

October 2008

Transportation Performance of the Canadian Provinces

by David T. Hartgen,
Claire G. Chadwick,
and M. Gregory Fields





**Studies in
Transportation &
Infrastructure**

October 2008

Transportation
Performance of the
Canadian Provinces

by David T. Hartgen, Claire G. Chadwick,
and M. Gregory Fields

Contents

Executive summary	1
Introduction	5
Overall findings and performance ratings for Canadian provinces	11
Passenger transportation	13
Freight transportation	37
Discussion	51
Appendix A: Provincial performance summaries	55
Appendix B: Methodology	59
Appendix C: Literature review	75
Appendix D: Provincial economic trends	79
Appendix E: Maps	83
References	101
About the authors	115
Acknowledgments	116
About this publication	117–118
Supporting the Fraser Institute	118
About the Fraser Institute	119
Editorial Advisory Board	120

Executive summary

The primary purpose of a transportation system is to provide the accessibility through which individuals and businesses can exercise mobility. That is, transportation systems provide the accessibility by which people get to jobs and recreation, trade in goods and services, interact with other regions, and develop land. A region's transportation system is a critical factor in its economic viability. The extent, use, cost, and impacts of transportation systems are often considered key "factors of production" in facilitating growth and economic health. In short, transportation systems provide a key base on which the economy of a nation rests.

Recognizing the importance of transportation performance to the economic health of the provinces, this study compares the 10 provinces on transportation system performance. The intent is to improve transportation performance nationwide by establishing key baseline information that can be used to track performance over time.

The study comparatively assesses the performance of the transportation systems of the 10 Canadian provinces by examining the extent, use, accessibility, cost, and condition of different modes of transportation. Two categories of transportation performance are assessed: passenger transportation (highway, transit, air, and ferry service) and freight transportation (highway, air, rail, and marine service). A total of 23 specific measures of performance are developed for each province (executive summary table 1). They include modal usage rates relative to service, costs of operation versus revenues, intercity driving times, local commuting times, system condition, congestion, accident rates, and access to jobs.

For each measure, the 10 provinces are compared and ranked using "performance ratios"—the ratio of each province's measure to the weighted national average. A value of one, for example, would indicate average performance compared to all other provinces. Low values of performance ratios mean that the province performs better than the average, and high values mean it is worse than average. The ratios for each measure are then combined to develop an overall modal rating for each province. Finally, overall passenger and freight performance ratios for each province were developed and combined into an overall transportation performance ratio.

Overall, Ontario has the best overall transportation system performance (performance ratio of 0.81), followed closely by Nova Scotia (0.83) and Quebec (0.92). They are followed by Manitoba, New Brunswick, Prince Edward Island, Alberta, Saskatchewan, Newfoundland & Labrador, and British Columbia (executive summary table 2).

Passenger transportation

The passenger transportation sub-component includes 14 measures of road, transit, air, and marine systems that involve the movement of people (executive summary table 1).

Executive summary table 1: Measures of transportation performance for Canadian provinces

Mode	Dimension	Measure
Passenger		
Highway	Traffic	Vehicle-km of travel per two-lane km of road
	Cost	Prov. expenditures per km, major road
	Condition	Percent of major roads in fair or poor condition
	Access	Travel time to Ottawa
	Access	Travel time to US border
	Safety	Fatality rate per billion vehicle km
	Congestion	Annual hours of delay per capita
	Access	Average round trip commuting time
Transit	Traffic	Ridership per capita served
	Cost	Operating cost per trip
Air	Traffic	Passengers per flight
	Safety	Accidents per million passengers
Rail		Not evaluated (see discussion in text)
Marine	Traffic	Government operating cost per passenger
	Safety	Accidents per million passengers
Freight		
Highway	Traffic	Tonnes of truck traffic per km of road
	Safety	Fatal collisions per million tonnes
	Trade	Total employment per truck border crossing
Air	Traffic	Tonne of cargo per flight
Rail	Traffic	Origin tonnes per km of first line track
	Safety	Rail accidents per mill. originating tonnes
Marine	Traffic	Port oper. expenditures per tonne handled
	Cost	Port expense/revenue ratio
	Safety	Shipping accidents per million tonnes

Ontario ranks first with a performance ratio of 0.77 (executive summary table 2). Nova Scotia and Quebec follow close behind with performance ratios of 0.82 and 0.89. The lowest-ranked province is British Columbia (1.55).

Ontario is rated either first or second on each of the four modes studied (executive summary table 3). Nova Scotia is rated first on air passenger, second on highway, and sixth on urban transit and marine, but is rated second overall. Quebec follows close behind, with a first-place rating on urban transit. On the other hand, British Columbia's high rating on marine ferry service (first) is not enough to overcome its tenth-place rating for highway travel and its modest ratings for transit and air travel, so it is rated tenth overall. Ratings for other provinces are more uniform across modes.

Freight transportation

The freight transportation sub-component includes nine measures of road, air, rail, and marine systems (executive summary table 1).

Newfoundland & Labrador has the best freight performance compared to the other provinces, with a performance ratio of 0.84 (executive summary table 2). Newfoundland & Labrador's top rating is based particularly on its rail and marine service and traffic (executive summary table 4). Nova Scotia is very close, rated second, based on superior rail service, although it ranks fourth on

Executive summary table 2: Overall performance ratios and ranks, Canadian provinces

	Passenger transportation		Freight transportation		Combined		Percent of max**
	Performance ratio*	Rank	Performance ratio*	Rank	Performance ratio*	Rank	
Ontario	0.77	1	1.14	5	0.80	1	1.00
Nova Scotia	0.82	2	0.91	2	0.83	2	0.95
Quebec	0.89	3	1.14	6	0.92	3	0.83
Manitoba	0.95	4	1.41	9	1.00	4	0.72
New Brunswick	1.04	5	0.98	3	1.03	5	0.67
Prince Edward Island	1.04	6	1.38	8	1.07	6	0.62
Alberta	1.13	7	1.67	10	1.18	7	0.46
Saskatchewan	1.48	8	1.25	7	1.45	8	0.08
Newfoundland & Labrador	1.53	9	0.84	1	1.46	9	0.06
British Columbia	1.55	10	1.13	4	1.51	10	0.00

*The "performance ratio" is the ratio of province statistics to the 10-province average, weighted over all measures. A higher ratio means the province performs worse; a lower ratio means the province performs better.

**The degree to which the provincial performance nears the performance of the best-rated province. Computed as $[(1.51 - \text{provincial performance ratio}) \div (0.71)]$.

marine services. New Brunswick is third, based on rail and air ratings, but is rated seventh on marine services.

Conclusion

The study recognizes the sensitivity of these findings to assumptions about the measures selected for each transportation mode and the weights assigned to various modes. Therefore no specific policy recommendations are made for individual provinces or for different transportation modes. Instead, the study concludes that this first detailed look at the comparative performance of the provincial transportation systems should be used primarily to improve reporting so that provincial performance can be compared more confidently.

Executive summary table 3: Summary of provincial ranks for passenger transportation

	Highway	Urban transit	Air	Marine	Overall rank
Ontario	1	2	2	2	1
Nova Scotia	2	6	1	6	2
Quebec	3	1	5	3	3
Manitoba	4	4	7	5	4
New Brunswick	6	9	9	7	5
Prince Edward Island	5	10	6	4	6
Alberta	7	3	3	NA	7
Saskatchewan	8	7	10	NA	8
Newfoundland & Labrador	9	8	8	8	9
British Columbia	10	5	4	1	10

Executive summary table 4: Summary of provincial ranks for freight transportation

	Highway	Air	Rail	Marine	Overall rank
Newfoundland & Labrador	4	6	1*	1	1
Nova Scotia	4	4	1*	3	2
New Brunswick	7	9	1*	5	3
British Columbia	8	3	4	7	4
Ontario	1	1	8	4	5
Quebec	2	2	7	6	6
Saskatchewan	9	8	5	NA	7
Prince Edward Island	4	10	NA	8	8
Manitoba	3	7	9	2	9
Alberta	10	5	6	NA	10

*Tie.

Introduction

Issues

Transportation systems provide the accessibility by which people get to jobs and recreation, trade in goods and services, interact with other regions, and develop land. History is replete with examples of transportation systems providing the key ingredient leading to economic advancement. For example, in the 1700s, Canada's "York boat" provided the innovative river transportation needed for efficient economic development of the fur trade. In the 1800s, the Canadian railroad system led to economic cohesiveness for the new nation.

These examples demonstrate how a region's transportation system is a critical factor in its economic viability. The extent, use, cost, and impacts of transportation systems are often considered key "factors of production" in facilitating growth and economic health. Yet transportation systems are also costly to build and maintain, and they also generate other direct and indirect benefits and impacts. In short, transportation systems provide a key base on which the economy of a nation rests.

The 10 provinces of Canada vary widely in the characteristics of their transportation systems. Moreover, highway and urban transit systems vary substantially both between and within provinces. In the larger cities, congestion is an important issue. Some provinces are distant from the federal government seat while others are close; some are near international borders while others are distant. Some have extensive rail-based freight service while others are landlocked or excel in marine service, and still others have adequate or limited airline service. There are also wide differences in the availability of data describing the systems. These factors mean that system performance is likely to vary widely depending on the measures selected. It follows that policy views of how to improve each province's systems will therefore also vary considerably.

Recognizing the importance of transportation performance to the economic health of the provinces, the Fraser Institute has undertaken a study to gather basic comparative information on the 10 transportation systems. The goal of the study is to organize and compare the 10 provinces on transportation system performance, considering all modes and circumstances. This study is not intended as criticism of the efforts of many dedicated and professional transportation managers and employees in numerous agencies. Rather, its intent is to improve transportation performance nationwide by establishing key baseline information that can be used to track performance over time. Further, it does not specifically attempt to explain performance

by relating performance measures to demographic, weather or climate, or economic activity.

The use of comparative performance assessments in Canadian transportation issues is not as prevalent as it is in the US. In our recent review of the professional transportation performance literature pertaining to Canada, we found about 100 recent references to transportation performance, but most of these dealt with comparisons of pavement performance at selected pavement test sites (Transportation Association of Canada, 2003). However, several more general efforts stand out. A nationwide study of the linkage between infrastructure and economic performance (Waters and Jiang, 2000) used data for the 10 provinces from 1961 to 1997 to estimate an aggregate “production function” relating provincial gross domestic product to labor, capital, and public infrastructure. The study found modest correlations that were similar to results for the US. Public capital investment was significant and had a greater impact on economic performance than private capital investment. It also showed declining influence between transportation investment and economic performance over time. A comparison of pavement condition reporting methods, referred to in this report (Transportation Association of Canada, 2006), found wide variations in methodology but did not compare the provinces on road condition. The National Energy Board has recently developed a performance assessment of pipeline safety using six indicators and a number of provincial ministries of transport have been active in performance measurement (CNEB, 2003). The province of Alberta has developed a road rating system based on condition, functional adequacy, and utilization/level of service and used it to forecast highway needs and set budget priorities (Jurgens, 2005). Nova Scotia has developed a detailed method of tracking maintenance performance using both condition surveys and customer satisfaction (Richard, 2003). The professional literature is reviewed briefly in Appendix C.

There are many ways to measure transportation system performance. The view taken in this report is that transportation performance and efficiency in each province contributes to that province’s overall economic performance, *but also to the performance of other provinces*. For instance, improvements to a road system in one province affect the quality of access to *other* provinces for passenger and freight service. This holistic view avoids internal “efficiency” measures of activity, such as projects accomplished. Instead, the review focuses on system use (traffic) versus cost to taxpayers and measures of results such as travel times, system condition, congestion, and safety. We believe that this approach is consistent with comparisons of provinces on entrepreneurial opportunities and business climate, as in the Fraser Institute’s annual business entrepreneur report (Clemens et al., 2007). However, it may produce results that differ significantly from other assessments, particularly those prepared by operating agencies that focus on internal measures.

Methodology

The methods used in this study are generally straightforward compilations of data from published sources. The following steps outline the process.

Statistical summaries of modal transportation data were obtained from various modal or agency websites and published reports. The detailed source for each data item is provided in Appendix B. The focus is on provincial data, but data for the territories is also shown where available (it is not included in the ratio calculations). Data are primarily for transportation modes operating within provinces rather than government agencies such as a provincial government. Because the resulting system performance is therefore a joint product of actions of both agencies and the private sector, this report should not be viewed as an assessment of government functions.

By reviewing available data for the 10 provinces, an initial listing of key performance statistics was prepared for each mode, focusing on use, government costs, accessibility, safety, and system operation.

Modal data was organized into spreadsheets by time, period, and province. Appropriate map-based data files were also prepared. Data are generally for the latest year available. [1]

Data items were compared with prior years for consistency. When large discrepancies appeared, data were fact-checked by contacting agencies by e-mail or telephone. Inconsistencies in reporting for various measures were also resolved or identified.

Measures of performance for each transportation mode were then developed using comparable data across provinces and statistics relevant to each mode. Different measures were used for each transportation mode, allowing relevant statistics to be independent for each mode. The mathematical structure of this method is outlined in Appendix B.

To consolidate the various measures, performance ratios were then computed for each measure according to each province. The provincial “performance ratio” for each measure is the ratio of one province’s measure to the weighted mean across 10 provinces (a measure of the total performance of the 10 provinces, rather than the average of their measures). This method provides a comparison of how each province is doing against others while permitting a wide variety of measures to be used. Several measures are inverted for ease in computation since it is useful to have all measures increase as performance worsens. Therefore, low values of performance ratios mean that the measure is better than the average, and high values mean it is worse than average. Although other ratios could have been used (i.e., medians) this would

¹ Relevant data is continuously being reported, and, since the preparation of this report (October 2007), more recent data has become available for a number of measures. These will be incorporated into later revisions.

have required estimation of an additional statistic (the median) and given less consideration to the larger provinces.

The individual performance ratios for each transportation mode/province were then averaged to determine an average performance ratio for each transportation mode/province. This method gives each measure equal weight within each transportation mode and allows for other measures to be added later. In future studies, measures might be weighted differently if a consensus on weights can be developed.

Overall passenger and freight performance ratios for each province were then developed by weighting the modal performance ratios by national modal shares of person trips and freight tonnes. This approach weights each measure by its share of traffic and also permits later tests for sensitivity so that the overall impact of assumptions on the results can be determined. However, the individual performance ratios are retained for subsequent analysis.

Finally, the passenger and freight performance ratios for each province are weighted according to the national share of travel (person trips and total freight tonnes) to determine the overall performance ratio for each province. Supporting material (background economic trends, references, data tables, websites, etc.) is shown in the appendices.

Table 1 shows how the ratings are determined. A total of 23 separate measures are used. Measures are weighted equally within mode of transportation. Modal weights are based on the percentage of traffic (person trips or freight tonnes) nationally by mode of transportation (provincial weights were not used because data for some modes were not available for individual provinces). Overall weights are based on the percentage of total national traffic (person trips or freight tonnes) that is either passenger or freight.

The use of measures of accessibility—that is, travel times to the US border and to Ottawa—is particularly noteworthy. These measures reflect the relative ease of access to key points. Even though they are partially dependent on mere geography, they are also subject to change over time and reflect the interactions of provinces with each other. They are also widely used by tourists and businesses in making travel and economic decisions.

Several other measures are conspicuously absent. Transit and air cargo fatal accidents, while certainly useful measures of performance, are so rare that even single occurrences can introduce wide fluctuations in regional performance. Other statistics, such as percent of province urbanized or percent of land devoted to transportation facilities, might also have been included. However, these are not strictly measures of transportation performance, there being no direct link to a “standard.” Several measures we do use (transit ridership per capita served, truck traffic per employee) do relate transportation use to relevant background statistics. Concerning other statistics, such as air pollution or energy use, these measures are important but are not the

Table 1: Measures of transportation performance for Canadian provinces

Mode	Dimension	Measure	Measure weight	Modal weight (trips or tonnes)	Grand weight (trips and tonnes)
Passenger					90%
Highway	Traffic	Vehicle-km of travel per two-lane km of road	1/8	96.50%	
	Cost	Prov. expenditures per km, major road	1/8		
	Condition	Percent of major roads in fair or poor condition	1/8		
	Access	Travel time to Ottawa	1/8		
	Access	Travel time to US border	1/8		
	Safety	Fatality rate per billion vehicle km	1/8		
	Congestion	Annual hours of delay per capita	1/8		
	Access	Average round trip commuting time	1/8		
Transit	Traffic	Ridership per capita served	1/2	3.24%	
	Cost	Operating cost per trip	1/2		
Air	Traffic	Passengers per flight	1/2	0.17%	
	Safety	Accidents per million passengers	1/2		
Rail		Not evaluated (see discussion in text)		0.01%	
Marine	Traffic	Government operating cost per passenger	1/2	0.08%	
	Safety	Accidents per million passengers	1/2		
Freight					10%
Highway	Traffic	Tonnes of truck traffic per km of road	1/3	23.80%	
	Safety	Fatal collisions per million tonnes	1/3		
	Trade	Total employment per truck border crossing	1/3		
Air	Traffic	Tonne of cargo per flight	1	0.10%	
Rail	Traffic	Origin tonnes per km of first line track	1/2	27.20%	
	Safety	Rail accidents per mill. originating tonnes	1/2		
Marine	Traffic	Port oper. expenditures per tonne handled	1/3	48.90%	
	Cost	Port expense/revenue ratio	1/3		
	Safety	Shipping accidents per million tonnes	1/3		

key elements of performance, and are therefore deferred for inclusion in later editions.

The trip versus freight grand weights (90/10%) are based on our observation that more than 10 times as many one-way person trips are made as are tonnes shipped. These weights place considerable importance on highway person travel, marine freight traffic, and on person travel relative to freight traffic. While these proportions might initially seem unfair, they *do* reflect the proportions of traffic as trips and by tonne. Weighting in another fashion would not be reflective of the on-the-ground situation in most of Canada. Recognizing the sensitivity of the analysis and even the findings to the weights, we believe that, while other policy-driven weights might be suggested (e.g., weight by passenger-kilometers, tonne-kilometers, value of goods, weights by provincial shares, etc.), the current method seems reasonable for an initial analysis.

An additional point on methodology is that the procedure here relies on simple statistics and ratios and avoids more complex methods. This is done purposely so that the provinces can be compared as clearly as possible without the prism of complex statistics, which generally do not hold for small samples such as the 10 provinces. Future studies can explore these more complex methods.

Overall findings and performance ratings for Canadian provinces

Our overall findings are summarized in table 2. On balance, Ontario has the best overall transportation system performance, relative to the average of the 10 provinces, followed by Nova Scotia and Quebec. At the other end, British Columbia and Newfoundland & Labrador have the lowest overall ratings.

Ratings vary considerably by transportation mode (i.e., Ontario is top rated for passenger transportation but fifth for freight; British Columbia is rated tenth for passenger transportation but fourth for freight). These differences reflect the different operating conditions for different transportation modes in the provinces. However, six provinces (Nova Scotia, Quebec, New Brunswick, Prince Edward Island, Alberta, and Saskatchewan) are rated similarly on passenger and freight.

The top three provinces (Ontario, Nova Scotia, and Quebec) are quite close in overall performance, the next two provinces' performance ratios are within about 15% on the overall performance ratio, and several others are close to that (figure 1). In total, six provinces are within 30% of each other in performance. This means that policy changes or changes in traffic could change results,

Table 2: Overall performance ratios and ranks, Canadian provinces

	Passenger transportation		Freight transportation		Combined		Percent of max**
	Performance ratio*	Rank	Performance ratio*	Rank	Performance ratio*	Rank	
Ontario	0.77	1	1.14	5	0.80	1	1.00
Nova Scotia	0.82	2	0.91	2	0.83	2	0.95
Quebec	0.89	3	1.14	6	0.92	3	0.83
Manitoba	0.95	4	1.41	9	1.00	4	0.72
New Brunswick	1.04	5	0.98	3	1.03	5	0.67
Prince Edward Island	1.04	6	1.38	8	1.07	6	0.62
Alberta	1.13	7	1.67	10	1.18	7	0.46
Saskatchewan	1.48	8	1.25	7	1.45	8	0.08
Newfoundland & Labrador	1.53	9	0.84	1	1.46	9	0.06
British Columbia	1.55	10	1.13	4	1.51	10	0.00

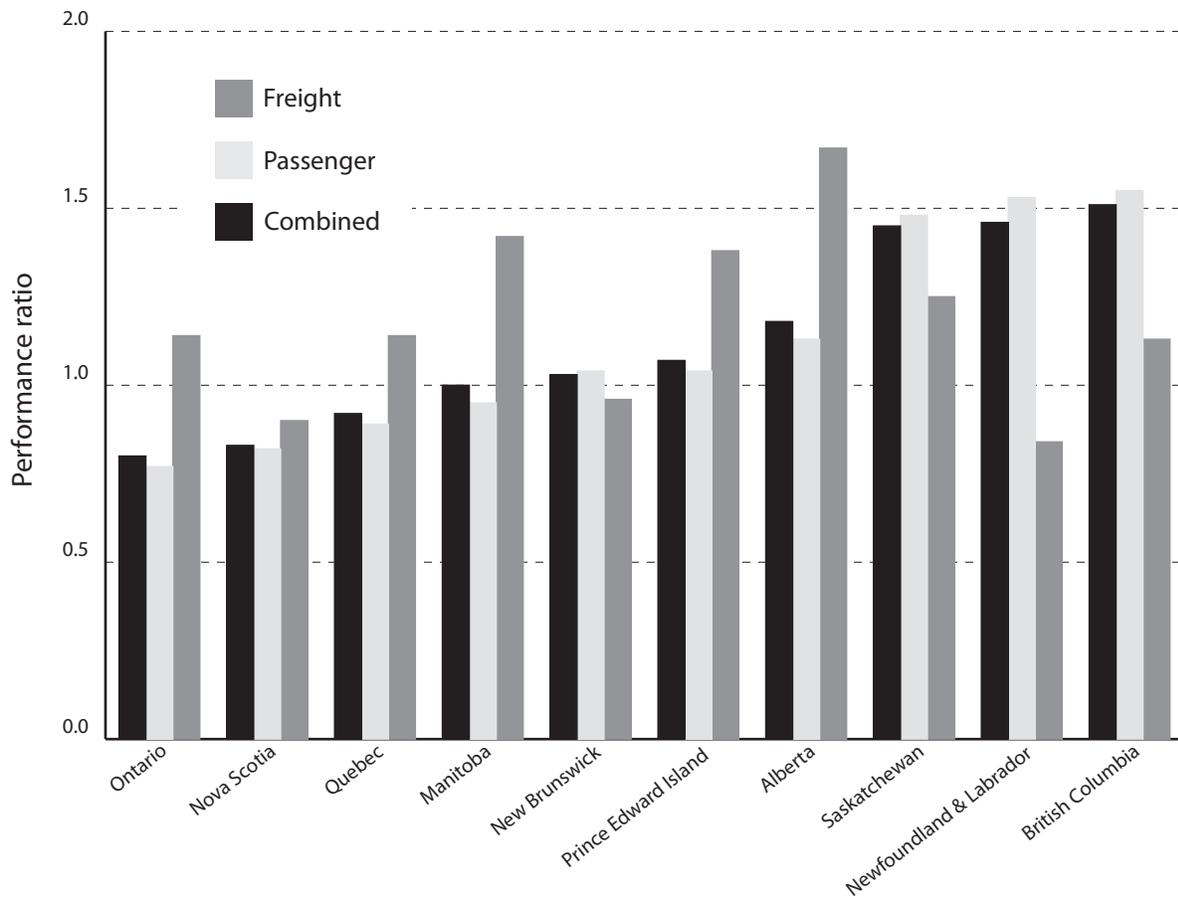
*The "performance ratio" is the ratio of province statistics to the 10-province average, weighted over all measures. A higher ratio means the province performs worse; a lower ratio means the province performs better.

**The degree to which the provincial performance nears the performance of the best-rated province. Computed as $[(1.51 - \text{provincial performance ratio}) \div (0.71)]$.

suggesting a continuing contest for top honors in the future. On the other hand, several provinces have circumstances that would be very difficult to overcome without very significant changes in traffic, costs, impacts, or efficiency.

Generally, eastern provinces rate higher than western provinces. Eastern provinces typically have higher traffic levels per unit of system or service and higher levels of accessibility through more extensive networks. Generally, western provinces are less accessible (more distant in time from Ottawa) and have less traffic per unit of road length (or unit of service), higher accident rates, and lower freight volumes (BC is an exception). These more than offset their generally lower costs (again, BC is an exception) and lower congestion. British Columbia is rated tenth in passenger travel (worst in congestion, highest road costs per kilometer, highest accident rates, longest travel time to Ottawa), but fourth in freight (efficient port and rail use, truck border crossings). Appendix A provides a detailed assessment of each province's circumstances.

Figure 1: Provincial transportation performance ratios



Passenger transportation

Highway

In the measurement of highway system performance, we focus on five key dimensions: system extent, use, access, cost, and impacts (condition, congestion, and safety).

Other dimensions might be added (i.e., air pollution or personal driving costs), but the chosen dimensions would certainly be considered in an initial assessment. Therefore, these other dimensions are left for later editions of the report.

System extent, use, and traffic density

The extent of each provincial highway system is an important measure of system availability for potential users (figure 2). In this study, highway system extent is measured by the length of the system in various jurisdictional categories. Table 3 summarizes the information.

The road system of Canada is about 1.41 million km in length, of which about 84% (1.19 million km) is locally classified. Among the 10 provinces, the most extensive highway system, in total, is that of Saskatchewan, at 250,000 km, followed by Ontario and Quebec. The smallest system, 6,500 km, is the Prince Edward Island system. The higher-function system, consisting of freeways, primary roads, and secondary or major arterials, is about 217,300 km in length for Canada as a whole.

Of course, these statistics are not adjusted for the geographical size of each province. A straightforward adjustment by size would produce an overall road density measure but would not account for wide variations in road use. A better measure is the relative traffic use (average traffic per kilometer of road), particularly on the major roads. Major road systems, largely provincially owned, serve as the economic backbone of each province and provide the means for trade, long-distance commuting, and tourism to occur. When measured according to traffic density—that is, the average daily traffic per kilometer of major road length—the overall utilization effectiveness of the primary system can be determined. This measure is an important indicator of the effectiveness of the higher road system and of the provincial transportation ministry’s focus on high-traffic facilities.

To ensure that all of our measures run the same way (where higher values indicate poor performance), we use road length per unit of traffic. This is interpreted as the amount of road length (in two-lane kilometres) [2] associated

2 Two-lane kilometer is the standard measure of road length in Canada.

Table 3: Canadian highway system length and use, 2004

	Billions of VKT*		Thousands of two-lane kilometers					Total
	2004	2005	Freeway	Primary	Secondary highway/ major arterial	Sub-total, major roads	Local roads	
Alberta	38.6	44.1	1.4	15.5	17.3	34.2	171.1	205.3
British Columbia	34.6	32.9	1.3	9.9	5.2	16.4	188.5	204.8
Manitoba	10.4	11.0	0.2	8.2	10.8	19.2	85.3	104.5
New Brunswick	7.3	7.8	1.3	1.5	6.2	9.0	67.5	76.6
Newfoundland & Labrador	3.7	4.4	0.2	1.4	5.4	7.0	20.1	27.1
Nova Scotia	9.6	10.0	1.6	2.8	3.3	7.7	40.9	48.7
Ontario	122.1	125.0	5.7	10.2	34.2	50.1	180.4	230.6
Prince Edward Island	1.2	1.3	—	1.3	2.2	3.5	2.9	6.5
Quebec	71.7	66.4	5.0	10.9	15.1	31.0	197.3	228.3
Saskatchewan	11.5	11.1	0.1	20.5	12.6	33.2	216.8	250.3
10 provinces	310.9	314.4	16.8	82.2	112.3	211.3	1,170.8	1,382.7
Northwest Territories	0.3	0.4	—	0.8	1.3	2.1	8.1	10.1
Nunavut	0.0	0.0	—	—	—	—	0.1	0.1
Yukon	0.5	0.5	—	2.6	0.9	3.5	12.5	16.1
Canada	311.8	315.3	16.9	85.8	114.6	217.3	1,191.6	1,408.8

*A “vehicle-kilometer of travel” (VKT) is defined as one vehicle traveling one kilometer, and is a standard unit of travel in transportation studies.

with one million annual vehicle-kilometers of traffic. Overall, the road system of the 10 provinces has about 4.45 kilometers of road per 1 million vehicle-kilometers of travel (VKT), or about 616 vehicles per day (table 4). Provinces with a high ratio on this measure have less dense traffic and, consequently, less traffic per system length. On the other hand, provinces with low ratios have relatively high traffic density. Table 4 shows the comparison. Overall, Ontario has the

Table 4: Road length needed to serve one million annual vehicle-kilometers of travel (VKT)

	Implied average traffic, vehicles per day	Total two-lane km per million VKT, 2004	Ratio of province to 10-province average	Rank
Ontario	1,450	1.89	0.42	1
Quebec	862	3.18	0.72	2
Nova Scotia	537	5.10	1.15	3
Prince Edward Island	519	5.28	1.19	4
Alberta	515	5.32	1.20	5
British Columbia	463	5.91	1.33	6
Newfoundland & Labrador	377	7.26	1.63	7
Manitoba	273	10.01	2.25	8
New Brunswick	262	10.44	2.35	9
Saskatchewan	126	21.68	4.88	10
10 provinces	616	4.45	1.00	
Northwest Territories	84	32.70		
Nunavut	810	3.38		
Yukon	91	30.25		
Canada	606	4.52		

lowest number (that is, the highest traffic density)—1.89 km of road serving one million annual vehicle-kilometers of travel—while the highest statistic (least traffic per unit length) is in Saskatchewan, just one tenth of Ontario’s traffic density. In other words, relative to length, Ontario’s roads have about 10 times as much traffic as Saskatchewan’s.

Of course, this calculation still does not account for wide variations in traffic volumes *within* provinces, but it does give an indication of the relative use of the 10 provincial road systems. Canadian cities have long-range transportation plans that place varying degrees of importance on highway and transit improvements (Palmer, 2007, September 11).

Provincial expenditures for roads

In conjunction with system extent, provincial expenditures for the maintenance and improvement of the road system are a basic measure of performance. A good measure of the fiscal performance of a system is how much money is being expended on it, per unit of length. Our measure of expenditure is net provincial expenditures per two-lane kilometer of freeway-primary road system. This indicator essentially adjusts the road budget for each province by a measure of

road length approximating its responsibility. [3] It includes both operating funds and capital expenditures but removes transfer payments to local governments. From a taxpayer perspective, a low expenditure per kilometer of responsibility is preferable since it indicates fiscal prudence. However, that must be balanced against the need to maintain the system over its entire length. All provinces have an ongoing road upgrade program that provides additional capacity and safety as well as better access (Walker, 2007, September 18; Bellavy, 2007, August 28; Nolan, 2007, August 10; *Canoe Money*, 2007, May 11).

Table 5 summarizes the results. Overall, the 10-province non-local road system, which measures about 211,300 km, has an annual expenditure of about \$7.562 billion, or about \$35,788 per km (coincidentally, this is about half the US average expenditure—\$70,000 per km). British Columbia, with about 16,400 km of non-local roads, has an operating budget of about \$2.216 billion, or about \$135,122 per km, almost four times the national average, while Saskatchewan, with a budget of \$256 million and a non-local road system of 33,200 km, spends just \$7,711 per km. Therefore, from a cost-effectiveness perspective, the Saskatchewan system is about 17 times as efficient as the BC system, assuming similar performance.

Of course, some provincial road managers would immediately point out that the provinces are not comparable. For example, British Columbia has road traffic, congestion, cost-of-business, weather, terrain, and climatic conditions that are vastly different from Saskatchewan. That might be, but other provinces might counter that they do not have the fiscal resources that the more populous provinces have and, therefore, are constrained as to actions they can take. Following this logic, one would be quickly led to the absurd conclusion that no comparisons between provinces are ever possible. Our view is that, even with different circumstances, each province is responsible for the road system's upkeep and expansion using the resources it has. And each province is dependent on others for accessibility, since modal systems connect provinces. Therefore, a measure that shows how much each province has to work with, relative to system and size, is a useful comparative measure of resources that should translate into results.

Road budgets tend to be relatively stable over time, but occasionally there is a major capital expenditure, as for a fix-up initiative. In our measure, such an infusion of funds would be treated as a negative unless it also produced improvements in capacity, travel time, safety, or surface condition which offset the increased expenditure. This is appropriate since it would not be politically or fiscally prudent for a major capital expenditure not to have an effect on system performance.

3 Our measure of extent does not include bridges, which may vary substantially in age and number by province. Sufficient data was not available from all provinces to permit their inclusion.

Table 5: Provincial road costs per kilometer of major road

	Net provincial expenditures, millions of dollars	Two-lane km, freeway, primary, secondary/major arterial roads (non-local; thousands)	Expenditures per two-lane km, thousands of dollars	Ratio of province to 10-province average	Rank
	2004/05	2004	2004/05		
Saskatchewan	256	33.2	7,711	0.22	1
Manitoba	288	19.2	15,000	0.42	2
Newfoundland & Labrador	121	7.0	17,286	0.48	3
Prince Edward Island	74	3.5	21,143	0.59	4
Alberta	799	34.2	23,363	0.65	5
Nova Scotia	190	7.7	24,675	0.69	6
Ontario	1,807	50.1	36,068	1.01	7
New Brunswick	332	9.0	36,889	1.03	8
Quebec	1,479	31.0	47,710	1.33	9
British Columbia	2,216	16.4	135,122	3.78	10
10 provinces	7,562	211.3	35,788	1.00	
Northwest Territories	28	2.1	13,333		
Nunavut	—	—	—		
Yukon	57	3.5	16,286		
Canada	7,649	217.3	35,200		

System condition

Road condition is a fundamental measure of system performance. Most nations use commonly accepted means of both measuring road condition and reporting it. In the US, the common measure of condition (for the higher-class roads) is the International Roughness Index (IRI), which is essentially a measure of the vertical variance (that is, bumpiness) in the surface of a road per unit of distance. This measure is mandated for use in rating the higher systems in the US, and most states (with just a few exceptions) use it. The resulting uniformity of reporting has enabled the development of periodic condition reports to the US Congress (USDOT, 2007).

In Canada, the situation is not so straightforward. There is no mandated rating system for road condition and the 10 provinces use a variety of methods. Most use some variant of the IRI method, but with different cutoff points for “poor,” “fair,” “good,” or “excellent”; they also apply the ratings to different road classes. A few use visual rating systems based on observations

of signs of distress. [4] There are also differences in reporting frequency: some provinces summarize and report the results regularly, others less frequently. Appendix B to this report provides an overview of the different methods used in the 10 provinces.

In this initial review of road conditions, we have elected to use the reported statistics from each province: their own assertions of what constitutes “good” versus “fair or poor” condition. This less-than-satisfactory procedure is based on the belief that the use of not-totally-comparable data is better than no use, given the importance of the topic. Hopefully, as more attention is placed on this topic, data standardization will improve over time.

Table 6 summarizes the findings from our review of road conditions, as reported by the provinces. Understanding that the measurements, definitions of “fair or poor” condition, roads surveyed, and age of the data vary, the table suggests that, overall, about 26.6% of the Canadian major road system is rated “fair or poor.” We use “fair or poor” as the criterion because roads rated “poor” would generally require reconstruction, while those rated “fair” would generally require overlays or lighter repairs. However, road condition varies considerably by province (and possibly by system), from just 4.2% poor (just 16% of the national average) in Nova Scotia to 41.0% poor (1.54 times the national average) in Ontario.

Because of measurement and definition differences, the actual differences between road conditions in the provinces may not be as large as suggested here, and the result might require a change in rank order. However, because numerous measures are used, the effect of this one statistic on overall ranks is quite small. For example, Nova Scotia’s overall rating would remain first in overall road performance even if its percentage of “fair or poor” roads were 45%. Particular attention should be paid in the next several years to generating comparable data on basic road indicators, including condition, so an accurate view of the overall condition of the system can be obtained.

Another important aspect of condition data is the extent to which it correlates to expenditures. To begin assessment of this question, we show a map (figure 3) relating the percentage of “fair or poor” pavement to the percentage of provincial budgets spent on maintenance. The map suggests that those provinces which are spending more on maintenance have lower percentage of roads in “poor” condition. [5]

-
- 4 Common visual distress signs include lengthwise and horizontal cracks, surface peeling, potholes, corner cracks, and edge drop-offs.
 - 5 A simple regression between “percent good” and “proportion spent on maintenance” suggests that a 0.10 increase in the maintenance proportion (from 0.4 to 0.5, for example) would increase the percentage of good condition roads by about 4.2 percentage points. However, the model is quite weak, $RSQ = 0.24$.

Table 6: Road condition, 2005–06

	Percent of primary highways in “good” or better condition	Percent of primary highways in “fair or poor” condition	Ratio of province to 10-province average	Rank
Nova Scotia	95.8	4.2	0.2	1
New Brunswick	86.1	13.9	0.5	2
Manitoba	80.1	19.9	0.8	3
Saskatchewan	77.0	23.0	0.9	4
Newfoundland & Labrador	74.6	25.4	1.0	5
British Columbia	74.0	26.0	1.0	6
Alberta	63.0	37.0	1.4	7
Prince Edward Island	62.6	37.4	1.4	8
Quebec	62.1	37.9	1.4	9
Ontario	59.0	41.0	1.5	10
10 provinces	73.4	26.6	1.0	

Intercity driving times

Over the past several decades, the road system of Canada has improved considerably in accessibility as speeds and road quality have improved and driving times between major cities have declined. While these changes are occurring relatively slowly, over a period of time they can have a substantial effect on both personal and freight travel choices.

There are a variety of ways to measure changes in accessibility, but one of the easiest to understand is a simple measure of drive time between key major points. For our measures, we chose travel time, in hours, from each province’s major cities to Ottawa, the national capital, and travel time, in hours, to the US border. The first is a measure of how accessible (in time) each province’s major cities are from the national capital, primarily along east-west movement. Although Ottawa may not be as important an economic center in Canada as Washington DC is in the US, we use it as a base point for measuring changes in driving times because it is a central point in east-west movement for both personal and freight traffic. The second measures accessibility (in time) from Canada’s major trading partner, and focuses primarily on the north-south movement important to truck traffic. The source of the information is data from contemporary driving maps for Canada, as published by Rand McNally.

Table 7 shows the results of the analysis. On average, British Columbia is the most distant in time from Ottawa, at 43.8 hours, while Quebec is the closest, at 3.1 hours. BC is more than twice the average travel time to Ottawa for all provinces, 20.2 hours. On the other hand, the province most distant

Table 7: Intercity drive times, 2007

	Average drive time to Ottawa	Ratio of province to 10-province average	Rank	Average drive time to US border	Ratio of province to 10-province average	Rank
Quebec	3.1	0.2	1	1.3	0.3	4
Ontario	8.2	0.4	2	0.9	0.2	2
New Brunswick	10.6	0.5	3	1.6	0.4	5
Prince Edward Island	13	0.7	4	4.9	1.1	7
Nova Scotia	15.5	0.8	5	5.9	1.3	9
Manitoba	20.1	1.0	6	1.1	0.2	3
Saskatchewan	26.6	1.3	7	3.8	0.9	6
Newfoundland & Labrador	27.9	1.4	8	19.4	4.3	10
Alberta	32.8	1.6	9	5.3	1.2	8
British Columbia	43.8	2.2	10	0.5	0.1	1
10 provinces	20.2	1.0		4.5	1.0	
Northwest Territories	53.2			—		
Nunavut	—			—		
Yukon	51.2			—		
Canada	25.4			4.5		

from the US border is Newfoundland & Labrador, at 19.4 hours, more than four times the average drive time to the border, 4.5 hours.

These travel times have been improving slowly. In 1989, the drive times to Ottawa were about 17% longer, on average, and travel times to the US border were 1.3% longer, according to comparisons between 1989 and 2007 travel time maps. One of the largest changes was for Prince Edward Island, where the opening of the new bridge to New Brunswick substantially improved access. These changes have not only improved cross-country personal driving and tourism, but they have also affected freight travel, saving time for shipments and increasing reliability.

Highway fatality rates

Highway fatality rates are a basic measure of road system performance, and statistics are maintained in substantially similar fashion across nations and provinces. For the 10 provinces as a whole, the 2005 overall rate was 10.7 fatalities per billion vehicle-kilometers of travel. Fatality rates in Canada have been declining slowly over time, as they have in most nations.

Across the 10 provinces, fatality rates vary by about two-to-one. The highest rate, 13.9, is recorded in British Columbia; the lowest, 6.3, in Ontario. Table 8 summarizes Canadian provincial fatality rates for 2004 and 2005.

Table 8: Provincial highway fatality rates

	Fatalities per billion vehicle-km		Ratio of province to 10-province average, 2005	Rank
	2004	2005		
Ontario	6.6	6.3	0.6	1
Nova Scotia	9.4	7.1	0.7	2
Newfoundland & Labrador	9.7	9.8	0.9	3
Manitoba	9.5	10.3	1.0	4
Alberta	9.9	10.6	1.0	5
Quebec	9.0	10.6	1.0	5
Prince Edward Island	22.6	11.3	1.1	7
Saskatchewan	11.0	13.2	1.2	8
New Brunswick	9.6	13.6	1.3	9
British Columbia	12.4	13.9	1.3	10
10 provinces	11.0	10.7	1.0	
Northwest Territories	9.6	5.4		
Nunavut	33.7	—		
Yukon	9.4	12.3		
Canada	8.8	9.3		

Traffic congestion

A recent study from Transport Canada provides a partial comparative assessment of the costs of congestion [6] in major Canadian cities (Transport Canada, 2005). Unfortunately, the study covers just nine cities in five provinces and does not include smaller cities which may have some modest congestion. Therefore, some provinces are missing from the analysis. However, because of the importance of congestion in transportation performance, we include this factor for the provinces available. Hopefully over time the study will be repeated and expanded to more cities.

The measure selected for congestion is the annual vehicle hours of delay, per capita, at a congestion level of 70% of free-flow speed or higher (table 9). This is the congestion roughly comparable to that of level-of-service E, in which driving speeds average about two thirds of free-flow speeds. According to the data, British Columbia (Vancouver only) has the highest number of annual hours of delay per capita—about 13 hours, almost twice the study average.

These numbers should be put in perspective. An average “delay” of 7.05 hours per person per year works out to about 1.7 minutes per commuter

6 Traffic congestion can be defined in several ways. Here we define it as “the delay in traffic caused by the presence of other vehicles.”

Table 9: Traffic congestion, 1992–2003*

	Annual vehicle hours of delay per capita (VHT per person) at 70% threshold	Ratio of province to 5-province average	Rank
New Brunswick	—		
Newfoundland & Labrador	—		
Nova Scotia	—		
Prince Edward Island	—		
Saskatchewan	—		
Ontario			
<i>Hamilton, Toronto (2001)</i>	5.3	0.75	1
<i>Ottawa-Gatineau (1995)</i>			
Manitoba			
<i>Winnipeg (1992)</i>	6.7	0.95	2
Alberta			
<i>Edmonton (2000), Calgary (2001)</i>	7.25	1.03	3
Quebec			
<i>Montreal (1998), Quebec (2001)</i>	8.4	1.19	4
British Columbia			
<i>Vancouver (2003)</i>	13	1.85	5
Five provinces	7.05		
Northwest Territories	—		
Nunavut	—		
Yukon	—		
Canada	7.05		

*Congestion data is for urbanized areas; years for congestion data vary by area.

trip, [7] or about 6% of a 30 minute commute. This is certainly a modest delay, compared with many US cities which have 30 to 50 hours of delay per year. So, while congestion is clearly increasing as a problem in major Canadian cities, it is clearly less a problem here than in other nations. Furthermore, there seems to be little consensus as to what should be done to alleviate congestion. Little support exists for pricing solutions, but calls for more road capacity are not popular either (Gray, 2007, September 10; Byers, 2007, January 27; Boomer, 2007, April 4).

7 $(7.05 \text{ hours per year}) \div (250 \text{ days per year}) \div (\text{two trips per commuter}) \times (60 \text{ minutes per hour}) \times (\text{two persons per commuter trip})$

Commuting time

Another important measure of road system performance is the time spent commuting. While this measure is related to congestion, it also reflects the spread of cities and the tendency for new development to be located in suburbs at the edges of cities which often have longer commutes, as well as commuter work, mode, and housing preferences. Improved accessibility is often reflected in greater livability and sometimes in land values (Toneguzzi, 2007, September 18).

Periodic surveys of commuting time are conducted by Statistics Canada. Table 10 and figure 4 show the average commuting times, round trip from home to work, for summarized data by province since 1992. In all provinces, average round-trip commuting times have been increasing, with a 10-province average of about 59.8 minutes in 2005, up about 20% in 13 years. This data is comparable to the US averages for larger cities—about 55 to 60 minutes round-trip.

The data indicate that Ontario (Toronto, Ottawa, Hamilton) have the longest round trip travel time, about 68 minutes, while several provinces (New Brunswick, Newfoundland, Nova Scotia, Prince Edward Island) have the shortest times, about 51 minutes. While these latter times may seem long, it should be remembered that these are two-way commuting travel times and include transit riders, for whom travel times are typically about 1.5 to 1.7 times drive-alone times. Overall, the best performance is about 15% below the 10-province average, while the longest commute time (Ontario) is about 8% longer than the 10-province average.

Table 10: Average commute times, round trip

	Average round trip travel time between home and workplace, minutes			Ratio of province to 10-province average, 2005	Rank
	1992	1998	2005		
New Brunswick	39	50	51	0.85	1
Newfoundland & Labrador	39	50	51	0.85	1
Nova Scotia	39	50	51	0.85	1
Prince Edward Island	39	50	51	0.85	1
Alberta	45	53	57	0.95	5
Manitoba	45	53	57	0.95	5
Saskatchewan	45	53	57	0.95	5
British Columbia	59	61	60	1.00	8
Quebec	52	57	63	1.05	9
Ontario	59	63	68	1.14	10
10 provinces	50.8	56.8	59.8	1.00	

Overall performance for highway passenger travel

Consolidating the above performance ratios for eight measures (seven, for those provinces without congestion statistics) and weighting each measure equally, table 11 summarizes highway passenger performance for the 10 Canadian provinces. Overall, Ontario is rated first, based on high utilization of the road system (first), travel time to the US border (second) and to Ottawa (second), low fatality rate (first), and low congestion delay (first). On the other hand, British Columbia is rated tenth, based on its high accident rate (tenth), high government expenditure per kilometer (tenth), and high congestion (fifth out of the five provinces for which data is available for this measure). Appendix A contains more details concerning the ratings for each province.

Table 11: Overall performance, highway passenger travel

	Sum of performance ratios	Average modal performance ratio	Rank
Ontario*	6.07	0.76	1
Nova Scotia	5.60	0.80	2
Quebec*	7.16	0.90	3
Manitoba*	7.52	0.94	4
Prince Edward Island	6.85	0.98	5
New Brunswick	6.91	0.99	6
Alberta*	9.02	1.13	7
Saskatchewan	10.32	1.47	8
Newfoundland & Labrador	10.56	1.51	9
British Columbia*	12.52	1.57	10

*The averages for these provinces are based on eight measures; the averages for all other provinces are based on seven measures.

Urban transit

These are major bus, urban rail, and commuter rail systems in the major cities (inter-city rail services offered by VIA Rail are not included). Data for this assessment comes primarily from *Transportation in Canada* and the *Quebec Public Transit Policy* study.

Urban transit trips per capita served

Canadian cities generally encourage transit use in urban areas and many cities place transit improvements at or near the center of their long-range transportation plans (Gyulai, 2007, August 17). Provincial and federal governments are typically less involved in transit policies. A key measure of transit performance is transit ridership relative to the population served. Larger cities continue to explore ways to increase transit use, which also raises costs (Logan, 2007, September 21). In some cities, notably Montreal and Toronto, citizens' ability to pay rising fares is a policy issue (*Canoe Money*, 2007, September 20; Kalinowski, 2007, September 12).

However, as figure 5 shows, transit ridership has increased less rapidly than urban population in most provinces; in some (Ontario, Manitoba), ridership has fallen in recent years. Table 12 shows the comparative use rates for the major cities in Canada's 10 provinces.

For the 10 provinces as a whole, the urban transit systems carried about 1.62 billion trips in 2004, generated from a population served of about 21.42 million persons. On average, therefore, the 10 provinces need about 13.2 persons served to generate 1,000 annual transit trips. We use this inverse ridership ratio to be consistent with other ratios where a higher value indicates a lower level of performance. This ratio varies widely, from a low of just 10.7 in Quebec to over 330 in Prince Edward Island.

Table 12 shows that it takes just 10.6 persons to generate 1,000 annual transit trips in Quebec, compared with 13.2 nationwide. On the other hand, three to five times as many persons served are needed to generate 1,000 annual transit trips in Newfoundland & Labrador and New Brunswick than the average province. Prince Edward Island's newly started Charlottetown system has a very low ridership rate, so we have reduced its performance ratio to 5.0, but it is still the highest.

Transit operating cost per trip

A common metric for transit performance is the operating cost needed to serve an individual trip. This metric is used because it reflects both operational effectiveness (cost per trip served) and also government investment in transit operations. Table 13 indicates the costs per trip for the Canadian provinces in 2004.

Table 12: Transit use per capita served, 2004

	Annual ridership, millions	Population served, millions	Population needed per 1,000 annual rides	Ratio of province to 10-province average	Rank
Quebec	509.2	5.39	10.70	0.80	1
Ontario	700.2	8.77	12.50	0.95	2
Alberta	137.9	2.07	15.00	1.13	3
Manitoba	39.4	0.64	16.20	1.23	4
British Columbia	192.6	3.29	17.10	1.29	5
Nova Scotia	17.2	0.40	23.50	1.78	6
Saskatchewan	15.8	0.45	28.10	2.13	7
Newfoundland & Labrador	3.1	0.15	46.10	3.49	8
New Brunswick	5.1	0.24	47.60	3.60	9
Prince Edward Island	0.1	0.04	330.40	5.00*	10
10 provinces	1,620.6	21.42	13.20	1	

*Edited to 5.0 from 24.99. A few inordinately high ratios were selectively edited in this study, to forestall inordinately high performance ratios. In no case did this change the rank order of provinces.

Table 13: Transit operating costs per trip

	Annual ridership, millions	Operating cost, millions of dollars	Operating cost per trip, dollars	Ratio of province to 10-province average	Rank
	2004	2004/2005	2004		
Prince Edward Island	0.1	0.1	0.94	0.58	1
Quebec	509.2	624.0	1.23	0.75	2
Saskatchewan	15.8	23.0	1.45	0.89	3
Newfoundland & Labrador	3.1	5.1	1.62	0.99	4
Ontario	700.2	1,221.0	1.74	1.06	5
Manitoba	39.4	74.4	1.89	1.15	6
New Brunswick	5.1	9.9	1.96	1.19	7
Alberta	137.9	271.9	1.97	1.20	8
Nova Scotia	17.2	34.2	1.99	1.21	9
British Columbia	192.6	395.9	2.06	1.25	10
10 provinces	1,620.6	2,662.0	1.64	1.00	

Overall, the 10 Canadian provinces served about 1.621 billion trips in 2004 at an operating cost of \$2.662 billion, or about \$1.64 per trip. Provincial operating costs per trip vary by about a factor of two, from a low of about \$0.94 per trip for Prince Edward Island’s small system (for which numbers are preliminary) to about \$2.06 per trip for British Columbia.

Overall performance for urban transit

Consolidating the two transit measures, table 14 shows overall performance for urban transit systems, by province. On balance, Quebec has the best performing urban transit system, based on the relatively low operating cost per trip and high usage rate per capita. Its performance is about 25% better than the 10-province average. At the other end, Prince Edward Island (Charlottetown) is rated poorest in performance, based on its low usage rate per capita, even though it has a low cost per trip. This is a newly started system that will hopefully improve over time.

Table 14: Consolidated urban transit performance

Urban transit	Sum of ratios	Average performance ratio	Rank
Quebec	1.55	0.77	1
Ontario	2.01	1.01	2
Alberta	2.34	1.17	3
Manitoba	2.38	1.19	4
British Columbia	2.55	1.27	5
Nova Scotia	2.99	1.50	6
Saskatchewan	3.01	1.51	7
Newfoundland & Labrador	4.47	2.24	8
New Brunswick	4.79	2.40	9
Prince Edward Island	5.58	2.79	10

Air passenger

Air passenger service performance is measured by relative effectiveness of airline service—that is, how many flights are needed to generate 1,000 air passengers annually (a measure similar to transit service effectiveness), and by accident statistics.

Traffic per flight

Although a large number of Canadian communities have airports, Canadian air passenger travel is concentrated in a few major cities, some of which connect to the US. The largest traffic volumes are between Toronto and New York, Montreal, and Vancouver, as illustrated by figure 6.

Figure 7 and table 15 show airline passenger traffic (in and out, scheduled and charter) by province, along with the number of arriving and departing flights (scheduled and charter) for 2004 (figure 7 also includes passengers by airport).

Overall, about 17.6 flights are needed to generate 1,000 passengers, or about 56.7 passengers per flight, on average. This performance measure varies from a high of 42.0 flights per 1,000 passengers for Prince Edward Island to a low of about 15.7 for Ontario. Most provinces have between 15.0 and 22.0 flights per 1,000 passengers. The resulting performance ratios for this statistic vary by about a factor of two, from a low of 0.89 (11% better than the 10-province average) for Ontario to a high of 2.38 for Prince Edward Island. In other words, Prince Edward Island needs about 2.7 times as many flights to generate 1,000 passengers as does Ontario. A proposed new airport for Toronto (Pickering) might relieve some of the Ontario growth pressure (Byers, 2007, September 6).

Table 15: Air passenger use and service, 2004

	Air passengers, millions	Flights, thousands	Passengers per flight	Flights per 1,000 passengers	Ratio of province to 10-province average	Rank
Ontario	32.9	516.6	63.8	15.7	0.89	1
Quebec	11.6	189.4	61.5	16.3	0.92	2
Alberta	13.2	216.6	61.0	16.4	0.93	3
Nova Scotia	3.0	53.1	56.6	17.7	1.00	4
Saskatchewan	1.6	28.2	55.4	18.1	1.02	5
British Columbia	18.8	381.6	49.2	20.3	1.15	6
Manitoba	3.1	69.0	45.0	22.2	1.26	7
Newfoundland & Labrador	1.3	37.6	35.2	28.4	1.61	8
New Brunswick	0.8	26.7	30.9	32.3	1.84	9
Prince Edward Island	0.2	6.9*	23.8	42.0	2.38	10
10 provinces	86.6	1,525.6	56.7	17.6	1.00	

*PEI (Charlottetown) estimated from schedules, 2007.

Air passenger accident rates

Accident rates are an important measure of performance for all modes of travel. For air passenger service, our measure of accident rate is the number of accidents per million passengers, which accounts for flight frequency and risk (some analysts use fatality rates, but the number of air accident fatalities in most provinces is so low that the overall accident rate is a better and more stable measure of performance). Table 16 shows overall air passenger accident rates for the 10 provinces.

Overall, Canada’s air passenger service (scheduled and charter) has an overall accident ratio of about 2.61 accidents per million passengers carried. Not counting Prince Edward Island, rates vary from a low of about 1.33 for Nova Scotia to a high of about 8.32 for Saskatchewan. The range of accident rates is about three-to-one. Saskatchewan has an accident rate about three times the 10-province average. Nova Scotia’s rate is just half the 10-province average. Accident rates can vary widely in the low-traffic provinces, where just one accident can affect the rate substantially. For instance, if Prince Edward Island had experienced just one air passenger accident in 2004, its rate would have been 6.06, second highest of the 10 provinces. One option for dealing with this sensitivity is to develop three-year accident rates for future editions of this report.

Table 16: Air passenger accident rates, 2004

	Number of passengers, millions	Number of accidents	Number of accidents per millions of passengers	Ratio of province to 10-province average	Rank
Prince Edward Island	0.16	0	0	0	1
Nova Scotia	3.00	4	1.33	0.51	2
Ontario	32.95	71	2.15	0.83	3
Alberta	13.22	30	2.27	0.87	4
British Columbia	18.78	45	2.4	0.92	5
Quebec	11.65	42	3.61	1.38	6
Newfoundland & Labrador	1.32	5	3.78	1.45	7
Manitoba	3.10	12	3.87	1.48	8
New Brunswick	0.83	4	4.84	1.85	9
Saskatchewan	1.56	13	8.32	3.19	10
10 provinces	86.58	226	2.61	1	

Consolidated air passenger performance

Summarizing air passenger performance, consolidation of the two measures is shown in table 17. Overall, Nova Scotia has the best performance (based on a low accident rate and high rates of passengers per flight)—about 24% better than the 10-province average. Nova Scotia is followed by Ontario, which is 14% better than the provincial average. Saskatchewan and New Brunswick have the worst performances, based on both having relatively low flight availability per 1,000 passengers and relatively high accident rates.

Table 17: Air passenger performance

	Flights per passenger ratio	Rank	Accident rate ratio	Rank	Average performance ratio	Rank
Nova Scotia	1	4	0.51	2	0.76	1
Ontario	0.89	1	0.83	3	0.86	2
Alberta	0.93	3	0.87	4	0.9	3
British Columbia	1.15	6	0.92	5	1.04	4
Quebec	0.92	2	1.38	6	1.15	5
Prince Edward Island	2.38	10	0	1	1.19	6
Manitoba	1.26	7	1.48	8	1.37	7
Newfoundland & Labrador	1.61	8	1.45	7	1.53	8
New Brunswick	1.84	9	1.85	9	1.85	9
Saskatchewan	1.02	5	3.19	10	2.11	10

Rail passenger

We were not able to develop comparative performance data for intercity rail passenger service in Canada (commuter rail and urban rail systems are covered in urban transit). Data on patronage by province are not readily available, and information on miles of track service from VIA Rail would not be usable without ridership data. Also, aggregate intercity rail passenger traffic is a very small share of all passenger travel (data on rail freight traffic were available and are discussed below). Hopefully this situation will change with future editions of this report; but, for the moment, we must defer an assessment of rail passenger service.

Marine passenger

Traffic and costs

Ferry services are an important transportation element of Canada's provinces. Ferry costs are assumed partially by passengers in the form of fares and partially by governments in the form of service and terminal operations. Costs and traffic vary considerably, with some provinces operating long distance, low volume ferry services at considerable government expense and others operating none. Some services have been partially privatized, increasing some services but with rising fares (Baldrey, 2007, August 29). Victoria, British Columbia is proposing a \$100 million harbour upgrade that includes a new passenger ferry terminal (Heiman, 2007, August 14). A Prince Edward Island-Nova Scotia ferry service has also been recently proposed (Willis, 2007, September 22).

Table 18 and figure 8 show basic traffic and provincial-federal operating costs for ferry services by province. We use federal and provincial costs here because they represent the government portion of costs and should be included as part of an assessment of within-province ferry usage and costs. Ferry traffic includes private services since those often use public landings and are reported in provincial totals. British Columbia has the most passengers, but government operating costs are higher in Newfoundland & Labrador, Nova Scotia, and Quebec. Overall, the government cost per passenger carried (trip) is about \$5.91. However, this varies widely from a low of \$1.40 in British Columbia to a high of \$60.21 in Newfoundland & Labrador, reflecting the different distances and costs of services as well as the amount of traffic. [8] Since the ratios vary so much, we have reduced the performance ratios for New Brunswick and Newfoundland & Labrador to 4.50 and 5.00, respectively, to

8 In the future, a "cost per passenger-kilometer" measure might be used to make these measures more comparable.

Table 18: Ferry passengers and service, 2005

	Passengers, thousands	Provincial and federal ferry expenditures, millions of dollars	Provincial and federal cost per passenger, dollars	Ratio of province to eight-province average	Rank
Alberta	NA	NA	NA	NA	NA
Saskatchewan	NA	NA	NA	NA	NA
British Columbia	28,475	39.90	1.4	0.24	1
Ontario	1,888	5.60	2.97	0.50	2
Prince Edward Island	800	3.13	3.92	0.66	3
Quebec	5,577	48.37	8.67	1.47	4
Manitoba	231	3.60	15.62	2.64	5
Nova Scotia	1650*	43.62	26.44	4.48	6
New Brunswick	214	11.97	55.95	4.50**	7
Newfoundland & Labrador	1,347	81.10	60.21	5.00**	8
Eight provinces	40,182	237.29	5.91	1	
Northwest Territories	242	4.2	17.36		
Nunavut					
Yukon					
Total	40,424	241	5.97		

*Estimated based on vehicle traffic.

**Edited from 9.47 and 10.20, respectively.

Table 19: Ferry accident rates

	Ferry accidents per million passengers, 2005	Ratio to average	Rank
Alberta	NA	NA	NA
Saskatchewan	NA	NA	NA
British Columbia	0.88	0.8	1
Quebec	1.26	1.15	2
Manitoba	1.42	1.29	3
Ontario	1.42	1.29	3
New Brunswick	2.24	2.05	5
Newfoundland & Labrador	2.24	2.05	5
Nova Scotia	2.24	2.05	5
Prince Edward Island	2.24	2.05	5
Subtotal	1.1		

account for their high value but retain their relative positions. This does not change the rank of these provinces, but does mitigate the impact of their quite costly (per passenger) services on their overall provincial performance.

Ferry service accident rates

To compute ferry service accident rates, we consolidated accident and passenger data according to the reporting procedures (Appendix B) which divide the nation into groups of provinces. As a result, provinces within a group have identical rates (table 19).

Based on this approach, the 2005 overall ferry accident rate was about 1.10 accidents per million passengers. This rate varies by about a factor of two, from a low of 0.88 accidents per million passengers in British Columbia, to a high of 2.24 accidents per million passengers in New Brunswick, Nova Scotia, Newfoundland & Labrador, and Prince Edward Island.

Overall marine passenger performance

Consolidating the ferry passenger data, table 20 shows the consolidated performance ratings for the two measures. Overall, British Columbia ranks first, based on its high traffic and subsequently low government cost per passenger, as well as its low accident rate. Nova Scotia, New Brunswick, and Newfoundland & Labrador are rated lowest based on high costs per passenger and high accident rates. Saskatchewan and Alberta are not rated since they have no ferry services.

Table 20: Consolidated ferry passenger performance

	Accident rate ratio	Rank	Cost per passenger ratio	Rank	Average performance ratio	Rank
Alberta	NA	NA	NA	NA	NA	NA
Saskatchewan	NA	NA	NA	NA	NA	NA
British Columbia	0.8	1	0.24	1	0.52	1
Ontario	1.29	3	0.5	2	0.9	2
Quebec	1.15	2	1.47	4	1.31	3
Prince Edward Island	2.05	5	0.66	3	1.36	4
Manitoba	1.29	3	2.64	5	1.97	5
Nova Scotia	2.05	5	4.48	6	3.26	6
New Brunswick	2.05	5	4.50**	7	3.27	7
Newfoundland & Labrador	2.05	5	5.00**	8	3.52	8

Overall findings for passenger transportation

Consolidating the four passenger modes, overall provincial performance for passenger travel is summarized in table 21 and table 22. Here, the individual modes of travel are weighted according to their shares of annual person trips nationwide. Since highway travel dominates the modal shares nationwide at about 96.5% of all trips, provinces scoring well on highway passenger performance tend to score well overall. While it might be useful to weight each province's performance by other criteria, such as passenger-kilometers or modal shares within province, this basic weighting is appropriate for an initial assessment.

Overall, Ontario has the highest passenger transportation performance rating, followed closely by Nova Scotia and Quebec. At the other end, British Columbia has the lowest passenger performance, followed by Newfoundland & Labrador.

Ontario is rated either first or second on each of the four modes studied. Nova Scotia is rated first or second on two modes (air passenger, highway) and sixth on two others, but overall is rated second. Quebec follows close behind, with a first-place rating on urban transit. On the other hand, British Columbia's high rating on marine ferry service (first) is not enough to overcome its tenth place rating for highway travel and its modest ratings for transit and air travel, so it is rated tenth overall. Ratings for other provinces are more uniform across transportation modes.

Table 21: Consolidated passenger performance ratios

Passenger mode weight*	0.965	0.032	0.002	0.001	1	
	Highway	Urban transit	Air	Marine	Weighted average performance	Rank
Ontario	0.76	1.01	0.86	0.9	0.767	1
Nova Scotia	0.8	1.5	0.76	3.26	0.824	2
Quebec	0.9	0.77	1.15	1.31	0.892	3
Manitoba	0.94	1.19	1.37	1.97	0.95	4
New Brunswick	0.99	2.4	1.85	3.27*	1.037	5
Prince Edward Island	0.98	2.79*	1.19	1.36	1.037	6
Alberta	1.13	1.17	0.9	NA	1.128	7
Saskatchewan	1.47	1.51	2.11	NA	1.477	8
Newfoundland & Labrador	1.51	2.24	1.53	3.52*	1.533	9
British Columbia	1.57	1.27	1.04	0.52	1.554	10

*Modes are weighted according to their shares of annual person trips nationwide.

Table 22: Summary of provincial ranks for passenger travel

	Highway	Urban transit	Air	Marine	Overall rank
Ontario	1	2	2	2	1
Nova Scotia	2	6	1	6	2
Quebec	3	1	5	3	3
Manitoba	4	4	7	5	4
New Brunswick	6	9	9	7	5
Prince Edward Island	5	10	6	4	6
Alberta	7	3	3	NA	7
Saskatchewan	8	7	10	NA	8
Newfoundland & Labrador	9	8	8	8	9
British Columbia	10	5	4	1	10

Freight transportation

Highway (truck) freight

Traffic density

The improving highway system has allowed increased volume and speed of truck traffic (Lambert, 2007, September 3). Data on truck traffic is available only for groups of provinces and, therefore, some of our performance ratios are the same. Overall, about 219.8 million tonnes of truck-carried freight originated in the 10 provinces in 2003, the largest tonnage being from Ontario (this does not include the “through” truck traffic which, in this case, cannot be assigned directly to intermediate provinces—table 23). Since most truck traffic is on the higher-class road systems, we use the two-lane kilometers of only the higher-class roads (major roads, freeway, primary, secondary) to measure relative traffic density. Similar to person travel, we use the inverse (two-lane kilometer of higher road per tonne of originating traffic) as a measure of performance—the higher this number, the thinner the truck use relative to road length. This means that we view higher truck traffic density on major roads as a good thing.

On average, it takes about 0.96 km of higher-road length to “generate” 1,000 tonnes of originating truck freight. Ontario ranks first in overall truck tonnage per unit length of road, at just 0.61 km needed to generate 1,000 tonnes, followed by Quebec and British Columbia. The Maritime provinces

Table 23: Truck traffic tonnes and major road length

	Domestic origins, million tonnes, 2003		Higher class highway system, two-lane km, 2004	Two-lane km per 1,000 tonnes, 2003-2004	Ratio of province to 10-province average	Rank
Ontario	82.2	Ontario	50.1	0.61	0.63	1
Quebec	43.1	Quebec	31	0.72	0.75	2
BC & Territories	15	British Columbia	16.4	1.47	1.53	3
AB, MB, SK	52.8	Alberta	34.2	1.64	1.71	4
		Manitoba	19.2	1.64	1.71	4
		Saskatchewan	33.2	1.64	1.71	4
NB, NF, NS, PEI	14.4	New Brunswick	9	1.89	1.96	7
		Newfoundland & Labrador	7	1.89	1.96	7
		Nova Scotia	7.7	1.89	1.96	7
		Prince Edward Island	3.5	1.89	1.96	7
Canada	219.8	Subtotal	211.3	0.96	1	

rate lowest on this criterion, needing about 1.89 km of road length to generate 1,000 tonnes of originating truck freight annually. To say it another way, on average there is about 3.08 times as much truck traffic, per kilometer, on Ontario's major highways as there is on those of the Maritimes.

Figure 9 shows the number of tonnes of truck freight by city of origin, number of two-way truck border crossings at major Canada-US border crossings, and employment by province (as a measure of provincial economic productivity).

Truck accidents

Although heavy trucks are involved in less than half of fatal accidents, these accidents are often more severe (Kalinowski, 2007, September 14). Fatal collision rates involving heavy trucks are a useful measure of truck-related safety. Table 24 shows the fatal collision rate (heavy truck involved) per million tonnes of freight originating from the 10 provinces.

Using this statistic, the overall rate is about 2.15 fatal collisions per million tonnes of originating freight. The provinces vary by about a factor of three on this statistic, from a low of 1.67 in Ontario to a high of 4.80 in British Columbia. British Columbia's high truck-involved fatal accident rate is of particular interest here because the province also scores tenth in highway passenger fatality rates.

Table 24: Heavy truck-involved fatal collision rates, 2003

	Number of fatal collisions involving heavy trucks	Truck fatal collisions per million tonnes freight	Ratio of province to 10-province average	Rank
Ontario	137	1.67	0.77	1
New Brunswick	12	2.15	1	2
Newfoundland & Labrador	8	2.15	1	2
Nova Scotia	8	2.15	1	2
Prince Edward Island	3	2.15	1	2
Quebec	101	2.34	1.09	6
Alberta	82	2.54	1.18	7
Manitoba	26	2.54	1.18	7
Saskatchewan	26	2.54	1.18	7
British Columbia	70	4.8	2.23	10
10 provinces	473	2.15	1	

Truck border crossings

A measure of truck impacts on economic performance is the degree to which truck traffic facilitates international trade with the US. Since many manufactured products and other goods cross the US border in both directions, truck border crossings relative to total provincial employment is a good measure of the use of trucks in supporting provincial economies. Although truck border crossing fees have recently risen (*Toronto Star*, 2007, June 1), demand has not abated. Some might argue that truck traffic has only a marginal relationship with economic activity, but the ubiquitous dependence on truck delivery for economic activity and the importance of modern road infrastructure to truck travel suggests that some measure of truck traffic, relative to economic activity, is appropriate. Truck traffic also affects infrastructure conditions.

Table 25 indicates the extent of such traffic, using border crossing data for the 20 largest border crossings (three provinces—Newfoundland & Labrador, Nova Scotia, and Prince Edward Island—do not have a US border and are not rated). Overall, the Canadian economy generates (in both directions) about 11.60 million annual truck crossings (using the top 20 US-Canada border crossings) or about 1.42 Canadian workers per US-Canada truck border crossing. The provinces vary by about a factor of eight on this statistic, from about 0.80 workers per truck crossing for Ontario, to 6.68 workers per truck crossing for Alberta. This means that, from a US-Canada trade perspective, Ontario is generating about eight times as much border crossing truck traffic per worker as is Alberta.

Table 25: Truck traffic border crossings, 2006

	Total employment, thousands	20 largest border crossing trucks, millions	Total employment per truck crossing	Ratio of province to 10-province average	Rank
Newfoundland & Labrador	215.7	NA	NA	NA	NA
Nova Scotia	441.8	NA	NA	NA	NA
Prince Edward Island	68.6	NA	NA	NA	NA
Ontario	6,492.7	8.10	0.802	0.564	1
Manitoba	587.0	0.37	1.586	1.116	2
British Columbia	2,195.5	1.22	1.800	1.266	3
New Brunswick	355.4	0.13	2.734	1.924	4
Quebec	3,765.4	1.35	2.789	1.963	5
Saskatchewan	491.6	0.15	3.277	2.306	6
Alberta	1,870.7	0.28	6.681	4.701	7
10 provinces	6,484.3	11.60	1.421	1	

Consolidated truck freight performance

Consolidating the three measures for truck freight performance, table 26 indicates the results, weighting the measures equally. Overall, Ontario has the best rating for truck traffic, based on its relatively high truck-related trade with the US, low accident rate, and high truck use of major highways; Ontario scores first on all three of the aforementioned measures. Newfoundland & Labrador, Nova Scotia, and Prince Edward Island share the fourth place rating, since their data is combined. Alberta and Saskatchewan have the lowest ratings, based on low truck use of major roads, limited truck-related trade, and relatively high accident rates (low use might mean unused capacity, which could attract business, offsetting system efficiencies).

Table 26: Truck freight performance

	Ratio, two-lane km/tonne	Rank	Fatal collision rate ratio	Rank	Ratio, employment per truck crossing	Rank	Average performance ratio	Rank
Ontario	0.63	1	0.77	1	0.564	1	0.66	1
Quebec	0.75	2	1.09	6	1.963	5	1.27	2
Manitoba	1.71	4	1.18	7	1.116	2	1.33	3
Newfoundland & Labrador*	1.96	7	1	2	NA	NA	1.48	4
Nova Scotia*	1.96	7	1	2	NA	NA	1.48	4
Prince Edward Island*	1.96	7	1	2	NA	NA	1.48	4
New Brunswick	1.96	7	1	2	1.924	4	1.63	7
British Columbia	1.53	3	2.23	10	1.266	3	1.67	8
Saskatchewan	1.71	4	1.18	7	2.306	6	1.73	9
Alberta	1.71	4	1.18	7	4.701	7	2.53	10

*Average performance ratios for these provinces are based on two measures; average performance ratios for all other provinces are based on three measures.

Air freight

Traffic density

Air freight performance is measured by just one measure: the efficiency of tonnage operations measured in tonnes of air cargo per flight. Air freight accidents are included in air passenger accidents. Figure 10 shows the number of tonnes of air freight by province and by airport. Table 27 indicates that, on this measure, air freight usage rates are highest for Ontario—about 1.69 flights needed to generate one tonne of cargo—and lowest in Prince Edward Island and New Brunswick, which have very little air freight per flight. Because the “flights needed/tonne of air cargo” ratio is so high for these two provinces relative to the others, we have edited the ratios to 4.50 and 5.0, respectively. This changes their overall ratios slightly (air freight is a small portion of total freight), but not the rank orders.

Table 27: Air freight performance, 2005

	Tonnes of air freight, thousands	Total arriving & departing flights, thousands	Flights per total tonnes	Ratio of province to 10-province average	Rank
Ontario	327.8	553.1	1.69	0.68	1
Quebec	108.8	188.8	1.73	0.7	2
British Columbia	135.6	411.1	3.03	1.22	3
Nova Scotia	13.6	50.4	3.71	1.49	4
Alberta	57.3	242.1	4.23	1.7	5
Newfoundland & Labrador	6.4	41.2	6.46	2.6	6
Manitoba	9.4	88.7	9.47	3.81	7
Saskatchewan	0.98	33.5	34.35	4	8
New Brunswick	0.44	24.8	56.24	4.50*	9
Prince Edward Island	0.04	6.9	183.31	5.00*	10
10 provinces	660.2	1,640.50	2.48	1	

*Edited to 4.5 from 22.64 and to 5.00 from 73.77, respectively. Editing reduces the wide variance for some provinces with extreme data, but does not change the rank orders.

Rail freight

Rail freight in Canada has changed significantly in recent years, from a heavy reliance on bulk commodities to new services integrating marine, rail, and truck modes through containerization and world trade. Many of Canada's provinces have seen increases in both rail and freight traffic as a result (LeRiche, 2007, March 13; Bernhardt, 2007, September 4).

Traffic density

Rail freight density is measured by traffic, in tonnes of originating goods, relative to kilometers of first-line track—that is, major track (figure 11 and table 28). This measure is sensitive to originating rail freight traffic within each province, but not to *through* traffic carried across a province; therefore, it may underestimate the traffic for prairie provinces, particularly Manitoba and Saskatchewan, which carry significant through traffic.

Overall, it takes about 0.19 km of mainline track to generate 1,000 tonnes of rail freight annually. However, in the Atlantic provinces, it takes only 0.08 km of major track, whereas, in Manitoba, 0.6 km is required. This means that the rail track system in terms of tonnage efficiency per kilometer of track is about 10 times more efficient in the Atlantic provinces than in Manitoba.

Table 28: Rail freight traffic density, 2005

	Km of first line track	Tonnes of originating traffic, millions	Km first mainline track per thousand tonnes	Ratio of province to 10-province average	Rank
Prince Edward Island	0	0.0	NA	NA	NA
New Brunswick	1,156	31.5*	0.08*	0.42*	1*
Newfoundland & Labrador	634**	31.5*	0.08*	0.42*	1*
Nova Scotia	742	31.5*	0.08*	0.42*	1*
British Columbia	6,808	54.7	0.12	0.65	4
Alberta	7,094	47.7	0.15	0.78	5
Quebec	6,102	30.3	0.20	1.06	6
Saskatchewan	8,438	38.9	0.22	1.14	7
Ontario	11,865	39.9	0.30	1.56	8
Manitoba	5,123	8.6	0.60	3.13	9
10 provinces	47,962	251.7	0.19	1.00	

*Atlantic provinces consolidated. **Source: Railway Association of Canada, 2006.

Rail freight accident rates

Rail freight accident rates are also a useful measure of performance. Looking at 2005 data, table 29 indicates the overall rates for each province. Overall, the rail freight accident rate is about 4.947 accidents per million originating tonnes. However, these rates vary widely, from a low of 1.30 for the Atlantic provinces to 9.96 for Ontario.

Table 29: Rail freight accident rates, 2005

	Rail accidents	Accidents per million originating tonnes	Ratio of province to nine-province average	Rank
Prince Edward Island	0	NA	NA	NA
New Brunswick	24	1.30*	0.26	1*
Newfoundland & Labrador	4	1.30*	0.26	1*
Nova Scotia	13	1.30*	0.26	1*
Saskatchewan	96	2.47	0.50	4
British Columbia	169	3.09	0.62	5
Alberta	247	5.18	1.05	6
Quebec	210	6.93	1.40	7
Manitoba	85	9.89	2.00	8
Ontario	397	9.96	2.01	9
Nine provinces	1,245	4.95	1	

*Atlantic provinces consolidated.

Consolidated rail freight performance

Consolidating the two measures of rail freight performance, table 30 shows that the Atlantic provinces have the best overall rail freight performance, based on high traffic volume per kilometer of track and low accident rate.

Table 30: Rail freight performance

	Sum of ratios	Average performance ratio	Rank
Prince Edward Island	NA	NA	NA
New Brunswick	0.68*	0.34*	1*
Newfoundland & Labrador	0.68*	0.34*	1*
Nova Scotia	0.68*	0.34*	1*
British Columbia	1.28	0.64	4
Saskatchewan	1.64	0.82	5
Alberta	1.83	0.91	6
Quebec	2.46	1.23	7
Ontario	3.58	1.79	8
Manitoba	5.12	2.56	9

*Atlantic provinces consolidated.

Marine freight

Marine freight services have been a mainstay of the Canadian economy since the continent was first explored in the search of the elusive Northwest Passage. While that quest is no longer the primary determinant of marine routes or shipping patterns, it has, ironically, taken on new meaning as climate change apparently shifts ice patterns. Of perhaps greater interest and impact now is Canada's concern for the potential of liquefied natural gas shipments to eastern Maine through Canadian waters, and the possible impacts of the widening of the Panama Canal on big boat shipping patterns and containerization traffic.

Traffic versus port operating cost

Ideally, port operating data would include such handling statistics as average tonnage "dwell time" at port, handling time, or other internal efficiency measures. Canadian marine freight data is reported through the Canada Port Authorities and individual port records. Typical reports contain operating costs (government only), tonnage loaded and unloaded, accident statistics, and similar information. Traffic data for the provinces are shown for 2004 in table 31. Overall, about 452 million tonnes of cargo were shipped in 2004, the largest volumes from Quebec and British Columbia. Alberta, Manitoba, Prince Edward Island, and Saskatchewan reported low volumes or no cost data (figure 12). The overall average port operating cost per handled tonne in the 10 provinces is about \$0.58; Newfoundland reported the most efficient system at \$0.05 per tonne, and Quebec and British Columbia the least efficient at \$0.82 per tonne.

Port operating expense ratio

Port expense ratios (ratio of expenses to revenues) are a key measure of economic viability since they indicate how the port is doing balancing revenues versus expenses. While port operations are not necessarily expected to break even or make a profit, the objective of balancing port expenses with revenues from port users is clearly a worthy goal from a public policy and taxpayer perspective. From an economic perspective, it is also worthy since low ratios, below 1.0, mean that the provincial port system is holding expenses down relative to revenues, while high ratios, above 1.0, indicate that port expenses are greater than the revenues being received and may warrant corrective action.

Table 32 indicates the composite (provincewide) expense ratios for each province in 2004. Overall, the 10-province weighted average is about 84.1%, meaning that overall Canadian port operating expenses are about 16% lower than port revenues (from shipping companies). The ratios range from a low of 67.1% for Nova Scotia to a high of 122.1% for Ontario, or about a factor of two.

Table 31: Port operating costs per tonnes, 2004

	Total tonnes shipped International & dome tic, millions	Canada Port Authorities financial profiles			Rank
		Operating expenses, millions of dollars	Port operating expenses per tonne shipped	Ratio of province to 10-province average	
Alberta	0	NA	NA	NA	NA
Manitoba	0.43	NA	NA	NA	NA
Prince Edward Island	0.86	NA	NA	NA	NA
Saskatchewan	0	NA	NA	NA	NA
Newfoundland & Labrador	63.9	3.4	0.05	0.09	1
Nova Scotia	45.2	18.1	0.4	0.69	2
New Brunswick	30.9	13.6	0.44	0.76	3
Ontario	78.2	34.7	0.44	0.77	4
British Columbia	127.8	104.4	0.82	1.42	5
Quebec	104.9	86.5	0.82	1.43	6
10 provinces	452.2	260.8	0.58	1	
Northwest Territories	0.03	—			
Nunavut	0.15	—			
Yukon	0	—			
Canada	452.3	—			

Table 32: Port operating expense ratios, 2004

	Canada Port Authorities financial profiles		
	Expenses/revenues (%)	Ratio of province to six-province average	Rank
Alberta	NA	NA	NA
Manitoba	NA	NA	NA
Prince Edward Island	NA	NA	NA
Saskatchewan	NA	NA	NA
Nova Scotia	67.1	0.798	1
British Columbia	77.6	0.923	2
New Brunswick	80.9	0.962	3
Newfoundland & Labrador	83.3	0.99	4
Quebec	87.3	1.038	5
Ontario	122.1	1.451	6
Six provinces	84.1	1	

Marine accident rates

In the absence of capacity or other internal operating efficiency data, we use accident rates per 1,000 tonnes handled as a comparative measure of port operations. Shipping accidents are reported for groups of provinces (western: British Columbia, Alberta, Saskatchewan [9]; central: Ontario, Manitoba, Saskatchewan; Maritime: New Brunswick, Nova Scotia, Newfoundland, Prince Edward Island; and Laurentian: Quebec), so averages rates for these province groups have been developed. It should be noted that these are shipping accidents, not necessarily in-port accidents.

Overall shipping accident rates are shown in table 33. Overall, the rate for 2004 is about 0.93 shipping accidents per million tonnes handled. Rates vary from a low of 0.59 for Quebec to a high of about 1.24 for the Maritime provinces. The rate for the three territories is also shown since it is considerably higher, but this rate is not included in the performance calculation.

Table 33: Shipping accidents, 2003

	Shipping accidents per million tonnes handled	Ratio of province to eight-province average	Rank
Alberta	NA	NA	NA
Saskatchewan	NA	NA	NA
Quebec	0.59	0.64	1
Manitoba	0.75	0.81	2
Ontario	0.75	0.81	2
British Columbia	0.98	1.05	4
New Brunswick	1.24	1.33	5
Newfoundland & Labrador	1.24	1.33	5
Nova Scotia	1.24	1.33	5
Prince Edward Island	1.24	1.33	5
Eight provinces	0.93	1	
Northwest Territories	38.4	18.79	
Nunavut	38.4	18.79	
Yukon	38.4	18.79	
Canada	2.04	1	

9 Saskatchewan is divided between western and central groups of provinces, but it is landlocked; both shipping accidents and shipping tonnes handled are zero.

Overall performance for marine shipping

Consolidating the three above measures, table 34 shows the results. Overall, Newfoundland has the highest rating, based on its very low operating cost per tonne handled. Manitoba (based on one measure out of a possible three) and Nova Scotia follow. British Columbia (with high costs) and Prince Edward Island (based on one measure out of a possible three) are rated worst.

Table 34: Marine shipping performance

	Sum of performance ratios	Average performance ratio	Rank
Alberta	NA	NA	NA
Saskatchewan	NA	NA	NA
Newfoundland & Labrador	2.41	0.80	1
Manitoba*	0.81	0.81	2
Nova Scotia	2.82	0.94	3
Ontario	3.03	1.01	4
New Brunswick	3.05	1.02	5
Quebec	3.10	1.03	6
British Columbia	3.39	1.13	7
Prince Edward Island*	1.33	1.33	8

*Based on just one measure; others three measures.

Overall findings for freight transportation

Consolidating the performance ratios for the four freight modes, and weighting by their national proportions of tonne-kilometers, table 35 indicates overall freight performance. This performance assessment is based on the weighting of freight tonnage according to the national distribution, which puts about 49% of tonnage in the marine mode.

Table 35 suggests that Newfoundland & Labrador has the overall best freight rating, based particularly on its rail and marine service and traffic. Nova Scotia is very close, rated second.

The freight analysis results are highly dependent on the weights assigned, particularly those for rail and marine freight, and on consolidation of data. Nationwide marine freight accounts for about half of all freight tonnes. If a different set of weights were used (for instance, weights based on value of shipment or tonne-kilometers), different results would be obtained and the ranks of some provinces would shift. While these measures might be used in the future, for now a straightforward measure based primarily on tonnage seems appropriate.

Table 35: Overall freight performance

Weight	0.238	0.001	0.272	0.489	1	
	Highway	Air	Rail	Marine	Weighted average	Rank
Newfoundland & Labrador	1.48	2.60	0.34**	0.80	0.84	1
Nova Scotia	1.48	1.49	0.34**	0.94	0.91	2
New Brunswick	1.63	4.50*	0.34**	1.02	0.98	3
British Columbia	1.67	1.22	0.64	1.13	1.13	4
Ontario	0.66	0.68	1.79	1.01	1.14	5
Quebec	1.27	0.70	1.23	1.03	1.14	6
Saskatchewan	1.73	4.00	0.82	NA	1.25	7
Prince Edward Island	1.48	5.00*	NA	1.33	1.38	8
Manitoba	1.33	3.81	2.56	0.81	1.41	9
Alberta	2.53	1.70	0.91	NA	1.67	10

*Edited.

**Atlantic provinces consolidated.

Discussion

Transportation and economic performance

The primary purpose of a transportation system is to provide the accessibility through which individuals and businesses can exercise mobility and interact. This study recognizes that transportation systems affect provincial economic performance across a wide range of dimensions in complex ways. Measures of transportation system quality or safety, such as road condition and accident rates, are important but not the only ways to assess transportation systems. Attention should also be paid to the importance of transportation systems on accessibility, interaction, and trade. This is consistent with the traditional view that travel and movement is not an end in itself but a means to achieving other goals. Measures such as intercity driving time and commuting times, while indirect measures of transportation performance, are widely understood features of transportation systems and help to bring out this effect. They also help to bring out the interaction between individuals (through their impacts on others) and provinces (through the impacts that system improvements have on the performance of other provinces). As a simple example, road improvements made in Saskatchewan also improve the accessibility of other provinces. Perhaps more importance has been placed here on the “connectivity” function of transportation systems than some might expect. But this feature, so clearly understood by individuals and businesses in their choices, should also be given considerable weight by government. Canadian transportation systems are not isolated to each province, but connect each province to others.

An important corollary is that transportation modes are not interchangeable but instead have inherent features best suited for different circumstances. Urban transit systems cannot be effectively operated in rural areas, for instance. Therefore, different measures should be used to assess performance for different transportation modes and geographies. This means that, since the provinces have varying mixtures of circumstances, they should not be expected to perform equally well on all dimensions.

Having identified the need for different measures for different transportation modes, we recognize that some dimensions of performance also cut across modes. Features like system condition, governmental expenditures relative to use, safety and reliability, and operating costs provide basic cross-modal comparisons of how systems are performing. This study provides an initial assessment of the status of the Canadian provinces on some basic dimensions, but others are not measured adequately. Significant examples are bridge condition and pavement condition data, and provincial intercity

rail ridership and costs. However, the lack of perfect data is not a reason to avoid comparisons. Over time, it is hoped that better data will become available and these inadequacies will be reduced.

Impacts

Of course, transportation systems also have impacts on users and non-users, both beneficial and negative. The benefits include reduced travel time and costs for users; wider ranges of choices of goods, services, and opportunities; and lower costs of trade and interaction. Costs include the use of land and government resources, environmental impacts, congestion, individual costs, and accidents, just to name a few. These benefits and costs are widely recognized. It would be ideal to have comparable measures of cost and benefits *across* various transportation modes, and, indeed, this is one of the “holy grails” of transportation research. But that is very difficult to achieve, given the different functions and operating features of the transportation modes. In this study, we have elected to stay with the most basic measures of impact (safety, congestion, travel times, condition, use, and costs), rather than engage in more complex and problematic calculations for other factors such as noise, land use, air quality, etc. This is not to say that these impacts do not exist; they do, and sometimes they are determinants in decision-making. Rather, our view is that *transportation systems should be evaluated primarily on their transportation functions*, leaving second-order impacts for later work.

A particularly thorny area of evaluation is the impact of transportation investment on induced travel and development. This is a subject of considerable research in recent years, but the findings remain elusive. Even the definitions of such terms as “induced travel” are open to a wide variety of interpretation and measurement problems. While many researchers believe that these impacts exist, it is extremely difficult to demonstrate their presence even for aggregate investments and certainly for a specific project. For this first round, we take the conservative position that these impacts are not sufficiently quantifiable for measurement at the provincial level.

Additional research

The above considerations do not negate the value of this research. Indeed, they highlight the importance of improving it in the future. Therefore, this initial assessment of the performance of the 10 Canadian provinces should be considered a first step in the development of more comprehensive and useful assessments in the future. Among the topics that warrant additional attention are the following:

- ❧ *Better road condition data*, particularly road condition and bridge condition data, and also congestion statistics for more cities.
- ❧ *Additional measures of performance* for each transportation mode.

- ❧ The development of *province-specific modal weights*.
- ❧ Addition of the *three territories* to the assessment.
- ❧ Addition of the *rail passenger mode*.
- ❧ Addition of the *pipeline mode* for freight traffic (typically considered a mode largely specific to the energy industry, but also viewed as an alternative to rail, marine, or truck movements).
- ❧ Methods to account for wide *variations in performance metrics within provinces*.
- ❧ Procedures for *tracking performance over time*.
- ❧ Better treatment of *cross-border trade* and its impact on provincial transportation.

These improvements will permit the comparative performance described here to be made even more useful, and hopefully lead to better and more uniform transportation conditions nationwide.

References

Airports International Magazine (2004a). Canadian Airport Special: Vancouver's Expansion. *Airports International Magazine* 37, 9 (December): 20–21.

Airports International Magazine (2004b). Canadian Airport Special: Montreal-Trudeau Expands. *Airports International Magazine* 37, 9 (December): 18–19.

Baldrey, K. (2007, August 29). Positives and Negatives to Privatization. *Coquitlam NOW*.

Barton, R., and G. Chow (2004). *Goods movement in central Ontario: trends and issues*. Ontario Ministry of Transportation.

Beatty, J. (2004, March 12). Railway Deal Goes Ahead. *Vancouver Sun*: B1–Front.

Bellavy, E. (2007, August 28). Highway 3 Widening to Begin Within Days. *Windsor Star*.

Bellon, P. (2006). Private Sector Involvement in Canada's Public Transport. *Public Transport International* 55, 2 (March): 8–10.

Benedict, E.W. (2007). Canada's Railway Safety Regulation Regime. *Transportation Law Journal* 34, 2: 147–165.

Bernhardt, D. (2007, September 4). Economic Corridor Touted. *The Star Phoenix*.

Boomer, R. (2007, April 4). Traffic Panic not Warranted: City Staff. *Halifax Daily News*.

Borsuk, I., D. Stephens, and S. Rathwell (2007). *BRT and LRT in Ottawa: Playing Well Together*. ITE Technical Conference on Managing Congestion, San Diego, CA, March 24, 2007.

Brander, J., and B. Cook (2000). *Enhancing competition in the presence of monopoly—an assessment of air policy options facing Canada*. Canadian Transportation Research Forum 35th Annual Conference, Charlottetown, PEI, Canada, June 4–7, 2000.

Brender, N., and A. Golden (2007). *Sustainable urban transportation: a winning strategy for Canada*. Conference Board of Canada.

Briggs, V., and K. Jasper (2001). *Organizing for Regional Transportation Operations: Vancouver Translink*. Booz Allen Hamilton.

Briginshaw, D. (2005). Toronto to Have a Private Airport Rail Connection. *International Railway Journal* 45, 4 (April): 35.

Brooks, M., and J. Frost (2004). Short Sea Shipping: A Canadian Perspective. *Maritime Policy and Management* 31, 4 (April): 393–408.

Brooks, M., and J. Hodgson (2005). The Fiscal Treatment of Shipping: A Canadian Perspective on Shipping Policy. *Research in Transportation Economics* 12: 143–171.

Brown, J.L. (2007). Toronto Plans Network of Light-Rail Systems. *Civil Engineering* 77, 5 (May): 30.

Buehler, R., and J. Pucher (2005). *Cycling trends and policies in Canadian cities*. Victoria Transport Policy Institute.

Byers, J. (2007, January 27). Planner Mulls Tax on Drivers. *Toronto Star*. <<http://www.thestar.com/News/Article/175502>>, as of August 19, 2008.

Byers, J. (2007, September 6). Pickering Airport Idea Revived. *Toronto Star*. <<http://www.thestar.com/News/Article/253704>>, as of August 19, 2008.

Canadian National Energy Board [CNEB] (2003). *Comparative Analysis of Pipeline Safety Performance*.

Canoe Money (2007, May 11). Intl Trade Minister Announces Asia-Pacific Gateway Funds.

Canoe Money (2007, September 20). Table Regionale des Organismes Volontaires d'Education Populaire [TROVEP]: Our Shoes are Worn.

- Chung, A., and Keung N. (2002, August 16). Companies Urged to Push Transit, but Tax Laws Deter Possible Incentive of Subsidized Pass. *Toronto Star*: B3.
- Clemens, J., et al. (2007). Canadian Provincial Investment Climate Report: 2007 Edition. *Studies in Entrepreneurship and Markets* 3 (January). Fraser Institute.
- Fischer, A. (2006). New USDA Rules Will Charge Truckers a Fee when Entering US from Canada. *Transport Topics* No. 3708.
- Flemming, B., et al. (2001). *Vision and Balance: Canada Transportation Act Review*. Public Works and Government Services Canada.
- Gillespie, K. (2003, January 20). Traffic Bad and Getting Even Worse; More People than Ever Driving Cars to Work. *Toronto Star*: B4.
- Gray, J. (2007, September 10). No Appetite for Congestion Charges before the Provincial Election. *Globe and Mail*. <<http://www.theglobeandmail.com/servlet/story/LAC.20070910.GRIDLOCK10/TPStory/National>>, as of August 19, 2008.
- Gyulai, L. (2007, August 17). City Hall to Spend \$400,000 Pushing Transportation Plan. *Montreal Gazette*. <<http://www.canada.com/montrealgazette/news/story.html?id=f222c8ab-bfcc-4efa-aa15-73ad8e134e98>>, as of August 19, 2008.
- Haas, R., N. Li, and S. Tighe (1999). *Roughness Trends at C-SHRP LTPP Sites*. Transportation Association of Canada.
- Hall, J. (2002, May 20). Transit, Profit Don't Go Together. *Toronto Star*: B5.
- Heaver, T.D., and W.G. Waters (2005). Transportation policy in Canada. In Hensher D (ed), *Handbooks in Transport* 6 (Elsevier): 779–801.
- Heiman, C. (2007, August 14). \$100 m. Harbour Dream for Victoria. *Times Colonist*. <<http://www.canada.com/victoriatimescolonist/news/story.html?id=b0c0159d-1e60-4dbc-b6cb-3607ba59cefc&k=94008>>, as of August 19, 2008.
- Hemily, B. (2004a). *Governance and business models for deployment and management of a multi-agency integrated transit fare system in the Greater Toronto area*. International Association of Public Transport 7th International Conference on Automatic Fare Collection, Brussels, Belgium, February 4–6, 2004.

- Hemily, B. (2004b). *Transit in the greater Toronto area: overview and challenges*. American Society of Civil Engineers.
- Jordan, W.A. (2001). *Adverse effects of mergers on airline performance: the case of Canadian Airlines International, LTD*. Canadian Transportation Research Forum.
- Jurgens, R., and J. Chan (2005). *Highway Performance Measures for Business Plans in Alberta*. Transportation Association of Canada.
- Kalinowski, T. (2007, June 9). Trip Planning Weak Link in System. *Toronto Star*: A10.
- Kalinowski, T. (2007, September 12). TCC Approves 15-Cent Fare Hike. *Toronto Star*. <<http://www.thestar.com/News/GTA/article/255880>>, as of August 19, 2008.
- Kalinowski, T. (2007, September 14). OPP Targets Aggressive Truckers. *Toronto Star*. <<http://www.thestar.com/News/GTA/article/256576>>, as of August 19, 2008.
- Kar, D.A. (2001). *Metropolitan transportation agencies: three case studies of multi-jurisdictional transportation planning in Canada*. American Public Transportation Association.
- Kennedy, C.A. (2002). A Comparison of the Sustainability of Public and Private Transportation Systems: A Study of the Greater Toronto Area. *Transportation (Netherlands)* 29, 4 (November): 459–493.
- Kidd, K. (2006, September 10). Put the Brakes on Traffic: A 10-Point Blueprint for Survival. *Toronto Star*: A10.
- Kruger, D., et al. (2007). *The costs of congestion in Canada: a model-based approach*. Transportation Research Board Annual Meeting, Washington, DC, January 21–25, 2007.
- Lambert, S. (2007, September 3). Feds Looking at Technology that Will Prevent Truck Speeding. *Canoe Money*.
- Lambert, W.G. (2003). *Evolution of BRT in greater Vancouver, BC*. ITE Annual Meeting, Seattle, WA, August 24–27, 2003.

Lampert, A. (2003, September 22). Transit Cash Hole \$50 Million Needed by Next Year. *Montreal Gazette*: A6.

Law, S.M., et al. (2001). *The application of option modeling to rail abandonment policy decisions in Canada*. Transportation Research Forum Conference on Transportation: A Time-Space Odyssey, Washington, DC, October 22–24, 2001.

LeRiche, E. (2007, March 13). All Roads Lead to Edmonton. *Edmonton Sun*.

Logan, S. (2007, September 21). Mayor Wants LRT Extension. *Calgary Sun*. <<http://calsun.canoe.ca/News/Alberta/2007/09/21/4514018-sun.html>>, as of August 19, 2008.

Lu, V. (2004, May 19). Mayors Laud Gas-Tax Move: Two Cents a Liter Will Go to Transit by Fall 2006. *Toronto Star*: B5.

McCormick, C. (2004). Canadian Airport Special: Toronto/Pearson—Curves and Light. *Airports International Magazine* 37, 9 (December): 16–17.

McGran, K. (2004, September 21). TTC Enjoys a Taste of Money; Province [Ontario] Hands Over \$70 m. Gas Tax Funds Coming Next. *Toronto Star*: B5.

Miller, E.J., and A. Shalaby (2003). Evolution of Personal Travel in Toronto Area and Policy Implications. *Journal of Urban Planning and Development* 129, 1 (March): 1–26.

Miller, L.S. (2003). Toronto in Transit: A Tale of Two Systems. *Railway Age* 204, 10 (October): 27–30.

Molony, P. (2002, January 26). Gas Taxes Fuel Transit Debate. *Toronto Star*: B4.

Montiero, J. (2001). *Regulatory reforms in Canadian transportation since 1987*. Canadian Transportation Research Forum.

Montiero, J., D. Krause, and A. Downs (2002). *The open skies agreement between the US and Canada: the results*. Canadian Transportation Research Forum.

Nix, F.P. (2002). *Toll roads in Canada*. Canadian Transportation Research Forum.

- Nolan, D. (2007, August 10). Highway Study Faces Public Roadblocks. *Hamilton Spectator*. <<http://www.thespec.com/article/232090>>, as of August 19, 2008.
- Nolan, J., and M. Fulton (2000). *Open or closed? Access and the regulatory future of the Canadian rail industry*. Transportation Research Forum 42nd Annual Meeting, Annapolis, MD, November 29–December 1, 2000.
- Nolan, J., et al. (2001). Competitive Access, the Next Step for the Canadian Rail Industry? *Journal of the Transportation Research Forum* 40, 2 (Spring): 81–95.
- O'Reilly, D. (2007). Quebec Overpasses under Scrutiny after 2006 Bridge Collapse near Montreal. *Engineering News Record* 259, 9 (September 10): 13.
- Ontario Ministry of Transportation (2005). *Moving forward with intelligence: Ontario's Intelligent Transportation Systems strategy*.
- Ottawa-Carleton Transportation Commission (1998). *Making transit the top priority for transportation investment*. National Association of Regional Councils.
- Ouellette, P., P. Petit, and S. Vigeant (2005). Investment and Regulation: The Case of Canadian Air Carriers. *Transportation Research E* 41, 2 (March): 93–113.
- Oum, T.H., and C. Yu (2001). *Assessment of recent performance of Canadian carriers in comparison with US carriers*. Canadian Transportation Research Forum.
- Outhit, J. (2007, February 24). Riders Pay Only 40 Percent of Region's Transit Costs. *Kitchener Record*: B1.
- Paez, A. (2007). *Mobility of Canadian elderly: multi-level analysis of distance traveled in the Hamilton census area*. Transportation Research Board.
- Palmer, V. (2007, September 11). Liberals Tout Gateway As \$ Billion in Benefits, "Negligible" Downside. *Vancouver Sun*. <<http://www.canada.com/vancouver/news/story.html?id=783dc687-0b89-489f-9fba-3fd5556fed94&p=1>>, as of August 19, 2008.

Passenger Transport (2005, March 7). Canadian Urban Transit Systems to Benefit for First Time from Federal Gas Tax. <http://apta100.apta.com/dbtw-wpd/exec/dbtwpub.dll?AC=GET_RECORD&XC=http://apta100.apta.com/dbtw-wpd/exec/dbtwpub.dll&BU=http%3A%2F%2Fwww.apta.com%2Fpassenger_transport%2Fthisweek%2Farchive_search.cfm&TN=passtran&SN=AUTO21529&SE=168&RN=0&MR=20&TR=0&TX=1000&ES=0&CS=2&XP=&RF=Brief+List&EF=&DF=Full+Text&RL=0&EL=0&DL=0&NP=3&ID=&MF=ptengmsg.ini&MQ=&TI=0&DT=&ST=0&IR=1396&NR=0&NB=0&SV=0&BG=0&FG=000000&QS=passtransearch>, as of August 19, 2008.

Perreux, L. (2002, July 11). Province [BC] Touts Tolls as Savior of Highways. *National Post* (Vancouver ed.): A1–Front.

Preece, M. (2006). Canada Line Opens in 2009. *Metro Report* 162. Reed Business Information.

Pucher, J. (2006). Why Canadians Cycle More than Americans. *Transport Policy* 13, 3 (May): 265–279.

Richard, P. (2003). *Measuring the Performance of Nova Scotia's Highway Maintenance Program*. The Transportation Factor, 2003. Transportation Association of Canada.

Ritchie, K. (2003, January 17). Hwy 7 to be Widened to 4 Lanes. *Ottawa Citizen*: B1–Front.

Robl, E.H. (2007). Toronto's Rail Systems are Pushed to Reform. *Metro* 103, 5 (June): 56–60.

Royson, J. (2002, January 26). Gas Tax Drains Wallets but Paves Few Roads. *Toronto Star*: A6.

Royson, J. (2005, January 14). Cash-poor Toronto in Transit Limbo. *Toronto Star*: B3.

Singer, Z., and J. Heath-Rawlings (2003, January 16). Ontario Wants to Widen Queensway to Eight Lanes. *Ottawa Citizen*: A1–Front.

Soberman, R. (2002). *Smart Transportation for Sustainable Development: a Case Study for Toronto*. Second International Conference on Urban Public Transportation Systems, American Society of Civil Engineers, Alexandria, VA, April 14–18, 2002.

Swan, D.J., et al. (2007). Estimation of Representative Capital and Maintenance Costs for Canadian Roads. *Transportation Research Record 1991*. Transportation Research Board.

Toneguzzi, M. (2007, September 18). Roads to Higher Property Values. *Calgary Herald*. <<http://www.canada.com/calgaryherald/news/calgarybusiness/story.html?id=58beae9e-bc45-445d-9047-c92d9ed5e722>>, as of August 19, 2008.

Toronto Star (2004, January 8). Lack of Competition Will Push Tolls Up. *Toronto Star*: A25.

Toronto Star (2007, June 1). Truckers “Getting Nickel and Dimed to Death.” *Toronto Star*: A2.

Tougas, F. (2006). Shippers vs. Railroads: A Canadian Perspective. *Journal of Transportation Law* 73, 2: 220–246.

Transport Canada (2001). *Transportation in Canada, 2001: Annual Report*. Transport Canada.

Transport Canada (2005). *Costs of Congestion in Canada’s Transportation Sector*. Prepared by Delcan for Transport Canada. Sustainable Development Branch, Contract No. T8080-01-1593.

Transport Canada (2006). *Transportation in Canada, 2006: Annual Report*. Transport Canada.

Transportation Association of Canada (2006). *Performance Measures for Road Networks: A Survey of Canadian Use*. Document prepared for Transport Canada.

US Department of Transportation [USDOT] (2007). 2006 Status of the Nation’s Highways, Bridges and Transit. Report to Congress. Washington, DC.

Vancouver Sun (2004, March 3). Privatization Plan Dropped. *Vancouver Sun*: G4.

Van Praet, N. (2003, November 7). Air Canada Fares under Scrutiny. *Montreal Gazette*: B1–Break.

Walker, P. (2007, September 18). City Shortchanged on Funding. *Edmonton Journal*.

Wallner, B., and J. Laires (2007). Canadian Parking Taxes: A Look Over the Border. *Parking* 43, 6 (July): 16–18.

Ward, D. (2002). *Airline restructuring in Canada: final report*. Transport Canada.

Waters, W. G., and B. Jiang (2000). *Public Infrastructure Capital and Economic Activity: Cross-Sectional Evidence from Canadian Provinces*. Transportation Research Forum.

Westell, D. (2000). Pearson Airport Rail Link Proposed. *Public Works Financing* 141 (June): 29–30.

Willis, N. (2007, September 22). PEI-Cape Breton Ferry Idea Floated. *Charlottetown Guardian*.

Yong, P. (2007). Pay by Cell Launched in Vancouver CA. *Parking Today* 12, 8 (August): 24–25.

Data references

Alberta (2007). *Alberta Infrastructure and Transportation Annual Report 2005–2006*. Government of Alberta.

British Columbia Ministry of Transportation [BC-MT] (2005). *2005/06 Annual Service Plan Report*. <http://www.th.gov.bc.ca/publications/ministry_reporting/service_plans/serviceplans.htm>, as of August 19, 2008.

Canadian Ferry Operators Association [CFOA] (2006). *2005 Annual Report*. <<http://www.cfoa.ca/annualreport.html>>, as of August 19, 2008.

Charlottetown Airport Authority (2008). [Charlottetown Airport flight schedule]. <<http://www.flypei.com>>, as of August 19, 2008.

Demographia (2007). *Demographia World Urban Areas (World Agglomerations) & Population Projections* (March). <<http://www.demographia.com/db-worldua.pdf>>, as of August 19, 2008.

Manitoba (2007). [Pavement conditions]. Information provided by Dennis Watson, Manager, Asset Management, Manitoba Transportation.

New Brunswick (2007). [Surface distress index for 500 meter road segments]. Information provided by George Thompson, Manager, Systems Planning Unit, Planning and Land Management Branch, Department of Transportation.

Newfoundland & Labrador (2007). [Roughness readings]. Information provided by Gary Gosse, via Doug Shea, Transportation Planning Supervisor, Newfoundland & Labrador Department of Transportation and Works.

Nova Scotia (2005). *Transportation and Public Works Business Plan 2005–2006*. <<http://www.gov.ns.ca/tran/publications/publication.asp>>, as of August 19, 2008.

Nova Scotia (2007a). [Passenger statistics for its intra-provincial ferry system, only vehicle statistics]. Information provided by Bill Yarn, Nova Scotia Department of Transportation and Public Works.

Nova Scotia (2007b). [Road conditions]. Information provided by Romeo Poirier, Construction Services Specialist, Nova Scotia Department of Transportation and Public Works.

Ontario (2007). [Road conditions as percentage of roads in good condition]. Information provided by Sarah Liyanage, Team Leader (2002–2006), Information Management, Investment Planning Office.

Prince Edward Island [PEI] (2007a). [Ridership and population statistics]. Information provided by Katie Dunn, Charlottetown Transit.

Prince Edward Island [PEI] (2007b). [SDI for road segments]. Information provided by Doug Gaudet, Traffic Planning Technician, Prince Edward Island Department for Transportation and Public Works.

Quebec (2006a). *Ministere des Transports Rapport Annuel de Gestion 2005–2006*. Transports Quebec. <http://www.mtq.gouv.qc.ca/portal/page/portal/ministere/ministere/organisation/rapport_annuel#contexte> (in French), as of August 19, 2008.

Quebec (2006b). *Quebec Public Transit Policy 2006*. Transports Quebec. <http://www.mtq.gouv.qc.ca/portal/page/portal/grand_public_en/transport_collectif/politique_quebecoise_transport_collectif>, as of August 19, 2008.

Quebec (2007). [Quebec provincial expenditures]. Information provided by Denis Godin, Transports Quebec.

Railway Association of Canada (2006). *Railway Trends 2006*. Railway Association of Canada. <http://railcan.ca/sec_pro/en_pro_publications.asp>, as of November 17, 2008.

Saskatchewan (2006). *Saskatchewan Highways and Transportation 2005–2006 Annual Report*. <<http://www.highways.gov.sk.ca/annual05/>>, as of August 19, 2008.

Statistics Canada (various issues—a). *Air Carrier Traffic at Canadian Airports*. Catalogue No. 51-203-XWE.

Statistics Canada (various issues—b). *Canadian Vehicle Survey*. Catalogue No. 53-223-XWE.

Statistics Canada (various issues—c). *Shipping in Canada*. Catalogue No. 54-205.

Statistics Canada (2005a). *Canadian Economic Observer* (August). Catalogue No. 11-010-XWB.

Statistics Canada (2005b). *Trucking in Canada 2003*. Catalogue No. 53-222-XIE.

Statistics Canada (2006a). *Annual Demographic Estimates: Canada, Provinces and Territories 2005–2006*. Catalogue No. 91-215-XWE.

Statistics Canada (2006b). *Human Activity and the Environment: Annual Statistics 2006*. Catalogue No. 16-201-XWE.

Statistics Canada (2006c). *The Time it Takes to Get to Work and Back 2005*. Catalogue No. 89-622-XWE2006001.

Statistics Canada (2007a). *Distribution of employed people, by industry, by province 2006*. Summary table.

Statistics Canada (2007b). *Land and freshwater area, by province and territory*. Summary table.

Statistics Canada (2007c). *Population of census metropolitan areas (2001 Census boundaries)*. Summary table.

Statistics Canada (2007d). *Population urban and rural, by province and territory*. Summary table.

Statistics Canada (2007e). *Rail in Canada 2005*. Catalogue No.52-216-XWE.

Transport Canada (2005a). *Annual Report 2005*. <<http://www.tc.gc.ca/pol/en/anre/menu.htm>>, as of August 19, 2008.

Transport Canada (2005b). *Transportation in Canada Addendum 2005*. <<http://www.tc.gc.ca/pol/en/Report/anre2005/add>>, as of August 19, 2008.

Transport Canada (2006a). *Canadian Motor Vehicle Traffic Collision Statistics: 2005*. <<http://www.tc.gc.ca/roadsafety/tp/tp3322/2005/menu.htm>>, as of August 19, 2008.

Transport Canada (2006b). *Transportation in Canada Addendum 2006*. <<http://www.tc.gc.ca/pol/en/anre/menu.htm>>, as of August 19, 2008.

Transport Canada (2007a). *Costs Of Congestion In Canada's Transportation Sector, Final Report*. Contract No. T8080-01-1593. Information provided by Cristobal Miller, Senior Economist, Sustainable Development, Transport Canada.

Transport Canada (2007b). *Statistics from T-Facts* [Marine data spreadsheet]. <http://www.tc.gc.ca/pol/en/T-Facts3/Statmenu_e.asp?type=pu&file=marine&Lang=>>, as of August 19, 2008.

Transport Canada (2007c). [Truck accidents]. Information provided by the Regulations Officer, Transport Canada.

US Department of Transportation (2007). *North American Transportation in Figures*. Catalogue No. BTS00-05. North American Transportation Statistics Database. <<http://nats.sct.gob.mx/nats/sys/index.jsp?i=3>>, as of August 19, 2008.

About the authors

David T. Hartgen, PhD, P.E., is emeritus professor of transportation studies at the University of North Carolina at Charlotte, where he established the Center for Interdisciplinary Transportation Studies and now conducts research in transportation policy. He recently established The Hartgen Group, a transportation planning and policy research organization. He is the author of about 335 publications on a wide variety of topics in transportation policy and planning, is US editor of the international academic journal *Transportation*, and is active in professional organizations. He is a frequent media interviewee in local and national publications. Before coming to Charlotte in 1989, he directed the statistics and analysis functions of the New York State Department of Transportation and served at the Federal Highway Administration. He holds engineering degrees from Duke University and Northwestern University, has taught at the State University of New York (Albany, Union, and Syracuse), and lectures widely. He has completed a wide range of transportation assessments, studies of sprawl, road condition, and growth and economic development. In 2006, he reviewed the performance of North Carolina's largest transit systems <www.johnlocke.org>. His recent nationwide study of congestion for the Reason Foundation, <www.Reason.org/ps346>, and his sixteenth annual review of the 50 US state highway systems <www.reason.org/ps350> have received wide national attention. His 2008 review of the readiness of large US regions to confront expected growth is of considerable interest in the US. In the course of his professional career, he has visited seven of the 10 Canadian provinces.

Claire G. Chadwick holds a bachelor's degree in geology from the University of Florida and a master's in geology from Idaho State University, through which she gained valuable research and spreadsheet management experience. Claire has visited the Canadian Rockies, and hopes to someday visit Toronto where her mother was born.

M. Gregory Fields is a graduate student at the University of North Carolina at Charlotte, pursuing degrees in transportation, earth sciences and sociology. A retired US Army officer, he holds a BS degree from the US Military Academy and an MA from Webster University in St. Louis. He has contributed to several transportation studies including a review of the cost-effectiveness of North Carolina's highway projects, county-level road condition trends in North Carolina, a review of South Carolina's traffic modeling systems, *Reason* magazine's recent nationwide study of congestion, and economic impacts of highway investments.

Acknowledgments

This study was designed and directed by **Prof. David T. Hartgen**, emeritus professor of transportation studies at the University of North Carolina (UNC) at Charlotte. Prof. Hartgen developed the study plan, directed data gathering and measure development, and prepared this report. However, the study could not have been completed without the cooperation and assistance of numerous individuals and organizations. **Jason Clemens** and **Niels Veldhuis** at the Fraser Institute provided guidance and funding for the work. **Claire Chadwick**, research analyst at the Hartgen Group, gathered the primary data, organized computational spreadsheets, prepared graphics, and drafted documentation and provincial summaries. **M. Gregory Fields**, research analyst at the Hartgen Group, assisted in data organization and preparation of maps and tables. **Caleb Cox**, a graduate student in economics at UNC Charlotte, reviewed recent transportation-related articles in Canadian newspapers and the academic literature. **Robert P. Zampieri**, retired IBM executive, provided advice on measures. Numerous professionals at federal and provincial transportation ministries and other federal, provincial, and local agencies kindly provided information concerning their systems and assisted in its interpretation. Several anonymous reviewers provided valuable comments. The contributions of all of these persons are gratefully acknowledged; but, of course, the authors remain solely responsible for the content and interpretation of the information. This report does not represent a standard or a specification for any organization.

About this publication

Periodically, the Fraser Institute publishes timely and comprehensive studies of current issues in economics and public policy. This study is one such example belonging to a series of related publications.

Distribution

These publications are available from <<http://www.fraserinstitute.org>> in Portable Document Format (PDF) and can be read with Adobe Acrobat® or with Adobe Reader®, which is available free of charge from Adobe Systems Inc. To download Adobe Reader, go to this link: <<http://www.adobe.com/products/acrobat/readstep2.html>> with your Browser. We encourage you to install the most recent version.

Ordering publications

For information about ordering the printed publications of the Fraser Institute, please contact the publications coordinator

- ❧ e-mail: sales@fraserinstitute.ca
- ❧ telephone: 604.688.0221 ext. 580 or, toll free, 1.800.665.3558 ext. 580
- ❧ fax: 604.688.8539.

Media

For media enquiries, please contact our Communications Department

- ❧ telephone: 604.714.4582
- ❧ e-mail: communications@fraserinstitute.org.

Disclaimer

The authors of this publication have worked independently and opinions expressed by them are, therefore, their own, and do not necessarily reflect the opinions of the supporters, trustees, or other staff of the Fraser Institute. This publication in no way implies that the Fraser Institute, its trustees, or staff are in favor of, or oppose the passage of, any bill; or that they support or oppose any particular political party or candidate.

Copyright

Copyright© 2008 by the Fraser Institute. All rights reserved. No part of this publication may be reproduced in any manner whatsoever without written permission except in the case of brief passages quoted in critical articles and reviews.

ISSNs

1918-0314 Studies in Transportation and Infrastructure (Print)
1918-0322 Studies in Transportation and Infrastructure (Online)
Printed and bound in Canada.

Date of issue

October 2008

Date of revision

November 2008 (version 1.1)

Editing, design, and production

Kendal Egli and Lindsey Thomas Martin

Cover design

Bill Ray

Images for cover

Aircraft taking off © Wayne Pillinger; iStockphoto
Daniel Johnson Dam © Adam Romanowicz; iStockphoto
Rusty water pipes © Norbert Biberstein; iStockphoto
Railroad locomotive traveling across Arizona © Paul Hill; iStockphoto
Busy Interstate traffic © Wendell Franks; iStockphoto
Containership © Olivier Lantzenoerffer; iStockphoto

Supporting the Fraser Institute

To learn how to support the Fraser Institute, please contact

- ❧ Development Department, Fraser Institute
Fourth Floor, 1770 Burrard Street
Vancouver, British Columbia, V6J 3G7 Canada
- ❧ telephone, toll-free: 1.800.665.3558 ext. 586
- ❧ e-mail: development@fraserinstitute.org.

About the Fraser Institute

Our vision is a free and prosperous world where individuals benefit from greater choice, competitive markets, and personal responsibility. Our mission is to measure, study, and communicate the impact of competitive markets and government interventions on the welfare of individuals.

Founded in 1974, we are an independent research and educational organization with locations throughout North America and international partners in over 70 countries. Our work is financed by tax-deductible contributions from thousands of individuals, organizations, and foundations. In order to protect its independence, the Institute does not accept grants from government or contracts for research.

菲沙研究所的願景乃一自由而昌盛的世界，當中每個人得以從更豐富的選擇、具競爭性的市場及自我承擔責任而獲益。我們的使命在於量度、研究並使人知悉競爭市場及政府干預對個人福祉的影響。

Nous envisageons un monde libre et prospère, où chaque personne bénéficie d'un plus grand choix, de marchés concurrentiels et de responsabilités individuelles. Notre mission consiste à mesurer, à étudier et à communiquer l'effet des marchés concurrentiels et des interventions gouvernementales sur le bien-être des individus.

تتمثل رؤيتنا في وجود عالم حر ومزدهر يستفيد فيه الأفراد من القدرة على الاختيار بشكل أكبر، والأسواق التنافسية، والمسؤولية الشخصية. أما رسالتنا فهي قياس، ودراسة، وتوصيل تأثير الأسواق التنافسية والتدخلات الحكومية المتعلقة بالرفاه الاجتماعي للأفراد.

Nuestra visión es un mundo libre y próspero donde los individuos se benefician de una mayor oferta, la competencia en los mercados y la responsabilidad individual. Nuestra misión es medir, estudiar y comunicar el impacto de la competencia en los mercados y la intervención gubernamental en el bienestar de los individuos.

Editorial Advisory Board

Prof. Armen Alchian	Prof. James Gwartney
Prof. Terry Anderson	Prof. H.G. Johnson*
Prof. Robert Barro	Prof. Ronald W. Jones
Prof. Michael Bliss	Dr. Jerry Jordan
Prof. James M. Buchanan†	Prof. David Laidler**
Prof. Jean-Pierre Centi	Prof. Richard G. Lipsey**
Prof. Thomas J. Courchene**	Prof. Ross McKittrick
Prof. John Chant	Prof. Michael Parkin
Prof. Bev Dahlby	Prof. F.G. Pennance*
Prof. Erwin Diewert	Prof. Friedrich Schneider
Prof. Stephen Easton	Prof. L.B. Smith
Prof. J.C. Herbert Emery	Prof. George Stigler* †
Prof. Jack L. Granatstein	Mr. Vito Tanzi
Prof. Herbert G. Grubel	Sir Alan Walters
Prof. Friedrich A. Hayek* †	Prof. Edwin G. West*

* deceased; ** withdrawn; † Nobel Laureate