The Economic Impact of Transit Investment: A National Survey

CUTA
ACTU
CANADIAN URBAN TRANSIT ASSOCIATION
ASSOCIATION CANADIENNE DU TRANSPORT URBAIN

Prepared by:

Metropolitan Knowledge International
McCormick Rankin Corporation
Dr. Jeff Casello, University of Waterloo

For:
The Canadian Urban Transit Association (CUTA)

CUTA's Mission Statement

To strengthen public transit's contribution to the quality of life, environment, health, mobility and economic development of Canadian communities, and to help members fulfill their mandates.

2010

Executive Summary

Public transit is a central component of Canada's economy, and is essential to closing Canada's productivity gap. Transit investment reduces the amount of public money that must be spent on everything from health care to municipal services such as water and wastewater. For the average Canadian, this means lower taxes, more jobs, and a higher quality of life.

The evidence of the need for transit investment surrounds most urban Canadians every day. Road congestion. An increasing number of "smog days". Existing transit systems in need of updating, and cities where transit infrastructure investment has not kept pace with development. As one example, a recent economic review by the OECD concluded that traffic congestion was costing the Toronto economy $3.3bn per year.

Investing in transit can be part of a broader strategy to improve Canada's productivity, by addressing the wasteful and economically damaging impacts of congestion, and by creating urban environments that support the changing economy of our major cities. At a time when employment growth is increasingly concentrated in knowledge-based sectors, creating safe, walkable, thriving urban environments is a central part of Canada's competitive advantage.

Public transit, as part of the broader transportation sector, is an industry that contributes jobs, income, and wealth to the Canadian economy. Transit can reduce the amount of income a household has to spend on transportation, increasing disposable income. More substantial benefits of investment in public transit result from other, less direct, but wide-ranging impacts on the Canadian economy. In short, public transit helps the economy run more efficiently, reducing waste, and thereby improving the prosperity of all Canadians.

This study was commissioned to review the economic benefits of transit investment on a national scale. It includes a review of industry and academic literature on the economic benefits of transit, provides a snapshot of the scale and impact of current investment in transit in Canada, and reports the results of a new evaluation of the economic benefits of transit on a national scale, conducted using a Multiple Account Evaluation framework. The key findings include:

- The total economic benefit of the existing transit network in Canada is at least $10bn annually, and likely considerably more;
- Transit reduces vehicle operating costs for Canadian households by about $5bn annually;
- Transit reduces accident related costs by about $2.4bn annually;
- Transit saves the health care system at least 175 hospital admissions and $115M annually, and likely considerably more;
- The transit industry in Canada currently employs some 45,200 persons, with a further 24,300 jobs in spin-off employment;
- Over the past eight years, capital investment in transit totals over $10bn, which has produced nearly 140,000 jobs and produced nearly $21bn in total economic output;
- A recent cost-benefit analysis of a large-scale national investment in transit found that an investment of $71bn in capital costs would return fully $239bn in benefits over 30 years, or an annual rate of return of 12.5%;
- Economic benefit analysis of projects across the country have demonstrated the economic benefits associated with transit investment, including (as examples):
  - $937M in benefits over 25 years associated with the Evergreen Line in Vancouver;
  - $1.3bn in benefits over 40 years associated with light rail transit on Montreal's Hwy 10;
  - $1.2 to $1.3 bn in benefits over 30 years associated with the extension of the TTC Yonge Subway to Richmond Hill in York Region.

Because Canada is a transit equipment exporter, investment in transit can remain in Canada, creating spin-off employment in manufacturing and related industries. As a capital intensive industry, transit investment generates employment in professional services, construction, and a wide range of other fields.

Our survey of the multitude of studies on transit's economic benefits in Canada yielded a series of relevant conclusions:

- The most detailed research on the environmental benefits of transit was conducted by Kennedy (2002), who estimated that private auto travel in the GTA was 2 to 3 times less efficient in terms of energy consumption per seat-kilometre than transit. In comparing greenhouse gas (GHG) emissions, Kennedy found that transit reduced carbon emission by 92-98% per person-km compared to private cars.
- A wide variety of studies that identify transit's impact on land use are available for major cities in Canada. For example, between 1992 and 2006, employment in Downtown Calgary grew by 18,000 jobs, without adding any additional road capacity. A Coopers & Lybrand/IBI study as part of the planning process for the Sheppard Subway found that condo prices were higher by 20% per unit than non subway station area condominiums.
- A University of British Columbia study, published in The Journal of Public Health Policy, finds that "people who take public transit are three times more likely than those who don't to meet the Heart and Stroke Foundation of Canada's suggested daily minimum of physical activity." The same researches quantified extensive health care cost savings associated with use of public transit.
- Transport Canada (2008) compares the costs of trips by private auto and transit considering time, out of pocket expenses and social costs. The analysis demonstrates that when social costs (congestion, air pollution) and parking costs are included, transit is one-third to one-half as expensive as auto for commuting in 10 major Canadian cities, thus providing both an economically efficient mode of transportation and allowing those Canadians who cannot use a personal vehicle to participate fully in the workforce.

The implication of the findings of this study is that transit is playing a leading role in improving Canada's productivity through a range of economic, environmental, and health benefits, and is only growing in importance as fundamental economic changes are reshaping our major urban centres.

TABLE OF CONTENTS

1 Introduction and Background

1.1 THE ECONOMIC ROLE OF TRANSIT: TELLING THE WHOLE STORY

An investment in public transit is an investment in a more efficient Canadian economy. Currently, with the twin challenges of climate change and economic change redefining many traditional industries, transit is taking a leadership position in providing urban transportation that improves productivity and responds to the challenges of growth.

While transit's benefits in terms of moving more people effectively and reducing environmental impact are widely recognized, less well understood are the multifaceted ways in which Canadians and the communities they live in benefit economically from investment in public transit. Increasingly, investment in transit is recognized to have benefits beyond those typically attributed to transportation projects. For example, a growing number of health care professionals and organizations have recognized the cost of poor air quality on the Canadian health care system and commensurately, that public transit can help reduce these impacts, to the economic benefit of all Canadians.

The evidence of this surrounds most urban Canadians every day. Road congestion. An increasing number of "smog days". Growing transit ridership, despite many systems being under financial or physical constraints. And the growing consensus among media, academic, and industry analysts that investment in public transit is the right response.

Observers of Canadian cities quickly reach the same conclusion. A recent economic review by the Organization for Economic Co-operation and Development (OECD) concluded that traffic congestion was costing the Toronto economy $3.3bn per year. It made a direct tie-in to Toronto's lagging productivity growth, citing "poorly integrated regional transit services and relatively underdeveloped public transport infrastructure" as a major reason for Toronto's underachievement. It went on to suggest a way to increase productivity:

> *Improve transport infrastructure - Financial incentives to use public transit instead of cars, such as congestion charges, high-occupancy toll (HOT) lanes, local fuel taxes and parking taxes could be considered, as could more revenue sources for Metrolinx, the regional transportation agency. The federal government should work with municipal governments on predictable, long-term, infrastructure funding and evaluation with a view to contributing to the competitiveness of the Toronto region and the country as a whole.*

Similar arguments could be made in urban centres across the nation. Investment in public transit is an immediate, lasting, and effective step to improving Canada's productivity, which is perhaps the most important economic issue of our time.

1.2 EVALUATING TRANSIT'S IMPACT ON THE ECONOMY: A STATUS REPORT

Evaluating the economic impact of public transit is something that is frequently undertaken on a project-by-project basis. Few national studies or surveys exist.

On a project basis, economic evaluation has become much more commonplace. With the return of intergovernmental co-operation in transit projects, formal evaluations of project benefits became a central element in making funding decisions, particularly at the Federal level. The result was a series of cost-benefit analysis exercises conducted for each major Canadian transit project in the recent past, first with a simplified cost-benefit framework, more recently with a broader approach, Multiple Account Evaluation. This report has provided a summary of many of these cost-benefit evaluations, which provide a much better sense of the range and scale of economic benefit of transit projects in Canada; it is interesting to note that few, if any, did not indicate a strong return on investment.

In terms of national research, work has been undertaken in Canada occasionally since the 1960's. In 2004, CUTA commissioned a national survey of economic benefits, to collect the existing information available through both academic and industry publications and present a picture of transit's impacts on the Canadian economy. The final report of this study, titled *Transit Means Business*, identified a wide range of economic impacts drawn from specific cities across the country. While this 2004 study identified hundreds of sources and cites individual examples from urban centres in most provinces, it was not possible as part of that study to evaluate many of transit's economic benefits on a national basis.

More recently, work has been conducted for CUTA to establish the economic benefits associated with moving from the current level of transit investment in Canada, to an optimum level. This hypothetical scenario looked at what the ideal supply of transit in Canada would be, and analyzed the economic benefits of the additional investment required to get to the optimum level.

This report presents the findings of a new economic benefits evaluation of Canada's existing transit investment. It looks at the benefits to the economy associated with faster travel, fewer accidents, reduced vehicle operating costs, reduced emissions, and public health benefits. These are all benefits of transit investment and part of an industry that is vital to keeping Canada's economy moving, and becoming more productive.

1.3 METHODOLOGY FOR THIS STUDY

This study has undertaken a quantitative evaluation of the economic benefits associated with the level of transit investment in place in Canada. It does not attempt to provide a cost-benefit evaluation, but rather, follows the structure of a multiple account evaluation (MAE) to outline the economic benefits associated with the investment already in place.

In addition to the MAE, we present the findings of a survey of both academic and professional literature, compiling the results of various economic evaluations of transit projects in Canada. Information concerning the scale and performance of Canada's existing transit industry is also presented. The surveys are intended to provide a broad cross-section of the work already completed to evaluate transit investments across Canada, and in some cases in the United States or overseas.

The report opens with a discussion of the ways in which investment in transit makes Canada's economy more productive – improving our productive efficiency.

2 PUBLIC TRANSIT: THE ECONOMIC ROLE

Public transit, as a central element of Canada's transportation system, is part of the economic framework of our cities. It provides choice in mobility and is an element of the complex infrastructure that underlies the movement of goods and people.

2.1 ECONOMIC EFFICIENCY - TRANSIT AND PRODUCTIVITY

Economists use a 'perfect economy' as a theoretical objective. A perfect economy is one where no inefficiencies exist. In its most basic form, any economy can achieve a certain degree of production of a mix of goods and services, if production is perfectly efficient. In such an economy, there is no shortfall or surplus of anything, nothing is wasted, and all decisions are made with perfect knowledge of supply and demand conditions.

In economic theory this is referred to as the production possibility, and is often simplified as a curve (the production possibilities curve). No real-world economy ever produces its production possibilities curve, because no real-world economy is perfectly efficient. Production inefficiencies exist in all economies that mean no economy ever attains its perfect state.

Productive inefficiencies include a wide range of phenomena, ranging from under-employment, to poor transfer of information, to accidents and waste. An inability for people to get to work is a source of inefficiency, as its wastes their labour. Traffic congestion is another – an individual's productive time is reduced as they wait in congested conditions. Accidents, which are much more common in travel by personal car than by transit, is another source of waste. Investment in public transit is a way to help correct some of these inefficiencies. In this way, investment in public transit is a way to make the economy more efficient and bring it closer to its optimal output.

Most agree that public transit can help in correcting productive inefficiencies resulting from congestion and lack of mobility. The biggest question – and the largest point of debate between pro- and anti-transit forces in the United States - is the degree to which investment in public transit reduces the range of negative externalities of automobile use. Without question, the degree of benefit ranges from clear and substantial in the case of passenger safety, for example, to less clear but potentially more significant in dollar terms, in the case of easing traffic congestion.

At the root of this issue is a failure of pricing. The costs of travelling by private car do not reflect the full cost of this travel decision, in terms of congestion, pollution, accidents, and other costs not borne by the consumer (driver). As a result, more Canadians choose to drive than would if the price of auto travel accurately reflected the true

HOW BIG IS CONGESTION'S CONTRIBUTION TO CANADA'S PRODUCTIVITY GAP?

There have been a variety of studies of the cost of congestion to the economy of Canada's largest cities. These studies have reported a range of results for the annual cost of congestion to major urban centres in Canada; however, the most comprehensive study was conducted by Transport Canada, who found that congestion cost between 2.3bn – 3.7bn in total for the 9 largest urban centres nationally, in 2002 dollars (Transport Canada, The Cost of Urban Congestion in Canada; 2007)

Other city-specific studies have found:

- 3.3bn – to the Toronto region alone, in 2009 dollars (OECD, 2009 Territorial Review: Toronto, 2009)
- 1.0bn – in Vancouver alone, in 2001 (Transport Canada, Transport Trends; 2001)
- 0.9bn – for Montreal alone, in 1998 (Ministère des Transports du Québec, 1998)

cost. Todd Litman of the Victoria Transport Planning Institute puts it this way: "*most transportation problems share a common root: market distortions that result in excessive automobile use. From this perspective, solving transport problems requires planning reforms that increase transport options, and market reforms that give consumers suitable incentives to choose the best option for each individual trip*."

Investment in public transit provides a transportation option for the majority of Canada's urban residents. The economic value of this option is as a balancing factor that allows urban economies to continue to function; to use scarce resources, such as land, capital, and fuel more efficiently, by being able to construct and operate more dense urban environments.

The role of government in Canada's economy is complex.   But there is widespread consensus that correcting market failures such as price distortions and negative externalities is a basic element of the government's role in the economy. For this reason, public expenditure on transit has become a central element of transportation policy at all levels of government.

2.2 FACTORS THAT INFLUENCE TRANSIT DEMAND

Transit demand is a multidimensional function encompassing areas of urban form (land use distribution) and transit service, as well as facets of demographics, economics and culture. Factors can be influenced in a positive or negative way, in the sense that a positive influence would be outstanding service standards, while a negative influence would be excessive traffic congestion.

In this section, the factors that influence transit demand will be delineated into the categories of those that directly influence transit ridership, and those that indirectly influence transit ridership. Urban form, the economics of personal car use, and similar points are factors that indirectly influence transit ridership since they are not likely to be directly controlled by a transit agency, but more by culture, history, and politics. Factors that directly influence transit ridership are related to service standards, and new community planning. Exhibit 2.1, below, summarizes the factors that influence and encourage transit usage. Discussion of these factors can be found in the "Millennium Cities Database for Sustainable Mobility, Analyses and Recommendations", published by UITP (International Association of Public Transport) and ISTP (Institute for Sustainability and Technology Policy); and "Making Transit Work, Special Report 257" published by the Transportation Research Board.

Exhibit 2.1 - *Factors that Influence and Encourage Transit Usage*

Direct Influencing Factor	Indirect Influencing Factor
Availability of transit	Population density
Variety of transit modes	City size
Price of transit service (fares)	Journey to work distance
Quality/Reliability of transit service	Travel time to work (level of congestion)
Convenience/Density of transit service	Cost of car ownership
	Marginal cost of car ownership
	City demographics

Priority ranking the influencing factors in order of which have the most impact on ridership levels is a heavily debated topic. It is generally agreed that population density and ridership levels are the most closely correlated. The remaining factors have varying degrees of influence depending upon how much of a factor the other influencing factors present. In other words, they are all inter-related, including population density.

Population density facilitates transit usage in several ways and is one of the greatest influences on transit ridership. Population density allows for economic viability of transit service, in that the more people who use it regularly, the better the service standards can be provided in a cost effective manner. Density also is conducive to roadway congestion, which makes transit more attractive from a time perspective to the rider or potential rider. Density also means that land costs will be higher, thus, owning a car, and storing it is more expensive than in less dense neighbourhoods, which provides a direct economic incentive to the traveler, which favours transit. When considering density as an influencing factor, it must be considered that good transit service is an influencing factor on population density. Across Canada, dense urban development has occurred in areas surrounding transit nodes, whether it is Skytrain stations in Burnaby, or Transitway stations in Ottawa.

City size influences transit ridership, especially in Canada, for the simple reason that the larger Canadian cities are more likely to have a higher population density than the smaller. Transit systems require a "critical mass" of potential customers such that service can be provided in an economically feasible manner, and this critical mass is unlikely to be found in smaller communities.

City demographics such as population age and income are all influencing factors on transit ridership, since they define the portion of the population that does not have – or chooses not to have – access to a car, often referred to as the "captive market". For instance, people who are too young or too old to legally drive a car or have a low income, rely on public transit for their means of transportation. And, although this is changing, younger adults and women have in the past been less likely to be able to afford a car, and as such were more likely to be "captive" to public transit as well. Number of vehicles per household, the cost of car ownership, and the marginal cost of car ownership all influence transit ridership in that they help to define the potential market.

Distribution of land use relates to the dispersion of major trip generators, such as business districts, colleges or universities. The more cohesive these generators are, the easier it is to provide transit service (in the same way that population density improves the feasibility of transit). Simply put, transit works when there is a need to move a lot of people between two major trip generators, and the various locations in between. It is not feasible to provide transit to all small trip generators.

From an individual rider perspective, the decision between driving and taking transit (for the "non-captive market"), is strongly influenced by the difference in time it will take to drive to a destination versus taking transit. Transit is much more competitive for shorter distances because the difference in time between driving and taking the bus is less significant. This also relates back to density and traffic congestion.

The remaining categories all relate to the level and quality of transit service that is provided to the customer. Since the economics of car ownership in Canada are essentially achievable at all levels, resulting in a small captive market, the choice to take transit for the average Canadian is strongly influenced by the reliability, convenience and comfort of the ride. It is also a widely held belief that riders are significantly influenced by the transit modes available to them. This "choice" market is much more amenable to using public transit if the transit vehicle is operating in a rapid transit or other high priority mode. Examples include Toronto, Montreal, Ottawa, Vancouver, Edmonton, and Calgary.

2.3 Benefits By Community Type

The economic benefits of transit investment increase as the size of an urban centre increases. This is because congestion and other transportation-related negative externalities are considerably more severe in larger centres.

In any urban centre where transit is in place, transit operations and affiliated industries bring with them certain benefits:

- Increased labour mobility supporting central business districts, to jobs in a wide range of sectors of employment, access for students to education, and mobility for those who choose or are unable to use an automobile to work, shop, or otherwise undertake economic activity
- Health and safety benefits including fewer accident-related costs and better air quality
- Economic activity and spending in the transit industry itself, through its supply chains, operations, and through research and development into new transit products for export

As the size of an urban centre increases, and the nature of a transit investment changes, additional benefits begin to accrue. These include:

- Property impacts, including increasing residential and commercial land values. This economic benefit typically occurs only in areas served by higher-order transit.
- In an urban area with significant road congestion, the value of taking traffic off the road through additional transit investment accrues extremely significant benefits. As the marginal cost of congestion increases rapidly, so do the benefits of providing alternative transportation (one additional car on a highly congested corridor incurs much greater costs to the economy than an additional car on an uncongested corridor).

The impact of transit in reducing inefficiencies due to congestion is strongest in larger urban centres. The costs of congestion generally increase exponentially with the size of an urban area.

2.4 Pitfalls Of Economic Analysis

There are some challenges associated with evaluating transit's impact on the economy that should be noted.

First is the constant challenge of attaching accurate values to non-monetary concepts, such as valuing an individual's time, and valuing emissions. In economic benefit analysis, this is typically handled by using benchmark values established through other research: for example, Transport Canada completed an evaluation of the value of time in different transportation conditions in all major Canadian centres in 2007.

A second concern is double-counting. An example of this is the calculation of travel time savings associated with transit, and the increased value of land in the area of transit stations. Essentially, these are the same benefit – consumers will pay more for a home or business location adjacent to a transit station in part because of the time savings associated with that location, and therefore, calculating travel time savings and the increased property value could involve some double-counting of economic benefits (although, there are many other factors affecting property value as well).

Perhaps the most significant challenge is that while some benefits are easy to quantify, such as travel time savings and emissions savings, others are very difficult to isolate. For example, Toronto's urban form is shaped in part by the presence of the subway on several major corridors, which has generated high-density nodes that use land and municipal services much more efficiently than a less dense urban form would. While the economic benefits of this urban form are multitude, they are difficult to quantify. Other forms of economic benefit share the same challenge.

CUTA ACTU

3 The Transit Industry in Canada – Scale and Economic Impact

This chapter reviews and describes the state of the transit industry in Canada today. It presents information about the current supply of transit service, including key performance indicators.

The data used is drawn largely from the Canadian Urban Transit Association (CUTA) Urban Transit Statistics (UTS) report. Analysis for Canada as a whole covers a time series of nine years from 2000 to 2008. The data for the year 2008 is broken down by province/territory and by population group.

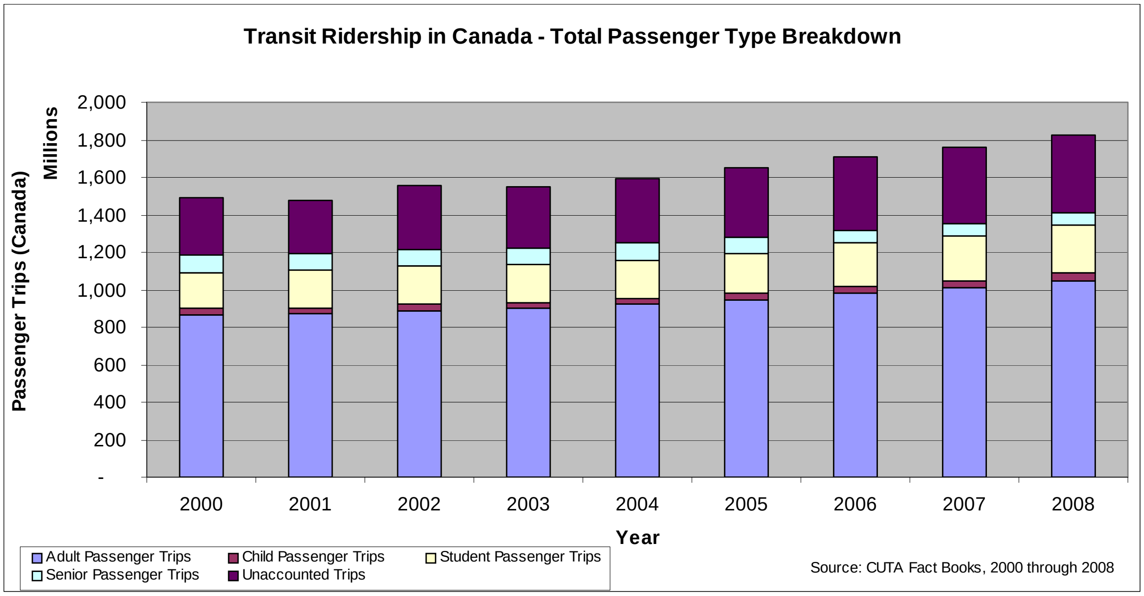
There are four population groups used in the UTS: communities of less than 50,000 people, 50,000 to 150,000 people, 150,000 to 400,000 people and over 400,000 people.

3.1 WHO RIDES, HOW MANY, AND WHERE - THE DEMAND FOR TRANSIT IN CANADA

The mobility needs of the people that live in urban Canada create a demand for transit service. This section reviews the current annual transit usage in Canada, the portion of the population of Canada served by transit, the per capita use of transit services, transit modal share and the factors that influence transit usage.

3.1.1 Transit Ridership in Canada

Transit ridership in Canada reached over 1.8 billion passenger trips (linked trips) in 2008, supplying service to 23 million of Canada's 25 million urban residents that year[1]. Roughly translated, transit service was available to 96% of urban residents in Canada. Transit's steady increase in ridership has consistently outperformed the pace of population growth in Canada, in part due to increasing prices for gasoline, expanded service in several large urban centers, and growing recognition of the environmental benefits of travel by transit.

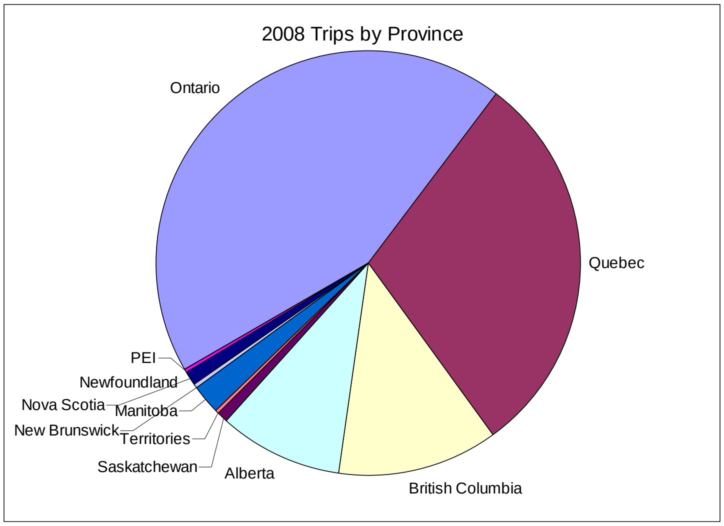


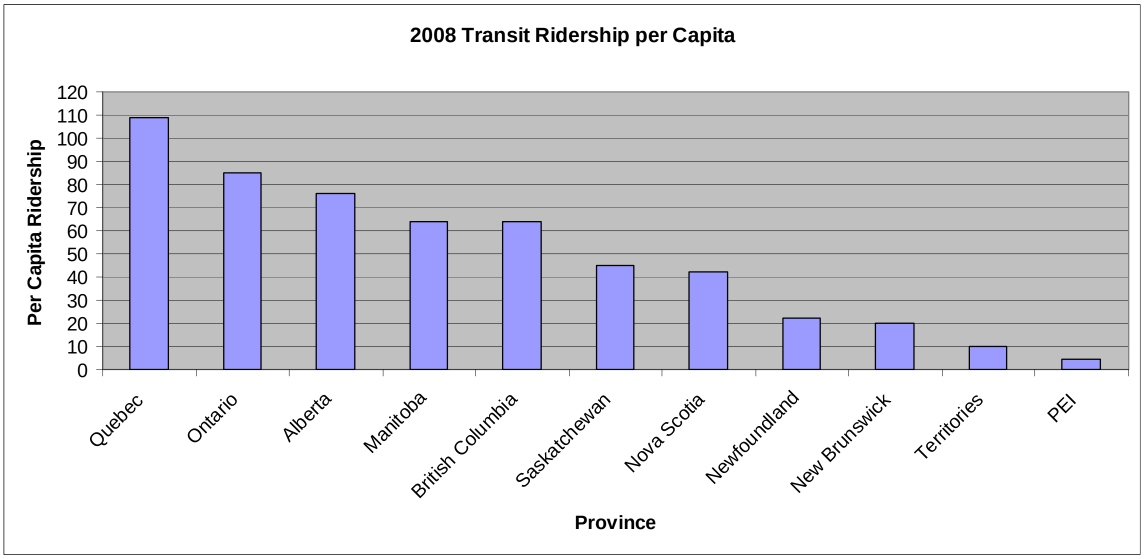
[1] Urban residents are defined by Statistics Canada as living in a community of 1,000 residents or more.

Transit Passenger Ridership

Ontario and Quebec make up the greatest proportion of transit passenger trips in Canada, servicing over 790 and 540 million passenger trips respectively, in 2008. The remaining Canadian provinces all serviced approximately 490 million passenger trips, with British Columbia and Alberta accounting for over 80% of those trips.

Quebec has higher trips per capita than Ontario, although Ontario services more passengers. One factor that may be contributing to this outcome is the different approaches to fare structures, notably for monthly passes, in the city of Montreal relative to the city of Toronto.





Of the trips in 2008, 57% were made by adults, 14% by students, 4% by seniors and 2% by children. Some agencies such as AMT and RTL in Montreal, OC Transpo in Ottawa, and Translink in Vancouver do not report to CUTA revenue passengers by passenger type, therefore these passengers are represented as unaccounted trips (23% of the total passengers reported in 2008). The data appears to show an increase in the proportion of students using transit over the eight years from 13% to 14%. The proportion of seniors using transit has decreased from 6% in 2000 to 4% in 2008. The proportion of child passenger trips has stayed constant at 2%.

Additional information regarding transit ridership for provinces and population groups is included in Appendix B. Per capita ridership is also presented for major urban areas.

3.1.2 *Transit Modal Share in Canada*

The 2006 transit modal share for work trips in Canada is included in Appendix B. This information, collected as part of the long form of the Canadian Census every five years shows that in Canada, on average in a 24-hour period, 76.9% of work trips are made by car, truck or van (including passengers), 15.2% by public transit, 5.6% by walking and 2.3% by other means. The modal split of major urban areas indicates a range of transit modal share over a 24-hour period of between 22% in Toronto, Ontario and 2% in Abbotsford-Mission, B.C. Although data was not collected for the peak hour period, surveys done in large cities show a much higher proportion of work trips by transit in this critical time period. It is worthy to note that daily transit mode share of downtown work trips is significantly higher for most of the larger urban centres.

According to Statistics Canada, the proportion of Canadians using public transit to get to work rose between 2001 and 2006. In 2006, "11% of Canadian workers used public transit to get to work, compared to 10.5% in 2001 and 10.1% in 1996. Compared to 2001, this corresponded to a 216,100 increase in ridership for the public transit authorities across the country. While the car is still the most frequently used mode of transportation for getting to work, there was a decrease in the proportion of drivers in the past five years, from 73.8% of workers in 2001 to 72.3% in 2006."[2]

[2] Statistics Canada, *Commuting Patterns and Places of Work of Canadians*, 2006 Census: National, provincial and territorial portraits

3.2 THE CURRENT SUPPLY OF TRANSIT IN CANADA

This section reviews and discusses how the demand for transit described in the previous section is satisfied. What types of transit service are provided in Canada today, how much service is offered, what type of equipment is used, how service is provided and some information about the labour force that provides the service, are all described.

3.2.1 Types of Transit Service in Canada

Transit service in Canada is supplied in a range of ways, from subways in Toronto and Montréal with capacities of more than 30,000 passengers per hour per direction to on-street bus services in mixed traffic and low capacity Para Transit and demand-responsive services. These are described in Appendix B.

Service is mostly provided by the public sector but about half of Canadian transit systems have some form of "alternate service delivery" (ASD) where service is provided by the private sector. Information about service delivery arrangements is also included in Appendix B.

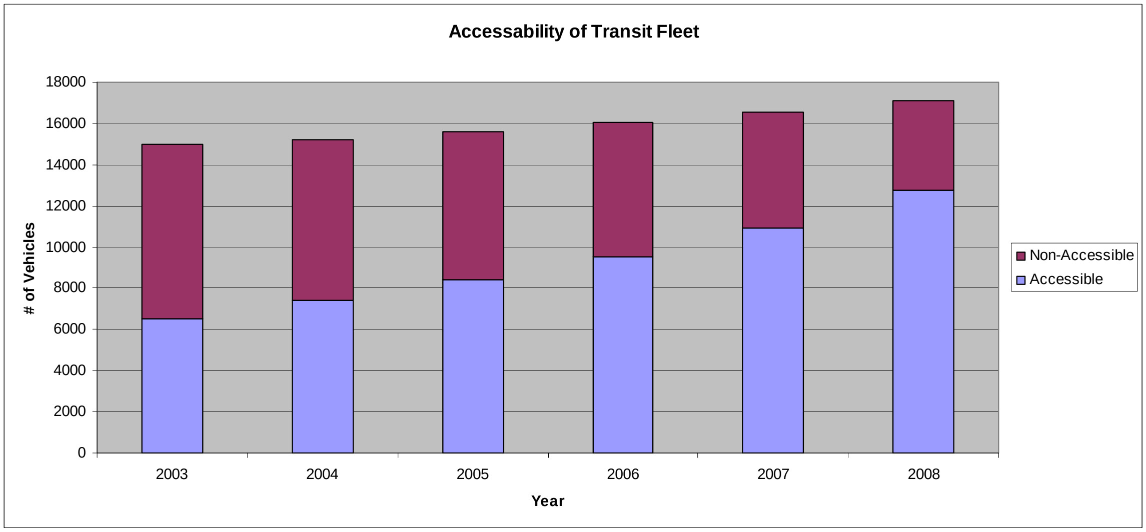
3.2.2 Amount of Transit Service in Canada

Transit revenue vehicle hours and revenue vehicle kilometres have both increased steadily across Canada over the eight years from 2000 to 2008. A time series of revenue vehicle hours per capita included in Appendix B indicates a relatively stable trend in the service provided. This shows that transit service capacity has been increasing at a similar rate to population growth. Additional information regarding Revenue Vehicle Hours for each province and population group is included in Appendix B.

3.2.3 Number of Transit Vehicles

In 2008, 17,092 active transit vehicles were reported to CUTA in Canada. In the six years from 2003 to 2008, the active vehicle fleet across Canada has increased in size by 14 percent. The vast majority of urban transit buses now being purchased are low-floor leading to the gradual phasing out of high floor buses. In 2008, 75% of Canada's urban transit bus fleet was low floor compared with 44% in 2003.

More detail on the accessibility of transit buses in 2008 by province is included in Appendix B.



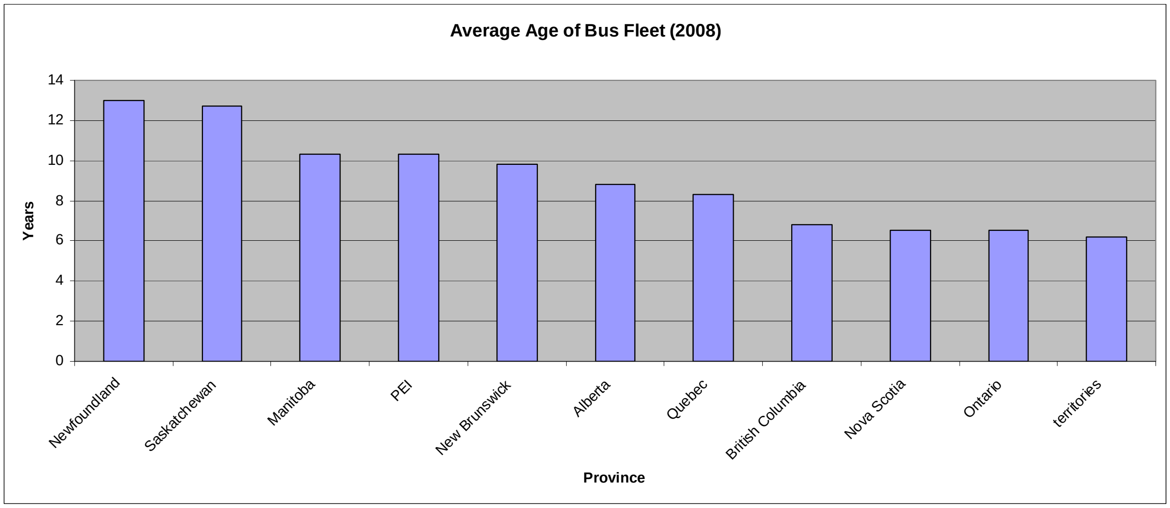
Transit systems in cities with populations greater than 400,000 are the only ones to provide rail service. Additionally, they have a larger proportion of low floor buses than do the smaller community providers.

3.2.4 Year of Manufacture

One of the critical issues facing municipalities as they plan for the future is their aging transit fleet. The United States standard is to expect an average service life of approximately 12 years, while most transit systems in Canada plan for their buses to last around 15 or 16 years. Thus the system should be supporting an average fleet age of around 8 years to be sustainable.

The average year of manufacture for each of the provinces is displayed below. The youngest fleet is in the Yukon, followed by Nova Scotia and Ontario. The oldest fleets are in Newfoundland and Saskatchewan. On closer examination of the larger individual systems, it can be seen that the average bus age ranges from 5 to 11 years. The youngest bus fleet is in the York and Mississauga region where the average bus age is less than 5 years. This is likely related to both the relative age of the service or system, and local and provincial decisions regarding fleet funding.

Additional information on the age and use of Canada's bus fleet can be found in Appendix B.



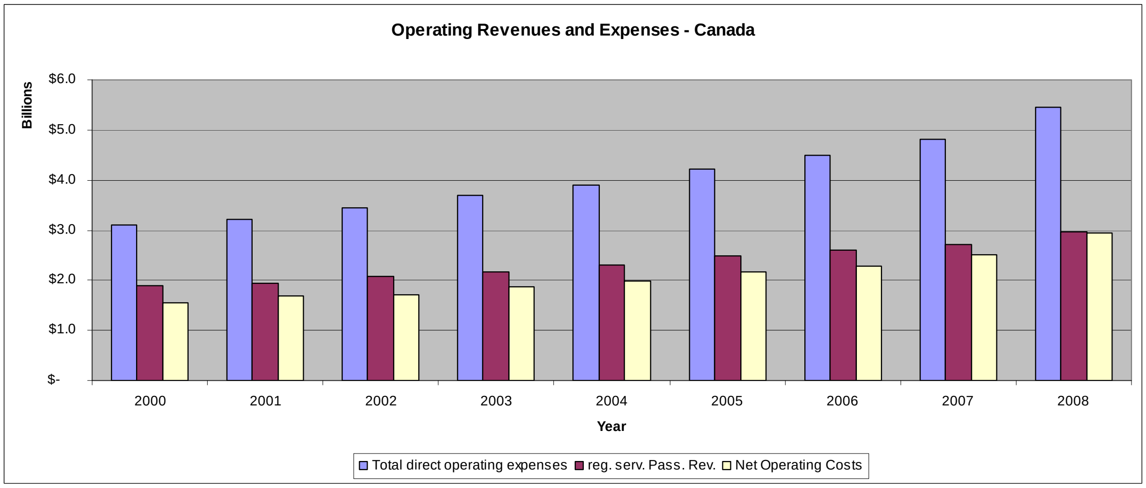
3.3 THE CURRENT COST STRUCTURE OF TRANSIT IN CANADA

Understanding the demand and supply components of the transit industry are important, but they do not show the complete picture. The cost structure of the transit industry includes consideration of operating revenue and expenses, capital revenues and expenses, financial performance, the costs of equipment and infrastructure and the sources of funding.

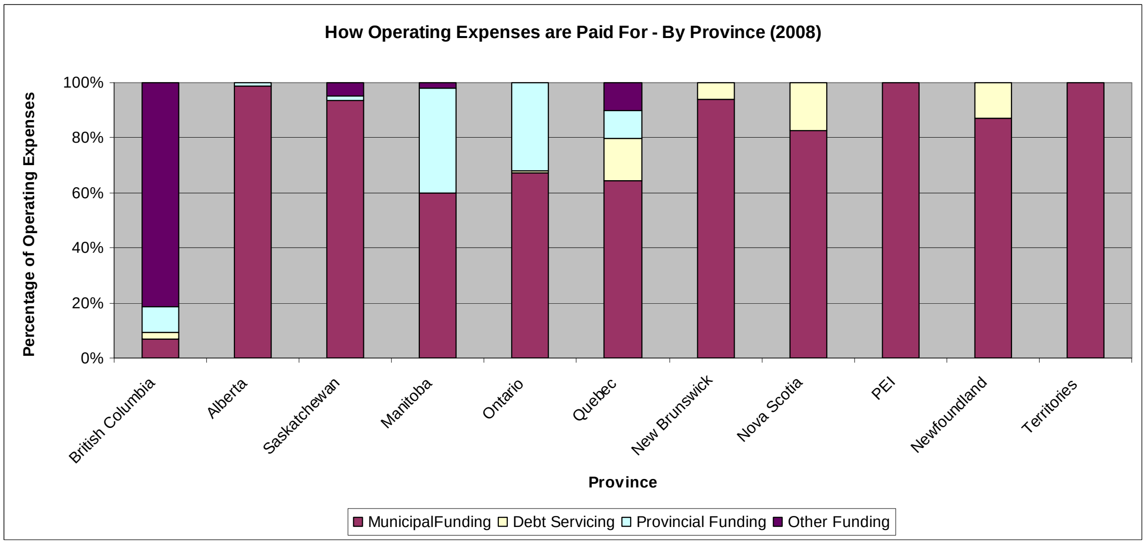
3.3.1 Operating Revenues and Expenses

The figure below shows the total direct operating expenses (operating expenses not including debt servicing), total regular service passenger revenues and in the third column, the publicly funded portion of operating expenses, which is the difference of total operating expenses and total revenues.[3] Since revenues essentially cover more than half of the operating expenses, net operating costs represent the portion of operating expenses that must be paid for by other funding sources, which have traditionally been the municipal and provincial governments.

[3] Note that this time series has NOT been adjusted for inflation using changes in GDP.

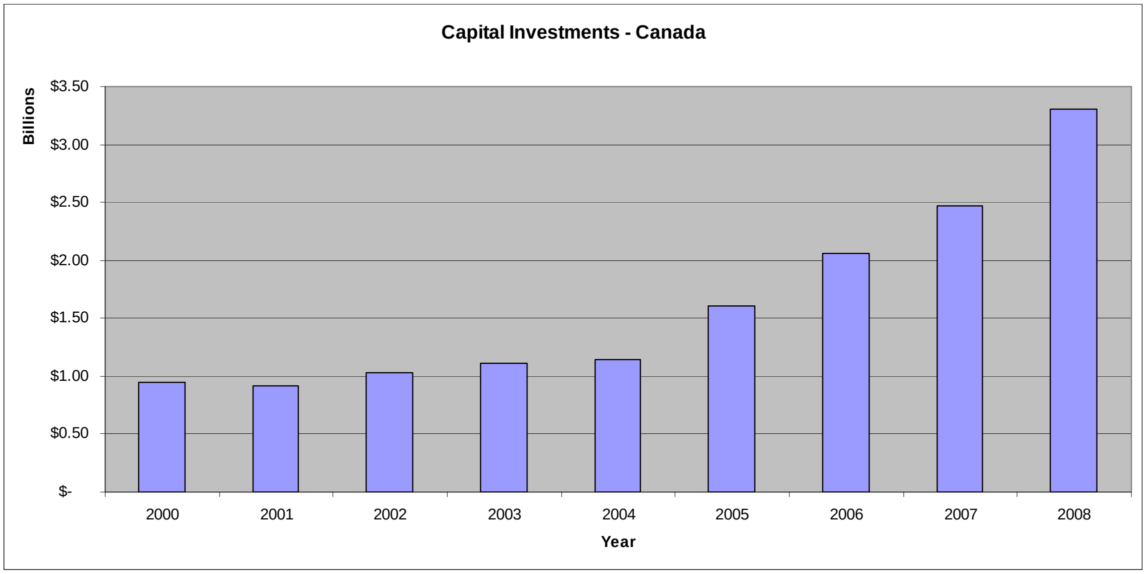


Operating expenses are paid for by operating revenues (customer fares), municipal and provincial funding and other sources. The 2008 provincial perspective indicates that Alberta, Manitoba, Saskatchewan, PEI and the Territories did not report any debt servicing that year. Ontario's debt servicing is below 1% of their operating expenses. The province with the largest percentage of debt servicing is Nova Scotia, followed by Québec and Newfoundland.

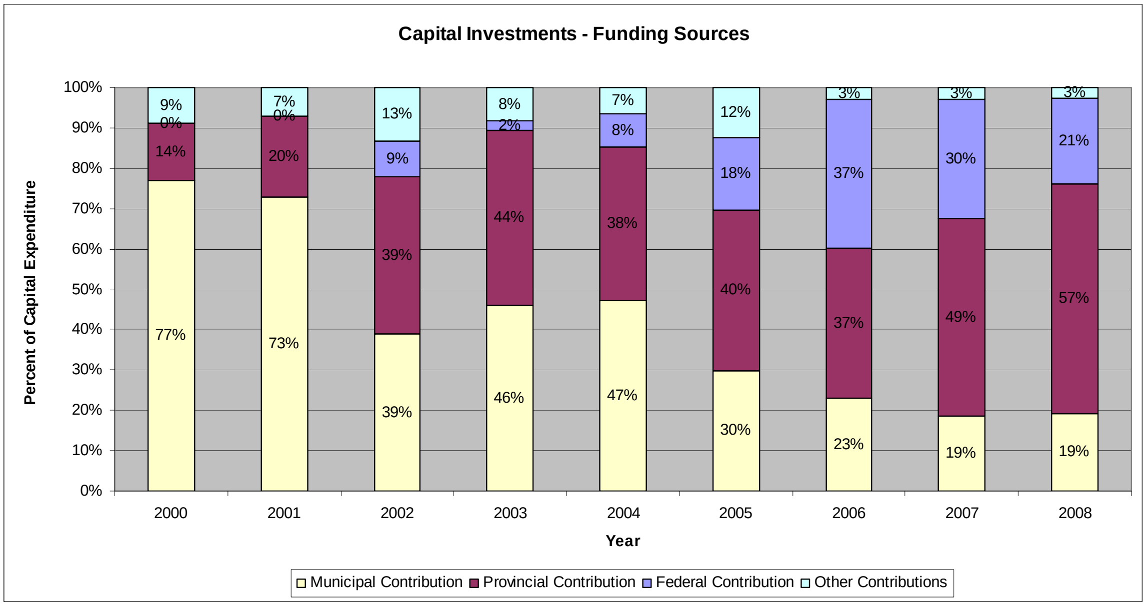


3.3.2 Capital Revenues and Investments

Capital investments in the year 2008 reached almost $3.3 billion Canada wide, with every province purchasing transit equipment or infrastructure. Capital expenditures were relatively constant prior to 2004 but have grown significantly in 2005, 2006, 2007 and 2008. Funding in the order of $2.9 billion came from federal, provincial, municipal and other sources to cover capital expenses, with the remaining $400 million being covered by debt or unused funding from previous years.

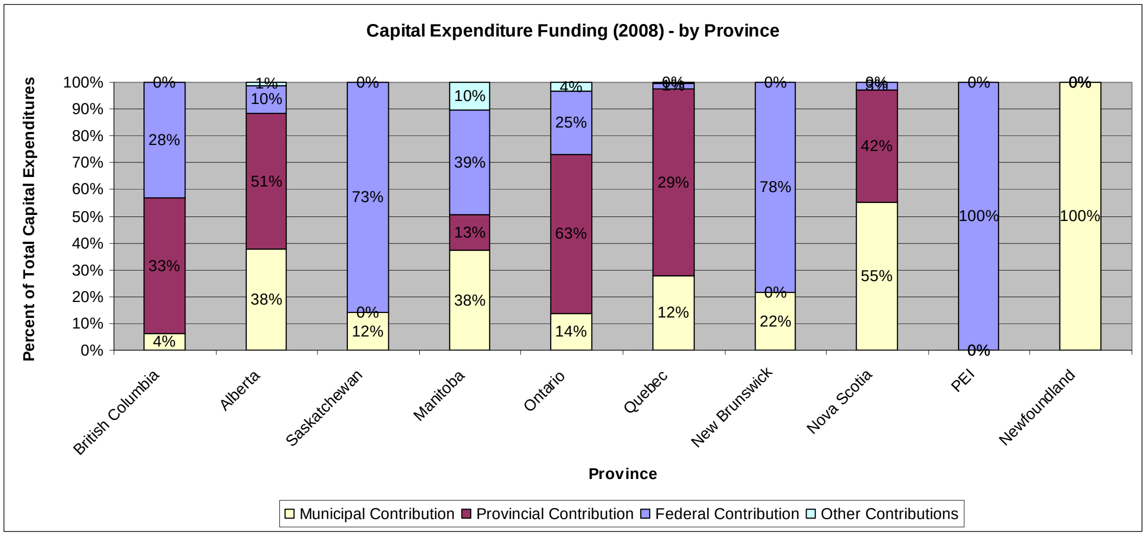


Similar to operating funding, capital funding from the provincial governments has experienced a general upwards trend. Municipal contributions have fallen steadily in response to the increasing provincial and federal funding.



These figures represent capital expenditures for the year reported by transit systems and do not necessarily reflect the funding commitments made during that same year for transit projects. The funding sources for each province in 2008 are illustrated below and clearly show the variations between the provinces. It should be emphasized the proportions and amounts of capital funding vary substantially from year to year as the various provinces announce new initiatives. The reason for the low municipal contribution in British Columbia has to do with the structure of BC Transit, which is provincially operated, rather than in other provinces where transit agencies are operated by municipalities.

It should be noted that municipalities and transit systems across Canada have different ways of reporting their financial information. Some report their capital expenses in the year they occur while others



depreciate their capital expenses over a number of years. This can make it difficult to compare capital expenses between individual agencies. Fortunately, the CUTA database is large enough that a realistic picture of overall capital expenses for Canada is provided because the agencies that report year by year balance each other out and the average can be added to those that use the depreciation method.

3.4 FINANCIAL PERFORMANCE

3.4.1 Revenue-Cost

The revenue to cost ratio is a standard financial performance indicator, used by transit systems to gauge the proportion of operating expenses that are covered by operating revenues. Between 2000 and 2008, revenue to cost ratios Canada wide has slowly decreased from 55% to 50%.

Additional information about revenue-cost ratios for provinces and population groups are included in Appendix B. In general, revenue-cost ratios increase with city size.

3.4.2 Municipal Operating Contribution per Capita

Municipal operating contribution per capita is another financial performance indicator, which is defined as the municipal operating contribution of net operating costs divided by service area population. Quebec and Alberta receive the greatest municipal funding per capita of Canadian provinces, while PEI, British Columbia and New Brunswick receive the least. In general, as city size increases, municipal funding per capita increases.

As noted above, the reason for the low municipal contribution in British Columbia has to do with the structure of BC Transit, which is provincially operated. Details regarding the municipal operating contribution are included in Appendix B.

3.4.3 Net Direct Operating Cost per Passenger

The net direct operating cost per passenger is an important financial indicator. It represents the overall cost to provide service per passenger. Across Canada, the lowest cost per passenger service in 2008 is provided in the provinces of Manitoba, Ontario and Quebec, while the highest is provided in PEI and the Yukon. The provincial variation is illustrated in Appendix B. From a city size perspective, as a city increases in size and ridership per capita increases, the operating cost per passenger decreases in dollar value.

4 LITERATURE REVIEW

4.1 ACADEMIC LITERATURE

The relationships between investments in public transportation systems and the economic benefits accrued have long been studied in academic literature. In this section we present a summary of the existing academic literature in an attempt to identify well-accepted relationships between transit investments and expected benefits. We further present research in which the general relationships are quantified for specific case studies. Canadian examples are highlighted whenever possible.

4.1.1 Transit investments and travel time benefits

The most common way to measure the travel time savings associated with transit investments is to quantify the traffic delays which would occur if the transit investment were not made. The cost of congestion is typically measured in minutes of delay or in dollar values of lost time and productivity. Studies of this type include Winston and Langer (2006), who used data from 72 U.S. cities and demonstrated that one kilometre of rail transit service reduced overall congestion costs four times as much as one additional kilometre of freeway construction. Garrett and Castelazo (2004) showed that congestion grew much more slowly in four U.S. cities (St. Louis, Baltimore, Sacramento and Dallas) after the construction of Light Rail Transit (LRT). Harford (2006) estimated the average congestion savings for US cities to be approximately US$0.47 per passenger mile traveled by transit. More generally, the Texas Transportation Institute (TTI) estimated in 2003 that if transit were eliminated in 85 US cities, congestion costs would increase by more than a US$18B.

A second travel time savings resulting from transit investments which is often overlooked are the benefits realized by existing transit passengers and travelers who switch modes to transit as a cost-savings alternative. In Canada, Casello and Hellinga (2008) examined these effects as a result of upgrading conventional bus service to express service in Waterloo, ON. They found that the improved service decreased the generalized cost of travel by transit for existing customers between 4.5% and 14.1%, with an average region-wide reduction of 9.5%. Moreover, they found that the improved serviced increased demand by 12.7% in the corridor.

Conceptually, Vuchic (1999) defined the “vicious circle” of urban transportation that occurred in many cities through 1965. He described under investment in transit that resulted in decreased ridership, lower fare revenues, decreased transit supply and increased auto use. Policy makers responded to increased congestion by improving highways at the expense of transit, which restarts the cycle. The negative impacts of this approach are well documented. Contemporary transportation planning advocates for what Small (2005) has defined as the “virtuous circle” of transportation planning. Increasing transit service quality attracts more users that generates more revenues and necessitates further service improvements. At the same time, more economically efficient auto pricing (such as the cordon pricing in London, UK) helps to manage auto demand and road space, and generate additional transportation infrastructure revenue. The result is a modal split equilibrium that is far more sustainable economically, environmentally and socially.

4.1.2 Transit investments and environmental benefits

Fundamentally, transit systems are designed to move many people with fewer vehicles, less energy consumption (typically fossil fuels) and with less land consumption than private vehicles. These higher-efficiency components of transit travel have many positive impacts on the environment, most notably reducing the production of airborne pollutants and greenhouse gas emissions that are known to have negative impacts on human health, physical infrastructure and long-term global climate change. Naturally, the extent to which transit achieves environmental benefits depends upon the ability to attract passengers, the propulsion source for the transit vehicles, and for electric vehicles, the source of the electricity (Puchalsky, 2007).

Perhaps the most noteworthy research associated with land use, transportation and energy consumption was completed by Newman and Kenworthy (1989). The authors plotted per capita petroleum use versus land use density (person per hectare) for 32 global metropolitan areas. The results showed that low density, non-transit supportive cities consumed as much as eight times the fossil fuels as high density, transit supportive cities. Toronto was a high density North-American city with per capita fuel consumption much less than peer cities in other countries.

Several researchers have attempted to estimate specifically the total costs of air pollutants generally associated with travel. One of the major challenges in completing these types of studies is to convert environmental impacts to economic measures. This subject is treated in great detail by Weisbrod et al. (2009). One of the most comprehensive studies was conducted in the European Union by Mailbach et al. who estimated direct air pollution costs (to health and physical structures), long-term climate change impacts and the life cycles of energy generation. They found that using typical vehicle load factors, urban rail transit produced a cost of 0.26 Euro cents per passenger kilometre, whereas auto travel produced a social cost of 1.11 Euro cents per passenger kilometre. Stated another way, electric powered rail transit produces approximately 23% of the negative air quality impacts as gasoline powered automobile travel on per person-km basis. A similar study conducted in Australia (Austroads, 2003) compared the air pollution impacts of automobile travel and bus travel. The findings suggest bus costs range from A$37 - 81 per 1000 passenger km whereas auto costs span from $A67-109 per 1000 passenger km.

In Canada, the most detailed research on the environmental benefits of transit was conducted by Kennedy (2002), who estimated that private auto travel in the Greater Toronto Area was 2 to 3 times less efficient in terms of energy consumption per seat-kilometre than transit. In comparing greenhouse gas (GHG) emissions, Kennedy found that transit reduced carbon emission by 92-98% per person-km compared to private cars.

4.1.3 Transit investments and land use benefits

The land use benefits of transit are well documented across the country. Land use benefits of transit include:

- Supporting higher density, more compact development, with considerable savings in public expenditures on municipal services
- Supporting more pedestrian-friendly urban environments, which generates an "amenity premium" associated with more desirable public spaces and conditions
- Creating spin-off economic activity associated with locations of higher access and improved mobility – the "mobility hub" argument
- Increasing land values, associated with the increased convenience and attractiveness of urban areas adjacent to transit service

Transit systems increase transportation capacity often within or between concentrated areas of population and employment. Because of the increased transportation convenience (or lower transportation costs), these areas often become more desirable to residents searching for housing and firms choosing locations to attract customers and employees.

Using an influence area of 800m around rapid transit stations, Canada's rapid transit stations have an influence area of about 32,600 ha[4]. These 32,600 hectares are among the most valuable real estate in Canada, which would not be nearly as valuable without the presence of transit.

[4] This does not account for potential overlap between station areas.

The impact of transit system construction on the desirability of neighborhoods is most often measured through increases in property values in areas surrounding a system or a station. The table below (derived from TCRP report 118) summarizes quantitative assessments of property value changes due to new transit system construction.

Mode	Transit system / city	Property Value Impacts	Citation
Heavy Rail	BART San Francisco	$1600 premium per 30 metres nearer to station	Lewis- Workman and Brod, 1997
Heavy Rail	Metro Washington	2.4% to 2.6% premium per 160 metres nearer to station	Benjamin and Sirmans, 1996
Light Rail	MAX Portland	$2300 premium per 60 metres nearer to station	Dueker and Bianco, 1999
Light Rail	San Diego Trolley San Diego	2% to 6% premium for multi-family units near to stations	Cervero and Duncan, 2002
Light Rail	DART – Dallas Area Rapid Transit	The average change in land values from 1997 to 2001 for retail and residential properties near DART stops was 25% and 32%, respectively; for “control” parcels, the average changes were 12% and 20%.	Weinstein and Clower, 2003
Light Rail/Heavy Rail	Various	Average housing value premiums associated with being near a station (1⁄4 to 1⁄2 mile of a station) are 6.4% in Philadelphia, 6.7% in Boston, 10.6% in Portland, 17% in San Diego, 20% in Chicago, 24% in Dallas, and 45% in Santa Clara County	Cervero et al, 2004
Bus Rapid Transit	Transitway Ottawa	$1 billion (C) in new construction at stations	TCRP 118
Bus Rapid Transit	East Busway - Pittsburgh	$302 million in land development benefits, of which $275 million was new construction. 80% clustered at stations	TCRP 118

In general, it is evident that transit systems increase the value of both residential and commercial properties significantly. In addition to the personal benefits realized by the owners of these properties, increased property values generate increased property taxes from which governments are able to provide greater services.

There has been much discussion in the academic literature with regard to so-called “value capture” - where increased property values are subject to more creative taxation methods to finance future transit investments. Rybeck (2004) describes such possibilities in the Washington DC area. For a fuller discussion, see Smith and Gihring (2006).

Beyond property values, transit systems have also been shown to increase land use density (Chen, et al. 2008), which has many positive economic benefits for municipalities. First, higher density requires less new infrastructure in terms of roads, utilities and social services by maximizing the use of existing systems (Urban Strategies, 2005). Further, higher density tends to increase the use of not only transit, but other high-efficiency, low cost (in infrastructure, operations, maintenance and social externalities) modes such as cycling and walking. By accommodating travel demand by these modes, municipalities save the costs of constructing, operating and maintaining more traditional infrastructure.

Transit's impact on urban form in Canada is mostly clearly demonstrable in the urban form of Toronto, Montreal, and to a lesser extent, Vancouver, Ottawa, Calgary, and Edmonton. A wide variety of metrics indicating transit's impact on land use are available for major cities in Canada. These include:

- Between 1992 and 2006, employment in Downtown Calgary grew by 18,000 jobs, without adding any additional road capacity
- In the five years following the commencement of the Scarborough LRT project (1984-1989), more than 2.3 million sq. ft. of office space and 10,100 residential units have been developed along the LRT line (Scarborough Economic Development Department, 1989)
- A detailed study conducted by researchers at the University of Toronto in 2000 indicated that proximity to a subway station in Toronto generated approximately $4,000 in additional residential property value for a home with a value of $225,000. (University of Toronto, 2000)
- Bajic (1983) reported that residential properties had an average premium of $2,237 for being in proximity to a subway line. Adjusting this figure using the annual housing price index for Toronto published by Statistics Canada, this amount translates to approximately $3,400 in 2000 dollars.
- A Coopers & Lybrand/IBI study conducted in 1991 as part of the planning process for the Sheppard Subway found that: "in the area of intense impact (the four corners adjacent to the stations), condominium sale prices were higher by 20% per unit than non subway station area condominiums. In the "area of impact" or within 460m from subway stations on primary streets, condominium sales prices were 15% higher per unit than non subway station condo prices. In the "area of influence" or 600m in each direction from subway stations, and along the major and secondary streets, condominium sales princes were 5% per unit higher than non subway station condo prices"
- The residential housing market in Ottawa produced some 2,832 housing units within 800 metres of Transitway stations between 1988 and 1993. The total construction value of this development was some $420 million. One of these developments was the Riviera, a condominium development of two high-rise towers. The Riviera's developers credit the announcement of the construction of a nearby Transitway station as being a major factor in helping them secure financing for the development, due to the belief by their financiers that close proximity to transit would increase the marketability of the building. One commentator argues "collectively, high-rise housing development along the Transitway debunks the myth that people eschew living near bus-transit nodes, and that densification occurs only around heavy rail stations"
- An IBI Study of the impacts of the Subway in Metro Toronto found that between 1959-1964: 90% of all new office spaces and 40% of apartment buildings in Toronto took place along the metro lines. Tax assessment values near City centre stations rose by 45% and by 107% around suburban stations, as opposed to 25% elsewhere. Office space rents adjacent to the stations average 30% more than average for the City as a whole, while office rents within 500 m. of stations rose by 10% more than average.
- Research conducted at the University of Texas in the early 1990's identified considerable property tax impacts in the early years of the Toronto subway's development. This study reported that the Yonge Street Subway increased property tax revenue by $5 million annually while the annual cost of servicing the subway's bonds was $4 million.

4.1.4 Transit investments and public health benefits

Public transportation systems achieve three primary goals with regard to public health. First, transit systems are inherently much safer than other modes, particularly the private automobile, which reduces the number of injuries and, as a result, health care costs associated with travel. Second, transit use can positively impact air quality thereby reducing the cost to treat ailments typically associated with poor localized air quality. Finally, as noted above, transit systems tend to encourage more active transportation modes which results in a more physically fit population.

Frumkin (2002) systematically reviews the negative impacts on health of auto dependency (or underutilization of transit) including increased fatalities and injuries for auto travelers and pedestrians, as well as the residual air and water quality impacts. A report for CUTA's Strategic Transit Research Program (2000) found that transit in Canada had a much lower fatality rate than other modes of travel – transit had a passenger fatality rate of just 0.157 per billion passenger kilometers, compared to 3.2 per billion kilometers for travel by car in urban areas. The US Federal Government (FHWA 2000) reported the following fatality rates per 100 million passenger miles: private auto 0.93; bus transit 0.10; Light Rail Transit 0.00. The World Health Organization (2002) notes that road traffic injuries are now the leading cause of injury related deaths worldwide, accounting for 25% of all injury-related fatalities. Litman (2009), quoting Kenworthy and Laube, demonstrates the inverse relationship between increasing transit use and decreased traffic related fatalities.

One of the most significant manifestations of poor localized air quality is increased health risks. Li and Newcomb (2009) studied asthma rates in the Dallas area and determined that asthma-related hospital visits by children were strongly correlated to auto traffic density. A University of British Columbia study estimates that 1000 passenger miles taken by public transportation versus private vehicle saves approximately $0.051 in expenditures related to health complications. According to UBC, "the study, published in The Journal of Public Health Policy, finds that people who take public transit are three times more likely than those who don't to meet the Heart and Stroke Foundation of Canada's suggested daily minimum of physical activity."

Besser and Dannenberg (2005) correlate transit use to achieving 30 minutes of physical activity recommended by the medical community to achieve healthy lifestyles. In a US household survey, the authors find that transit users on average walk 19 minutes daily, with 29% of transit users walking at least 30 minutes. Further, they find that low income and minority travelers are more likely to achieve the active lifestyle goals. Wener and Evans (2007) had commuters wear pedometres for a typical week. Transit commuters walked 30% more steps per day while travelling significantly more often, and were 4 times more likely to walk 10,000 steps than automobile commuters. Frank et al. (2009) showed that various neighborhood design characteristics in Atlanta, including proximity to transit, can accomplish dual goals of reduced climate change impacts and greater physical fitness.

Some researchers have converted the health benefits of transit systems to financial savings. Edwards (2008) used the US household survey and estimated that obesity reduction from transit use can save between US$4800 and US$9900 of which US$3800 - US$8000 would be borne by the public. Stokes et al. (2008), who present an extensive literature review on the relationship between transit and improved health, studied the Charlotte North Carolina LRT system and projected that the proposed system will reduce health care costs associated with obesity by US$12M over nine years.

Pucher and Buehler (2006) compare Canadian and American cities on the likelihood to use transit and to bicycle. The authors find that commuters are almost three times as likely to cycle and use transit in Canada versus the US largely as a result of the density of development and more balanced transportation policies.

4.1.5 Transit investments and equity benefits

The spatial mismatch theory first developed by Kain (1968) suggested that a major impediment to personal quality of life was the difficulty associated with travelling long distances between home and locations of work, education or health care. More recently, spatial mismatch has been redefined to consider the cost of travel (in time, effort and monetary expenditures). Research in this area has established that transit has the potential to serve transportation demand more cost effectively than other modes. Allen (2008) writing on behalf of the International Association of Public Transport (UITP) cites estimates of the proportion of income allocated to transport in the range of 3%-30% in developing countries and approximately 10% for low-income earners in developed countries. Transport Canada

(2008) compares the costs of trips by private auto and transit considering time, out of pocket expenses and social costs. The analysis demonstrates that when social costs (congestion, air pollution) and parking costs are included, transit is one-third to one-half as expensive as auto for commuting in 10 major Canadian cities. Litman (2009) summarizes many studies comparing the cost of travel by different modes.

As a result, cities with extensive public transportation systems are more accessible - providing greater quality of life opportunities to persons regardless of income level or physical well-being. The relationship between public transportation and finding meaningful employment was studied by Kawabata (2003) in Los Angeles, San Francisco and Boston. The findings suggest that in San Francisco and Los Angeles, having transit access to jobs made low-skilled workers 30% more likely to have a job and to work more than 30 hours per week. The author recommends increasing quantity of public transportation service (in time and space) as a means of advancing accessibility. Sanchez (1999) wrote generally that access to public transit is a significant factor in determining average rates of labor participation. The United States Government Accountability Office (GAO, 2009) has indicated that "the introduction of light rail in the past decade" in conjunction with housing initiatives "has helped improve the availability of quality, affordable housing near transit … while transit lines can provide better transit access to low-income residents in the short term."

As populations age, the role of public transportation in providing access to health care is becoming increasingly important. Evidence suggests that the issue of access is particularly serious in rural areas (Oluwoye and Gooding, 2006) and in Canada, amongst immigrants (Asanin and Wilson, 2007). Martin et al. (2008) describe the importance and present a methodology for improving transit access by coordinating transit service schedules amongst operators.

4.1.6 Transit investments and regional economic competitiveness

The research surrounding regional economic development and competitiveness suggests that transit investments can be powerful stimulants for economic growth. The construction and operation of transit systems produce direct economic benefits throughout the economy through employment and the production of physical infrastructure. ECOnorthwest (2002) estimates the economic multipliers ranging from 1.5 to 1.7 for various components of transit investments. This suggests that for every dollar spent on transit infrastructure, approximately $1.50 will be generated in local economic activity. In the same report, the authors suggest that a US$1M investment in infrastructure produces 30 - 60 jobs. A Canadian study (CUTA 2003) indicates that investments in transit produce the highest return of all modes in terms of job creation.

Beyond direct economic activity, transit investments are known to generate additional benefits for cities. Vickerman (2008) presents an extensive review of theoretical and empirical analysis on the topic. He cites an analysis of British rail investments that indicates non-transportation related benefits (agglomeration effects, productivity enhancements, and increased regional competitiveness) are valued 7B GBP, or approximately 35% of the total benefits from the project. Aschauer and Campbell (1991) were amongst the first to recognize the relationship between transit investments and worker productivity.

Most recently, public transportation has been identified as a key component in attracting firms and employers to a Region. Florida (2004) defines the "creative class" - highly skilled and highly productivity young workers in search of urban vibrancy - as critical to urban revitalization; Florida states that public transportation contributes directly to the attraction of these workers (and the firms that employ them) to a metropolitan area.

4.2 PROJECT CASES, ECONOMIC ANALYSIS, AND COST-BENEFIT ANALYSIS

Transit projects across Canada have been preparing economic benefit analyses as part of the project planning process for roughly the past decade. A clear picture of the types and nature of economic benefit emerges from these reports. This section summarizes the findings of a selection of project-based studies of economic benefit, including cost-benefit analysis, multiple account evaluations, and other quantitative and qualitative assessment of the economic benefits of specific transit projects in Canada.

Translink - Evergreen Line Rapid Transit Project Business Case

This report assesses potential technologies and route options for the Evergreen Line with a discussion of the cost and benefits of each option. The comparison criteria were targeted at the frequency, reliability, speed, capacity, safety and route location. The ridership demand and capacity were also considered along with capital and operating costs for each alternative.

The capital and operating costs were compiled to compare to the economic benefits of the transit projects. The user benefits were defined as transit passengers' time savings, road users' time and vehicle operating cost savings and road user accident cost savings were estimated compared to the producer benefits which included transit fare revenue, advertising revenue and operating/maintenance savings on buses. While these benefits were quantified, they were not broken down into individual unit costs. The Present Value User Benefits ($2008 million) are shown on the next page:

Costs	NW Corridor		SE Corridor	
	ALRT	LRT	ALRT	LRT
Capital Costs ($ millions)	1,400	1,250	1,400	1,100
Annual Operation & Maintenance Costs ($ 2007 millions)	10.2	15.3	10.8	15.1
Operating Costs ($ 2007) per passenger (2021)	$0.45	$1.70	$0.48	$1.49

The user benefits defined as transit passengers' time savings, road users' time and vehicle operating cost savings and road user accident cost savings were estimated compared to the producer benefits which included transit fare revenue, advertising revenue and operating/maintenance savings on buses. While these benefits were quantified, they were not broken down into individual unit costs. The Present Value User Benefits ($2008 million) are shown below:

Category	NW Corridor		SE Corridor	
	ALRT	LRT	ALRT	LRT
User Benefits	792	540	712	530
Producer Benefits	145	110	133	100
Total Benefits	937	650	845	630

The cost benefit analysis took into account the project life-cycle and assumed a 20 year analysis period. A detailed break down of the calculations was not provided. The Present Value of Benefits and Costs ($2008 millions) is shown below:

Category	NW Corridor		SE Corridor	
	ALRT	LRT	ALRT	LRT
PV Total Benefits	937	650	845	630
PV Total Costs	740	718	745	631
Cost-benefit ratio	1.27	0.91	1.13	1.00

The development opportunity along each corridor and the ability of each corridor to be integrated to the existing transit infrastructure was taken into consideration. A discussion of the environmental assessment requirements, timelines as well as stakeholder and community members' opinions was made prior to the final recommendations. A qualitative Project Delivery Analysis Summary was provided comparing all scenarios using Ridership, Cost-benefit Ratio, Development, System Integration, Environment, Stakeholders and Schedule.

Calgary Transit - Plan it

Plan It Calgary is the integrated new Municipal Development Plan (MDP) and Calgary Transportation Plan (CTP) setting out a long-term direction for sustainable growth to accommodate the 1.3 million additional people expected to make Calgary their home in the next six decades. The transit strategy focuses on a base transit network providing access to transit in all areas of the city as well as a primary transit network focusing on a high level of service to areas with high population or employment densities. While the city does not document a comparison of alternatives in their transportation plan, they describe the factors influencing the choice of transit corridors. The important factors for the primary transit network were the level of service, speed, reliability, connectivity and proximity to major activity centres as well as providing an enhanced customer experience. There were no quantitative values used to describe the importance of these factors or the methodology in selecting the recommended transit plan.

Winnipeg – Construction of a Bus Rapid Transit System

A benefit-cost analysis for a BRT project in Winnipeg was undertaken in 2004 which demonstrated a positive result with the ratio of benefits to costs of 2.14 and a payback period of seven years. Construction of this project is now underway. It consists of a 3.7 km busway and stations, on-street diamond lanes on Main Street and Pembina Highway, transit signal priority measures at at-grade intersections, intelligent transportation systems (ITS) to provide real time schedule and on-board next stop information as well as a recreation path adjacent to the busway has just begun.

The benefit-cost analysis, that used the federal government's TransDec model, focused on identifying the amount of consumer surplus (benefit) resulting from the implementation of the project compared to the costs of the project. The analysis period was set at 30 years and conservative assumptions were made about travel time savings and ridership growth.

The capital cost of the project was $47.7M and annual incremental operating and maintenance costs $319,000.The annual benefits calculated for the project were $17.6M based on travel time savings, vehicle operating cost savings, emissions cost savings (CAC and GHG), accident cost savings, cross-sector benefits and affordable mobility benefits. All costs and benefits were calculated in constant $2004.

Scarborough Rapid Transit Benefits Case

This study examined the benefits to upgrading the existing subway rapid transit service between Kennedy and McCowan stations and replacing the old fleet of vehicles in addition to extending the subway to

Malvern Town Centre. The base case assumed all vehicles are replaced and any infrastructure improvements required as part of this upgrade are completed. Four options were compared to the base case which included various opportunities to extend the subway to Malvern through different alignments, at-grade extensions and technology changes. The same multiple account evaluation as used in the VIVA Next and Sheppard-Finch Rapid Transit Benefits cases was used to evaluate the benefits to the transportation user, financial accounts, environmental impacts, economic impacts and socio-community impacts. The same unit prices developed for the Sheppard-Finch Rapid Transit Benefits Case were used in this study.

For the five options evaluated in this business case, total economic benefits ranged from $1.6bn to $2.0bn, over the 30-year analysis period.

Metrolinx - Sheppard-Finch Rapid Transit Benefits Case

This project assessed 5 LRT corridors versus an existing base case bus network and used the Multiple Account Evaluation method over a 30-year analysis period.

The assessment considered the benefits to the transportation user such as travel time savings, automobile operating cost savings, safety benefits and qualitative user benefits such as improved reliability. The financial impacts of the study included direct capital and operating costs, forecasted revenues based on ridership and fare structure projections and considered benefit/cost ratios. Ridership and fare revenues were developed using a forecasting model to estimate ridership for each scenario. The environmental impact assessment included a measure of green house gas emissions (particularly CO_2) and a description of qualitative environmental impacts such as transit technologies and local area impacts based on alignment alternatives. The economic impacts of each corridor were assessed in terms of temporary employment created during construction, long-term economic impacts due to reduced dependency on vehicles, and property value impacts both negative and positive. Each option was compared in terms of estimated person-years of employment, wages and GDP. Finally, the socio-community impacts regarding transit's influence on development, particularly close to stations and the proximity of each corridor to the City of Toronto Priority Neighbourhoods, was evaluated.

For the five options evaluated in the business case, total economic benefits ranged from $1.3bn to $2.2bn, over the 30-year analysis period.

VIVA Next Benefits Case

This study compared two possible construction timelines for a bus rapid transit corridor against the existing base case. The multiple account evaluation methodology was applied to the VIVA Next Benefits Case and the same criteria were considered as the Sheppard-Finch Rapid Transit Benefits Case including benefits to the transportation user, financial accounts, environmental sector, local area economy and the social community. While the same methodology was applied to this study as the Sheppard-Finch Rapid Transit Business Case, the unit price of vehicle operating costs was different and the estimate provided was $0.15/km.

This evaluation found a total of $1.5bn in economic benefits from the project over 30 years.

Spadina-York Subway Extension Committee - Spadina-York Subway Extension

This study was prepared to inform decision makers of the benefits of the proposed Spadina-York Subway extension. The study discusses the need for expanded transit infrastructure in the study corridor based on population and growth projections, the congestion on the existing transportation network, and opportunities for development in the area. The report provides a detailed description of the proposed project as well as land use opportunities and transit demand along the Spadina-York Subway corridor.

The benefits of the project are emphasized for the transportation network in regards to reducing the traffic congestion. The transportation benefits are described through a qualitative discussion of the high growth being seen in Vaughan, Brampton, Richmond Hill and Barrie and the importance of transit to meet the Province's Smart Growth agenda.

Land use benefits are described in regards to the population and employment projections for the City of Toronto, York University and City of Vaughan with particular emphasis on linking the two cities and the opportunity for development intensification close to subway stations. It was estimated that an additional 124,000 employees/post-secondary students and 28,000 residents could be accommodated by the subway extension. This estimate assumed 55% to be located within 500m of the subway station and 45% to be located within walking distance but further than 500m.

The environmental factors are described through the reduction to greenhouse gas emissions and noise levels with improved transit ridership as well as the ability to support government environmental initiatives and promote sustainable transportation modes. The study estimated that 54% of total transportation greenhouse gas emissions come from personal vehicles while only 1% comes from transit vehicles. A qualitative discussion was made in support of sustainable development, Kyoto Accord emissions targets and avoiding outwards development near environmentally sensitive areas.

The health benefits are considered in relation to the annual costs of air pollution on the medical system due to exposure to air borne chemicals and smog levels as well as the costs of traffic accidents to the City of Toronto. The study referred to the Ontario Medical Association's figure of $1 billion spent annually in Ontario on air pollution related health effects including hospital admissions, emergency room visits and absenteeism from work or school. It was also stated that "exposure to airborne chemicals increases the likelihood of long-term health problems and has the potential to shorten lifespan". The study also referred to traffic collision data for the City of Toronto in 1997 when the "total societal cost of traffic accidents in the City was estimated between $2.5 to $2.9 billion annually".

GO Transit Lakeshore Corridor Express Rail Benefits Case

The GO Transit – Lakeshore Express Rail project is intended to increase the capacity of the rail line by widening the network of tracks and introducing electric power over the current diesel powered locomotives. This study compared the benefits of continuing with diesel operations to 2015 or switching to electrified operations through to 2015 or 2031. This study focused on the multiple accounts evaluation approach with comparisons focusing on the transportation user benefits, the financial and environmental impacts, the economic development impacts and the socio-community impacts, similarly to the other Metrolinx Transit Benefits Cases. The same unit prices developed for the Sheppard-Finch Rapid Transit Benefits Case and Scarborough Rapid Transit Benefits Case were used in this study.

For the three options evaluated in this business case, total economic benefits ranged from $3.6bn to $5.8bn, over the 30-year analysis period.

Region of Waterloo Rapid Transit – Multiple Account Evaluation

This study utilized the multiple account evaluation approach to consider 2 potential light rail corridors, 2 bus rapid transit corridors and 2 construction staging options. These were all compared to an existing base case to quantify the benefits.

The direct transportation cost benefits were considered including capital costs, operating/maintenance costs, net operating costs and operating revenues. The user benefits included in the analysis were travel time savings, vehicle operating cost savings, accident avoidance savings, parking cost savings, consumer cost per passenger kilometre and increased transportation choice. The environmental account took into consideration reduction in greenhouse gas emissions and critical air contaminants emissions. The land use economic development was discussed for residential and non-residential development, the applicability to meeting regional land use objectives, the employment generated, the increase in land value and the taxes generated. The employment generated was produced from a multi-region input-output model developed for the Province of Ontario. The taxes generated were also determined using an input-output model to estimate the tax revenues accruing from capital investments in transit at all three levels of government. The final benefits account was the social and community benefit which considered public health benefits in relation to air quality and active transportation, accessibility to transit for low income areas, community livability and the disruptions caused by construction.

The results indicated that the Waterloo Rapid Transit project will have the following benefits:

- $296M in user benefits over 30 years (travel time savings, vehicle operating costs, and accident savings)
- Reduced greenhouse gas emissions of some 14,000 tonnes annually by 2031, with an annual economic benefit of $13.6M
- Generate just over 6,000 jobs through capital spending, operations, and spin-off benefit
- Prevent 38 hospital admissions and reduce health care costs by more than $10M in the Region

Montréal

Études D'Avant-projet d'un Système Léger sur Rail : L'axe de l'autoroute 10/Centre-ville de Montréal

A study was undertaken to consider the implementation of a light rail transit corridor along Highway 10 to downtown Montreal. The study described the need for a transit corridor in this region and the possible alternatives to address the congestion. One section of the report was dedicated to an economic and financial analysis of the proposed project. The financial analysis focused on three areas:

An Analysis of Expected Revenues Generated by the LRT Project

The revenue analysis includes projections from construction to 2051. While the revenue is not expected to cover the costs of the LRT project, the net residual value by 2051 is expected to make the investment worthwhile.

Description	Time Period (Years)				
	1-4	5	9	20	44
Construction Cost	-869.9	-	-	-	-
LRT Revenue	-	20.9	21.5	22.8	25.6
LRT Operations & Maintenance	-	-32.7	-32.0	-35.1	-36.6
Major repairs and replacement	-	-0.3	-3.4	-28.2	-1.3
Impact on existing transportation network	-	24.7	6.1	6.0	6.4
Residual Value	-	-	-	-	432.5
Total	**-**	**12.6**	**-7.8**	**-34.5**	**426.6**

A Cost-Benefit Analysis

The costs considered in the analysis include the capital and operating expenses of the LRT project, additional operating costs for the subway due to increased ridership and a decrease in the expected transit revenue for the existing transit services as riders are drawn to the new LRT system. The benefits include LRT ridership revenue, a reduction in current operating and capital costs to the existing transit network as ridership is drawn to the new system, time savings, improved safety, user savings in downtown parking fees, user savings in car operating costs and a reduction in air pollution. A cost-benefit summary table was included in the study but a detailed description of the assumptions used to calculate these values were not. The summary table is shown below:

Cost-Benefit Analysis	Actual Value	%
Benefits		
LRT Revenue	194.9	15%
Reduction in Existing Costs		
-Capital Costs	37.2	3%
-Operating Costs	147.2	11%
Transit Users Benefit		
-Time Savings	225.3	17%
-Safety	65.6	5%
-Reduced Parking Fees	122.0	9%
-Reduced Vehicle Operating Costs	174.5	13%
Car User Benefit		
- Time Savings	283.6	22%
- Safety	2.7	1%
- Reduced Vehicle Operating Costs	14.8	1%
- Community Benefit	31.8	3%
Total Benefits	**1,299.6**	**100%**
Costs		
Construction Costs	713.9	61%
Operation Costs	339.5	29%
Reduced Revenue from Existing Transit	111.5	9%
Additional Metro Operating Costs	6.1	1%
Total Costs	**1,171.1**	**100%**
Net Value	**128.5**	
Cost-Benefit Ratio	**1.11**	

An Economic Recovery Evaluation

The economic recovery figures were estimated by L'Institut de la statistique du Québec in 2004. The assumptions were that the construction of the LRT project will create employment opportunities equivalent to 9,027 person-years with salaries and benefits totalling $571.9M. Tax revenue is expected to be $99.4M for the government of Québec and $42.8M for the federal government. The operation of the LRT line is expected to create jobs for an additional 724 person-years with a total salary and benefits cost of $86.3M. The taxes from these jobs will amount to $13.7M for the government of Québec and $6.2M for the government of Canada.

Prince Edward Island Transit Coalition - Island Wide Transit Feasibility Study

This study was undertaken to provide a broad plan for implementing public transit in PEI. One section outlines the benefits of public transit and another is dedicated to the cost implications. The benefits included in the analysis are access and equity, economic efficiency, access to employment, personal productivity, retail support, employment opportunities, safety, health and the environment. The benefits of transit are primarily described in qualitative terms with a few costs drawn from various studies to support the discussion.

The discussion on access and equity highlights the difficulty young, old, disabled or low-income citizens have in accessing services, education, social gatherings and job opportunities without a transit network. The study states that "a household earning $20,000 annual income typically spends about $2,500 per year on transport. On this budget, a non-driver in a community with no transit if residing in Montague or Summerside could only afford about five taxi trips per week…A non-driver living in a community with good transit service can purchase a monthly transit pass and still afford two or three taxi trips per week, providing a relatively high level of mobility".

The economic efficiency of public transit versus personal vehicles was estimated for the user as well as the marginal social cost of either mode of transportation. Data drawn from an international study of five Canadian cities (Montreal, Toronto, Ottawa, Vancouver, and Calgary) estimated the average cost of a passenger-kilometre of travel as $0.12 by transit compared to $0.46 by car. Similarly, a study for the federal government and referenced in the PEI Transit Feasibility Study estimated a marginal social cost of transit travel at $0.30 per passenger-kilometre compared to $0.46 for car travel.

Transit was described as providing access to employment by enabling business owners to choose where they are located and employees' to seek new opportunities. While the economic advantage to access to employment was not quantified, a number of industries including aerospace, agriculture processing, the GST centre and seafood processing were listed as industries which represent centralized employment that would benefit from access to employees residing in neighbouring regions.

The cost savings benefit estimated usable travel time while on transit as opposed to operating a motor vehicle. It was estimated that a commuter trip from Summerside to Charlottetown would take 45 minutes or 350 hours per year at a cost of $6,000. This was supported by a reference to Transport Canada's models "which discount the cost of transit users' travel time by 25 percent".

The economic costs of a safer mode of transportation were not quantified but the risk of fatality while travelling on public transit was estimated to be 20 times lower than by car travel. It was explained that a higher number of collisions impacts the province economically through medical expenses. The study references the PEI Public Transit Coalition's estimate that "the economic costs of motor vehicle crashes [in Canada] amount to an estimated $26 million each day".

The benefits to health and the environment were discussed in terms of greenhouse gas emissions, air pollution and its effect on residents' health. The economic impacts of air pollution were not estimated for PEI but "In Ontario, the impacts of poor air quality [were] estimated to result in health and related economic costs in excess of $10 billion – about $2,000 per household annually". It was also estimated that both emissions and greenhouse gases "can be reduced by 85% by using transit" on the island. The importance of promoting physical activity through active transportation was highlighted. An estimate of $2.1 billion annually was give as the cost of Canadians' physical inactivity and it was stated that "a 10% reduction in inactivity could produce health care savings of $150 million each year".

The cost implications of transit are calculated for a five year projection and include capital costs, operating costs, ridership and revenue. The total costs for years 1 to 5 range from $0.25 to $0.45 per person-kilometre.

Halifax Regional Municipality – MetroLink Bus Rapid Transit

In 2005 a limited-stop, direct, fully accessible bus rapid transit (BRT) between downtown Halifax and Dartmouth and two surrounding suburban areas was introduced. The initiative involved the purchase of

20 high-quality MetroLink buses with a distinctive paint scheme to highlight the MetroLink brand. Two new bus terminals were built at Portland Hills and Sackville, and the existing transit terminals in Dartmouth and downtown Halifax were upgraded to handle significantly increased passenger volumes. Transit signal priority measures were implemented at 14 intersections and queue jump spaces were provided. Metro Transit developed and executed a marketing and communications plan designed to educate and encourage non-transit users to change their mode of transportation.

The total project cost was approximately $12.3 million covering: vehicles ($8.3 million); infrastructure, including transit priority, terminals and bike/trail connections ($3.7 million); and project management ($0.3 million). Operating costs for the MetroLink service are in the order of $2.3 million, or $3.16/passenger for the 730,000 passengers carried annually. This compares to $2.45 for Metro Transit system-wide, but the additional MetroLink operating costs per passenger are offset by an additional 50 cent charge on the $2 fare for regular transit that is applied to reflect the premium service.

The MetroLink service has been highly successful in attracting new riders to transit, with ridership increasing by 160% in 2006 compared to 2005. Significant travel time savings have been achieved through the introduction of the service, as much as 60% in one of the corridors and, on an annual basis, 1.6 kilotonnes of GHG emissions have been saved.

5 MULTIPLE ACCOUNT EVALUATION OF TRANSIT IN CANADA: AN ECONOMIC BENEFIT REVIEW

The assessment of the economic benefits has been undertaken under a broad Multiple Account Evaluation Approach. MAE provides decision-makers with a broader representation of the project's benefits by allowing the consideration of factors that could not be considered in a traditional analysis, and the structuring of metrics into a series of separate accounts allows for a relative assessment of the project's impacts on different aspects of the economy and society.

In this context our approach is to assess the economic impact of Canada's transit systems as a whole, within an MAE framework. The underlying assumption is that in the absence of transit, the majority of current transit passengers would be forced to use personal automobiles for undertaking their usual travel requirements, with a wide range of costs to the economy. The results of the MAE are therefore estimated based on a Project Case that includes "Transit" as incremental, over a "No Transit" Base Case scenario.

An MAE framework is the list of accounts and the proposed metrics within the accounts. The table on the next page outlines the metrics within each account.

Scope and Limitations

The conduct of the MAE is based on consolidating data from various sources to provide an overall assessment of the "project", which in this case is Canada's existing transit network in all (or in some cases, most) major urban centres. The inputs and assumptions used are provided to MKI from various sources, and MKI has not independently audited or verified these data prior to using them in the MAE. All the data used in the MAE was collected in November 2009. MKI reserves the right to update or modify this report in the event that more accurate or up-to-date data become available.

SUMMARY - MULTIPLE ACCOUNT EVALUATION
ALL VALUES INCREMENTAL OVER BASE CASE (NO TRANSIT INVESTMENT)

Account	Metric	Unit
Direct Project and Transportation Benefits		
	Operating Costs	$ (Annual)
	Operating Revenues (Fares)	$ (Annual)
	Net Operating Costs	$ (Annual)
Economic Development Benefits		
	Output	$ (Annual)
	Employment Generated – All industries	Jobs
	Taxes	$ (Annual)
	Employment Generated – Direct operations	Jobs
Direct Transportation User Benefits		
	Time Savings	Hrs
	Value of Time Savings	$ (Annual)
	Vehicle Operating Cost Savings	$ (Annual)
	Accident Cost Savings	$ (Annual)
	Summary Metric: User Benefits	$ (Annual)

Environmental Benefits

GhG Emissions Savings	Tonnes/Year
Monetary Value of GhG Emissions Savings	$ (Annual)
Critical Air Contaminants (CAC) Emission Savings	Tonnes/Year
Monetary Value of Critical Air Contaminants (CAC) Emissions Savings	$ (Annual)
Summary Metric: Environmental Benefits	**$ (Annual)**

Public Health Benefits

Air Quality Hospital Admissions Avoided	Hospital admissions
Air Quality Economic Damage Avoided	$ (Annual)

5.1 DIRECT ECONOMIC IMPACTS OF THE TRANSIT INDUSTRY

Investment in transit can create spinoff impacts to the economy. The effect of spending money on public transportation creates immediate jobs and income by supporting manufacturing, construction and public transportation operation activities.

Spending on transit infrastructure creates and supports jobs in a wide variety of related industries, and furthermore the impacts of transportation services available in many cases can result in potential cost savings for the passengers, that in turn may result in income benefits for households and businesses. The operation of transit directly provides employment to staff and workers.

For this analysis, input – output multipliers obtained from Statistics Canada were used to obtain the direct and indirect job impacts. The output by the investment has also been estimated with the use of these multipliers. Data from CUTA indicates a total of $2 Billion was invested in transit projects in Canada in the year 2007. Multiplier analysis of this investment impact on the Canadian economy indicates that this investment results in creation of 22,570 full-time equivalent jobs in the Canadian economy. The economic activity generated from this investment is expected to create GDP output of over $3.7 Billion for that year. This is in addition to the over 45,000 full time equivalent jobs provided by transit operations annually.

Results

RESULTS		
Economic Impacts	**Unit**	**Project Case**
Output	$ (Annual, 2007)	$3,682,670,207
Employment Generated	Full-time Equivalent Jobs	22,570
Taxes	$ (Annual, 2007)	$159,467,870
Direct operations jobs	Full-time Equivalent Jobs	45,263

5.2 TRANSPORTATION USER BENEFITS

The Multiple Account Evaluation (MAE) of Canadian transit systems quantified the economic benefits of transit investment in terms of travel time savings, vehicle operating cost savings and accident avoidance savings.

5.2.1 *Travel Time Savings*

Transit projects typically produce travel time savings in two ways; first, by increasing the speed of travel for transit passengers; secondly, by shifting some travel from cars to transit, which in turn relieves road congestion in the transit corridor. Reduced traffic on the roadways implies reduction in traffic on the network. This results in reduction in congestion during peak period resulting in improved speed flow characteristics for the automobiles that use the road network translating into improved speeds for non transit users. The time saving has not been captured in the analysis since effectively traffic studies have not been undertaken to model impact of "no transit" scenario on road. Estimation of automobile traffic for the entire country at peak period would be beyond the scope of this analysis.

Travel time savings estimation for GO transit passengers and TTC at peak time indicates that the peak period passengers saved nearly 20 million hours in a typical year (2007), and the monetary value of these savings are estimated at over $230 million. The travel time for transit for peak period was estimated from the average trip length and travel speed. For estimation of time saving benefits, only peak period benefits were estimated. The assumptions for undertaking the analysis are presented in the appendix.

Other transit systems such as Montreal (STM), Ottawa (OC Transpo) and Vancouver (Translink) may also provide savings in time for transit users in peak periods, however, sufficient data is not available at this time to estimate the savings associated with a scenario where transit does not exist in these cities.

5.2.2 *Vehicle Operating Cost Savings*

This metric is a calculation of the operating costs avoided for car owners who travel by transit instead. The calculation is the product of vehicle kilometres travelled (VKT), and the costs per kilometre of operating a standard four-door sedan. The assumptions for undertaking the analysis are presented in the appendix. The metric is reported as the monetary value of these savings.

5.2.3 *Accident Avoidance Savings*

This metric represents the savings to society resulting from the road accidents avoided through modal shift to transit. The calculation is performed using incident factors for accidents per vehicle kilometre, typical costs of fatal, injury, and property accidents, and the number of vehicle kilometres avoided. The metric is reported as the net present value of the monetary value of these savings for the full 30-year analysis period. The assumptions for undertaking the analysis are presented in the appendix.

5.2.4 *Results*

Vehicle Operating Cost savings are a function of the number of riders on transit, which in turn affects the number of vehicle kilometres travelled (VKT) on the network. The vehicle operating cost savings are estimated to be nearly five billion dollars. Accident avoidance savings are also a result of reduced vehicle kilometres travelled (VKT) due to trips being taken by transit instead, this accounts for an additional saving of nearly $2.5 billion when estimated in monetary terms. The results in a total saving of nearly $7.5 billion in monetary terms.

RESULTS		
Transportation User Benefits - Vehicle Operating Costs and Accident Costs Saving	**Unit**	**Project Case**
Vehicle Operating Cost Savings	$	$4,987,360,047
Accident Cost Savings	Fatal/Injury/Property, $	$2,469,159,522
Summary Metric: User Benefits	**$**	$7,456,519,569

5.3 ENVIRONMENTAL BENEFITS

This account identifies the economic benefits associated with transit operations in Canada, associated with reductions in greenhouse gas emissions (GHGs) and critical air contaminant (CAC) emissions.

5.3.1 *Greenhouse Gas Reductions*

Studies[5] have shown that the transportation sector is a significant contributor of GhG emissions. Within this sector automobiles are a significant source of emissions. As a result the GhG emissions are reduced by shifting travel from cars to rapid transit. In this analysis, passengers on transit were modelled to travel by automobile. It was assumed that with the exception of captive riders, the rest of the riders would travel by personal automobiles either as drivers or as co-passengers. Greenhouse gas emissions were estimated from the Urban Transport Emissions Calculator (UTEC). UTEC estimation of emissions are based on the vehicle kilometres travelled by the personal, and public transit vehicles. The emission of Greenhouse Gases for the base case and the project case were estimated to arrive at the reduction in emissions resulting from transit use in Canada. The volume of GhG emission savings is reported in tonnes per year for a typical year (2023). The monetary value of the GhG emission savings are calculated using a per-tonne value of $37 per tonne, calculated by Transport Canada as reported in *Estimating the Costs of Greenhouse Gas Emissions from Transportation (Transport Canada, 2007).*

5.3.2 *Criteria Air Contaminants*

CAC emissions were also estimated using the Transport Canada Emissions Calculator (UTEC). These are monetized using a per tonne unit cost. The CAC emissions calculated by the model are carbon monoxide (CO), volatile organic compounds (VOC), nitrous oxides (NOx), sulphur oxides (SOx), and particulate matter (PM). The CAC emission unit values were taken from *Evaluating the Total Cost of Air Pollution due to Transportation in Canada (Transport Canada, 2007)*, using the values for Canada as a whole. Details of this calculation can be found in Appendix.

5.3.3 *Results*

For the year 2007, it is estimated that riders that travel by transit rather than personal automobiles results in a reduction in green house gas emissions of over 2 million tonnes. This is equivalent to more than 60 kilograms of GhG's for every Canadian, every year. The Critical Air Contaminants (CAC) Emission Savings is estimated to be 119 thousand tonnes. The monetary values of emissions savings are estimated to total over 132 million dollars annually.

RESULTS		
Environmental Account	**Unit**	**Project Case**
GhG Emissions Savings	Tonnes/Year	2,396,237
Monetary Value of GhG Emissions Savings	$ (Total)	$110,161,465
Critical Air Contaminants (CAC) Emission Savings	Tonnes/Year	119,319
Monetary Value of (CAC) Emissions Savings	$ (Total)	$22,390,790
Summary Metric: Environmental Benefits	**$ (Total)**	$132,552,255

5.3.4 *Reducing Sprawl*

It should be noted that additional and significant environmental benefits result from the more compact urban form supported by public transit. Although these may be unquantifiable, they are certainly substantial. These benefits include:

- Reduced need to consume additional land for development, resulting in a smaller urban footprint
- Reduced long-distance travel for other purposes, due to the concentration of daily needs
- Stronger urban economies, reducing crime and other problems associated with ex-urbanization

The US EPA put the consequences this way:

[5] http://www.ec.gc.ca/pdb/cac/Emissions1990-2015/2005/2005_ON_e.cfm

In its path, sprawl consumes thousands of acres of forests and farmland, woodlands and wetlands. It requires government to spend millions extra to build new schools, streets and water and sewer lines. In its wake, sprawl leaves boarded up houses, vacant storefronts, closed businesses, abandoned and often contaminated industrial sites, and traffic congestion stretching miles from urban centres. As a result, we suffer from increased traffic congestion, longer commutes, increased dependence on fossil fuels, crowded schools, worsening air and water pollution, threatened surface and ground water supplies, lost open space and wetlands, increased flooding, destroyed wildlife habitat, higher taxes, and dying city centres.

(http://www.policyalmanac.org/environment/archive/urban_sprawl.shtml)

5.4 PUBLIC HEALTH BENEFITS

Within this category, the MAE examined transit's benefits in improving air quality, in terms of hospital admissions avoided and potential savings in economic damage as a result of transit. The MAE model was used to estimate the degree to which individuals realize economic benefit through reduced costs to the public health care system and improved personal health.

5.5.1 Encouraging Active Transportation

Canadians made some 1.75 billion trips by transit in 2007. This trip to work typically involves walking on one or both ends of the transit trip. Most studies[6] identify an average walking distance to transit of between 500 and 650m, or 1.0 to 1.3km per day. The health benefits of even this modest distance walked every workday are substantial and ongoing. Regular walking has a direct impact on the cardiovascular and musculoskeletal systems, by reducing the risk of coronary disease and stroke, lowering blood pressure, reducing cholesterol levels in blood, increasing bone density, hence preventing osteoporosis, managing the negative effects of osteoarthritis, and easing back pain.

In addition to the significant number of Canadians who walk to transit, an increasing number ride bicycles to and from transit, as transit operators continue to expand the number of vehicles capable of accommodating bicycles (such as Ottawa's "Rack and Roll" program).

5.5.2 Improving Air Quality - Hospital Admissions Avoided

The benefits of the project are measured in two ways, as the number of Hospital Admissions Avoided, and in terms of the Economic Damage. Criteria Air Contaminants (CAC's) are pollutants with a variety of impacts on

University of British Columbia - Media Release | Mar. 26, 2009
Public transit users three times more likely to meet fitness guidelines: UBC research
A new study by researchers at the University of British Columbia suggests taking public transit may help you keep fit.

The study, published in The Journal of Public Health Policy, finds that people who take public transit are three times more likely than those who don't to meet the Heart and Stroke Foundation of Canada's suggested daily minimum of physical activity.

Doctoral student Ugo Lachapelle and Assoc. Prof. Lawrence Frank of the UBC School of Community and Regional Planning used 4,156 travel surveys from metropolitan Atlanta, Georgia, to examine whether transit and car trips were associated with meeting the recommended levels of physical activity by walking.

Because transit trips by bus and train often involve walking to and from stops, the study found that users are more likely to meet the recommended 30 minutes of moderate physical activity a day, five days a week.

According to the study, people who drove the most were the least likely to meet the recommended level of physical activity.

"The idea of needing to go to the gym to get your daily dose of exercise is a misperception," says Frank, the J. Armand Bombardier Chairholder in Sustainable Transportation and a researcher at the UBC Institute for Resources, Environment and Sustainability. "These short walks throughout our day are historically how we have gotten our activity. Unfortunately, we've engineered this activity out of our daily lives."

The researchers conclude that making transit incentives more broadly available may produce indirect health benefits by getting people walking, even if it's just in short bouts.

"This should be appealing to policy makers because it's easier to promote transit incentives - such as employer-sponsored passes or discount fares - than to restructure existing neighbourhoods," says Frank.

The research could have major implications for urban planning and public transit development, Lachapelle says.

"You don't necessarily have to rebuild communities or make major investments in infrastructure to promote public health," he says. "There are things we can do in the interim, such as encourage people to drive less, and adapt their lifestyles which will get people more physically active and generate fewer greenhouse gasses."

[6] See for example – Transportation Research Record: Journal of the Transportation Research Board, Issue Volume 1927 / 2005; Pages 38-45; also Journal of Transportation Engineering, Vol. 111, No. 4, July/August 1985, pp. 365-376; a bibliography compiled by Fairfax County, Virginia, containing 9 pages of studies, online at: www.fairfaxcounty.gov/planning

the natural environmental and human health. These are associated with vehicle emissions and as such, are also a function of vehicle kilometres travelled, as forecast by the transportation model. The CAC emissions calculated by the model are carbon monoxide (CO), volatile organic compounds (VOC), nitrous oxides (NOx), sulphur oxides (SOx), and particulate matter (PM). Using factors generated by Canadian Medical Association (CMA) to quantify the health costs of poor air quality, the air quality impacts of base case and project case were analyzed in terms of the hospital admissions due to poor air quality. The hospital admissions avoided were estimated by calculating the percentage of air pollutants attributable to vehicle traffic, and the estimated change in emissions resulting from transit.

5.5.3 Improving Air Quality – Economic Damage Avoided

CMA also provides estimates of estimated economic damage due to poor air quality. The estimation of economic damage saving due to availability of transit in 2007 was estimated by calculating the percentage of air pollutants attributable to vehicle traffic, and the identified change in emissions resulting from transit use.

Results

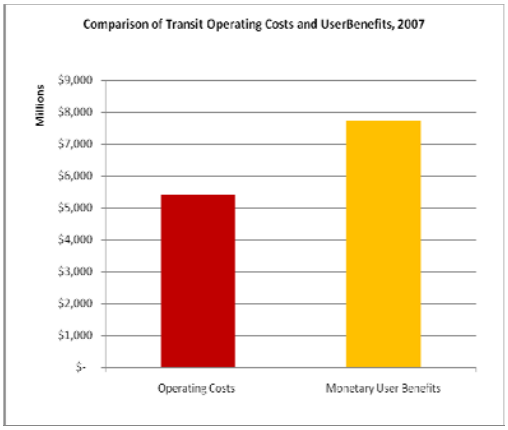
As a result of the reduction in emission of criteria air contaminants due to transit availability, it is estimated that 157 hospital visits were avoided in 2007. The overall impact in terms of economic damage associated with poor air quality associated with the increased travel that would be required if transit was not present, is estimated at $115M in 2007.

RESULT		
Social and Community Benefit Account	**Unit**	**Project Case**
Public Health - Air Quality Hospital Admissions Avoided	Hospital admissions	157
Public Health - Air Quality Economic Damage Avoided	Economic Damage $	$115,312,394

Summary findings of the MAE are presented in the following chart.

SUMMARY - MULTIPLE ACCOUNT EVALUATION ALL VALUES INCREMENTAL OVER BASE CASE (NO TRANSIT INVESTMENT)			
Account	**Metric**	**Unit**	**PROJECT CASE - WITH TRANSIT**
Direct Project and Transportation Account			
	Capital Costs	$ (2007)	$2,471,624,333
	Operating Costs	$ (Annual, 2007)	$5,388,221,131
	Net Operating Costs	$ (Annual, 2007)	$2,508,225,786
	Additional Metric - Operating Revenues (Fares)	$ (Annual, 2007)	$2,879,995,345
Direct Transportation User Benefits Account			
	Vehicle Operating Cost Savings	$	$4,987,360,047
	Accident Cost Savings	Fatal/Injury/Property, $	$2,469,159,522
	Summary Metric: User Benefits	**$**	$7,456,519,569
Environmental Account			
	GhG Emissions Savings	Tonnes/Year	2,396,237
	Monetary Value of GhG Emissions Savings	$, (Total)	$110,161,465
	Critical Air Contaminants (CAC) Emission Savings	Tonnes/Year	119,319
	Monetary Value of Critical Air Contaminants (CAC) Emissions Savings	$, (Total)	$22,390,790
	Summary Metric: Environmental Benefits	**$, (Total)**	$132,552,255
Economic Development Account			
	Output		$3,682,670,207
	Employment Generated		22,570
	Taxes		$159,467,870
	Direct operations jobs		45,263
Social and Community Benefit Account			
	Public Health - Air Quality Hospital Admissions Avoided	Hospital admissions	157
	Public Health - Air Quality Economic Damage Avoided	Economic Damage $	$115,312,394

The accounts reviewed in the MAE included traditional, monetary benefit accounts including transportation user benefits, environmental benefits as well as public health benefits from improved air quality in terms of damage avoided when transit is in place.



The results of the MAE indicate that for the study year of 2007, the transport user benefits are the largest category, estimated at over $7.5 billion. A comparison of the operating costs for 2007 with the imputed benefits to the economy indicate that economic user benefits to are significantly larger than the overall operating costs when seen from an economic perspective.

Based on estimates provided by CUTA, the capital investment in 2007 is $2.5 billion. This investment can be attributed an increase of over three billion dollars in the output of the Canadian economy. In this year, the generation of over 22,000 man-days of employment in the economy can be attributable to the investment made in the transit sector.

In the project case, the economic benefit due to reduction in environmental emissions is estimated to be valued at nearly $133 million. The environmental effect of the use of public transit results in improved air quality. It is estimated that economic damage avoided due to this improved air quality can be estimated at $115 M annually, when quantified in monetary terms.

6 DIRECTIONS FOR FUTURE RESEARCH

6.1 RESEARCH NEEDS

In conducting national surveys of transit's economic benefits, it is clear that there are few if any national studies that have evaluated the full impact of the transit network on a national basis. This study is a first, albeit high-level, initial look at this issue.

Future work could assess this issue in much greater detail. For example, while a brief assessment of travel time savings was possible as part of the MAE for this study, the work did not delve into the congestion condition in major centres to identify the level of congestion savings in each major centre. This would provide compelling evidence of the degree to which transit is improving Canadian economic productivity.

The link between transit investment and public health also deserves a much more detailed investigation. Not only does transit reduce emissions that cause public health impacts due to poor air quality, but it encourages active transportation and in most cases, a trip by transit includes a walk on either end which can have substantial health benefits to Canadians. A more detailed accounting of the scale of this benefit would be a useful future exercise.

Finally, the links between transit and sustainable land use have been examined in detail but are relatively poorly documented in terms of quantitative evidence in Canada, to date. With the advent of such useful database as building permit data, the RealNET market database, and employment surveys, not to mention digital availability of census data, it would certainly be possible to conduct time-series analysis of development near transit stations in major centres. This could provide compelling evidence of the impact of transit on the built form of Canada's largest urban centres.

6.2 RISK

An emerging and important field of inquiry associated with major public investment is risk evaluation. Risk evaluation is an opportunity to assess the range of possible outcomes associated with investment and provide more clarity regarding outcomes of a significant investment. In addition, central elements of the value proposition for transit can be assessed in the broader framework of operational considerations and the process of major construction projects.

Risk evaluation will assist in ensuring that decision-makers have a fuller sense of the scope of projects in advance of funding commitments, and help in matching procurement strategies to broader public objectives. CUTA can assist the industry in developing risk assessment frameworks for transit investment, to solidify some of the analysis that currently supports project funding submissions.

In a broader sense, it would be desirable to establish consistent evaluation frameworks across Canada for transit investment. Early efforts by Transport Canada to establish their TransDEC evaluation tool as the standard have since been relaxed to allow the more comprehensive MAE approach to be used. However, MAE frameworks are inconsistent and can result in common challenges (such as how to handle fare revenues) being applied differently depending on the project. CUTA could provide best practices in this regard, helping to clarify transit project evaluation, and ensuring that the full range of economic benefits of transit investment are captured by proponents and reported to government.

Appendix A – Data Sources, Inputs, and Assumptions

This appendix outlines a summary of data sources and assumptions used to generate values for the inputs required for each account for the purpose of MAE modelling. The inputs include ridership and traffic inputs that are used in calculations in many accounts. Account-related inputs are specific to individual metrics in the MAE modelling.

The inputs can be grouped under the following categories:

- Ridership and Traffic;
- Direct Project and Transportation Account;
- Direct Transportation User Benefits Account
- Environmental Account;
- Land Use/Economic Development Account;
- Social and Community Benefit Account.

A discussion of the sources of data and associated assumptions in each category follows below.

RIDERSHIP AND TRAFFIC

The passenger ridership data for all provinces was available by mode of transit. This was compiled to obtain the passenger volumes per annum. Highway travel data is used to determine overall corridor performance and quantify the impact of transit in improving the congestion condition faced by traffic. For the purpose of this analysis the annual passenger volumes were used to obtain the highway traffic in terms vehicle kilometres travelled (VKT). To account for higher accessibility provided by transit it was assumed that 20% of the transit traffic is captive, i.e these passengers do not have the option of travelling by alternate mode either due to lack of automobile access or due to other reasons such as disability. Students and seniors comprise as captive passengers as well. As a result when considering a scenario where no transit is available, the rest of the 80% transit passengers are assumed to travel by automobiles based on an average occupancy of 1.2 passengers per car. Peak period traffic was assumed to comprise 30% of the daily traffic.

DIRECT PROJECT AND TRANSPORTATION ACCOUNT:

Direct project costs refer to the cost incurred by the infrastructure provider. The cost estimates included capital costs and annual operating/maintenance costs.

Capital Costs

Capital cost estimates for the year 2007 were compiled from the CUTA database.

Operating and Maintenance Costs.

The operating costs estimates for the year 2007 were compiled from the CUTA database.

Operating Revenues

For the purpose of this analysis, fares for each person boarding transit were assumed to be the only source of revenue. Operating revenues for the year 2007 were compiled from the CUTA database.

Net Operating Costs

Net operating costs were estimated from operating revenues net of operating costs per passenger boarding on transit. The net operating costs the year 2007 were compiled from the CUTA database.

Employment Generated

Economic impact analysis was undertaken using provincial level input output multipliers for transportation sector for the investment incurred in Alberta, British Columbia, Ontario and Quebec. The output provided estimates of the direct and indirect employment impacts of the capital investment in transit in these provinces.

Data from CUTA transit fact book was used to compile the jobs created directly by the transit industry for transit operations.

Output Generated

Economic impact analysis was undertaken using provincial level input output multipliers for transportation sector for the investment incurred in Alberta, British Columbia, Ontario and Quebec. The output provided estimates of the direct and indirect output generated as a result of the capital investment in transit in these provinces.

Taxes Generated

Economic impact analysis was undertaken using provincial level input output multipliers for transportation sector for the investment incurred in Alberta, British Columbia, Ontario and Quebec. The output provided estimates of the direct and indirect taxes generated as a result of capital investment in transit in these provinces.

DIRECT TRANSPORTATION USER BENEFITS ACCOUNT

Travel Time

One of the major benefits of transit is the time saving that transit can provide to users under congestion conditions faced by auto traffic. This benefit is measured in terms of the reduction in total travel time spent by the transit user travelling by the faster mode. This benefit was quantified in monetary terms based on value of travel time (VOTT). The value of travel time for Toronto is reported at $11.35, based on a recent Transport Canada study, *Value of Time and Reliability for Local Trips in Canada, March 2008.* These values were de-escalated to the 2007 level by applying the rate of inflation based on CPI.

Travel Speed in Congestion Conditions

In order to estimate travel speeds faced by automobile traffic in congested conditions in Toronto, a travel rate index of 1.173 was used. The Travel Rate Index measures the additional time required to travel (under congestion), relative to free-flow conditions. These indices were prepared for a Transport Canada Study – *Cost of Congestion in Canada's Transportation Sector (2007)*.

Vehicle Operating Costs

Total vehicle operating costs were estimated by multiplying per kilometre costs for vehicle operating expenses with vehicle kilometres travelled for automobiles.

According to Canadian Automobile Association (CAA) estimates, the average costs to operate a typical four-door sedan driven 18,000 km annually was placed at 46.9 cents per kilometre in 2008. This cost included variable operating costs including fuel and oil as well as fixed ownership costs such as insurance, license fees, registration fees, taxes, finance costs, and depreciation.

Accident Costs

Incident rate for accidents is directly related to the number of vehicle kilometres travelled. For the purpose of this analysis the incident rate of accidents in Canada overall was multiplied by the average cost of accidents and the total automobile vehicle kilometres travelled (VKT).

Accident incidents can be categorized into fatal accidents, injury only, and property damage incidents. The values of average cost of these accidents and average incident rate for accidents are outlined below. The cost data was available for 2004 and was inflated to 2007 values.

Average Cost of Accident by Collision Severity		2004
Fatal Collisions	$	15,700,000
Injury only	$	82,000
Property damage only	$	8,000

Source: Transport Canada Accidents Analysis and Estimation of the Social Cost of Motor Vehicle Collisions in Ontario.
http://www.tc.gc.ca/roadsafety/tp/tp14800/pdf/TP14800E.pdf.

Rate of Incidence Accidents by Collision Severity

Incidence Rates per Billion VKT

Fatal Collisions 8.9

Injury Only 604

Property Damage Only 3670

Source: Canadian Motor Vehicle Traffic Collision Statistics: 2006.

ENVIRONMENTAL COSTS

Urban transportation is a major contributor of Green House Gases (GhG) and Criteria Air Contaminants (CAC). Changes in emissions affect ambient air quality and related environmental impacts.

In order to estimate the environmental impacts the underlying assumption is that reduction in GHG and CAC emissions will result primarily from the number of cars taken off the road as a result of increased transit ridership.

For this analysis data on emissions for base case as well as project scenario was estimated by the UTEC model from Transport Canada.. For estimating the monetary impacts, the average emission cost by pollutant are detailed below.

Green House Gas Emissions

According to a Transport Canada study, unit cost of GhG emissions is estimated at $37.38 per tonne of CO2 equivalent. This value was updated by applying inflation to get current values for the analysis year.

Critical Air Contaminants

The unit cost of air pollution by pollutant emitted had been estimated by Transport Canada in a study of evaluation of Total Cost of Air Pollution Due to Transportation in Canada. These are:

Unit Cost of Air Pollutant Emitted (Canada)

Pollutant	Unit Cost per tonne	
VOC	$	436
NOx	$	3,580
SO2	$	3,960
PM10	$	13,900

Source: Transport Canada, Study of Evaluation of Total Cost of Air Pollution Due to Transportation in Canada, 2007

SOCIAL AND COMMUNITY BENEFIT ACCOUNT

Public Health Benefits – Hospital Admissions

Poor air quality and smog – caused in part by vehicle exhaust – are resulting in increased hospital admissions, heart attacks and strokes, respiratory illnesses and premature deaths particularly in urban areas. In order to assess the related costs to society, within the social and community benefits account, a reduction in the number of hospital admissions as a result of the project scenarios was estimated.

A 2008 report entitled "No Breathing Room, National Illness Cost of Air Pollution (ICAP) by the Canadian Medical Association (CMA) provided the background data for estimation of health and related economic damages associated with air pollution exposure in Canada. According to the ICAP report, hospital admissions attributable to poor air quality (increased PM2.5, CO, SO2, No2 and O3) are estimated to increase from 10966 to 17748.

Hospital Admissions - Canada

	2008	2016	2031
	10966	12685	17748

Source

http://www.cma.ca/multimedia/cma/content_Images/Inside_cma/Office_Public_Health/ICAP/CMA_ICAP_sum_e.pdf

The underlying assumption is that reduction in GhG and CAC emissions will result in improved air quality and hence reduce the health impact of air pollution. This in turn will impact the number of hospital admissions.

In order to quantify the impact of improved air quality associated with the project scenario, the following steps were taken.

- Project the share of hospital admissions due to poor air quality.
- Calculate the share of transportation sector on air quality.
- Calculate the share of automobiles in transportation.
- Calculate the reduction of air pollution due to the transit.

According to a study on air pollutant emissions for Ontario, nearly 59% of the Air Contaminant emissions were attributable to the transportation sector. Data from the same study indicates that out of the total mobile sources of air contaminants, light vehicles were responsible for nearly 29% of the pollution.

Applying these shares to the projected hospital admissions for the period of analysis established the baseline data of hospital admissions attributable to light vehicles.

In order to estimate the reduction of air pollution due to the project scenarios, reduction factors were estimated. The reduction factors were arrived as a share of CAC emissions in project case as compared to base case.

Applying these reduction factors the number of hospital admissions due to improved air quality was estimated for all the project scenarios.

Public Health Benefits – Economic Damage

The other endpoint evaluated under the social and community account was an estimation of reduction in economic damages as a result of improved air quality. The ICAP report provides estimates of economic damages. A summary of the economic damages for 2008, 2016 and 2031 in constant 2003 dollars for Canada are provided below:

Economic Damages for Canada (S million)

		2008		2016		2031
Lost Productivity	$	688	$	721	$	765
Healthcare Costs	$	438	$	486	$	614
Quality of Life	$	379	$	410	$	487
Loss of Life	$	6,552	$	7,805	$	11,838
Total	$	8,057	$	9,422	$	13,704

Source

http://www.cma.ca/multimedia/cma/content_Images/Inside_cma/Office_Public_Health/ICAP/CMA_ICAP_sum_e.pdf

Quantifying the impact of improved air quality associated with the project scenarios in economic terms the following steps were involved.

- Project the share of economic damages due to poor air quality for the analysis period.
- Estimation of share of transportation sector on air quality.
- Estimation of share of automobiles in transportation.
- Estimation of reduction of air pollution due to the project scenarios.

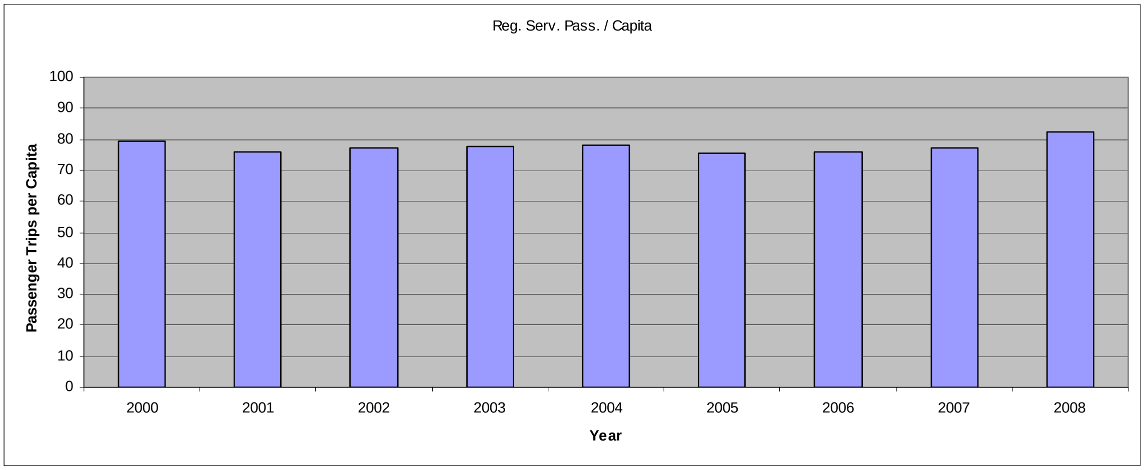
As in the case of hospital admissions, the base case scenario of economic damages that are attributable to light vehicles was established, as a point of comparison.

In order to estimate the reduction of air pollution due to the project scenarios, reduction factors were estimated. The reduction factors were arrived as a share of CAC emissions in project case as compared to base case.

Applying these reduction factors, the reduction in economic damages due to improved air quality was estimated for the project case.

Appendix B – Additional Data – Transit Industry and Operations

As shown in the figure below, in the nine years from 2000 to 2008, annual transit ridership per capita has ranged between 75 and 85.   Note that CUTA calculates per capita data based on the population served by transit rather than total population.



The table below shows the ridership in 2008 for some of the largest Canadian urban areas (note that these are the overall urban areas that, in some cases, include multiple transit systems serving multiple jurisdictions).

Year 2008 Transit Ridership in Urban Areas			
Urban Area	Transit Service Population	Total Ridership (Millions)	Per Capita Ridership
Calgary	1,042,892	94,892,400	90.99
Edmonton	752,412	66,092,169	87.84
Halifax	312,400	19,531,986	62.52
Quebec City	534,488	45,577,172	85.27
Vancouver	2,271,224	178,803,205	78.73
Victoria	349,613	23,715,622	67.83
Winnipeg	666,600	42,637,167	63.96
Grand River [1]	422,211	15,810,871	37.45
Montreal [2]	2,652,905	451,384,133	170.15
Ottawa/Gatineau [3]	1,047,206	112,149,165	107.09
Toronto [4]	6,074,359	617,706,895	101.69

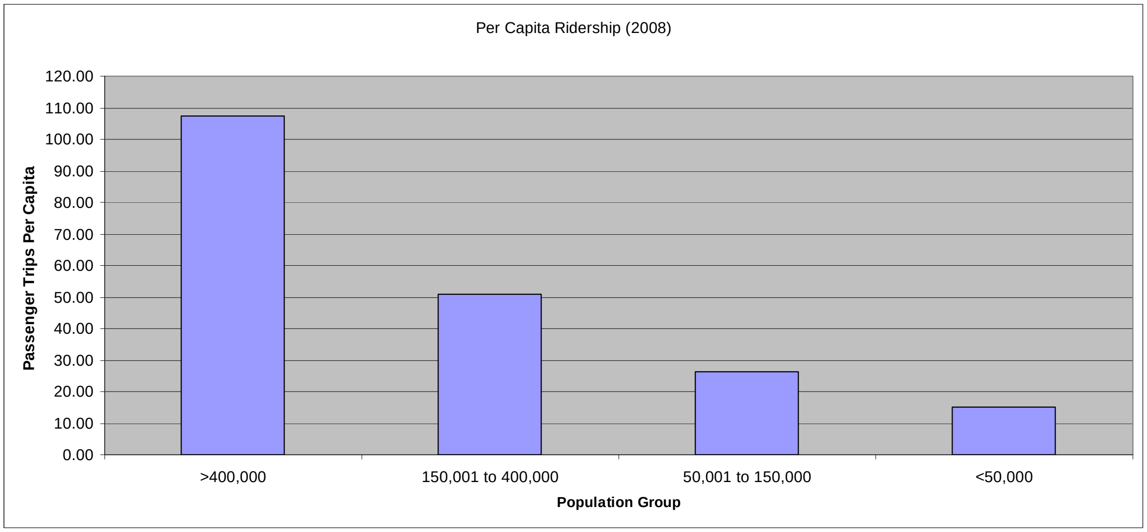
1 - Kitchener, Waterloo and Cambridge served by one transit provider

2 - AMT, Laval, Montreal and Longueuil

3 - OC Transpo and STO

4 - Brampton, Burlington, DRT, GO, HSR, Mississauga, Oakville, Toronto, YRT

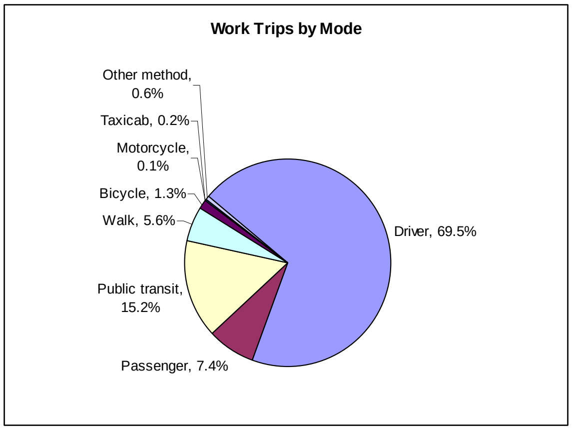
The exhibit below clearly indicates that larger cities support larger ridership levels per capita in Canada, although there are ranges of ridership in each population group.

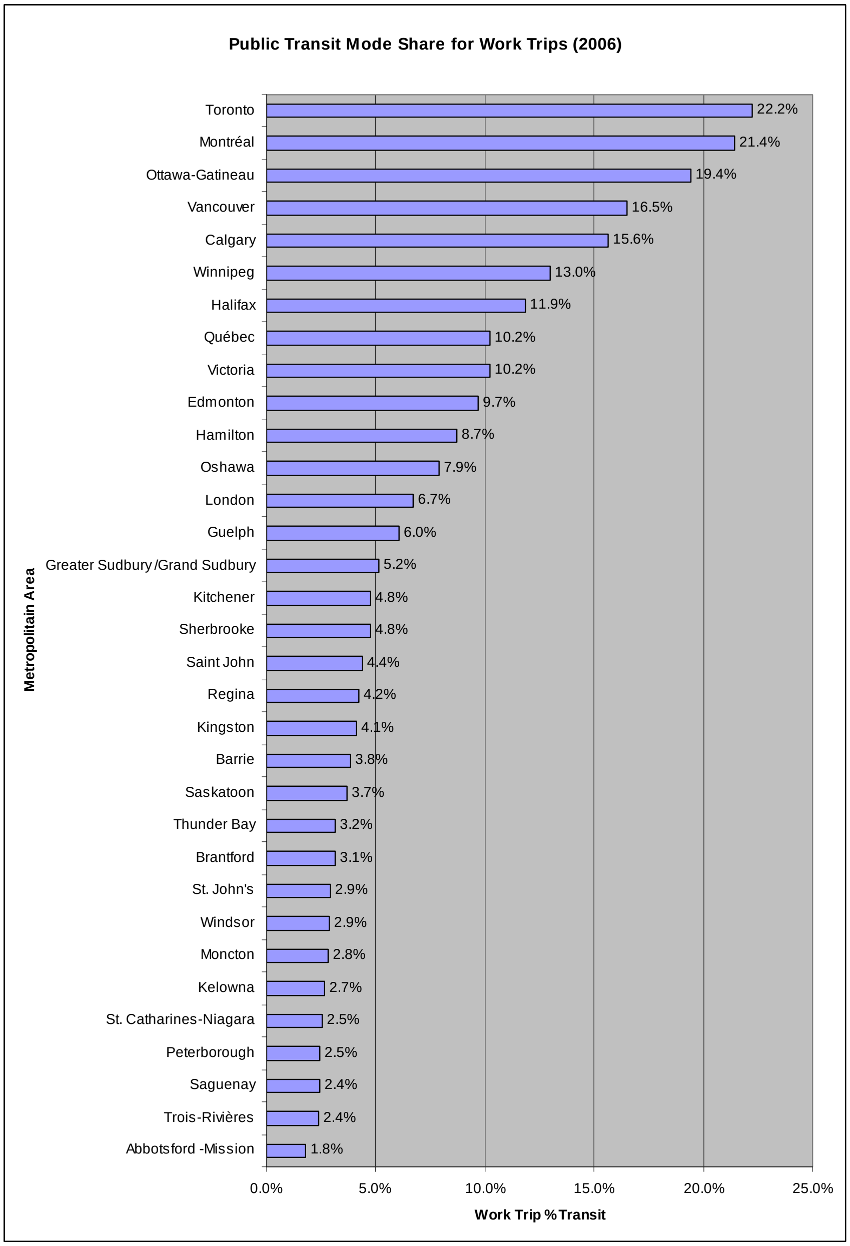

Per Capita Ridership (2008)
Passenger Trips Per Capita
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
>400,000
150,001 to 400,000
50,001 to 150,000
<50,000
Population Group

Work Trips by Mode

The figure below also shows that in general, transit modal share increases in accordance with city size. This predictable trend is likely a factor of several obvious influences such as higher levels of congestion in larger urban centres, higher population densities, as well as the ability for larger cities to provide a more comprehensive range of transit services to its residents.

Source: 2006 Census of Population over a 24-hr period

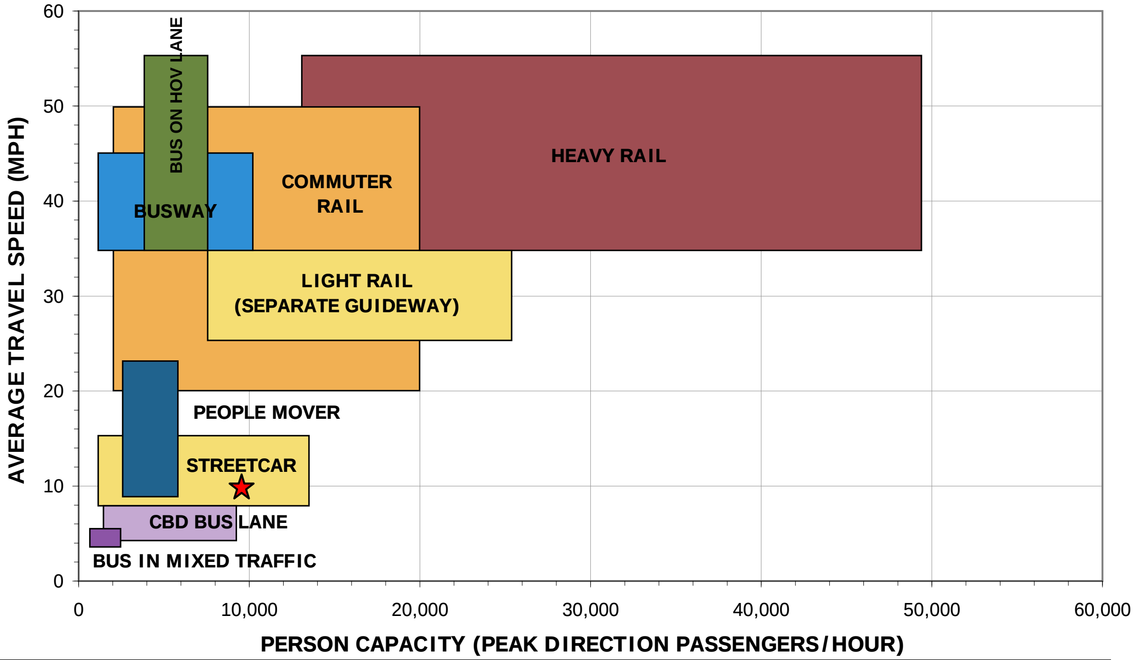




Types of Transit Service in Canada

The easiest way to classify and describe transit service in Canada is to consider services in a hierarchical framework based on the capacity they provide and the level of exclusivity from regular traffic.

Average Travel Speed and Capacity by Technology (Transit Capacity Quality of Service Manual)



Note: "Streetcar" is dependent on the Transit Platform Length that could be accommodated on Street. In a downtown environment with short blocks, a Streetcar may be restricted to 2-car trains that would limit its capacity.

High capacity transit services can achieve ridership reaching 50,000 passengers per hour. Examples include the subways in Toronto and Montreal, commuter rail services offered by GO Transit, AMT and West Coast Express in Toronto, Montreal and Vancouver respectively. Generally the definition of these services considers long multi-unit vehicles, each offering a high capacity, and in the case of the subways, a high frequency of service. The two Canadian subways have passenger volumes of approximately 30,000 people in the peak hour, peak direction.

Light rail transit (LRT) and bus rapid transit (BRT) services refer to facilities that would typically be able to carry from 3,000 up to 15,000 passengers per hour, usually on separate lanes or rights-of-way. LRT services are typically rail services and are as varied as the systems in Edmonton and Calgary, the Ottawa O-Train and the Spadina median streetcar in Toronto, while BRT can describe exclusive busways such as the Ottawa Transitway or on-street bus lanes such as the VIVA service in York Region. In general, LRT and BRT systems do not provide the same capacity as the heavy rail transit services described above, but can offer the same and higher range of frequencies. Ridership examples include the Scarborough RT with up to 4,000 passengers per hour in the peak direction, and the Ottawa Transitway and Calgary C-Train with volumes approaching 10,000 passengers per hour.

As with all classification systems, there is some overlap. Services such as the Calgary and Edmonton LRT, the Vancouver Skytrain and the Scarborough RT have some of the elements of both classifications. The important point is that all of these services provide a rapid transit service of a quality and frequency that is a step above conventional on-street bus/streetcar transit services and they demonstrate the wide range of options available for implementing rapid transit.

Conventional on-street transit is provided by a variety of buses. These buses can range from high capacity articulated and double decker buses to smaller buses operating on a conventional low volume route (Community Bus). The key element of this classification is that the service operates in mixed traffic on a scheduled route. The streets operated on can include major suburban arterials, downtown roads, and residential collector streets. Capacities offered can range from less than 50 passengers per hour to more than 1,500.

Low capacity services describe a range of transit options that include Paratransit, demand responsive routes and flexible community bus services. These are different from conventional bus services because they offer more personalized, on demand service with a much higher degree of flexibility. They usually use small buses but can sometimes operate with large conventional cars. It is usually more difficult to assess capacity because of the flexibility of the routes.

Alternate Service Delivery

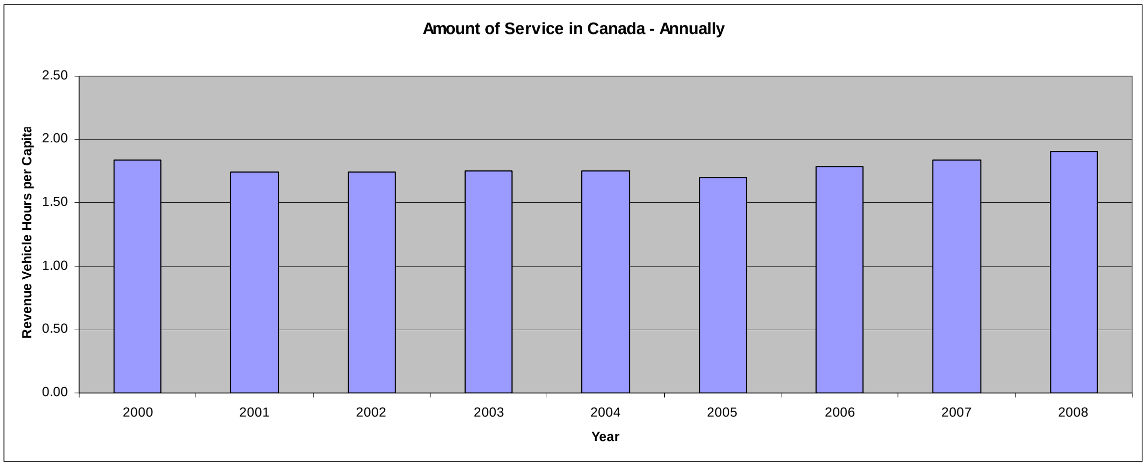
In the context of urban transit, alternate service delivery (ASD) refers to the provision of transit services by resources other than the traditional model. In Canada, there is substantial experience and practice of ASD. Private sector operating and/or maintenance contracts are in place in a number of transit agencies. In addition, transit properties occasionally provide contract services to neighbouring municipalities, providing a lower-cost alternative to establishing a specialized or conventional transit system. Examples include::

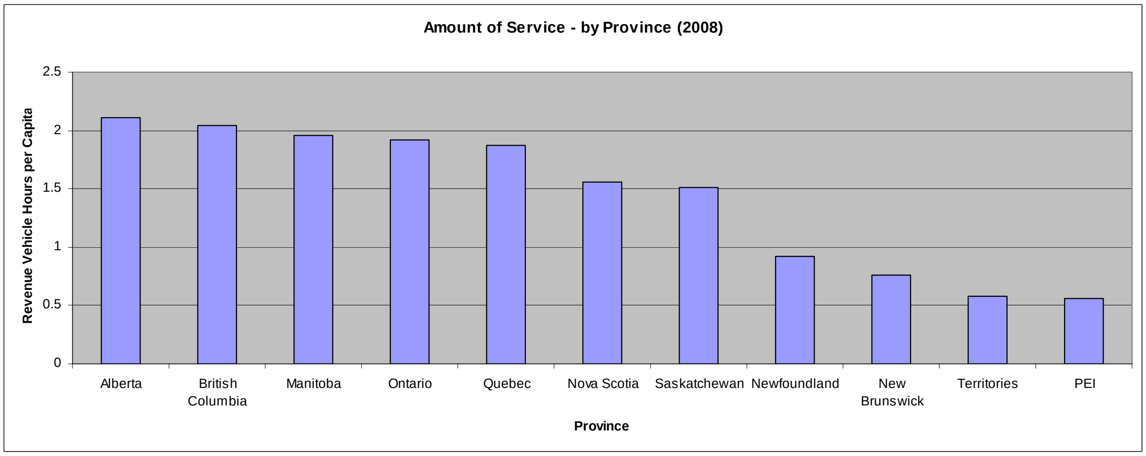
Property	Province	Contractor
BANFF	AB	Brewster Transportation
GRANDE PRAIRIE	AB	Cardinal Coach Lines Limited-driver/dispatch service only
ST. ALBERT (StAT)	AB	Diversified Transportation
WOOD BUFFALO	AB	Diversified Transportation
AIRDRIE	AB	First Bus / Cardinal
VANCOUVER (TRANSLINK)	BC	Coast Mountain Bus, BC Rapid Transit, West Coast Express, West Vancouver Transit, Bowen Island Commuter ferry
KELOWNA (BC TRANSIT)	BC	Farwest Transit Services Inc.
WHISTLER (BC TRANSIT)	BC	Whistler Transit Ltd.
YELLOWKNIFE	NWT	Cardinal Coachlines
GO	ON	(Trains) Bombardier, CP
COBOURG	ON	Coach Canada (Trentway-Wagar)
DURHAM REGION (DRT)	ON	Coach Canada (Trentway-Wagar)
BARRIE	ON	Greyhound Canada Transportation ULC
WATERLOO REGION (GRT)	ON	Hendry Coachlines Inc. (limited services)
LOYALIST	ON	Kingston Transit
YORK REGION (YRT)	ON	Miller, Tokmakjian, Veolia, Laidlaw, TTC, Student Express, GO Transit
MILTON	ON	Oakville Transit
CHARLOTTETOWN	PE	Trius Tours Ltd.
AMT	QC	Uses Rights of way: CN, CFCP, Bus services: RTL
PRINCE ALBERT	SK	First Bus Canada Ltd.

Source: CUTA Transit Factbook 2007

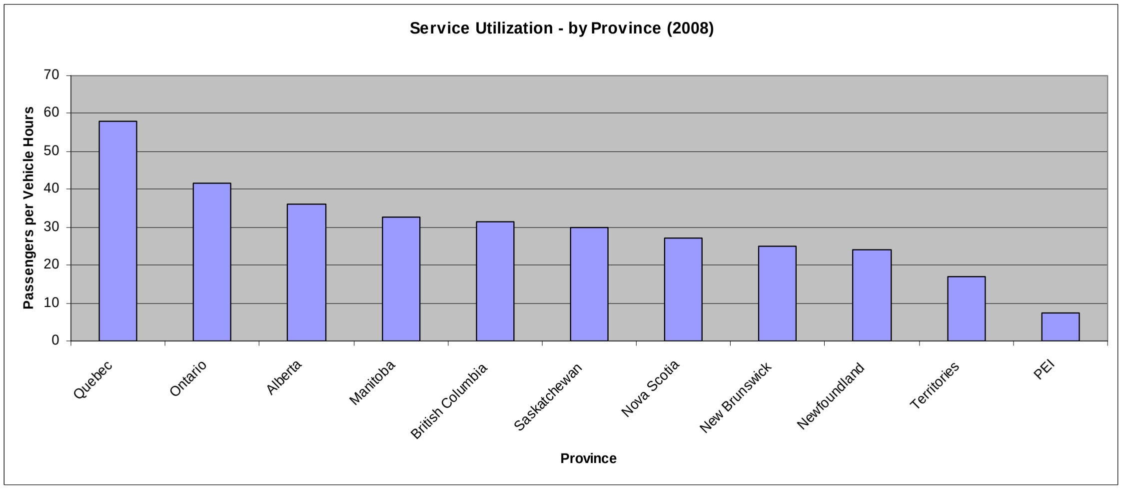
In addition to these conventional transit services, many Canadian cities have private sector contracts for the operation and/or maintenance of their specialized systems (for persons with disabilities). These include Victoria, Vancouver, Saskatoon, Regina, and Laval, to name a few. The examples listed in the previous paragraphs refer to situations where the private sector is responsible for operating and/or maintaining significant elements of the transit system. Many of the other transit systems in Canada that are largely publicly operated also incorporate elements of ASD into their operations. An example is in the area of vehicle maintenance where some systems use a tendering process for work such as engine and transmission rebuilding, warranty work and vehicle refurbishing including major structural repairs, body and paintwork.

Amount of Service



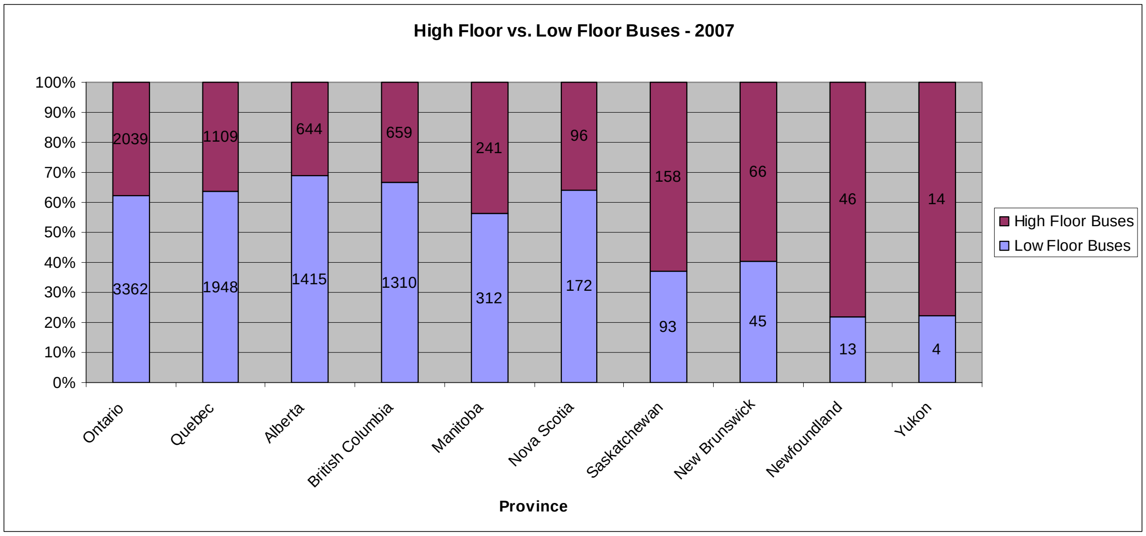


An indication of service efficiency is shown below and illustrates the service utilization of transit across Canada in 2008. Quebec records the highest rate of passengers per vehicle hour, with most other provinces falling in the range between 25 and 42 passengers per revenue vehicle hour. The population group analysis shows that service utilization increases with city size.



Accessibility of Transit Fleet

In 2008, Ontario had over 4,100 low floor buses accounting for over 70% of the bus fleet. Alberta, BC, and Quebec have all reported that their fleet is also comprised of over 70% low floor buses. Newfoundland and the Yukon territories are the lowest percentage of low-floor buses. The smallest fleet belongs to PEI with 17 vehicles of which only 10 vehicles are low floor. Across Canada, 71% of the bus fleet is made up of low floor buses.

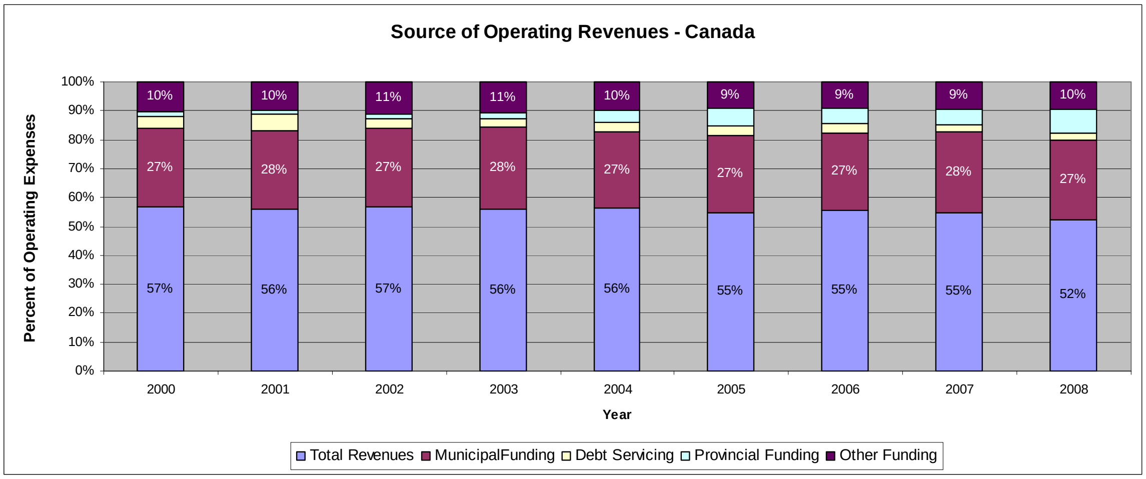


Average Age of Bus Fleet for Select Cities in 2008

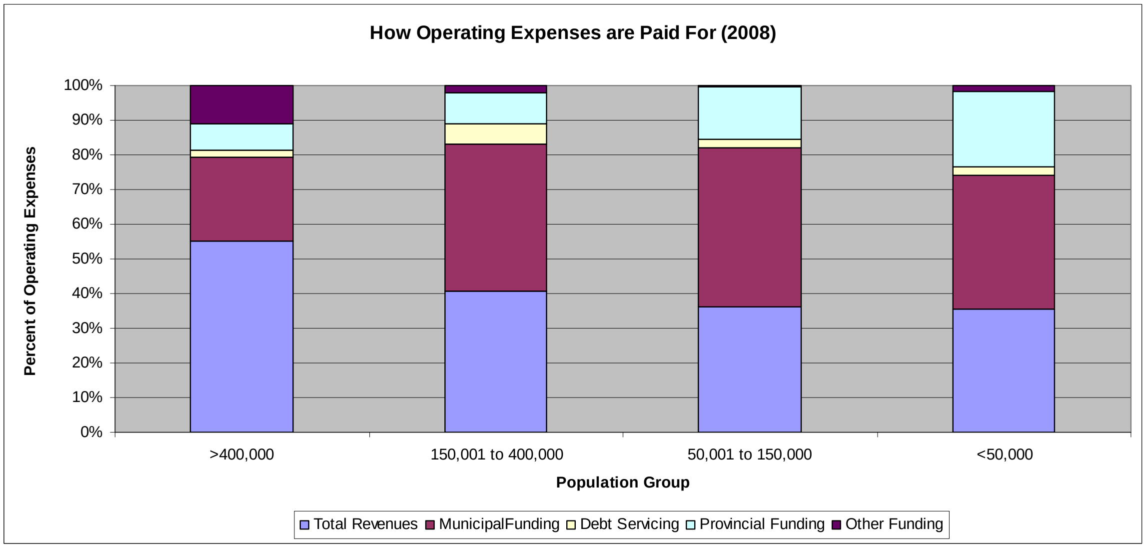
City	Average Age
Montreal (STM)	8.4
Toronto (TTC)	6.3
Durham	7.2
York	4.9
Ottawa	7.1
Vancouver	6.3
Edmonton	7.6
Calgary	9.7
Winnipeg	10.4
Quebec City	7.4
Mississauga	4.2
Victoria	9.7
Laval	8.6
Hamilton	6.2
Gatineau	10.1

Operating Revenues and Expenses

During the nine years of examined data from 2000 to 2008, funding from operating revenues has slowly been decreasing, from accounting for 57% to 52% of the operating expenses. Provincial funding has increased steadily from 1% in 2000 to 8% in 2008. Municipal funding as well as funding from other sources has stayed fairly constant. Additional information is included in Appendix B.

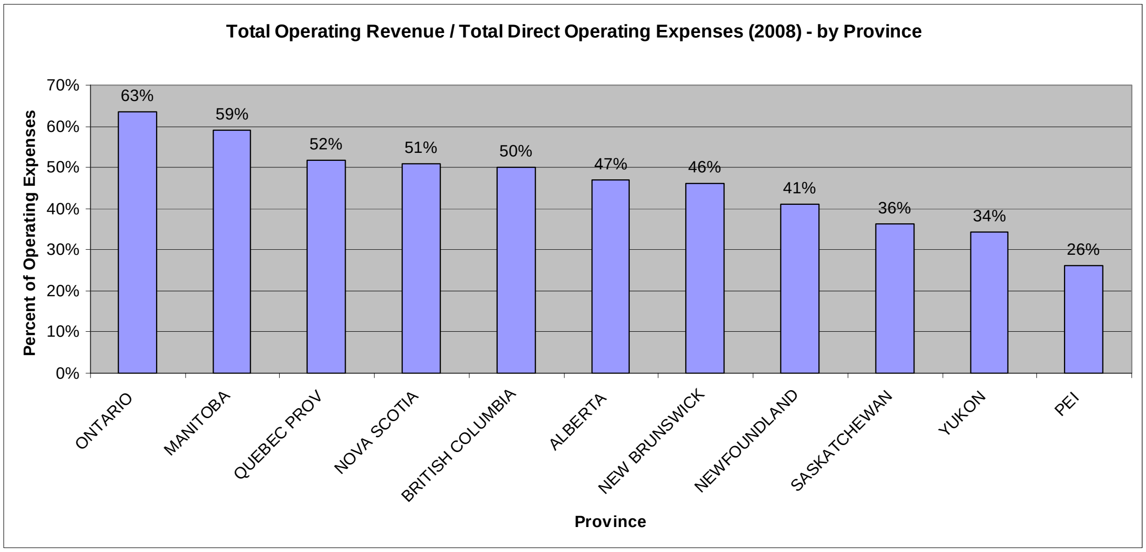


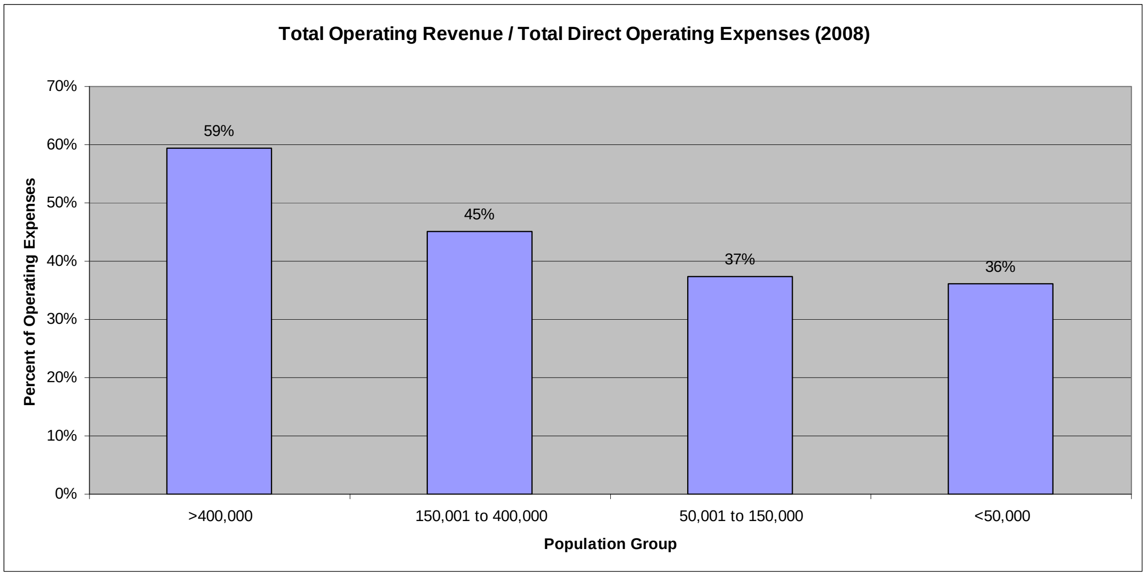
From a population group perspective, the larger transit systems (greater than 400,000) cover more of their operating expenses with revenues, and receive less provincial and municipal funding, while receiving more funding from other sources than the smaller agencies.



Revenue-Cost Ratio

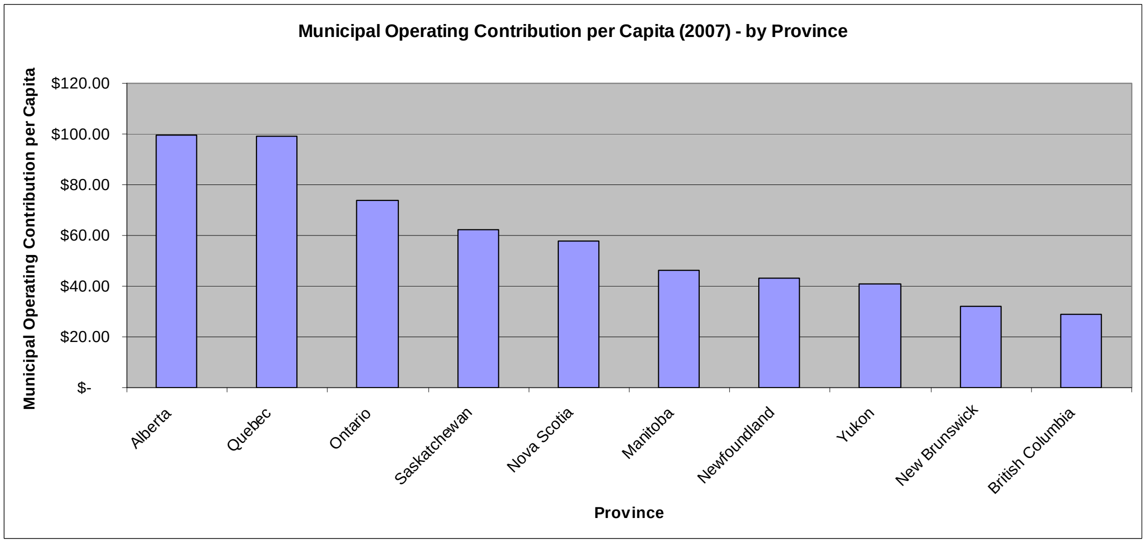
Ontario and Manitoba have the highest revenue to cost ratios of the provinces in 2008, as is shown below. Higher average fares in these two provinces as well as lower than average operating costs explain the higher revenue to cost ratio. In general, revenue-cost ratios increase with city size.

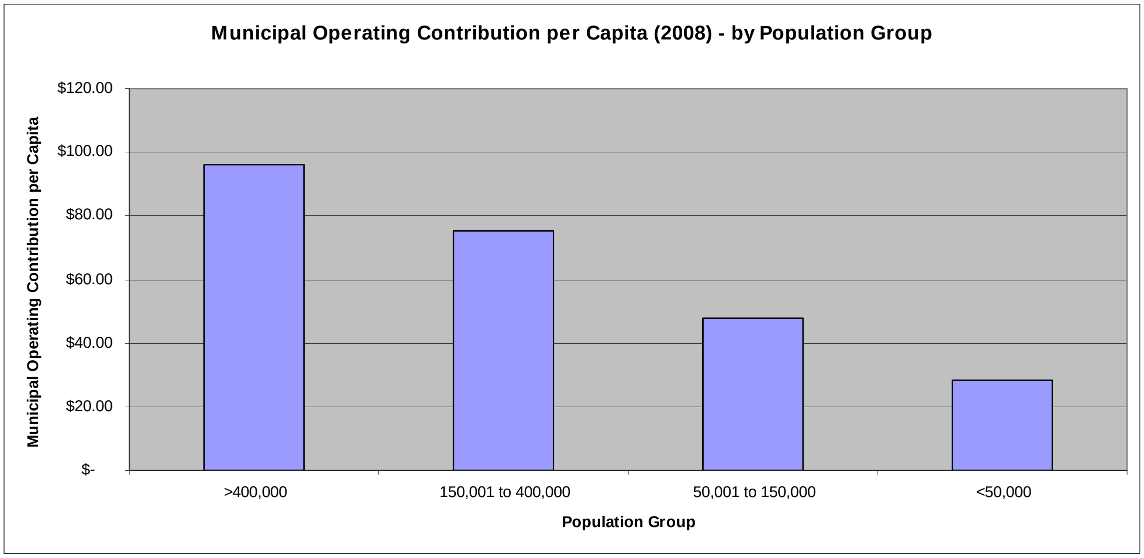




Municipal Operating Contribution per capita

As is shown below, Quebec and Alberta receive the greatest municipal funding per capita of Canadian provinces, while British Columbia and New Brunswick receive the least. The reason for the low municipal contribution in British Columbia has to do with the structure of BC Transit, which is provincially operated, rather than in other provinces where the transit systems are operated by the municipality. Quebec and Alberta both charge lower than average fares, which would increase their per capita municipal funding requirements. Also, Alberta supplies light rail transit in both of its major cities, which has a higher operating cost than bus transit. In general, as city size increases, municipal funding per capita increases.





Net Direct Operating Cost per Passenger

The provincial variation is illustrated below. From a city size perspective, as a city increases in size and ridership per capita increases, the operating cost per passenger decreases in dollar value.