appendix 7 Mode profiles

Road – The Physical System

Roads

The term "road" refers to everything from freeways and other paved highways and streets to dirt roads. Only one-third of all roads in Canada are paved; the rest are gravel, oil-treated, or earth surfaces.

A common – and expensive – challenge in large countries with small populations is building and maintaining enough roads to link people and communities scattered over huge land areas. Canada has 32.4 kilometres (kms) of roads for every 1,000 people; the US has 24.5; France 14.0; and Japan only 8.9.

Jurisdiction

Most of Canada's roads are the responsibility of municipal governments to build and maintain. Provincial governments have recently been transferring some of their roads to municipal governments.

Canada's 902,000 kms of roads are located:

- 61% in the Western provinces and territories (Saskatchewan alone has 22%),
- 32% in Ontario and Quebec, and
- 7% in Atlantic Canada.

National Highway System

The 7,306-km TransCanada Highway is a part of the 25,000-km National Highway System that connects Canada from coast to coast. This vital network provides interprovincial and international links, and almost 40% of it is four or more lanes wide. Although it accounts for less than 3% of the total road network, more than one-quarter of all highway travel takes place on the National Highway System.

Maintaining Our Roads

More than $12 billion is spent each year to build and maintain roads in Canada. Most of this is funded by provincial and municipal governments. The federal government, through Transport Canada, provides some funding support to the provinces and territories through various programs.

Roads in Canada	(000 kilometres)	%
Saskatchewan	201.9	22.4
Alberta	181.4	20.1
Ontario	167.9	18.6
Quebec	119.9	13.3
Manitoba	87.9	9.7
British Columbia	65.7	7.3
Nova Scotia	26.0	2.9
New Brunswick	21.9	2.4
Newfoundland	13.1	1.5
PEI	5.7	0.6
NWT	5.5	0.6
Yukon	5.1	0.6
Total	**901.9**	**100.0**

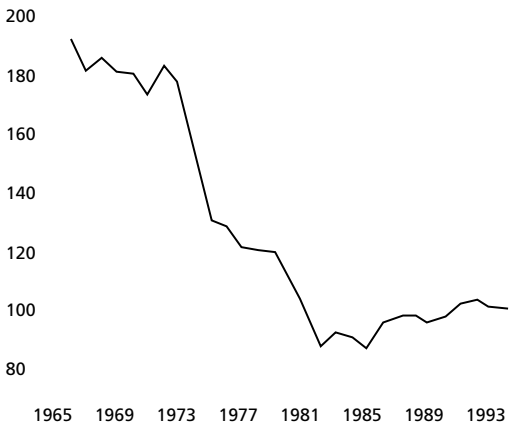
Source: Transport Canada, 1995 data; two-lane equivalents (see below).

Ownership of Roads (000 kilometres)

Year	Municipal	Provincial	Federal	Total	Municipal % of total
1985	566	261	14	840	67%
1989	588	277	15	880	67%
1991	599	275	15	889	67%
1995	656	231	15	902	73%

Source: Transport Canada .
Roads are measured in two-lane equivalent kilometres (kms). A two-lane equivalent is a length of road measured as if it had only two lanes. For example, a 1-km stretch of road with two regular lanes and one passing lane down the middle counts as 1.5 km of road.

Spending on Roads vs. Traffic Growth



Source: Transport Canada.
Road expenditures/vehicle-km by the three levels of government, index 1980=100

Road Revenues

To pay for the roads, governments collect revenues from road users, including fuel taxes, tolls, permit and licence fees, and parking fines. It is estimated that the three levels of government collect more than $12 billion each year from users. Most of the revenue is from provincial and federal fuel taxes.

Vehicles

There are 17.5 million vehicles of all types registered to drive on our public roads. More than three-quarters are passenger automobiles, including taxis and other for-hire automobiles.

Trucks

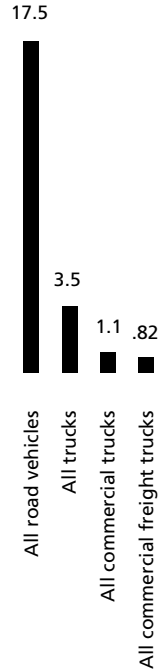
Vehicles classified as "trucks" number approximately 3.5 million, including many small pickups and vans. Some 1.1 million operate in the trucking industry. Commercial trucking industry vehicles have a registered weight of 4,500 kilograms (kgs) or more, and at least six tires. These trucks haul goods or conduct other commercial services, such as garbage collection, fire fighting, and towing.

Cost of Trucks

Tractor-semi-trailer units cost between $100,000 and $150,000; specialized trailer equipment, including dry vans, flat decks, tankers, auto carriers, dump trailers, and livestock carriers, can cost as much as $200,000.

Buses

Almost 65,000 buses carry passengers on Canada's roads. Most are transit or school buses operating within urban and suburban areas. Some 4,500 buses provide inter-city scheduled and charter services. Various motor coaches, most seating 20 to 50 passengers, cost as much as $400,000.



Vehicles on Our Roads
(millions of vehicles)
Source: Statistics Canada

Registered Vehicle Distribution:
Ontario and Quebec – 59%
Western provinces and territories – 33%
Atlantic Canada – 8%

Road – Work Done

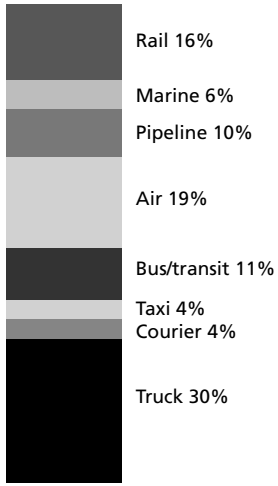
Moving Freight

Roads are key to commercial transportation. Trucks carry virtually everything consumed in Canada today, and move 75% of the value of all Canadian freight shipments to domestic and international destinations. The old saying is still true: "If you got it, a truck brought it."

Private trucking accounts for most freight moved in urban centres. For-hire trucking

Commercial Transportation Revenue, 1995/96

Half of all transportation industry revenues depend on the public road system.



dominates in longer-distance movements, carrying freight between cities and across the US border. Since most private truck fleets are part of some other economic activity (e.g., forestry or the food industry), private trucking statistics are limited. Therefore, data shown here refer to for-hire trucking. It is estimated, however, that the value of private trucking approaches or even exceeds the value of for-hire trucking.

For-Hire Trucking Revenues

The industry earned $10 billion in revenues in 1996. Some 62% of that came from domestic activities, and 38% from international activities.

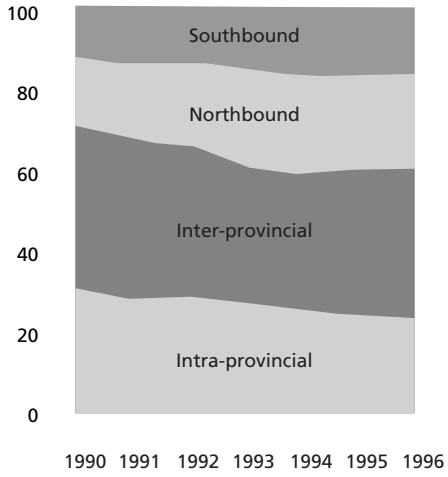
North-South vs. East-West

On a tonne-km basis (e.g., the movement of one tonne of freight a distance of one kilometre), north-south trucking across the US border increased significantly in the 1990s (% of all for-hire traffic):

	1990	1996
Traffic across US border	30%	41%
Traffic within Canada	70%	59%

This reflects changing trade patterns. In 1981, trade between the provinces accounted for 27% of Canadian Gross Domestic Product (GDP), on a par with international trade. By 1997, interprovincial trade had dropped to 20%, while international exports had risen.

Growth of North-South Traffic, 1990 - 1996*



** Tonne-km basis.*
Source: Statistics Canada

Top Commodities Moved by Truck

Commodity Group	1996 Revenues (millions)	% of total
General freight*	$4,310	42.7
Food & food products	1,574	15.6
Forest products	1,471	14.6
Manufactured end products	718	7.1
Chemical products	579	5.7
Petroleum products	371	3.7
Motor veh., engines & parts	684	6.8
Non-metallic minerals	248	2.5
Grains	106	1.1
Metallic ores	24	0.2
Total	**$10,086**	**100.0**

**Mainly manufactured products and fabricated materials.*
Sources: Statistics Canada; Transport Canada

Moving People

Buses carry passengers by road within and between cities. The bus industry includes: urban transit, school buses, charter buses, and inter-city scheduled services.

Urban transit is the largest part of the industry, employing 84,000 people and carrying 1.36 billion revenue passengers each year. In 1996, urban transit fares covered just 50% of the cost of providing the services.

Of the 77 urban transit companies in Canada earning at least $200,000 in operating revenues each year:

- 56 are in Ontario and Quebec,
- six are in Atlantic Canada, and
- there are 15 in the West.

Transit ridership for all Canadian urban centres grew in the 1980s but declined more than 11% between 1990 and 1995. An estimated 10% of the population travelling to and from work in cities uses public transit for all or part of the trip.

School buses represent a large share of industry operators and earn a large share of bus industry revenues, although school bus operations are not strictly commercial services competing for riders.

Charter buses serve groups of travellers all embarking and disembarking at the same point. Services range from a half-day school trip to a three-week excursion, and they can be one way or return and include local sightseeing tours.

Inter-city services carry passengers on scheduled trips between cities. The number of passengers opting to take the bus between urban centres has declined as air travel and the use of private cars has grown:

1996 – 10.3 million bus passengers
1980 – 32.5 million bus passengers
1949 – 129.7 million bus passengers (peak yr.)

Bus Industry Revenues, 1996*

	(millions)
Urban transit buses	$3,676
School buses	1,032
Scheduled inter-city bus services	342
Charter buses	270
Total	**$5,320**

** Includes $2.1 billion in subsidies.*
Source: Transportation in Canada, 1997, *Transport Canada*

The number of inter-city bus passengers between 1980 and 1996 declined 68%, while vehicle-kms travelled declined just 35% in the same period. This meant that, on average, fewer seats were filled on each trip.

Rail – The Physical System

Rail infrastructure in Canada was originally developed and supported by governments through direct ownership, as well as through various grants and subsidies over more than a century. Today it is privately owned and maintained.

Canadian National Railways (CN) and Canadian Pacific Railway Company (CPR) together operated 84% of all track in Canada in 1997, including industrial tracks, sidings and tracks in rail yards, and double-tracked lines.

Canada has more than twice the rail lines per person than the US, and more than six times that found in western Europe. However, Canada's huge land area, harsh terrain and climate, and small population make it difficult and expensive to build and maintain enough rail lines to link all of the people and communities scattered over a large area. This is reflected in a relatively low measure of rail lines compared to the land area.

Rail Systems, 1996

	Kms of rail per 1,000 persons	Kms of rail per 1,000 square km of land area
Canada	2.58	8.4
US	1.20	23.9
EU-15	0.42	48.4

Sources: Eurostat EU Transport in Figures, 1999*;* Pocket Guide to Transportation, *US Bureau of Transportation, 1998; Transport Canada*

Growth and Rationalization

Railways were built-up from the late 1800s: by 1900 there was 29,000 kms of track in Canada, and by 1930, there was more than 90,000 kms. This changed little right up until 1985, at which point there was 95,670 kms. However, rationalization after 1985 reduced that by 22%, to 74,950 kms, by 1997.

Route-kilometres

The commonly used measure of rail-track infrastructure is the route-km, which is the length of the route over which a railway operates its service. Industrial tracks, and

sidings and tracks in rail yards are excluded, and the length is counted only once where there is more than one parallel rail line.

Canadian railways operated trains over 50,000 route-kms of rail lines in 1998. Approximately 36,300 route-kms, or 73%, are owned or leased by CN and CPR, with most of the remaining lines owned or leased by regional and shortline carriers.

Regional Split

Of the total 50,000 route-kms:

- the Western provinces have 60%,
- Ontario and Quebec have 35%, and
- Atlantic Canada has 5%.

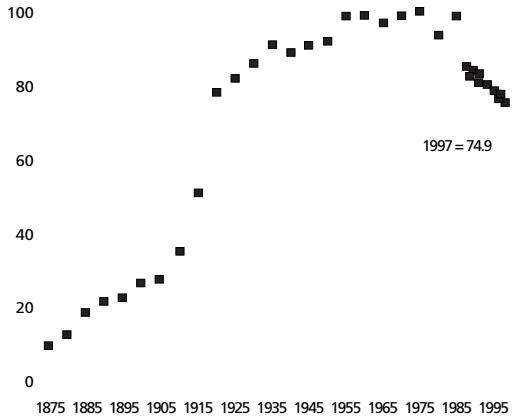
Shortline Railway Growth

Closing a railway line or line segment once meant a loss of service to shippers and communities. Although abandonments still occur, track and operations are increasingly being sold or leased to shortline railway companies. New rules under the *Canada Transportation Act* effective in mid-1996 simplified the process for railways to transfer lines to other carriers. Eight new shortline railways were formed in 1997, and another nine in 1998. Together, they account for 26% of the rail network, on a route-km basis.

More Line Transfers Expected

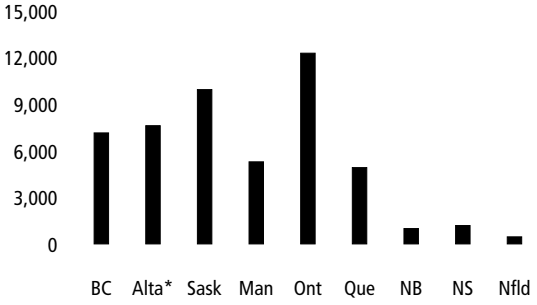
During 1998, rationalization by CN and CPR reduced their combined share of route-kms of track from 78% of the network to 73%. This is expected to further decline to 67%, and shortline and regional railways are expected to grow from 26% to almost one-third of the track over the next few years.

Growth of Canada's Rail Network (000 kms)



Source: Statistics Canada

Distribution of Rail in Canada
(route-kms, Dec. 31, 1997)



** Includes the Northwest Territories*
Source: Rail in Canada 1997, *Statistics Canada*

Rolling Stock

Railway vehicles – the locomotives and freight cars – are called "rolling stock." Diesel locomotives cost more than $3 million each, and freight cars more than $80,000. The amount of rolling stock in use has declined 12% over the last decade, as more-efficient freight cars and locomotives replaced older ones, and as passenger service was cut back.

Equipment in Service

	1987	1997	% change
Freight cars	121,679	107,976	(11.3)
Passenger cars	926	426	(54.0)
Locomotives	3,855	3,143	(18.5)

Source: Rail in Canada 1997, 1987, Statistics Canada

Rail – Work Done

Moving Freight

Commodities carried by railways tend to be bulk products, and goods packed in containers. Railways are the most economical form of land transport to carry these products over long distances. On average, rail transport is about 30% of the cost of truck transport.

In 1997, railway freight traffic in Canada totalled 291 million tonnes. The top 10 commodities accounted for 70% of that volume. Most of these commodities are transported to ports for export by water. Large volumes are also delivered directly to the US – mainly lumber, potash, newsprint, wood pulp, and containers on flat cars (COFC).

Top 10 Commodities Carried by Rail in 1997

Commodity	Tonnes (millions)
Bituminous coal	40.2
Iron ore, concentrates	38.8
Wheat	26.3
Containers on flat cars (COFC)*	17.8
Potash	14.2
Woodchips	13.4
Lumber	9.5
Wood pulp	9.3
Sulphur	5.7
Gypsum	5.4

** All freight moved in containers is reported as COFC, not by commodity, even if the contents are known.*
Source: Rail in Canada 1997, *Statistics Canada*

Railway Classes

CN and CPR (and VIA Rail for passengers) are called the Class I railways. The Class II railways are the 50 shortline and regional railways operating in Canada. Class III railways are bridge and terminal companies.

Activity

There are various ways to measure the work done by freight railways. The most common measure is the tonne-km, which is the movement of one tonne of freight over a distance of one kilometre. Revenue freight tonnes are also used.

Class II Share

Shortline and regional carriers handled 29% of the revenue freight tonnage carried by Canadian railways in 1997, although they handled just 9% of the tonne-kms. This is because the average length of haul for these smaller carriers is just 302 kms, compared with a haul length of more than 1,200 kms for the Class I railways.

Rail vs. Truck

Railways carry more tonnage than trucks; railways carry 59% of the tonnage moved by surface transport. Rail dominates even more on a tonne-km basis – 70% – since railways are relatively more cost-effective in carrying bulky freight over longer distances.

Freight Revenues

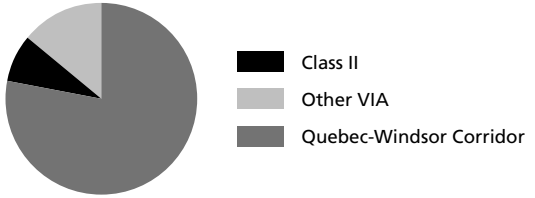
The combined revenues of CN and CPR were $6.8 billion in 1997, representing 91% of the freight revenues of all Canadian railways. The balance is earned by the regional and shortline railways.

VIA Rail

VIA Rail moved 3.8 million passengers in 1997, on its four main routes:

- between Quebec City and Windsor, Ontario,
- on the Western transcontinental (Toronto to Vancouver),
- on the Eastern transcontinental (Montreal to Halifax and Montreal to Gaspé), and
- on the northern routes (in Quebec, Ontario, Saskatchewan and British Columbia).

Rail Passenger Distribution



Intercity Rail Passengers, 1997 = 4.1 million

Moving People

Inter-city passenger rail services are dominated by VIA Rail, which accounts for 92% of all inter-city passengers. About 85% of VIA's passengers and 70% of the trains are in the Quebec City-to-Windsor corridor.

In the past, VIA Rail has received a large share of its revenues from federal government subsidies, but this has declined dramatically.

In 1993/94, 15% of VIA's revenues were from subsidies; in 1997/98, that figure was less than 4%. Despite increases in operating revenues and reductions in total costs, VIA Rail recovered just 39% of its total costs in 1997.

Several smaller passenger railways (e.g., BC Rail, Rocky Mountaineer, Algoma Central, Ontario Northland, and Quebec, North Shore & Labrador Railways) carried 339,000 passengers, most on tourist services, in 1997.

Commuter rail, serving large urban centres such as Montreal, Toronto and Vancouver, carries an estimated 30 million riders annually.

AIR – The Physical System

Airports

There are 631 Transport Canada-certified airports that handle Canada's commercial aviation. These include basic sites with a single runway and one multi-purpose building, to large complexes with multiple runways, hangars, terminals and warehouses, and Customs, immigration and agricultural inspection facilities. Most airports are owned by municipalities, provincial or territorial governments, or the federal government.

Airport Policy

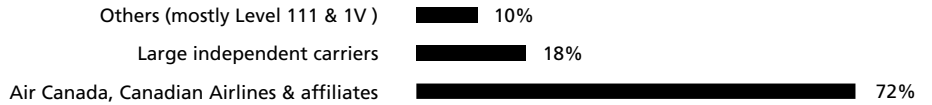
In 1994, the federal government announced a new policy designed to commercialize most federally owned airports. The transfer process, once completed, will affect 136 of 149 Transport Canada airports.

National Airports System (NAS)

Airports located in national, provincial and territorial capitals, and those which handle at least 200,000 passengers a year, are designated as NAS airports. Together, all NAS airports handle 95% of passenger and 98% of cargo traffic in Canada.

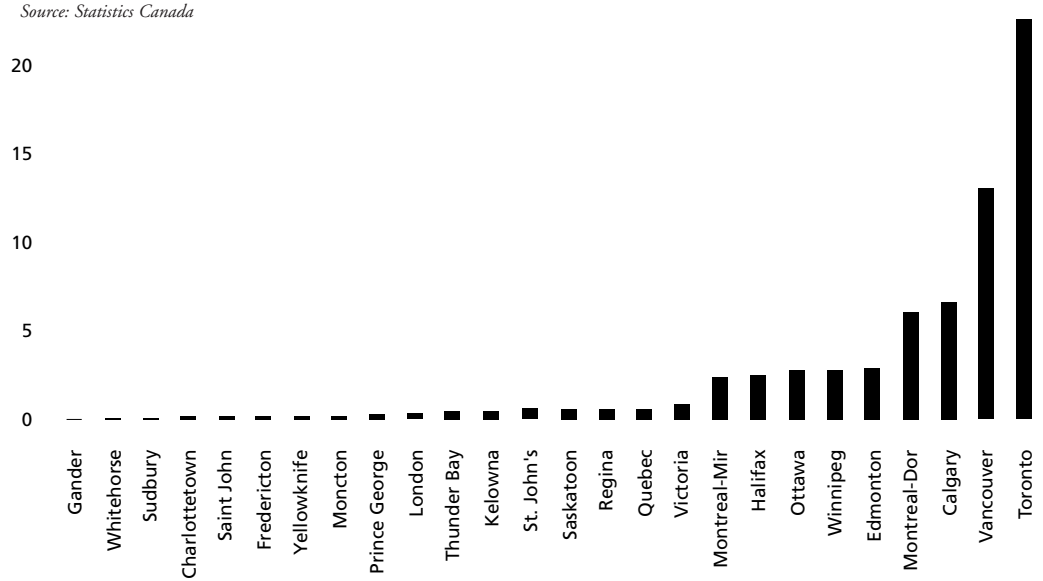
Airline Revenues, by Carrier

Source: Transport Canada



Airport Traffic in Canada, 1996 (millions of enplaned + deplaned passengers, 1996)

Source: Statistics Canada



Canadian Airports as of December 31, 1998

Type	Status	Number
National Airports System (NAS) airports	• federal government continues to own, but has divested airport operations to not-for-profit authorities under long-term leases* • 16 airports transferred; 10 to follow by early 2000	26
Regional and local	• 50 airports transferred; 20 to follow by early 2000	70
Small and satellite	• no scheduled passenger services • 22 airports transferred to local interests; nine to follow by early 2000	31
Arctic	• based in Yukon and NWT • have been transferred to territorial governments	9
Remote	• provide year-round access to isolated communities (one in each of BC, Alberta and Ontario; two in Manitoba; eight in Quebec) • continue to receive federal assistance; not slated for transfer	13

** Except Whitehorse and Yellowknife, which have been transferred to territorial governments, and are included as NAS airports even though they are Arctic airports.*
Source: Transport Canada

Civil Air Navigation

Civil air navigation services in Canada are provided by NAV Canada, a private, not-for-profit corporation. The system consists of seven area-control centres, more than 100 airport control towers and flight service stations, and a network of navigation and landing aids. The country's almost 2,000 air traffic controllers are employees of NAV Canada. In 1998, the system supported 7.6 million aircraft arrivals and departures at Canadian airports.

NAV Canada was formed in 1996. The services were previously supplied by Transport Canada, funded mainly through the Air Transportation Tax. This tax is no longer collected, and NAV Canada is now funded through user fees. Safety is the joint responsibility of NAV Canada and the Minister of Transport, whose mandate includes safety oversight of all operations.

Air Service Policies

Rules for domestic and international services differ under economic regulations, but all air service providers must meet safety regulations.

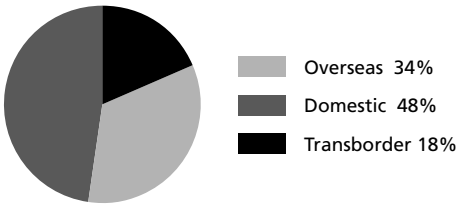
For domestic passenger and cargo service, such factors as routes, aircraft capacity, service frequency and fares are not regulated. For international service, the Canadian government has made a series of agreements, called bilateral agreements, with more than 60 individual countries, specifying the routes and other rules by which airlines are to operate between Canada and each country. There are different rules for scheduled and charter services, and for passenger and cargo services. Once a bilateral agreement is made, the Minister of Transport designates the Canadian carrier(s) permitted to serve the routes that have been negotiated.

Major Airlines

Canada has two major air carriers: Air Canada and Canadian Airlines International Ltd. These airlines:

- have comprehensive domestic and international route networks,
- operate a number of regional or local carriers as subsidiaries,
- compete with each other and with other domestic and foreign carriers, and

Passenger Revenues, by Type of Travel



Source: Transport Canada, 1998

- have alliances and other agreements with international carriers to widen their networks (Air Canada is a member of the STAR Alliance; Canadian Airlines is a member of the OneWorld Alliance).

Other Airlines

A number of independent carriers (e.g., Air Transat, Canada 3000, Royal Airlines, SkyService, WestJet and First Air) offer various services on a smaller scale. Some regional carriers not affiliated with the two major carriers provide domestic services, mostly in remote areas. Cargo service is usually an important part of these services. There are a number of smaller carriers that operate in all regions of the country, offering passenger and cargo services, as well as dedicated carrier and on-demand charter services.

Airplanes

A new 747-400 jet costs approximately $150 million (US), and a McDonnell Douglas MD-11, some $100 million (US). Factors such as the type of aircraft, seating capacity, and flight range all affect the price.

Air – Work Done

Moving People

Air services may be grouped in a variety of ways, including:

- scheduled or charter services on domestic, transborder (US), or international (non-US) routes,
- Level I (largest) through Level VI carriers, depending on the number of revenue passengers or tonnes of goods carried, or
- first class, business class, economy fares, discounted, and other fare classes.

Transborder Traffic Growth

Canada's transborder market is growing the fastest. Air Canada, Canadian Airlines, and the large charter airlines increased their number of transborder flights from 60,000 in 1994 to 115,000 in 1997. This growth follows a liberalized Canada-US bilateral agreement on air services which came into effect in 1995.

Revenues

In 1997, 90% of the combined revenues of the two major carriers, their affiliates, and the large independent carriers came from passengers; the rest was from freight and other flying services. Passenger revenues were:

- 48% from domestic services, down from 56% in the mid-1980s,
- 89% from scheduled services, and
- 11% from charter services – most from overseas markets.

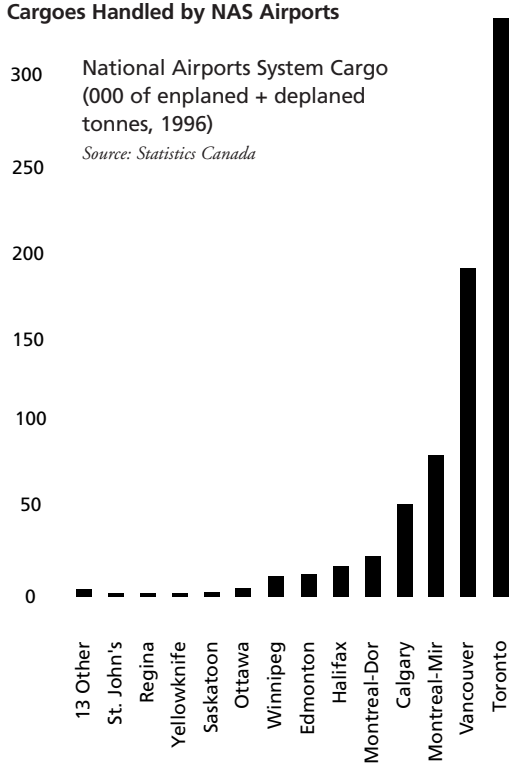
Measuring Airport Activity

Airlines measure business activity by counting the number of revenue-generating passengers or tonnes of cargo they carry. Airports, however, count each passenger twice – as "enplaned plus deplaned" passengers – since each passenger is served both departing and arriving. Similarly, cargo is counted by the originating airport and the destination airport.

Private-Sector Aviation

This sector includes business aviation – for which privately owned aircraft provide an alternative to commercial air services – and recreational aviation. Recreational flying accounts for more than two-thirds of Canada's pilots and three-quarters of the country's aircraft.

Cargoes Handled by NAS Airports



Moving Freight

Cargo

Cargo is carried on all-cargo aircraft, as well as in the cargo section of passenger aircraft. Canadian air carriers earn more than $1 billion each year carrying goods. Two-thirds of that is for moving domestic cargoes. The business generated by couriers is an important part of this sector.

Goods Trade

The air industry carries a negligible share of Canada's trade volume, but 9% of its trade value. The reason is that the industry carries high-value products such as telecom-munications, computer, transportation, aircraft, and office machinery equipment. Imports exceed exports, accounting for about two-thirds of the value of goods carried by air.

Marine –The Physical System

Ports

"Ports" is the collective term for the marine terminals, docks and facilities that permit the loading and unloading of vessels along Canada's three coastlines and the Great Lakes/St. Lawrence Seaway System.

Until recently, more than 2,000 ports and small harbours were operated under several different pieces of federal transport legislation, each with its own rules. The *Canada Marine Act*, which became law in June 1998, brings ports under one set of rules and is reshaping marine transport so that we have fewer ports and a more commercial system.

St. Lawrence Seaway

This major waterway is connected by a series of locks that allow ships to travel between ports along the Great Lakes and those on the lower St. Lawrence River. It enables the marine industry to move various commodities from Western Canada to Central and Eastern Canada and overseas markets, and iron ore westward from Quebec to steel plants in Ontario.

The Seaway is a joint responsibility of Canada and the US. In October 1998, the authority that had been responsible for Canada's part of the Seaway since it opened in 1959 was dissolved. A new organization, the St. Lawrence Seaway Management Corporation, now operates the facilities. The federal government continues to own the infrastructure. The corporation is responsible for the Canadian locks between Lake Erie and the Port of Montreal.

Northern Marine System

The Mackenzie River in the western Arctic and Lake Athabasca in northern Alberta and Saskatchewan are two waterways that are critical to remote communities. The small population is spread over a vast area with few roads, and marine and air services are their access to one another and to the rest of the world. Tugs and barges supply fuels, equipment and general supplies.

Coast Guard

Under the federal Department of Fisheries and Oceans, the Canadian Coast Guard provides five main services to the marine industry and the public.

Canadian Ports

Type	Characteristics	Status
Canada Port Authorities (CPAs)	There are 18 ports considered self-sufficient and critical to domestic and international trade.	• CPAs: Fraser River, Halifax, Hamilton, Montreal, Nanaimo, North Fraser, Port Alberni, Prince Rupert, Trois-Rivières, Quebec City, Saguenay, Saint John, Sept-Îles, St. John's, Thunder Bay, Toronto, Vancouver, Windsor
Remote ports	Ports in remote areas which serve the basic transportation needs of isolated communities.	• Transport Canada continues to administer these 34 remote ports in Quebec, Ontario, Manitoba and BC.
Regional and local ports	Public ports other than remote facilities or CPAs.	• Transport Canada is transferring these ports to other federal departments, provincial governments, municipal authorities, or community or private interests, or is closing them. • In 1995, there were 515 regional and local ports; by the end of 1998, 193 had still to be transferred or closed.
Harbours	Smaller facilities used for commercial and recreational boating and fishing.	• Federal Department of Fisheries and Oceans administers about 1,680 harbours.
Other ports	At the end of 1998, there were 87 ports: 34 provincial, 18 municipal and 35 private.	• This category will grow as the regional and local ports are transferred by Transport Canada.

Source: Transportation in Canada 1998, *Transport Canada.*

Canadian Coast Guard Services

Service	Infrastructure
Marine navigation service	• Aids to navigation (e.g., light stations, communications stations, transmitter sites, land-based fixed marine aids, and floating aids)
Marine communications and traffic services	• Staffed communications centres, and remote transmitter and receiver sites
Ice-breaking services	• Ice-breaking vessels (part of fleet management infrastructure)
Rescue, safety and environmental response	• Search-and-rescue stations, rescue boats, and spill response equipment
Fleet management	• Vessels, aircraft and facilities (e.g., 132 major ships, some 500 small craft/rescue boats/air cushion vessels, 32 aircraft, and bases and hangars)

Marine Pilotage

Marine pilotage ensures that ships move safely and efficiently in coastal waters and port areas. The marine pilot's familiarity with local waters enables mariners from elsewhere to travel in unfamiliar territory.

There are four pilotage authorities, operating:

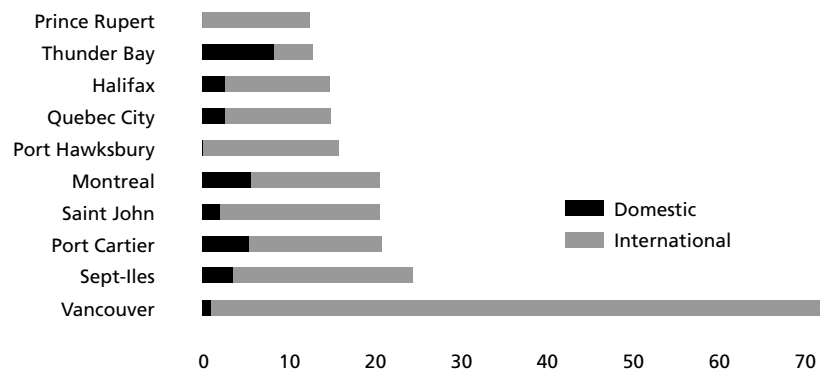
- on the Pacific coast,
- on the Atlantic coast,
- on the Great Lakes, and
- in the Laurentian (i.e., St. Lawrence) region.

These authorities report to the Minister of Transport. They establish pilotage areas, prescribe which ships are subject to pilotage, set out classes of pilot licences and qualifications, and set tariffs.

Vessel Types

Marine traffic includes general cargo ships, bulk carriers, tankers, container ships, tugboats, roll-on/roll-off automobile ferries, cruise ships, and barges. Container ships can cost more than $100 million to build, and cruise vessels, more than $400 million.

Canada's Top 10 Ports, 1997 (millions of tonnes)



Source: Statistics Canada

Marine – Work Done

Moving Freight

Port Traffic

Canadian ports handled 376 million tonnes of goods in 1997. One-quarter of that volume (i.e., 93 million tonnes) was domestic shipments moving between two Canadian ports. International shipments totalled 283 million tonnes, of which two-thirds was exports and one-third imports.

Seaway Traffic

Approximately 49 million tonnes of commodities were moved through the St. Lawrence Seaway in 1997. The main commodities are grain, iron ore, steel products, and coal, with smaller amounts of petroleum products, salt, potash, and construction materials.

East-West Split

Ports located along the Great Lakes, St. Lawrence River and the Atlantic coast handle two-thirds of the volumes moving through Canadian ports; Pacific ports handle one-third.

Fraser River Port Authority

Significant volumes moved by the towboat industry on the Pacific coast are not captured in the above port data. The traffic through Fraser Port totalled 22.2 million tonnes in 1997.

Cargo Traffic in Canada, 1997

Cargo class	Main commodities	Domestic handled*	International loaded	International unloaded	Total (Millions of tonnes)
Bulk liquid	Crude petroleum, fuel oil, gasoline	12.7	18.8	36.6	68.1
Dry bulk	Minerals and base metals, grains	41.6	119.6	37.0	198.2
General	Minerals and base metals, forest and agriculture products, semi- and manufactured goods, refrigerated cargo	39.1	49.6	21.3	**110.0
		39.1	49.6	21.3	**110.0
Total		**93.4**	**188.1**	**94.9**	**376.4**

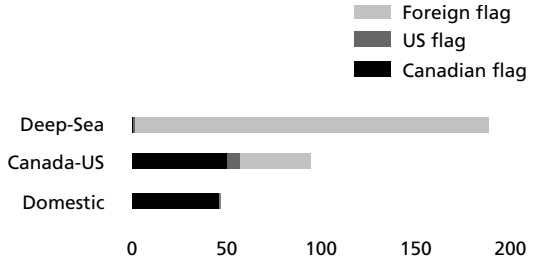
** Domestic volumes of 46.7 million tonnes of goods are counted twice, measuring the activity of one port when they are loaded, and another port when they are unloaded.*
*** Includes containerized goods.*
Source: Shipping in Canada 1997, *Statistics Canada*

Canadian Ferry Services, 1997

Ferry Operator	Service	Passengers (millions)	Vehicles (millions)
British Columbia Ferry Corporation	• largest ferry operator in North America • 40 vessels and 24 routes serving 42 ports on the BC coast	22.3	8.2
Government of British Columbia	• inland service	5.2	2.2
La Société des traversiers du Québec	• five year-round services across the St. Lawrence River within Quebec	5.1	1.8
Marine Atlantic	• constitutionally guaranteed ferry service between Nova Scotia and Newfoundland	1.0	0.5
Other providers	• 10 other providers or government-supported private operators in the Atlantic region, Ontario, Manitoba and Quebec, many of which are seasonal	4.6	1.7

Source: Transportation in Canada 1998, *Transport Canada*

Canadian Share of Waterborne Trade, 1997
(330 million tonnes)



Source: Transport Canada

Container Traffic

Canadian ports handled 20 million tonnes of containerized goods in 1997, most through Montreal, Vancouver and Halifax. Almost all containerized goods were general cargo – mainly machinery, equipment, and miscellaneous cargo.

Traffic by Port

Cargo was handled at 176 Canadian ports in 1997, with the top 10 ports accounting for 61% of the total 376 million tonnes.

Water Transport

Water transport is vital to Canada as a major trading nation, particularly for trade with countries other than the US, where road and rail are not options.

In the east, 17 companies operate a Canadian merchant fleet of 105 Canadian-registered vessels which have a maximum gross registered

tonnage of over 1,000 tonnes. Most are dry-bulk and liquid-bulk vessels. They handle domestic and Canada-US traffic on the Great Lakes, along the St. Lawrence River, and on the Atlantic coast.

On the west coast, there is a fleet of 250 tugs, 750 barges, and various offshore supply ships operating in domestic trade. Towing commodities and log booms is the dominant activity.

Liner Services

Containerized and other non-bulk cargoes use liner services, which are provided by carriers according to published schedules, on specified trade routes with fixed itineraries. Ocean carriers operating on a common trade route may elect to form a "conference" and collectively agree on rates and/or conditions of service. Those serving Canadian ports must file their tariffs with the Canadian Transportation Agency. Shipping lines not operating within a conference are termed "independents" or "non-conference" operators, and are not required to file their tariffs.

Moving People

Ferry Services

Ferry services are provided on both coasts, along the St. Lawrence River, and on various lakes and rivers. Operating companies range from small, private operators under contract or subsidized by federal or provincial governments, to federal and provincial Crown corporations. The largest operator, the British Columbia Ferry Corporation, is a provincial Crown corporation. It receives a federal grant to provide services in coastal waters. In 1997, ferries carried 38 million passengers and 14 million vehicles.

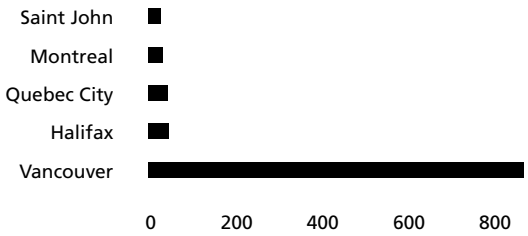
Federal Role

The federal government is commercializing various ferry services by transferring them to provincial or private operators. It will continue to regulate safety and security and to subsidize constitutionally guaranteed ferry services, as well as those provided to remote communities.

Cruise Ship Services

Cruise ship services are provided by large, foreign-based ships offering luxury cruises from Vancouver to Alaska, along the Atlantic seaboard, and up the St. Lawrence to Montreal. There are also domestic "pocket" cruises (e.g., lock, harbour and river cruises and excursions, such as whale watching) provided on vessels carrying fewer than 150 passengers.

Cruise Ship Traffic at Major Canadian Ports, 1998
(000 revenue passengers)



Source: Transport Canada

Pipeline – The Physical System

More than 540,000 kms of pipeline lie beneath the Canadian landscape. Almost all of our oil and gas production – nearly two-thirds of our total energy supply – moves through pipelines for all or part of its journey from producers to consumers. Pipelines are comparable to a network of roads, ports, railways, air services, and electrical transmission lines, and they form a vital part of our transportation system. In 1997, more than 8,000 people were directly employed by the pipeline industry. Another 24,000 were employed indirectly because of the industry.

Types of Pipelines

There are two main parts to the oil and gas industry: the upstream sector produces oil and natural gas from underground reservoirs, and the downstream sector refines, markets and distributes the products.

There are three types of pipelines. In the upstream sector, oil and gas producers operate the more than 200,000 kms of flow lines or gathering systems that move the raw products from wells to processing facilities, or directly to transmission pipelines.

Transmission pipelines, which can be more than a metre in diameter, carry oil and gas from producers to local distribution companies, or directly to large industries. One company, Enbridge Inc., operates the world's longest oil transmission system and transports some 75% of Canada's oil production. The major natural gas transmission systems in the country – which are operated by companies such as TransCanada PipeLines Ltd., Foothills Pipe Lines, and Westcoast Energy Inc. – are among the largest in the world. These systems also connect with US gas transmission systems.

Distribution pipelines are owned by distribution companies, which deliver natural gas to homes and businesses over an 80,000-km network.

How Pipelines Work

Gases and liquid hydrocarbons are moved through pipelines by pressure created by compressors and pumping stations. In natural gas pipelines, the gas can be compressed by up to 100 times normal atmospheric pressure, and it moves through the lines at more than 20 kms per hour – the speed of a world-class marathon runner. By contrast, liquid hydrocarbons, which move in separate "batches," travel at a walking pace of 5 kms per hour.

Regulation

Due to the high cost of building and operating pipelines, the industry has been strictly controlled by government regulation, which is designed to balance the interests of producers, consumers, and operators. Rates or tolls are strictly monitored by federal or provincial agencies to ensure fair pricing, as well as a fair return to service providers. Increasingly, tolls are being negotiated between shippers and pipelines, reducing the need for regulated settlements.

The National Energy Board (NEB) regulates natural gas and liquid hydrocarbon transportation across interprovincial and international borders. The NEB approves exports, transportation charges, and design and operation of facilities. It also regulates safety standards.

A pipeline that is entirely within a province is regulated by a provincial authority, such as the Alberta Energy and Utilities Board. Together, many federal, provincial and municipal authorities regulate various aspects of energy transportation, ranging from safety, taxation and labour practices, to environmental impacts.

Pipelines – Work Done

What and How Much?

In 1997, natural gas pipelines in Canada carried 5.6 trillion cubic feet. Of that, 46% was for domestic use, and 54% was for export.

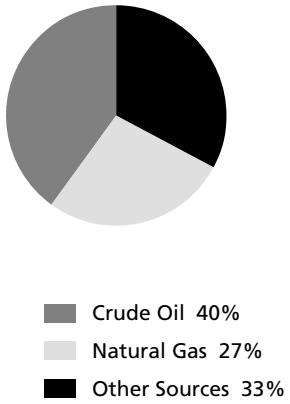
Liquid hydrocarbon pipelines carry various grades of crude oil and refined products. Other liquid hydrocarbon lines carry natural gas liquids and petrochemicals. Some 2.1 million barrels of liquid hydrocarbons were shipped daily in 1997, equivalent to more than 40,000 truckloads. This amounted to 760 million barrels for the year, split about equally between domestic use and export.

Importance in Trade

Only a fraction of Canada's oil and gas is consumed where it is produced. Crude oil carried by pipeline meets approximately 40% of Canada's energy needs. Imported supplies are shipped, primarily by pipeline, to Quebec from the Atlantic provinces. Canadian pipelines also deliver crude oil and natural gas to US pipelines. The percentage of Canadian natural gas used to supply the US market has more than tripled since 1980.

Since 1990, demand for Canadian oil and natural gas has been increasing significantly, and Natural Resources Canada predicts continued growth in North America for both commodities.

Sources of Canada's Energy Supply



Source: Natural Resources Canada

Canada-US Energy Trade

- Canada supplies 15% of the US's natural gas requirements, up from 4% in 1980.
- Our balance of trade with the US is a positive $14.5 billion for crude oil, refined products, and natural gas.