty extended chassis, 3.2 Power Stroke Diesel is approximately \$60,000 before taxes.

#### 5.3.4.2.2. Dodge Pro-Master van body-on-chassis

The Dodge Pro-Master is available as a van build, similar to the Ford Transit with the exception that it cannot be ordered directly from the factory with ambulatory seating. The ambulatory seating, up to 11 seats, must be installed by a third party manufacturer.

Malley Industries from Moncton N.B. provided a quote for an entry level Dodge Pro-Master with 11 seats for \$58,000.



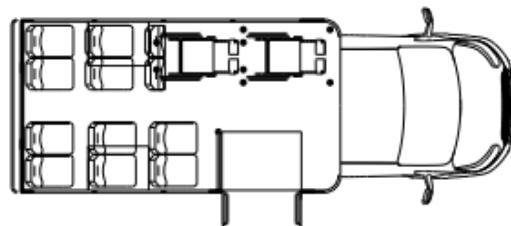
#### 5.3.4.2.3. Ford Transit body-on-chassis

The Ford Transit is available as a body-on-chassis build from Crestline Coaches. They have a model named The Spirit of Independence that has seating for 15 ambulatory passengers, or 12 ambulatory passengers and two wheelchairs.

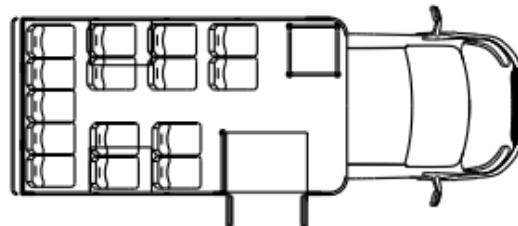
Similar to the Ford Transit van it is available with either the 3.7L V6 gasoline engine or the 3.2L Power Stroke Diesel engine.

The Ford Transit body-on-chassis is available from Crestline with an approximate cost of \$90,000.

**178" WB - 12 Passenger, 2 WC**



**178" WB - 15 Passenger**



#### 5.3.4.2.4. Dodge Pro-Master body-on-chassis

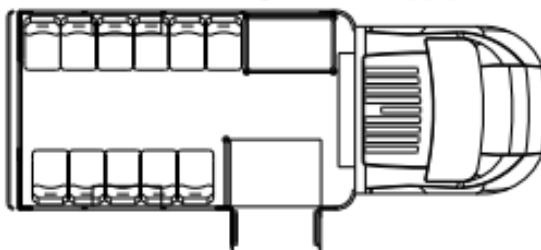
The Dodge Pro-Master is relatively the same as the Ford Transit, with the exception that the Pro-Master has a shorter wheelbase length by 12".

The Pro-Master is built on the Dodge Ram 3500 chassis and offers two engine options:

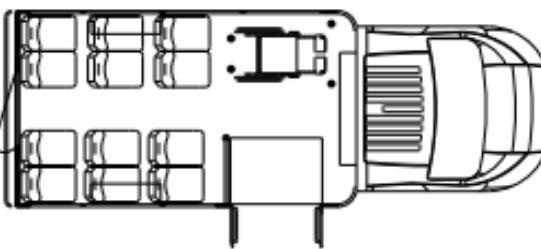
- 3.6L Pentastar V6 gasoline engine
- 3.0 EcoDiesel V6

The Dodge Pro-Master is available for purchase through Malley Industries and Crestline, with a similar purchase price to the Ford Transit of \$90,000.

**165" WB - 11 Passenger w/42" Luggage Rack**



**165" WB - 12 Passenger, 1 WC**



#### 5.3.4.3. Electric vehicles

Battery-electric vehicles (BEVs) are powered by motors that draw electricity from on-board storage batteries, which act as an "engine" to propel the vehicle. The use of purely battery-electric vehicles hasn't reached significant levels in Canada for three reasons: the cost; the size and weight of the battery; and the lack of an adequate refueling infrastructure.

Electric buses have numerous advantages over conventional diesel and gasoline vehicles. An electric vehicle emits no air pollutants from the vehicle during use although emissions may be caused elsewhere to generate the electricity to charge the batteries. Further advantages include lower fuel costs, reduced maintenance costs due to less moving parts, and improved performance in stop-and-start city driving. An electric motor does not idle or waste energy when stopped at a bus terminal, traffic light or for other reasons, while a gasoline or diesel engine would need to be shut off to stop idling.

Although an electric bus produces no emissions at the tailpipe, greenhouse gas emissions associated with the regional electricity fuel source are one of the primary concerns when measuring its environmental impacts. High carbon fossil fuel sources such as coal, oil and natural gas for electricity generation increase the total greenhouse gas emissions associated with supplying energy for the bus. In the absence of renewable electricity sources, the extraction, refining and combustion of fossil fuels for vehicles and electricity is responsible for significant greenhouse gas emissions.

There are a limited number of electric bus manufacturers around the world, and only one on Canada. This chart breaks down a few of the manufacturers and their electric buses based on characteristics that are important considerations for the MusGo Transit project.

Bus	Size (feet)	Capacity (seats)	Range (km)	Top Speed (km)
EV-250	30-32	25	280	110
EV-STAR	25	19	240	110
LIONM	26	22	120	N/A
EBUS	22	22	72	72
CARTA	22	22	95	65

Purchasing costs:

- CARTA Electric Bus \$160,000 - \$180,000 US

The “fuel cost” of an electric bus is approximately \$0.066 / kilometer compared to a gasoline engine at approximately \$0.26/km or \$0.20/km for a diesel engine.

Electric vehicles need to be recharged, sometimes multiple times per day depending on the demand. There are three primary ways to recharge an electric vehicle.

- Charging Station/ Plug-In: The most common way of charging is by plugging into a charging system using a cable, much like an electric car. The BYD K9, for example, has an on-board charger (rectifier) that converts AC power to DC for use in the

battery. Power is usually run through a charging pole at high voltage. Different buses require electricity at different voltages for charging which affects how fast a battery can be fully charged. Typically a plug-in charging station requires the least amount of infrastructure for electric buses, but tends to require more time to charge. (Groszko, 2013)

- Overhead charging station: The overhead charging unit, such as the Opbrid Busbaar (pictured), uses a conductive metal bar that connects to the top of the electric bus. As the bus approaches the station, a metal contact on the top of the bus is activated by the driver at the push of a button to connect with the bar. The overhead charger can deliver either a full charge or short intermittent charges at different points of the buses route. Proterra's FastFill overhead charging system, for example, can provide a full charge to an electric bus in 10 minutes (Proterra, 2013b) (Groszko, 2013).



- Underground induction charger: One of the newest charging technologies is a wireless induction charging system, which is positioned underneath the pavement at different points along the route. Bombardier is currently developing its Primove project for buses, where an induction coil is placed underneath the road to charge vehicles by induction without cables or connections (Bombardier, 2013). The benefit of this technology is that there are no above-ground connections required to the charge the bus, and there is potential to install the chargers underneath multiple bus stops in a city.

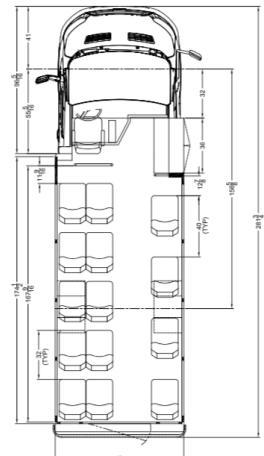
Charging stations, depending on the rate it re-charges range from \$30,000 to \$50,000.

### 5.3.5. Vehicle recommendation

There are a lot of variables to take into consideration when choosing a transit vehicle: ridership levels, target market, weather conditions, passenger comfort, passenger safety, fuel consumption, maintenance costs and capital costs are all critical decision points.



Taking these variables into consideration the recommended vehicle for this system is a non-accessible Ford Transit body-on chassis with a 3.2 Power Stroke diesel engine. The vehicle would have a similar layout as pictured, to the right, with 14 forward facing seats. This vehicle has added value in that it can adequately handle an additional 7 standing-room passengers providing an overall ridership capacity of 21, without a driver.



#### 5.3.5.1. Accessible vehicle passengers

To service any passengers living along the route with accessibility needs, these passengers can make arrangements with MusGo Rider's existing door-to-door service. These passengers will be picked up anywhere along the route and taken to their destination (if it is along the service route) or to either the Portland Hills or Porters Lake terminal for the same charge as the fixed route service.

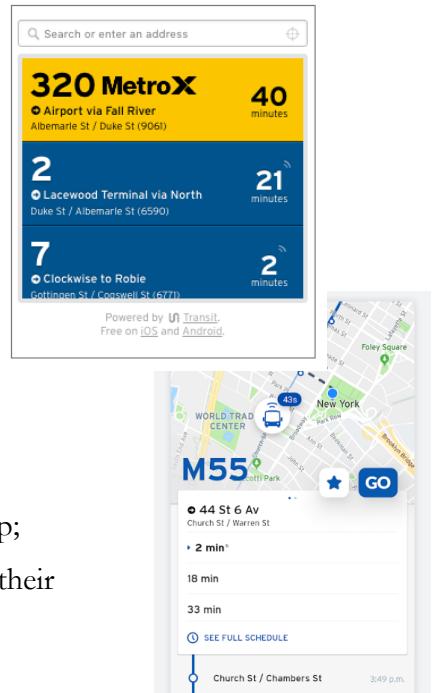
### 5.3.6. Vehicle Tracking

With technology evolving each day and virtually everyone connected to the Internet via their smartphone, a way for MusGo Rider Transit to stay modern and in touch with many of their passengers is through a smartphone application.

Transit: Real-Time Transit is an application created by Transit App. Inc. Their app allows users to track transit buses in real time, and is currently used by Halifax Transit.

There are several features that make the app user friendly and appealing:

- Allows users to track real time arrival and departure schedules
- Users can find nearby stops and routes
- Users can set reminder alerts for departure times
- Search by route for a map of stop locations
- Vehicle accessibility information
- View schedules and route itineraries (available offline)



Transit systems do not need to utilize the real-time component of the app; alternatively they can upload their schedules for users to download onto their phone so they can have immediate access to transit schedules.

The Transit app is free to users. The Transit app is available for iPhone and Android and has a 4.2 out of 5 star rating on Google Play.

Utilizing this app will allow the fixed route service to be much more convenient for passengers, especially where there will only be a few fixed stops and no bus shelters. Having access to real-time location data for the transit vehicles will allow passengers to be on the route on a just-in-time basis.

#### 5.4. Fee structure

The need for a safe, affordable means of transportation to get from place to place is fundamental to the health of individuals and the community as a whole. Having affordable transportation will allow residents living along Highway 207 to get to medical appointments, workplaces, community events and allow them to do things that people with reliable transportation take for granted. In this regard, this fee structure is an attempt to balance affordability for customers, sustainability of the transit system and current Halifax Transit fare rates.

	Cash Fare	Pre-sold tickets (10)	Monthly pass	Transfer to Halifax Transit	Transfer to Metro X or MetroLink
<b>Adult</b>	\$3.00	\$25.00	\$50.00	Free	\$0.50
<b>Child/Student/Senior</b>	\$2.50	\$20.00	\$45.00	Free	\$0.50

To encourage passengers to pre-purchase tickets, options of 10 packs and monthly passes will be made available at a discounted rate to the full fare rate.

### Halifax Transit Fare Rates

Conventional bus, ferry, and Access-A-Bus				
Fare Category	Cash Fare	10 Tickets	MetroPass	Transfer
Adult	\$2.50	\$20	\$78	Free
Senior & Child	\$1.75	\$14.50	\$58	Free
Student	\$2.50	\$20	\$70	Free

MetroLink				
Fare Category	Cash Fare	MetroLink Pass	With ticket, MetroPass, UPass or transfer	
Adult	\$3.00	\$94.50	+\$0.50	
Senior & Child	\$2.25	n/a	+\$0.50	
Student	\$3.00	n/a	+\$0.50	

MetroX				
Fare Category	Cash Fare	MetroX Pass	With ticket, MetroPass, UPass or transfer	With MetroLink pass or transfer
Adult	\$3.50	\$111	\$1	\$0.50
Senior & Child	\$2.75	n/a	\$1	\$0.50
Student	\$3.50	n/a	\$1	\$0.50

### 5.5. Licensing

Within Nova Scotia the Nova Scotia Utility and Review Board (NSUARB) has the responsibility of overseeing and licensing public passenger transportation providers within the province.

### General USARB requirements

Applications for new public passenger services are advertised in the Royal Gazette and local newspapers. Other licensed carriers have an opportunity to object to the issuance of new licenses. If objections are received, a public hearing is held and the NSUARB makes a decision on whether or not the license will be granted. If no objections are received, licenses are generally granted if all requirements are met.

Insurance requirements are \$2 million third party liability and \$2 million passenger liability and property damage for vehicles 20 passengers and under, and \$2 million third party liability and \$3 million passenger liability and property damage for vehicles 21 passengers and over.

Inspection of all vehicles by the Motor Carrier Division of Department of Transportation and Infrastructure Renewal is required twice per year. There is no fee for this inspection, but the owner is responsible to provide a place for the inspection and a person to drive the vehicle during a road and brake test.

There are no application fees for licensing, however, the annual fee for a Motor Carrier License is \$515.30 per vehicle. NSUARB recommends new applicants not invest in vehicles until they have been granted an operating authority (license).

The motor carrier license is required for vehicles that can accommodate nine or more passengers. This license allows operators to pick up and drop off passengers within the community and set a flexible range of fares compatible with its mandate. With this license operators are required to submit to the NSUARB its schedule and fare structure; the operator is then required to obtain permission from the NSUARB for any subsequent changes to the schedule or fare structure.

## 6. RIDERSHIP LEVEL SCENARIOS

Estimating potential ridership for any transit system can be complicated as there is no exact formula to accurately project how many riders per year, month or day a transit system can expect. There are many variables to take into consideration such as population, income levels, employment levels, service area, service hours and the type of transit service offered.

Ridership projections for MusGo Rider Transit have been developed using rides per capita information gathered from other small-scale community transit systems:

Transit System	Population	Rides	Rides per capita
<b>Antigonish Community Transit (2015)</b>	4,364	8,357	1.9
<b>Yarmouth Transit (year 1)</b>	5,408	11,215	1.66

Given these ridership statistics from other similar sized transit systems, the following sensitivity analysis has been developed to project ridership statistics for the MusGo Rider Transit service.

	Population (within 2.5km)	Rides per capita	Rides per year	Rides per day
Low ridership level	9,060	1.0	9,060	36
Mid ridership level	9,060	1.8	16,308	64
High ridership level	9,060	3.0	27,180	107

The 64 riders per day as a mid-ridership level can be justified as a reasonable figure given that Halifax Transit's Route 401 currently has, on average, 27 riders per day along a short nine-kilometer stretch of Highway 207 most of which is a low density population area. The proposed route will cover areas that have a higher population density such as Lawrencetown and Upper Lawrencetown. Additionally, according to Census data there are 110 individuals within the service area that are already using transit services to commute to work, it is reasonable to assume that some of these individuals will utilize the Route 207 service.

It typically takes three to five years for any new transit system to grow its ridership potential. This is demonstrated by both Yarmouth Transit and Antigonish Community Transit continuing to experience growth in their transit systems as they continue to mature. As ridership grows, fare revenue increases and the transit system operates more cost-efficiently in terms of revenue recovery. As a result, the cost of operating a transit system during the development years can be considerably higher once the system becomes “mature”. Ridership is expected to increase with linear growth for the second and third year of operations.

	Pilot (12 mths)	Year 2	Year 3
Population (within 2.5km)	9,060	9,105	9,151
Rides per year	16,308	18,028	19,931
Rides per day	64	71	78
Rides per bus trip (avg)	3.6	3.9	4.3
Rides per capita	1.8	2.0	2.2
Growth		10%	10%

By the end of the second year of operation it is anticipated that MusGo Transit will achieve 2.2 rides per capita.

## 7. COST IMPLICATIONS

Detailed capital cost requirements and annual operating costs have been prepared to determine the financial feasibility of MusGo Rider Transit.

### 7.1. Start-up capital costs

Start-up costs for MusGo Rider Transit system include the recommended purchase of two Ford Transit cutaway chassis' and signage for designated stopping locations.

The amount of start-up expenditures required for the development of MusGo Transit is limited due to its utilization of existing resources of MusGo Rider.

Item	Budget
<b>Light-duty cutaway chassis</b>	\$180,000
<b>Signage (12 installed signs)</b>	\$6,000
<b>Total</b>	\$186,000

The MusGo Rider Transit service has a distinct advantage over other new transit systems in that it doesn't require many of the other capital costs involved in starting up an operation such computers and office equipment.

## 7.2. Operating budget

Detailed operating cost estimates for MusGo Rider Transit have been prepared based on a recommended service level, from 5:30am to 9:25pm five days per week - with two buses serving the route during peak hours from 5:00am to 9:30am and 3:30pm to 6:45pm.

Operating Budget MusGo Fixed Route			
Expenditures	Pilot (12 mths)	Year 2	Year 3
Administration wages	14,690	14,690	14,690
Driver wages & benefits	124,865	127,362	130,546
Administration	2,400	2,400	2,400
Rent	3,600	3,600	3,600
Phones (drivers)	1,200	1,200	1,200
Repairs and maintenance	10,000	12,500	15,000
Fuel	51,700	56,871	59,714
Insurance	4,000	4,200	4,400
Licensing	1,032	1,032	1,032
Advertising	7,500	5,000	5,000
Miscellaneous	4,000	4,000	4,000
<b>Total</b>	<b>224,987</b>	<b>232,855</b>	<b>241,582</b>

MusGo Rider Transit once again has an advantage over many other community transportation services in that it will not have the full burden of overhead costs such as administration, office rent and utilities; instead they will be shard with the current MusGo Rider organization. In this regard, when compared to other systems its cost per passenger hour is significantly lower than other services within the province. The cost per passenger

for the pilot project for MusGo Rider Transit is \$13.39 (\$218,474 / 16,308 passengers), while the average for the other community transportation systems in the province is an average of \$28.08.

### 7.2.1. Wage calculation

The highest, as with most community transportation systems, expenditure is wages. MusGo Rider Transit is fortunate in that the only full wage expenditure is for vehicle operators; the other administration wage costs will be shared with MusGo Rider.

Pilot 12 Months	Pay rate	Hours per week	Weeks	Total	MERC's	Total
Executive Director	\$32.00	5	52	8,320	1,082	9,402
Operations Manager	\$18.00	5	52	4,680	608	5,288
Drivers - Route 1	\$17.00	40	52	35,360	4,597	39,957
Drivers - Route 2	\$17.00	85	52	75,140	9,768	84,908
				110,500	14,365	139,555

The Mandatory Employment Related Costs (MERC's) are the employer's contribution to Canada Pension Plan and Employment Insurance and are calculated at 13% of wage costs.

### 7.2.2. Fuel calculation

Aside from driver wages the second highest expenditure category is fuel. The following charts details how fuel consumption calculations were derived.

	Total	
Kilometers	41	41
Times serviced per day	6	12
Total route km per day	246	492
Off-route/idle time	10%	10%
Total km per day	271	541
Avg. litres / 100 km	18.5	18.5
Fuel usage (L)	50	100
Fuel cost (per L)	1.35	1.35
<b>Total fuel cost per day (\$)</b>	<b>67.58</b>	<b>135.16</b>
		<b>202.75</b>

### 7.3. Projected operating and revenue budgets

To demonstrate the long-term financial sustainability of the MusGo Rider Transit fixed-route system, a projected two-year operating and revenue budget based on the recommended service level has been developed. An additional two budgets have been developed for alternative, but not recommended, service levels.

#### 7.3.1. Recommended service level

Detailed operating budgets for MusGo Rider Transit have been prepared based on a recommended service level, from 5:30am to 9:25pm five days per week - with two buses serving the route during peak hours from 5:00am to 9:30am and 3:30pm to 6:45pm.

Operating Budget MusGo Rider Fixed Route		
Expenditures	Pilot (12 mths)	Year 1
Administration wages	14,690	14,690
Driver wages & benefits	124,865	127,362
Administration	2,400	2,400
Rent	3,600	3,600
Phones (drivers)	1,200	1,200
Repairs and maintenance	10,000	12,500
Fuel	51,700	56,871
Insurance	4,000	4,200
Licensing	1,032	1,032
Advertising	7,500	5,000
Miscellaneous	4,000	4,000
<b>Total operating costs</b>	<b>224,987</b>	<b>232,855</b>
<hr/>		
<b>Revenue</b>		
Fare Revenue	48,924	54,085
<b>Funding required</b>	<b>176,063</b>	<b>178,769</b>

#### 7.3.2. Alternative – operating one vehicle full time

An alternative to the recommended service level would be operating one bus along the same route from 5:30am to 9:25pm. A disadvantage to this service level is that it only provides one opportunity for passengers to connect with other transit services at the Portland Hills terminal to make it to the downtown core in time for work at 8:30. This could result in buses

being overloaded during these peak times, with the possibility of having to reject passengers wanting service.

Operating Budget MusGo Rider Fixed Route		
Expenditures	Pilot (12 mths)	Year 2
Administration wages	14,690	14,690
Driver wages & benefits	84,908	86,606
Administration	2,400	2,400
Rent	3,600	3,600
Phones (drivers)	600	600
Repairs and maintenance	5,000	6,250
Fuel	34,467	37,914
Insurance	2,000	2,100
Licensing	516	516
Advertising	7,500	5,000
Miscellaneous	4,000	4,000
<b>Total operating costs</b>	<b>159,681</b>	<b>163,676</b>
<hr/>		
<b>Revenue</b>		
Fare Revenue	29,354	32,451
<b>Funding required</b>	<b>130,327</b>	<b>131,225</b>

### 7.3.3. Alternative 2 – operating two buses full time

A second alternative to the recommended service level would be to operate the two buses along the same route from 5:30am to 9:25pm. This would provide a higher than needed service level resulting in higher maintenance, wage and fuel costs for a minimal increase in fare revenue.

Operating Budget MusGo Rider Fixed Route		
Expenditures	Pilot (12 mths)	Year 2
Administration wages	14,690	14,690
Driver wages & benefits	169,816	173,213
Administration	2,400	2,400
Rent	3,600	3,600
Phones (drivers)	1,800	1,800
Repairs and maintenance	15,000	19,000
Fuel	68,934	75,827
Insurance	4,000	4,200
Licensing	1,032	1,032
Advertising	7,500	5,000
Miscellaneous	4,000	4,000
<b>Total operating costs</b>	<b>292,772</b>	<b>304,762</b>
<hr/>		
<b>Revenue</b>		
Fare Revenue	56,263	62,198
<b>Funding required</b>	<b>236,510</b>	<b>242,564</b>

## 7.4. Funding sources

### 7.4.1. Nova Scotia Transit Research Incentive Program (NS-TRIP)

NS-TRIP provides funding to support capacity building initiatives intended to generate new and improved public transit services in rural and under serviced urban areas of Nova Scotia.

Applications can include but not limited to:

- Feasibility studies
- Business plans
- Pre-pilot
- Pilot project
- Start-up costs (first year of operations)
- Research projects

Pilot project funding eligible expenses (50% up to \$50,000) include:

- Manager wages
- Driver wages
- Advertising
- All vehicle expenses (except purchases)
- Dispatcher wages
- Office expenses
- Board insurance

#### 7.4.2. Public Transportation Assistance Program (PTAP)

PTAP covers a portion of the capital cost of a public transit system operated by a municipal unit or a not for profit organization. Funding is allocated using a formula that takes into the service area population of the service, which is defined as the population within a kilometer of a bus stop and ridership.

MusGo Rider Transit should be able to apply to PTAP in the first year of operations after the successful completion of a pilot project.

There are only a few transportation systems within Nova Scotia that can access the PTAP including:

- Halifax Transit
- Transit Cape Breton
- Antigonish Community Transit
- Kings point-to-point transit
- Yarmouth Transit

#### 7.4.3. Communities, Culture and Heritage – Community Trans. Action Plan

Through the Community Transportation Action Plan the Nova Scotia Department of Communities, Culture and Heritage (CCH) have been able to fund several initiatives aimed at supporting local community transportation services throughout Nova Scotia. One such project includes the funding of a pilot project for Maritime Bus to provide fixed route service to link Bridgewater to Halifax.

While there is no formal application process the department should be approached to see if funding can be accessed for the pilot project phase.

<https://cch.novascotia.ca/investing-in-our-future/community-transportation-action-plan-strengthening-communities-through-transportation>

#### **7.4.4. Rural Transit Funding - Halifax Transit (RTF)**

In 2014 Halifax Regional Council voted to adopt the Rural Transit Funding Program, a grants program through which rural transit operators can apply for funding to subsidize the cost of operating their service in Halifax.

Which services are eligible for funding?

In order to be eligible under the Rural Transit Funding Program, the transit service provided must meet the following criteria:

- It serves residents of the municipality: The organization must offer a public transit service within the municipality or is intended to serve the residents of the municipality.
- The service meets an unmet demand: The service must be in an area of the municipality not currently serviced by Halifax Transit or alternately, the service can be in an area which is serviced by Halifax Transit if it can be demonstrated that the rural transit service would complement existing Halifax Transit service and address an unmet need in the community.
- The service is available to the public: The organization offers a public transit service that is available to any member of the public and does not require a membership to access.
- The organization operating the service is a non-profit society or cooperative: The organization which operates the service must be a non-profit society incorporated under the *Societies Act*, R.S.N.S. 1989, c.435 and registered with the Nova Scotia Registry of Joint Stocks, or be a non-profit cooperative incorporated under the *Co-operatives Associations Act*, R.S.N.S., 1989, c. 98 and registered with the Nova Scotia Registry of Joint Stocks.

How are the grants awarded?

Grants provided through the Rural Transit Funding Program are disbursed through in two ways:

- An annual lump sum payment; and
- A flat rate of \$0.50 per kilometer travelled while providing transit service.

The amount of the annual lump sum payment is determined based on the level of service provided to the community and is valued between \$5,000 and \$10,000.

- Where the organization provides service more than 16 hours per day, at least one day per week, the lump sum is \$10,000;
- Where the organization provides service 8.1 to 15.9 hours per day, 6 to 7 days per week, the lump sum is \$10,000;
- Where the organization provides service 8.1 to 15.9 hours per day, 1 to 5 days per week, the lump sum is \$5,000; and
- Where the organization provides service 1.0 to 8.0 hours per day, at least one day per week, the lump sum is \$5,000.

The total amount of the flat rate payment will be based on the number of in-service vehicle kilometers travelled in each quarter of the municipal fiscal year, as reported in the required quarterly financial report.

There are currently four organizations accessing the Rural Transit Fund: Musgo Rider Cooperative, MusGo Valley-Sheet Harbour, Bayrides and East Hants Community Rider and the total budget was just under \$130,000.

With the fixed route service MusGo Rider Transit should be able to access the RTF and its flat rate of \$0.50 per kilometer funding. If MusGo Transit were to access the RTF, a significant increase in the RTF by HRM council would be required.

#### **7.4.5. Green Municipal Fund (GMF)**

The Green Municipal Fund is funded through the Federation of Canadian Municipalities and has a funding program for transportation and fuel efficiency. The program focuses on two main areas:

- Reducing or avoiding fossil fuel use in municipal fleets
- Reducing pollution in Canadian cities and communities of all sizes by improving transportation networks or encouraging people to switch to less polluting commuting options

The Green Municipal Fund will support pilot projects that reduce pollution in Canadian communities by improving transportation systems and networks or encouraging people to switch to less polluting transportation options. This funding helps Canadian cities and communities of all sizes reduce energy consumption and greenhouse gas (GHG) emissions and improve air quality.

The pilot project will need to compare several options or assess the capacity of one option to do at least one of the following:

- Reduce the number of vehicles on the road, the number of kilometres they travel, or the amount of time they spend transporting people or goods
- Get people to use their vehicles more efficiently or switch to less polluting forms of transportation (i.e., a modal shift to public transit, walking, or cycling).

The GMF will fund pilot projects that examine either the financial performance of environmentally proven initiatives, or the financial or environmental performance of a new initiative. The pilot should also assess a project's social benefits (e.g., better health for local residents, job creation, youth engagement, whether people will use it).

Eligible organizations can receive:

- Regular loans and grants: Receive a low-interest loan of up to \$5 million and a grant worth 15% of the loan; cover up to 80% of eligible costs.
- High-ranking project loans and grants: These qualify for a low-interest loan of up to \$10 million and a grant worth 15% of the loan; cover up to 80% of costs.

<https://www.fcm.ca/home/programs/green-municipal-fund/transportation-networks-pilot-project-grant.htm>

#### 7.4.6.Funding summary and scenario

MusGo Rider Transit has several funding opportunities that it has the ability to access. Having formal conversations with each of these funders/lenders before moving to the business planning stage to secure some multiyear funding will be essential to moving this project forward.

	Capital	Operating	Deadline
RTFP	N	Y	January
NS-TRIP	N	Y	March
PTAP	Y	N	March
CCH	?	Y	March
GMF	Y	N	None

#### 7.4.7.Possible funding scenario

Possible funding scenario for the first two years of operation:

Operating Budget MusGo Rider Fixed Route		
Expenditures	Pilot (12 mths)	Year 1
Administration wages	14,690	14,690
Driver wages & benefits	169,816	173,213
Administration	2,400	2,400
Rent	3,600	3,600
Phones (drivers)	1,800	1,800
Repairs and maintenance	15,000	19,000
Fuel	68,934	75,827
Insurance	4,000	4,200
Licensing	1,032	1,032
Advertising	7,500	5,000
Miscellaneous	4,000	4,000
<b>Total operating costs</b>	<b>292,772</b>	<b>304,762</b>
 <b>Revenue</b>		
Fare Revenue	48,924	54,085
<b>Operational funding required</b>	<b>243,848</b>	<b>250,677</b>
NS-TRIP (up to \$50,000)	50,000	-
RTF (207,000km @ \$0.50)	103,000	103,000
CCH	90,848	147,677
<b>Capital funding required</b>	<b>186,000</b>	
CCH	93,000	
Other	93,000	

## **8. RECOMMENDATIONS**

This report has examined many of the different aspects that help determine the feasibility and sustainability of a fixed route transportation system for Route 207. While car transportation will likely remain the predominant mode of transportation in the area, there is a core group of users already using the Halifax Transit Route 401 service and likely many residents connecting with Halifax Transit service at Portland Hills or Porters Lake. Having a core group of users already familiar and comfortable with transit services can be a big benefit when introducing a new service to an area.

**Recommendation: Keep the proposed service top of mind for area residents; keep them informed on how the project is progressing**

A key success determinant for public transit systems consistently surrounds the cost of providing the service and the availability of funding and ongoing support from government and municipal units. Fixed route transit services require time, a minimum of two years, for them to gain momentum as evidenced by both the Town of Antigonish and Town of Yarmouth fixed route transit systems.

**Recommendation: Secure a minimum of two years of operational funding before moving to business plan stage**