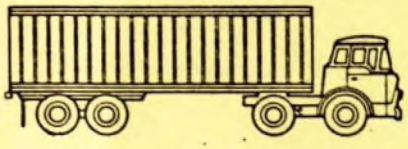
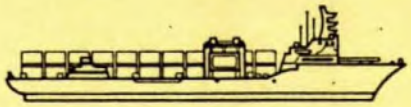
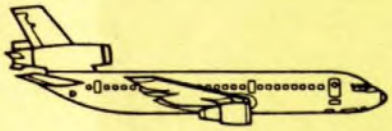
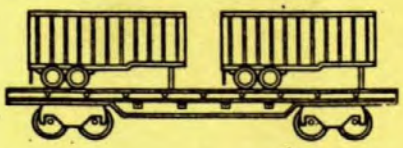
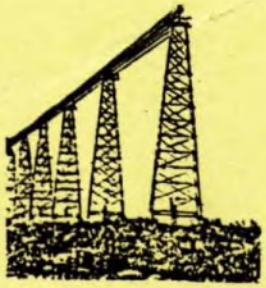




TRANSPORTATION MODES







Regional Economic Expansion

Western Region
Regional Analysis Branch
Saskatoon

December 1976

INTRODUCTION

This report presents a perspective on transportation modes in Canada, specifically: road, water, rail, air, pipeline and power line.

The Federal Government has long had a significant involvement in, impact upon, and responsibility for transportation development in each of Canada's regions. The need to diversify the economic base of Western Canada is a persistent and central issue for the Federal Government and each of the four Western Provinces. In particular, the Department of Regional Economic Expansion has a strong commitment to assist in the orderly development and diversification of the region's economy and recognizes that an efficient transportation system is essential to maintain the relative prosperity of Western Canada.

The material in this document was collected from many sources to consolidate and provide specific geometric information on the modes of transporting goods and people, and to assist in the assessment of policy options and the subsequent development of department program and policy responses. This paper reviews the role and extent of transportation in Canada, with emphasis on Western Canada. It also examines some of the related issues, problems and implications for regional growth and development. A bibliography of related studies is included at the end of each section.

TRANSPORTATION DEVELOPMENT

The importance of transportation in shaping Canada's history is obvious. Navigation by ocean-going ships dictated the location of early settlements on the east and west coasts, and inland forts were located at strategic junctions of lake and river travelways. Then, the railways became the backbone of the forming nation. Roads and highways were important for land transportation during the latter half of the 19th century, but assumed growing importance with the advent of automobiles and trucks which caused an explosive growth in road building and paving.

The era of intermodality may be said to have begun by the middle of the 20th century. It is characterized by the continuing importance of marine transportation (expansion of ocean ports, construction of the Welland Canal and the St. Lawrence Seaway) the advent of containers, piggyback and intermodal rail/truck transportation, and the construction of major oil and gas pipelines and power transmission lines. Air transportation has become important as a mover of both cargo and passengers. As well, long distance travel in Canada is now dominated by the air mode and it is assuming growing importance for moving high value freight.

In Canada, transportation provides the sinew that holds together the political, social and economic systems. The history of this country is closely interwoven with the development of transportation facilities, because Canada's shape, size and location, as well as its diversity of climate, topography, natural resources and industries, make transportation one of the principal forces in attaining national unity. The presence of major transportation modes has been essential for the development and settlement of Canada and its creation as a political entity, and specifically has contributed directly to the diversification of the Western Canadian economy.

Owing to the low population densities, vast distances and harsh terrain of our country, government has had to play a leading role in actually building major transportation facilities. The strong role government has taken in transportation development has served such purposes as defence, political union, economic development and national sovereignty.

The scope of federal and provincial jurisdiction in transportation has been the subject of much discussion. It is very complex but certain precedents and a division of powers does exist. In general, the Federal Government is predominent in air, rail, water and pipeline transportation, and the provinces are predominent in highway and power transportation. However, the more comprehensive approach demanded by transportation issues today, will require a wider degree of interface for federal and provincial transport activities in the future.

Transportation is of vital economic and social importance to the country. Gross expenditures in both the public and private sphere are enormous, reaching into the billions of dollars. Not only do transportation services support economic development, but in turn, the resulting volume of traffic influences the development, expansion and progress of transportation facilities. On a wider plane, modern transportation and communication technologies are binding the world into a single economic unit and are changing human attitudes, customs and social institutions.

Another measure of the economic importance of transportation is employment as the transportation industry is still labour intensive. Again, the approximately one million jobs in these industries are an important source of employment and income to every Canadian region with some 34 percent being located in Ontario, 26 percent in Quebec, 16 percent in the Prairie region, 13 percent in the Pacific region and 11 percent in the Atlantic region.

Transportation is also a major consumer of energy, with motor vehicles accounting for some 13 percent of total energy consumed in Canada, pipelines some 1.5 percent, railways some 1.2 percent, air transport 1.1 percent, and marine transport 1.0 percent. As well as being a consumer, the transportation of energy places significant loads on our transportation system: in particular, coal by rail and water and oil and gas by pipeline. These loads are expected to grow rapidly in the future and future transportation and regional development policies will have to take this, and the associated transportation costs, into account.

Another measure of the importance of transportation to the various regions of Canada relates to their self-sufficiency in terms of food and energy. The daily restocking of food supplies, medical and health related supplies and energy for all regions of Canada is very much dependent upon the various transportation modes. Any interruptions of more than a few days would leave the country at the mercy of the elements.

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I HIGHWAY DEVELOPMENT IN CANADA

Geography is the most important factor in Canadian transportation. Canada's shape, size and location as well as its diversity of climate, topography, natural resources and industries make transportation one of the principal socio-economic forces in the country. The impact of roads on Canadian economic development has been enormous.

Most authorities agree that Canada's early roads were of poor quality. Because their primary function was to meet the short-haul requirements of small settlements, roads seldom extended beyond the limits of the early communities. Initially roads served as access routes to other transport modes: first to the waterways, later to the railroads. They remained a relatively inferior mode of transport partly because they remained the financial responsibility of the localities (later the provinces) which they served.

The standards of the Canadian Highway System vary in the different regions of Canada. In the north the roads are largely gravel. In the remainder of the country they are mostly two lanes, paved, except near Metropolitan areas and in the Windsor-Quebec corridor where they are mainly four or more lanes. In rural and remote areas there are still a considerable number of improved roads, mostly dirt. In fact, in 1970 a total of 516,000 miles of roads, highways and streets existed

in Canada. Of these, 199,000 were municipal roads and streets with the remaining 317,000 miles being rural highways, only 90,000 miles of which were paved. While current data is not available, this section will provide a mix of data by year (1969 - 1974).

There are three main classes of roads that make up the various primary, secondary and access routes in the Canadian Highway System. They are:

Primary Roads

Roads which serve as the major linkages in an East-West direction, as the major international routes to the U.S.A. in a North-South direction, and as the main linkages to the northern parts of the provinces and to the Territories.

Secondary Roads

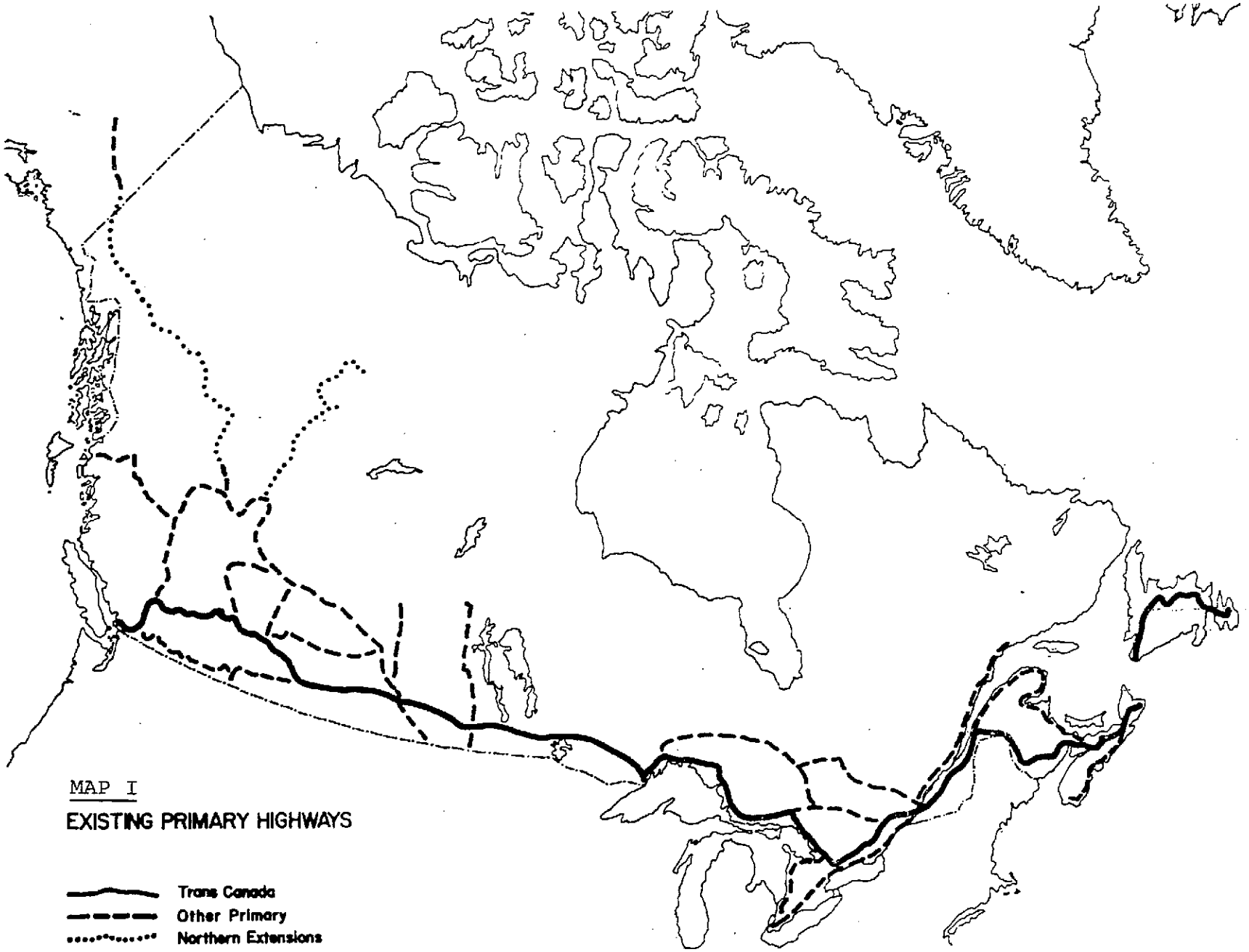
Existing roads which serve to make the primary system more complete, and linkages which serve a number of cities and communities not in the major transportation corridors.

Access Roads

Roads necessary to connect all communities which are outside the main network. Single purpose roads to recreational areas, resource areas, isolated communities, defence establishments, ports and airports are included.

Inserted at the back of this section is a Highways Map of Western Canada. It lists the principal through highways that link the western provinces.

The primary highway network is illustrated in Map I and basically follows the same pattern as rail development. These primary highways comprise some 17,000 miles of major



MAP I

EXISTING PRIMARY HIGHWAYS

SOURCE: An Interim Report on Freight Transportation in Canada, Ministry of Transport, 1975.

and although some like the TransCanada Highway were completed with federal assistance, now fall under the jurisdiction of the province within which they lie. Of the 317,000 miles of rural highways, only 9,000 miles were under federal jurisdiction in 1970. Provincial highway expenditures in 1970 were $1,325 million compared to a federal expenditure of $156 million. The remaining expenditure of $616 million was made by the municipalities making the total highway expenditure in Canada in 1970 by the three levels of government $2,101 million.

Gross annual transportation expenditures for all modes both public and private, were estimated at $15 billion in 1970 with an associated activity of 122 billion passenger-miles of travel and 314 billion ton-miles of goods movement.

Accumulated total investment in all transportation modes rose to over $30 billion in 1969 with half of this investment being related to highway transportation. Of this sum half was invested in the highway itself. Travel by private automobile accounted for over 110 billion passenger-miles in 1970. Currently between 85 percent and 90 percent of all passenger-miles are on roads.

In terms of employment, the total transportation sector directly employed 800,000 persons, 60 percent of whom were in the highway field in 1969.

II THE CANADIAN HIGHWAY SYSTEM

As only 8.0 percent (9,000 miles out of a total of 516,000) of the total roads and streets in Canada in 1972 were owned and maintained by the federal government, the terminology - Canadian Highway System - is not intended to imply that this is a federal government system. Rather it refers to a system of roads which are of significance in that they serve to link the major centers of population and economic activity, forming the backbone of Canada's highway transport system.

Of the 516,000 miles of roads, streets and highways in Canada, 199,000 miles are municipal roads and streets, and 317,000 miles are provincial and inter-provincial highways and special purpose roads.

A. Highway Administration In Canada

The scope of federal and provincial jurisdictions in transportation has been the subject of much discussion over the years. This subject has also been raised many times in federal-provincial conferences. It is very complex but certain irreversible precedents and a division of powers seem to exist. In general, it can be stated that the federal government is predominent in air, rail, water and pipeline transport, and the provinces are predominent in highway transportation.

Because highways have traditionally fallen under provincial jurisdiction as local works and undertakings, they have been built, by and large, by the provinces.

1. Federal Interest In Highways

In the past, federal interest in highways has been an offshoot of other larger federal government objectives where highways are incidental to the accomplishment of those stated objectives. For example, highways on federal lands such as national parks, airports, defence establishments, Indian and Eskimo lands, and the Canadian North, have always been the sole responsibility of the federal government. In all other cases, the federal interest stems from either constitutional arrangements and/or federal-provincial agreements.

During the fiscal year 1974-75, the Government of Canada spent $155 million on highways and access roads. In addition, $30 million was lent to the province of Quebec. Approximately, 50 percent of the 1974 expenditure was on primary and secondary routes. For the fiscal year 1975-76, it has been estimated that the total expenditure on highways and access roads will be about $213 million. In addition, $40 million was set aside to be lent to the province of Quebec.

Besides highway construction, there are a number of inter-provincial and international bridges and ferries that are funded by the federal government. For example, the ferry service to Prince Edward Island and the ferry service to

Newfoundland. On the other hand, the best known federal involvement in this field is the construction of the Trans-Canada Highway, the purpose of which was to increase national unity and transport efficiency. This resulted in a federal expenditure in the provinces of $825 million. Federal-provincial agreements for participation were required for this.

In an effort to reduce regional economic disparities, the federal government has entered into special area agreements with the various provinces and consequently contributed to related highway development. In 1970, federal expenditures were $156 million out of a total of $2,101 million. This federal expenditure was less than 8 percent of the total highway expenditure by all three levels of government. About 50 percent of this expenditure was for exclusive federal responsibilities (Indian Affairs, Northern Development, Ferries, Railway Grade Crossing Fund, Park Roads etc.). The remainder is generally expended as assistance to provinces on a cost-sharing basis and is devoted mainly to the construction of highways.

As mentioned previously, the federal government owns and maintains roads and streets on federal lands and in the Yukon and Northwest Territories. In 1970, there were 9,000 miles of federal roads out of a total road mileage of 516,000 in all Canada. Of this, 3,000 miles were in the Yukon and the Northwest Territories.

Many federal departments such as Indian and Northern Affairs, Public Works, Regional Economic Expansion, Transport, etc., share the responsibility for highway development. Responsibility for the co-ordination of federal highway programs and the development of highway policy has been assigned to the Ministry of Transport. For example, the Department of Indian Affairs and Northern Development is responsible for roads on Indian and Eskimo lands, within national parks and in the Yukon and Northwest Territories. However, construction is generally undertaken by the Department of Public Works. Responsibility for highway policy is assigned to the Ministry of Transport, which also has the responsibility for ferry services as well as inter-provincial and international bridges.

Other departments, such as Regional Economic Expansion and Public Works, act as catalysts for highway development where highways play an integral part in achieving their departmental goals and objectives. They generally assist the provinces financially and accelerate the rate of development. Once the highways are built, they are usually owned and maintained by the provinces.

A large block of federally funded roads is accounted for in National Parks. There are currently over 1,550 miles of roadway open to the public in National Parks including portions of the TransCanada Highway, parkways both paved and

unpaved, townsite streets and access roads to hiking trails, day use areas and campsites. A number of roadways located within National Parks serve the dual purpose of providing a major route for through traffic, as well as visitor access. In 1974-75, Parks Canada spent $8.5 million on capital road projects.

2. Provincial Highway Administration

Highway administration varies from province to province depending upon the local government structure. In five provinces, British Columbia, New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland, virtually all rural highways are under direct provincial jurisdiction. In the remaining five, Alberta, Saskatchewan, Manitoba, Ontario and Quebec, some of the rural road systems are the responsibility of local governments, for which they receive financial assistance from the province.

Although the focus of policy-making and administration in many provinces is changing from a concern with highway transportation alone to a multi-modal perspective, the provinces (and municipalities, since constitutionally they are creations of the provinces) are still involved largely in highway transport and to a lesser extent railway transport. Provincial authorities have jurisdiction over freeways and highways and are responsible for the licensing of private passenger and commercial vehicles.

Regulations involve the control of entry in for hire truck and bus transport and the control of related tariffs.

Because the administration of highways varies from province to province, the western provinces will each be briefly described.

British Columbia

Public roads in British Columbia are the responsibility of the provincial Department of Highways. The Department has jurisdiction over all freeways whether they fall within municipalities or not. Except in municipalities with a population of over 30,000, the Department is responsible for roadway and drainage of all arterials and it shares the roadway and drainage costs of all secondary roads.

Otherwise all roads within municipalities are under municipal jurisdiction. All extra-municipal rural roads are the complete responsibility of the province.

Alberta

Roads in Alberta are classified as primary, secondary or local.

Primary highways are under provincial jurisdiction, built, maintained and administered by the province. However, they are under local administrative jurisdiction in towns and villages, although the province constructs and maintains the route. Cities receive provincial grants for maintenance of primary highway routes, and construction grants are available through grants to urban transportation systems.

Secondary roads are under municipal jurisdiction, maintained and administered by the municipalities. However, within the maximum annual secondary road budget, the province bears the entire cost of construction, excluding right-of-way. Some municipalities undertake additional secondary road projects with no provincial assistance.

Local roads are under municipal jurisdiction, built, maintained and administered by the municipalities.

The Department of Lands and Forest also builds and maintains a significant mileage of forestry roads.

Saskatchewan

Roads and streets in Saskatchewan may be divided into four basic categories. These are: the provincial highway system; northern access and resort roads; grid and main farm access roads; local roads.

The provincial highway system is the total responsibility of the provincial government. They are responsible for the construction, maintenance and administration of the 11,000 mile system.

Northern access and resort roads are mainly low volume roads which are administered by the provincial government through other departments.

The grid roads concept may be regarded as the secondary highway network, or as collector roads for the provincial highway system. The main farm access roads concept consists of the more important feeder links to the grid road network. The combined mileage of grid and main farm access roads is 33,000 miles. Although these rural roads remain under rural municipal jurisdiction, financial assistance for capital construction and technical guidance is provided by a provincial government department. Maintenance of these rural roads remains the responsibility of the rural municipal jurisdiction.

Local roads in rural areas are under full municipal jurisdiction, that is, they are built, maintained and administered by the rural municipalities.

Local roads in urban areas fall within municipal jurisdiction. However, several programs exist by which financial assistance for road improvements may be obtained from the provincial government.

Manitoba

Roads in Manitoba may be divided into three categories: provincial trunk highways, provincial roads, and local roads. The first two are under provincial jurisdiction, except in incorporated cities, towns and villages, which receive a provincial subsidy for construction and maintenance.

In 1965, an additional 4,000 miles of municipal rural roads were added to the system of provincial roads. These roads are constructed, maintained and administered by the province. As a result there are no road grants to rural municipalities.

Local roads are a municipal responsibility, but in urban areas the province gives financial assistance for designated roads and streets.

In addition to the Department of Highways, other provincial departments have certain degrees of jurisdiction over roads and highways: The Department of Mines, Resources and Environmental Management, The Department of Northern Affairs, and the Department of Tourism, Recreation and Cultural Affairs.

The Manitoba Hydro-Commission is also involved in the building and maintenance of roads servicing their power plants.

B. Highway Regulation

The federal government establishes motor vehicle safety standards, while registration of motor vehicles and regulation of motor vehicle traffic lie with the legislative jurisdiction of the provincial and territorial governments. There are some differences in the individual provincial motor vehicle and traffic regulations, driver licensing control, safety responsibility legislation and judgement faults, but a certain degree of commonality exists.

Trucking companies in the country are regulated directly by the provinces, and indirectly by federal and municipal governments. There are more than 15,000 "for hire" trucking companies in the country in addition to a host of private ventures. "For hire" means the companies carry goods they do not own. A "private" carrier, such as Imperial Oil, carries only its own products.

All provinces regulate maximum height, width, length and axle weight of a truck, plus the speed at which it can travel. In other words, most of the factors directly relating to the productivity of equipment are carefully overseen.

Many provinces also have boards to approve rates truckers charge shippers and licensing boards to control entry into the trucking business based on some minimum criteria. At present, these criteria include the specification that companies serve certain areas that may be only marginally profitable, at best.

Detailed regulations governing specific vehicles, and for route restrictions can be obtained from the respective provincial licensing authorities. The following is the range in summary of the size and weight requirements for commercial vehicles in all provinces:

OVERALL Length Single Powered Vehicle (ft)		35 -40
LENGTH Combination (ft)		65 - 72
MAXIMUM WIDTH (inches)		102
MAXIMUM HEIGHT (feet)		13½ - 14½
NUMBER OF TRAILERS ALLOWED		2
MAXIMUM AXLE LOADS (lb)	Single Axle (except front)	18,000 - 22,000
	Tandem Axles	32,000 - 40,000

In terms of truck rates, of course, there are different rates by weight size and distance, but it is interesting to note that Quebec and Ontario have substantially higher truck rates

than those enjoyed by the western provinces, with Maritime rates lying between the two extremes. A number of factors could be involved in these differences, including union representation, degree of regulation, levels of traffic congestion, length of haul, size of trucking companies, Sunday trucking limitations, and others. The important point to note is that Western and Eastern Canada both enjoy lower truck rates than Quebec or Ontario and rail rates throughout the country are competitive with those offered by truck.

C. Highway Capacity

The impact of truck traffic on highway capacity is, of course, a function of the geometric characteristics of the route. Generalizations about the nature of this impact in the national sense are therefore, not meaningful.

A review of older studies conducted by MOT as part of the review of transportation policy indicated that some 20 percent of the nations's primary highway network presently experiences congestion problems. Most of these problems occur in British Columbia, Ontario, New Brunswick and Newfoundland with some problems in the other provinces. If no major improvements are made to the system, about 43 percent of these roads are expected to be congested by 1982 if current traffic trends continue. All provinces except Saskatchewan and Manitoba will probably experience congestion problems by that time.

At present, truck traffic is not a critical consumer of highway capacity in most cases as truck traffic usually constitutes 20 percent or less of the traffic on an intercity highway, and is much less peaked than private automobile traffic. A number of policy options could be considered which would reduce private automobile traffic, particularly at peak times, thereby lessening the pressure for capacity expansion expenditures and easing the cost of congestion delays to truckers. These include higher fuel prices, higher fuel taxes, higher camping fees at federal and provincial parks, particularly for non-residents, and possible prohibition of the use of certain highway links by recreational vehicles. Any actions of this type would, of course, require detailed federal/provincial consultation and agreement.

There has been a trend of general cargo from rail to truck carriage during the past few decades, which has contributed to the rapid growth of truck volumes, particularly in and around our major urban centres. It is possible that higher fuel costs, greater road congestion, and more effective use of piggybacking will arrest or reverse this trend. This would marginally ease road congestion on heavily travelled intercity links, but would have no effect on major urban roads between rail yards and the ultimate urban destinations and origins of such goods.

In the rural areas, there is concern for the capacity and adequacy of roads to meet the larger number of heavy grain trucks expected to accompany the inland terminal concept.

III ROAD TRANSPORT STATISTICS

The trucking industry consists of thousands of individual enterprises owned by individuals, corporate users, railway companies, etc. Of the over one million trucks registered in Canada in 1972, about 6 percent were estimated to be in the "for hire" category which carried about 45 percent (in tons) of the 1972 intercity freight traffic carried by rail and "for hire" truckers and earned about 57 percent of the freight revenues to these carriers. About 40 percent of the value of Canadian exports to the U.S. are estimated to move by truck.

It is more difficult to estimate annual expenditures on relevant parts of the total truck fleet, because of the difficulty of identifying trucks used for intercity carriage and the lack of knowledge about the private trucking industry. It has been estimated that there were about 1.8 million trucks operating in Canada in 1973; of these, it is estimated that 60,000 - 80,000 are used for intercity, "for hire" operations. If we assume that a further 40,000 trucks are used for intercity private trucking operations, we have a total of about 100,000 to 120,000 intercity trucks at present. Assuming that these are replaced approximately every 10 years, and that the number of intercity trucks is increasing at approximately 5 percent per annum compound, we arrive at an investment in new and

replacement intercity trucks of approximately $4 - $5 billion over the next 15 years, or approximately $270 - $330 million per year. While this projection is very rough it does point out the magnitude of the industry.

At the end of 1971, Canada had over a half million miles of road. Of these, 315,821 miles of highway and roads were under federal or provincial jurisdictions and 202,497 miles of roads and streets under municipal jurisdiction (Table 1). Most of this mileage is in the more populated sections. Roads built by logging, pulp and paper, and mining companies provide some access to remote communities but large areas of most provinces and the territories are still very sparsely settled and are virtually without roads. The table classifies the mileage in each province by type, pointing out that over 60 percent of the roads and streets are gravel.

Of course, the cost of construction, maintenance and administration of roads and streets is staggering as indicated in Table 2 which presents expenditure data for 1971, 1972 and 1973. In 1972-73 total expenditures equalled $2,696 million, an increase of 7.4 percent over the previous year. Construction expenditures increased 8.4 percent and maintenance and administration costs rose by 5.8 percent.

Motor vehicle registrations have continued to increase yearly reaching 10.6 million in 1973. Of that total, 7.9 million were passenger cars, 2.4 million were

TABLE 1

ROAD AND STREET MILEAGE CLASSIFIED BY TYPE AND PROVINCE, 1971

Province or territory and jurisdiction	Surfaced				Earth	Total
	Rigid pavement	Flexible pavement	Gravel	Other		
FEDERAL AND PROVINCIAL JURISDICTION	2,602	76,161	190,425	4,198	42,435	315,821
Newfoundland	-	1,757	3,831	-	220	5,808
Prince Edward Island	833	822	985	-	611	3,251
Nova Scotia	6	5,159	10,406	-	76	15,647
New Brunswick	-	5,405	7,530	-	15	12,950
Quebec	232	16,500	24,098	-	13,386	54,216
Ontario	1,216	19,939	49,228	4,198	3,155	77,736
Manitoba	301	4,357	7,490	-	-	12,148
Saskatchewan	-	8,053	4,210	-	1,546	13,809
Alberta	6	6,501	64,681	-	17,049	88,237
British Columbia	8	7,638	14,696	-	6,377	28,719
Yukon Territory and Northwest Territories	-	30	3,270	-	-	3,300
MUNICIPAL JURISDICTION	6,881	32,980	91,475	176	70,985	202,497
Newfoundland	7	470	627	2	31	1,137
Prince Edward Island	16	98	27	-	-	141
Nova Scotia	75	954	237	24	2	1,292
New Brunswick	50	828	114	6	19	1,017
Quebec	1,970	7,801	1,851	3	274	11,899
Ontario	2,686	11,552	6,013	43	565	20,859
Manitoba	1,258	540	20,380	37	12,812	35,027
Saskatchewan	195	1,590	56,658	-	56,374	114,817
Alberta	473	2,667	2,808	39	733	6,720
British Columbia	151	6,451	2,702	10	171	9,485
Yukon Territory and Northwest Territories	-	29	58	12	4	103

SOURCE: Canada Year Book 1975.

TABLE 2

CONSTRUCTION, MAINTENANCE AND ADMINISTRATION EXPENDITURE ON ROADS AND STREETS, BY PROVINCE, Years Ended March 31, 1972 and 1973 (Thousand Dollars)

Item and province or territory	Construction		Maintenance and administration		Total expenditure	
	1972	1973	1972	1973	1972	1973
EXPENDITURE ON PROVINCIAL AND FEDERAL ROADS[1,2]	982,431	1,051,781	461,367	472,085	1,443,798	1,523,866
Newfoundland	38,426	37,915	17,052	19,534	55,478	57,449
Prince Edward Island	5,907	7,122	4,965	6,007	10,872	13,129
Nova Scotia	55,113	45,655	24,425	28,989	79,538	74,644
New Brunswick	38,168	44,445	28,267	29,898	66,435	74,343
Quebec	363,592	407,353	122,169	129,612	485,761	536,965
Ontario	212,137	183,912	159,838	153,406	371,975	337,318
Manitoba	29,294	41,079	19,850	21,013	49,144	62,092
Saskatchewan	52,331	47,016	18,485	16,646	70,816	63,662
Alberta	68,470	74,444	19,125	14,957	87,595	89,401
British Columbia	105,658	138,825	38,132	42,497	143,790	181,322
Yukon Territory and Northwest Territories	13,335	24,015	9,059	9,526	22,394	33,541
EXPENDITURE ON MUNICIPAL ROADS[2,3]	501,797	556,936	565,500	614,702	1,067,297	1,171,638
Newfoundland	3,114	3,472	5,580	4,654	8,694	8,126
Prince Edward Island	280	400	690	741	970	1,141
Nova Scotia	6,493	11,304	8,488	9,038	14,981	20,342
New Brunswick	4,491	5,128	7,745	7,759	12,236	12,887
Quebec	70,813	89,059	136,984	147,726	207,797	236,785
Ontario	256,755	286,371	258,757	290,129	515,512	576,500
Manitoba	18,747	18,243	21,796	23,284	40,543	41,527
Saskatchewan	22,893	26,212	36,496	35,555	59,389	61,767
Alberta	72,170	68,957	53,448	56,070	125,618	125,027
British Columbia	45,502	47,018	34,826	38,830	80,328	85,848
Yukon Territory and Northwest Territories	539	772	690	916	1,229	1,688

1 Includes small amounts paid by private companies and other organizations in connection with railway grade crossings, overpasses, etc.

2 Provincial and federal subsidies to municipalities amounted to $327 million in 1971-72 and $331 million in 1972-73 and should be added to provincial and federal expenditures and subtracted from municipal expenditures to arrive at net expenditures for the respective levels of government.

3 Fiscal year for municipalities ends the previous December 31.

SOURCE: Canada Year Book 1975.

TABLE 3

TYPES OF MOTOR VEHICLES REGISTERED, BY PROVINCE, 1973

Province or territory	Passenger cars[1]	Commercial cars, trucks, etc.[2]	Buses	Motor-cycles	Total
Newfoundland	115,444	34,714	1,062	2,365	153,585
Prince Edward Island	37,014	10,695	357	1,075	49,141
Nova Scotia	242,538	77,819	782	4,732	325,871
New Brunswick	198,671	50,057	1,304	6,010	256,042
Quebec	2,009,868	556,191	16,820	135,545	2,718,424
Ontario	3,002,091	704,332	14,197	62,200	3,782,820
Manitoba	355,175	108,549	305	7,478	471,507
Saskatchewan	304,885	233,569	4,086	6,617	549,157
Alberta	627,931	292,500	5,166	27,028	952,625
British Columbia	961,497	286,925	-[3]	33,495	1,281,917
Yukon Territory	5,466	5,146	102	480	11,194
Northwest Territories	5,504	6,462	84	795	12,845
Canada	7,866,084	2,366,959	44,265	287,820	10,565,128

[1] Includes taxis.
[2] Includes service cars, road tractors, farm tractors, snowmobiles, etc.
[3] Included with trucks.

SOURCE: Canada Year Book 1975.

TABLE 4

PROVINCIAL REVENUE FROM THE REGISTRATION AND OPERATION OF MOTOR VEHICLES, By Province, Year Ended March 31, 1973 (dollars)

Province or territory	Passenger automobile licenses	Truck, bus trailer and other vehicle licenses	Motor-cycle licenses	Chauffeur, driver and dealer licenses[1]	Public service vehicle tax	Motive fuel taxes	Total[2]
Newfoundland	5,587,890	-[3]	-[3]	644,934	163,808	30,246,805	37,425,017
Prince Edward Island	1,110,099	602,947	4,092	130,643	72,690	7,609,676	9,815,520
Nova Scotia	7,729,263	6,780,809	-[4]	1,067,275	342,370	50,734,977	68,494,907
New Brunswick	6,350,849	5,040,536	46,665	586,009	-	43,923,124	57,168,473
Quebec	66,975,145	48,753,235	1,355,450	13,586,571	4,682,189	372,994,540	513,443,320
Ontario	102,101,077	64,596,628	793,224	8,510,213	8,449,123	547,115,942	762,621,223
Manitoba	7,115,657	3,787,191	42,281	1,689,630	3,626,515	56,202,986	73,757,324
Saskatchewan	6,860,825	8,313,449	229,214	1,107,759	-	59,500,244	78,565,835
Alberta	12,660,450	15,950,181	-[3]	2,440,911	329,457	100,932,435	136,878,132
British Columbia	49,793,684	-[3]	-[3]	-[3]	703,633	130,912,999	181,444,708
Yukon Territory	112,905	371,793	1,435	107,015	88,834	2,866,466	3,685,051
Northwest Territories	493,252	-[3]	-[3]	37,216	-	2,376,400	2,908,351
Canada	266,891,096	154,196,769	2,472,361	29,908,176	18,458,619	1,405,416,594	1,926,207,861

[1] Operator licenses are issued for different periods in different provinces.
[2] Includes other items not shown such as transfer of motor vehicles, garage and service station licenses, and fines for infractions of motor vehicle laws.
[3] Included with passenger automobiles.
[4] Included with other vehicles.

SOURCE: Canada Year Book 1975.

commercial cars and trucks with the rest being made up of buses, motorcycles and other motor vehicles. Registrations by province are given in Table 3.

The registration and operation of motor vehicles is big business for the provinces accounting for almost $2 billion of revenue in 1973. The taxation of motive fuels, motor vehicles, garages, drivers, chauffeurs, etc., is an important source of provincial government revenue. In every province licenses or permits issued by the provincial authorities are required for motor vehicles, trailers, operators or drivers, paid chauffeurs, dealers, garages and gasoline and service stations. The more important sources from which provincial revenue from motor vehicles is derived are shown in Table 4. It is interesting to note that almost 70 percent of the total revenue comes from motive fuel taxes.

TABLE 5

SUMMARY STATISTICS OF INTERCITY AND RURAL PASSENGER BUS COMPANIES, 1972

Province	Firms	Revenue earned ($'000)		
	No.	Passenger	Other	Total
Newfoundland	21	1,529	8	1,537
Nova Scotia	10	1,695	99	1,794
New Brunswick	10	2,310	159	2,469
Quebec	45	19,552	4,258	23,810
Ontario	28	35,561	3,088	38,649
Manitoba	4	2,841	428	3,269
Saskatchewan	7	3,727	107	3,834
Alberta[1]	7	28,798	358	29,156
British Columbia	25	4,061	99	4,160
Total	157	100,074	8,604	108,678

[1] Northwest Territories grouped with Alberta to meet confidentiality requirements.

SOURCE: Canada Year Book 1975.

Table 5 presents selected statistics of intercity and rural bus companies for the 1972 year. During this year, 157 firms collected over $100 million worth of revenue.

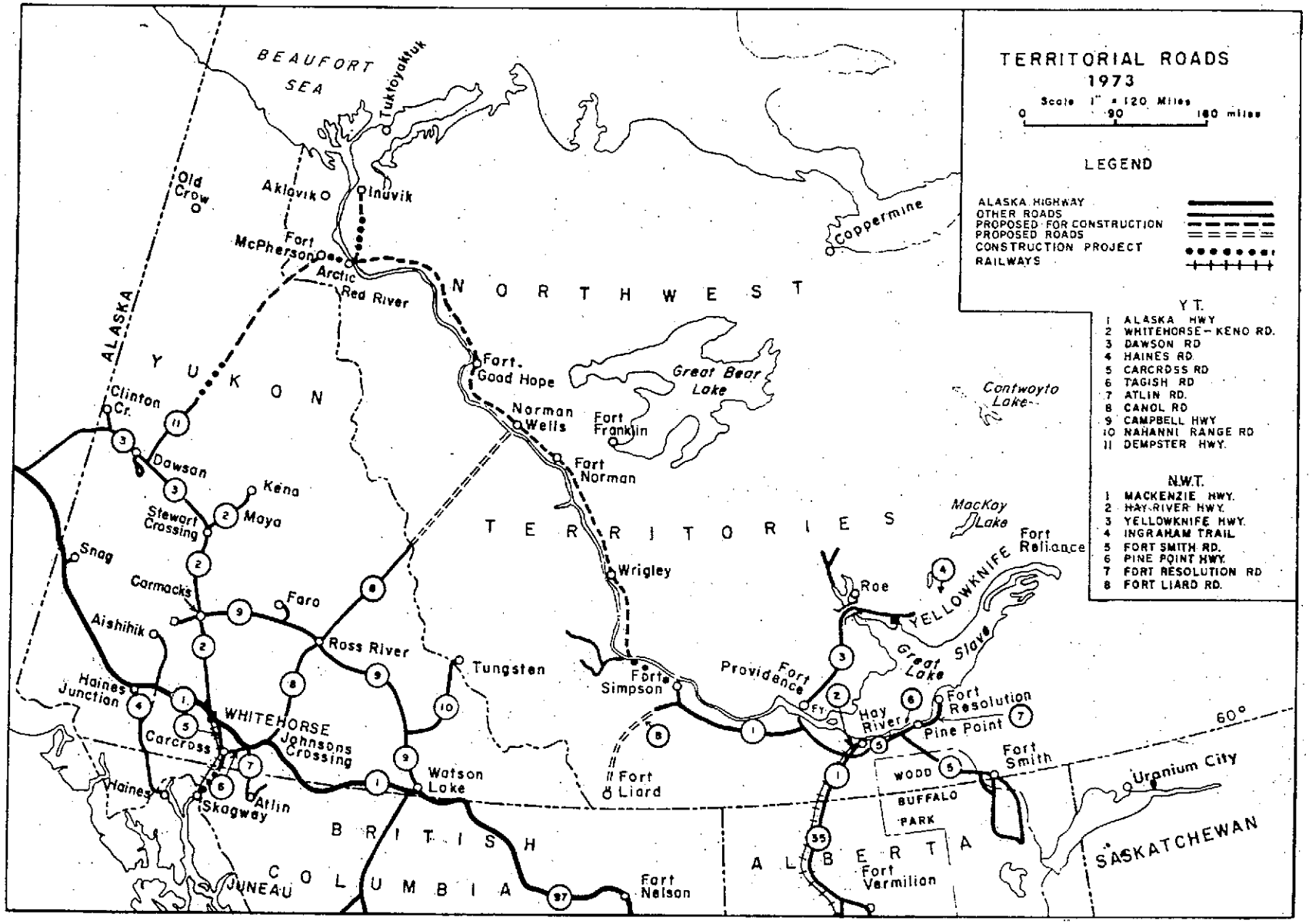
IV NORTHERN ROADS

The Mackenzie and Yukon Rivers and the Arctic Ocean were the principal transportation arteries of the region for many years. With the coming of road and air transport, the importance of the Yukon River for transportation has diminished to the point where its current use is negligible. The Mackenzie River remains an important transportation artery carrying some 500,000 tons of freight in 1972, and with the development of oil and gas in the Mackenzie Delta it has become even more important. The Arctic Ocean serves to supply the exploration and development activities in the Arctic Islands and the communities in the far North and is also expected to become more important as development proceeds.

Map 2 shows the state of road and rail transportation in 1973 in the Territories. Obviously roads are the spine of northern development and integral to resource development.

The Territories are rich in resources. Over half of Canada's potential oil and gas reserves are believed to exist in the sedimentary basins down the Mackenzie Valley and across the Arctic Islands. Major gas discoveries have already been made in the Mackenzie Delta and in the Arctic Islands and exploration is proceeding with huge annual expenditures. These resources are important to Canada and to North America. Mineral potential in the form of metals is also substantial.

MAP 2



SOURCE: Northern Road Development in Canada, Indian and Northern Affairs, 1973.

Water is another important resource, both from the point of view of its hydro-electric potential and as representing nearly 50 percent of Canada's fresh water supplies. Forest resources are substantial in the southern regions and could ultimately contribute significantly to the local economy but not in relation to Canada's total forestry resources. Transportation then is the key to the viability of these resources and road transportation an important element.

In 1965, the Government of Canada announced a policy for the construction of a road network in the Territories, updating this policy in 1971. The essential concept underlying this policy was that the creation of a network of roads would bring in its wake the exploration and subsequent development of the region's resource potential. In most parts of the world, roads are built to link population centres or to serve already discovered resources but under this policy the essential concept is one of building roads ahead of development through areas of promising potential. Since commencement of this road program in 1965, more than 2,000 miles of roads have been built. Costs per mile in 1973 varied from $24,000 to $200,000 in an area of continuous permafrost where soils are fine grained with a high ice content and where granular materials are both very limited and inaccessible. A large part of the area over which these roads have been constructed are permafrost zones and present special construction and maintenance problems.

Without fear of contradiction, it can be said that the developments in the North were both aided and accelerated by these roads. Similarly, while the pace of exploration has quickened, one cannot say that this has been due solely to the roads program. One can say, however, that these roads have contributed significantly to this exploration and have to some extent dictated the specific areas in which the exploration is taking place. Of all the incentive programs offered by government to encourage exploration and development in the North, this is the one supported the most by industry.

V FACTORS AFFECTING HIGHWAY DEVELOPMENT

A. Social Change

It has been estimated that Canada will have a population of between 25 and 27 million by 1981 depending upon fertility, immigration and government policies. Recent studies also indicate that by 1981 84 percent of Canada's population will be living in urban areas and also that this will increase to 92 percent by 1991. If this happens the patterns of work and leisure will change radically. Many enterprises are now operating 4-day and 3-day work weeks, without strict adherence to the 8-hour work day. Leisure time is expected to increase significantly in the future. Studies indicate that the length of the work week and the number of hours worked per week will decrease and longer vacations and periodic sabbaticals will become more common.

Increased leisure time will substantially increase the amount of travel by Canadians and longer week-ends and vacations will generate additional travel. Due to the nature of recreational and leisure travel, much of the increase in available leisure time will be accommodated by, and put additional demands on the highway mode.

B. Environmental Aspects

The necessity of conserving environmental resources is no longer in doubt and generally the responsibility of the

various levels of government to protect and preserve environmental quality is evident.

Though not necessarily refined, information bases and analytical methodology are available for evaluating the environmental impact of highway development. Environmental elements can be defined and delineated for highway impact analysis. These environmental considerations can and are being incorporated into the highway planning process adding both time and money to the overall projects.

C. Technological Aspects

Transportation experts have stated that they do not expect any of the new technologies or innovative management techniques to have a noticeable impact on intercity highway investment until the late 1980's.

However, the development and implementation of improved public transportation for intercity travel in Canada by 1982 could perhaps be justified on the ground of improved levels of service and the availability of alternative means of transport for those without access to the private automobile, rather than as a means of significantly reducing highway expenditures. Considerable effort is being put into alternative modes of transporting goods and people but not much effort is being directed at the highway itself.

D. Economic Aspects

Highways are a significant component of the Canadian economy with multiplier effects spilling over to other sectors. However, the present rate of highway investment by the provinces has slowed down a bit and appear to be heading for a low profile within the total scheme of resource allocation by the provinces. The emphasis seems to be on road improvement and paving rather than new construction. Of course, north of 60°, the opposite is true.

Any expansion to the road network seems to be directed towards the provision of access highways to natural, recreational and social resources.

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Road Transport Service Bulletin

53-606

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Printed in Canada Imprimée au Canada

Published by authority of the Minister of Industry, Trade and Commerce

Publiée avec l'autorisation du ministre de l'Industrie et du Commerce

CGOT-B1114 (west)

Canadian Government Office of Tourism

Office de tourisme du Canada

Highways of
WESTERN CANADA

SCALE: 1 Inch Equals 32 Miles

Multilane Divided, Controlled Access
Multilane Divided, Controlled Access, Toll
Multilane Divided
Two or More Lanes Paved
Two Lane Gravel

Multilane Divided
Two or More Lanes Paved
Gravel

To give maximum clarity to this map, only a limited network of PRINCIPAL THROUGH HIGHWAYS is printed in red. Many of the gray roads shown offer equally good travelling conditions.

Trans Canada — Yellowhead
Autoroute — United States
Interstate — Provincial or State

Local Mileage between black pointers
Accumulated Mileage between red pointers

International Airport
Principal Ports of Entry Open 24 Hours
Steamer or Ferry Route
Toll Bridge

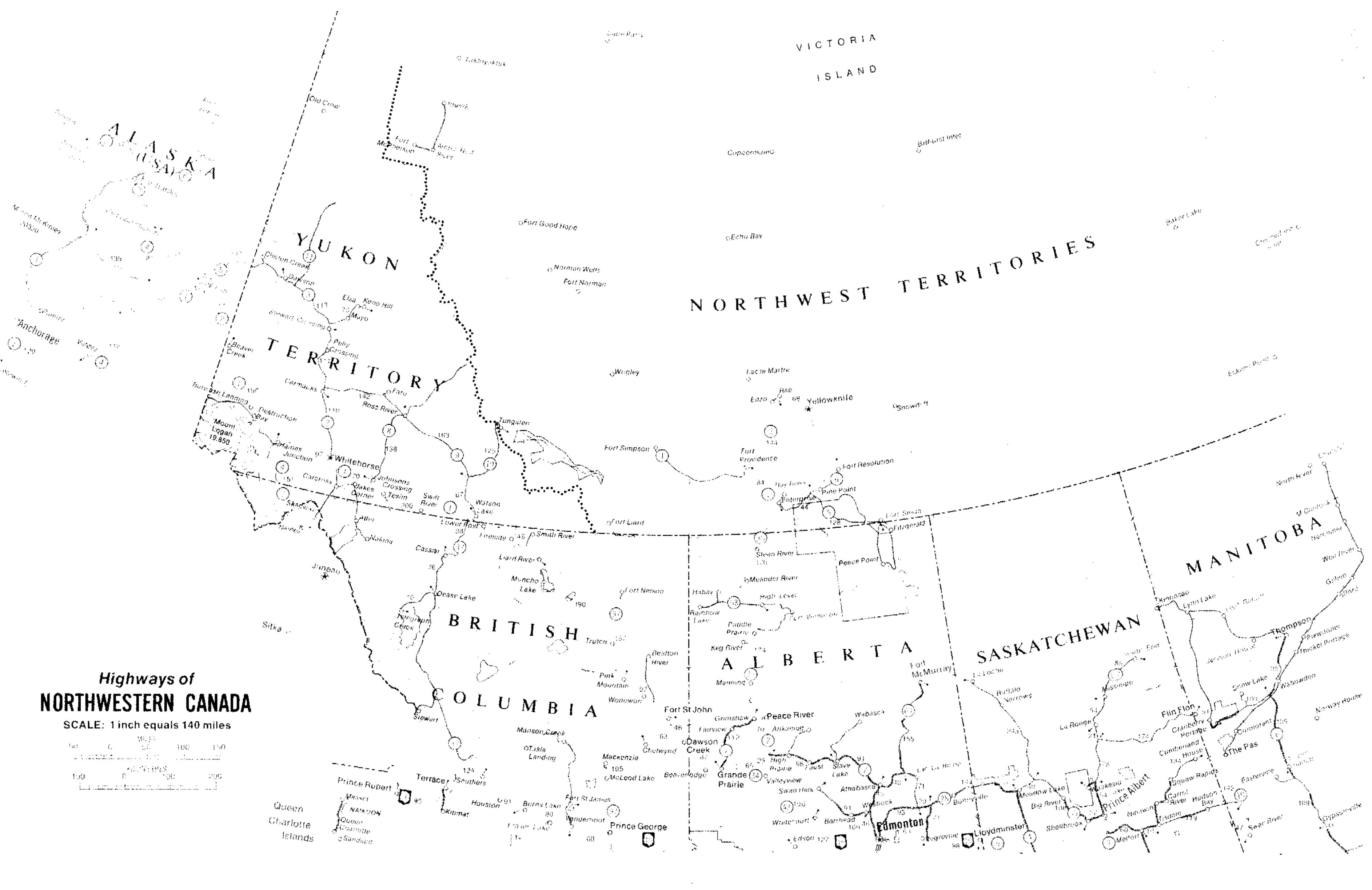
International — National Park
Provincial — Provincial Park
State

MONTREAL (over 500,000) **Calgary** (100,000-500,000)
Belleville (25,000-100,000) Yorkton (5000-25,000)
(0-5000)
National Capital — Provincial or State Capital

Shown thus on this map stretches from the Atlantic to the Pacific Ocean, covering nearly 5000 miles from St. John's, Newfoundland, to Victoria, British Columbia. Traversing wonderfully varied and exciting scenery, it is the world's longest national highway.

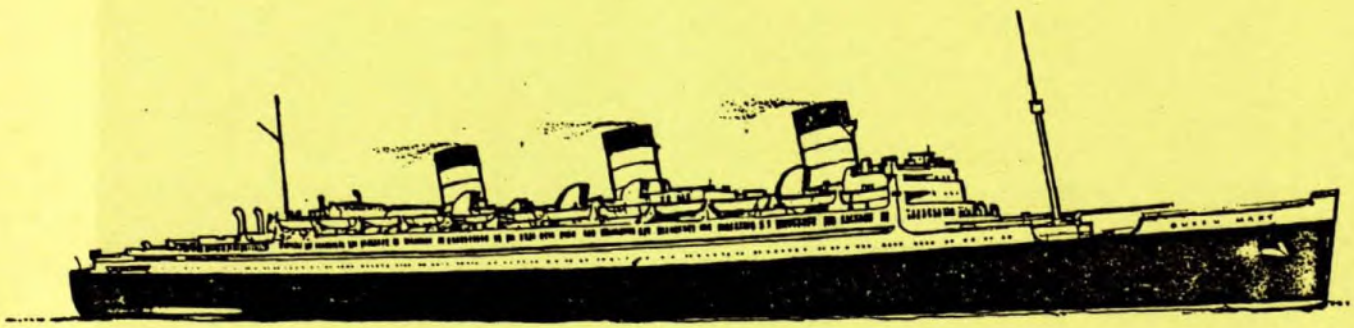
AVERAGE DRIVING TIME AND DISTANCE

Time 2:30
Distance in miles ....
Distance in kilometres ....



Highways of
NORTHWESTERN CANADA

SCALE: 1 inch equals 140 miles



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I WATER TRANSPORTATION DEVELOPMENT

Since the mid 1940's, several important events have occurred to foster increased water transport in Canada. Foremost of these was the completion of the St. Lawrence Seaway which permitted ocean going ships to reach the Great Lakes and also allowed the lake boats to proceed down to the iron ore ports of Port Cartier and Sept Isles, thus changing the established trade patterns by water. Of importance to Canada's North was the organization of navigation systems, in particular that on the Mackenzie River; a combination of summer barging and winter trucking has provided the western half of the territories with a comparatively good transportation system. As well, improvements have been made to east and west coast ferry systems and associated coastal shipping between Vancouver and Vancouver Island, New Brunswick and Prince Edward Island, and Nova Scotia and Newfoundland.

Water transportation requires considerable coordination of the land and water facilities at each port. Facilities provided to enable interchange movements included the necessary docks and wharves, some for passenger traffic but most of them for freight, warehouses for handling of general cargo, and special equipment for bulk freight of all kinds. Facilities may include cold storage warehouses, harbour railway and switching connections, grain elevators, coal bunkers, oil storage tanks

and, in the chief harbours, vessel repair docks.

The ports and harbours of Canada comprise 25 large deep-water ports and about 650 smaller ports and multi-purpose government wharves on the east and west coasts, along the St. Lawrence Seaway and Great Lakes, in the Arctic, and on interior lakes and rivers. Except in the case of the coastal trade, all Canadian waterways, including canals, lakes and rivers, are open on equal terms to the shipping of all countries of the world so that Canadian shipping must compete with foreign flag shipping.

The carriage of goods and persons from one Canadian port to another, commonly referred to as the coastal trade, is restricted to ships registered in Canada within the region from Havre-Saint-Pierre on the St. Lawrence River upstream to the head of the Great Lakes. Elsewhere in Canada, the coastal trade is restricted to ships registered and owned in a Commonwealth country. As at December 31, 1974, there were 30,491 ships constituting 4.1 million gross tons registered in Canada.

Table 1 shows the number and tonnage of all vessels (except those of less than 15 registered net tons, naval vessels and fishing vessels) entering Canadian customs and non-customs ports.

TABLE 1

VESSELS ENTERED AT CANADIAN PORTS, 1971-73

Year	In international seaborne shipping		In coastwise shipping		Total	
	Vessels	Registered net tons	Vessels	Registered net tons	Vessels	Registered net tons
1971	24,930	114,252,881	68,083	96,274,780	93,053	210,527,661
1972	24,771	121,535,914	63,438	92,675,867	88,209	214,211,781
1973	23,258	121,419,102	58,759	90,799,809	82,017	212,218,911

SOURCE: Canada Year Book 1975.

Freight movements through large ports take different forms, including cargoes for or from freight countries and cargoes loaded and unloaded in coastwise shipping, i.e. domestic freight moving between Canadian points.

In 1974 a total of over 300 million tons were loaded and unloaded at Canada's principal ports.

Over the past few years vessels are becoming larger and larger. These economics of scale are reflected in the lake vessels which tend to be built to the maximum dimensions permitted by lock size at the time of the ship's construction. At present these limits are represented by a ship 730 feet in length, with a 75-foot beam (20,000-29,000 tons capacity). The tugs and barges in the sheltered waters of British

Columbia are much larger, however, an indication of the potential for water transport when the physical restrictions caused by locks are not present. The trend in ocean shipping is similarly towards larger vessels and, although Canada is not a major manufacturer of ships, developments in the trade are important since bulk vessels are used to export many Canadian commodities, such as iron ore, coal, grain and potash.

Present day marine economics militate against inland ports, although it was not always so. Ocean ports offering adequate water depth and quick vessel turn around time through modern handling facilities are now in vogue on both of Canada's coasts - at the bulk commodity port of Roberts Bank in the west and at the container ports of Halifax, Saint John and Quebec City in the east. The advent of containerization and the evolution of an integrated water - land transport technology is expected to facilitate traffic movement, reinforce security of the cargo and, fulfil more efficiently the major role played by the marine element in transportation from coast to coast.

II THE WATER TRANSPORT SYSTEM

The administration of Canadian ports is generally under the Ministry of Transport's Canadian Marine Transportation Administration. Canada's harbours are subdivided into National Harbours Board ports, harbour commission ports, public harbours and government wharves. The principal harbours of Canada are administered by the National Harbours Board and a similar number of other major harbours are administered by Harbour Commissions, which include municipal as well as federal government appointees. In addition, there are some 300 public harbours under the direct supervision of the Ministry of Transport. About 2,000 fishing harbours and facilities for recreational boating are administered by the Department of the Environment.

Throughout the country there are several hundred wharves and breakwaters administered by the Ministry of Transport. At many ports, in addition to public harbour works operated by the administering authority, there are extensive dock and handling facilities owned by private companies including railway, lumber, pulp and paper, coal, steel, iron ore, petroleum, grain fish and other industries moving large volumes of bulk materials.

At present, the National Harbours Board (NHB) provides facilities for the berthing of vessels and for the handling and protection of waterborne transit cargo and promotes the utilization of national harbours. It owns and operates harbour

facilities, including shipping lanes, wharfs, piers, grain elevators, warehouses, container and bulk handling facilities, roadways, railway tracks, etc. in 15 ports which are designated as national harbours. The major ports include Vancouver, Prince Rupert, Churchill, Montreal, Quebec, Chicoutimi, Sept Isles, Halifax, Saint John and St. John's (Map 1). Its undepreciated assets in 1973 were worth $590 million. For comparison assets in 1972 of Commission harbours (including Thunder Bay, Toronto, Hamilton and Fraser River) were $123 million, 1972 assets in government wharves were $600 million, and assets of private harbours (including Port Cartier, Pointe Noire and the eastern oil ports) are estimated to exceed those for all public harbours. Eleven of Canada's major multi-purpose harbours are administered by Harbour Commissions, federal bodies operating semi-autonomously under the general supervision of the Ministry of Transport. These ports include The Lakehead (Thunder Bay), Windsor, Hamilton, Toronto, Oshawa and Belleville, Ontario on the Great Lakes; Winnipeg-St. Boniface, Manitoba on the Red River-Lake Winnipeg System; Fraser River (New Westminster), North Fraser, Nanaimo, and Port Alberni, British Columbia.

The St. Lawrence Seaway Authority (SLSA) was incorporated for the purpose of constructing, maintaining and operating the works comprising the Canadian portion of a deep

waterway between the Port of Montreal and Lake Erie. The waterway is divided into two sections: the Montreal-Lake Ontario section comprises seven locks and approaches, five of which are located in Canada, and operated by SLSA; the Welland Canal section comprises eight locks, all of which are in Canada and operated by SLSA. The undepreciated assets of SLSA in 1973 were about $818 million.

In July 1976, the Cabinet approved a task committee report and recommendations directed at establishing a new Canada Ports Act that would enable the establishment of a new unified system of management for Canadian Ports. The new management structure, as proposed, would create a new Canadian Ports Commission, headed by a Commissioner, within the Marine Administration of Transport Canada. As well, the new structure will comprise Local Port Commissions, a Canadian Ports Policy Council, and Regional Advisory Councils.

The local port commissions would be set up to operate the major ports across the country while the remaining 300 public harbors and 500 government wharves would be managed directly by the Canadian Ports Commission.

A Canadian Ports Policy Council will advise the Minister of Transport, through the Canadian Ports Commissioner, on national port management policy while regional advisory councils will be established to advise on port policy matters

of regional concern.

This new "Canada Port Act" was being drafted for presentation to Cabinet in the fall of 1976.

III CANADIAN PORTS

The early exploration and development of Canada hinged directly on water routes. Since that time, Canada has grown and its transportation system has grown with it to the point where today Canada ranks seventh in the world in the use of ocean shipping for imports and exports. In 1974, Canadian overseas commerce included about $19 billion in direct waterborne export and import trade representing a total of about 187 million tons of cargo through our ports. That same year 210 million bushels of grain moved by rail from the prairies to our west coast ports, while 445 million bushels were transported by rail and laker through Churchill, our St. Lawrence ports, and our east coast facilities. Over and above these 445 million bushels, another 116 million bushels of U.S. grain were shipped through Eastern Canadian ports. It should be noted that in some earlier years volumes of cargo handled by Canada's ports were even higher than in 1974 and that grain is only one of the commodities shipped.

Obviously with this scope of cargo movement ports are a vitally important part of our transportation and national economic system.

Before going any further it is important to understand a couple of definitions.

a. The term international seaborne shipping is used for vessels classed as being in foreign service, that

is when (1) the vessel arrives from or departs for a foreign port; or (2) cargo is loaded for or unloaded from a foreign port; or (3) the registry of the vessel is other than Canadian or British Commonwealth (even though the vessel may have sailed between two Canadian ports).

b. A vessel is classed as being in coastal service if (1) it is of Canadian or British Commonwealth registry, sails between two Canadian ports, and loads or unloads no foreign freight; or if (2) it is of foreign registry, but is granted a waiver to engage in coasting service.

Another important point to remember when analysing cargo loading data is that transhipments of cargoes, which are cargoes coming into a Canadian port en route to a port in a foreign country by water, are reflected in port totals. For example, cargoes unloaded from one vessel at Vancouver and reloaded onto another vessel are recorded as a loading and unloading at that port.

The location of major ports in Canada as of 1974 are shown on Map 1 and the cargo data is found on Table 2. A further listing of ports, port authorities and major cargoes handled by type of commodity and by province can be found in the table inserted at the back of this section (Insert 1).

Table 3 lists the 10 Canadian ports handling the largest volume of cargo for 1975 and ranks them for the years 1971-1975. The port of Vancouver has handled the largest volume of cargo of any port in Canada for the past five years.

Table 4 is a summary by province of cargoes loaded and unloaded. In terms of cargo handled, the western provinces account for only 23 percent of the national total.

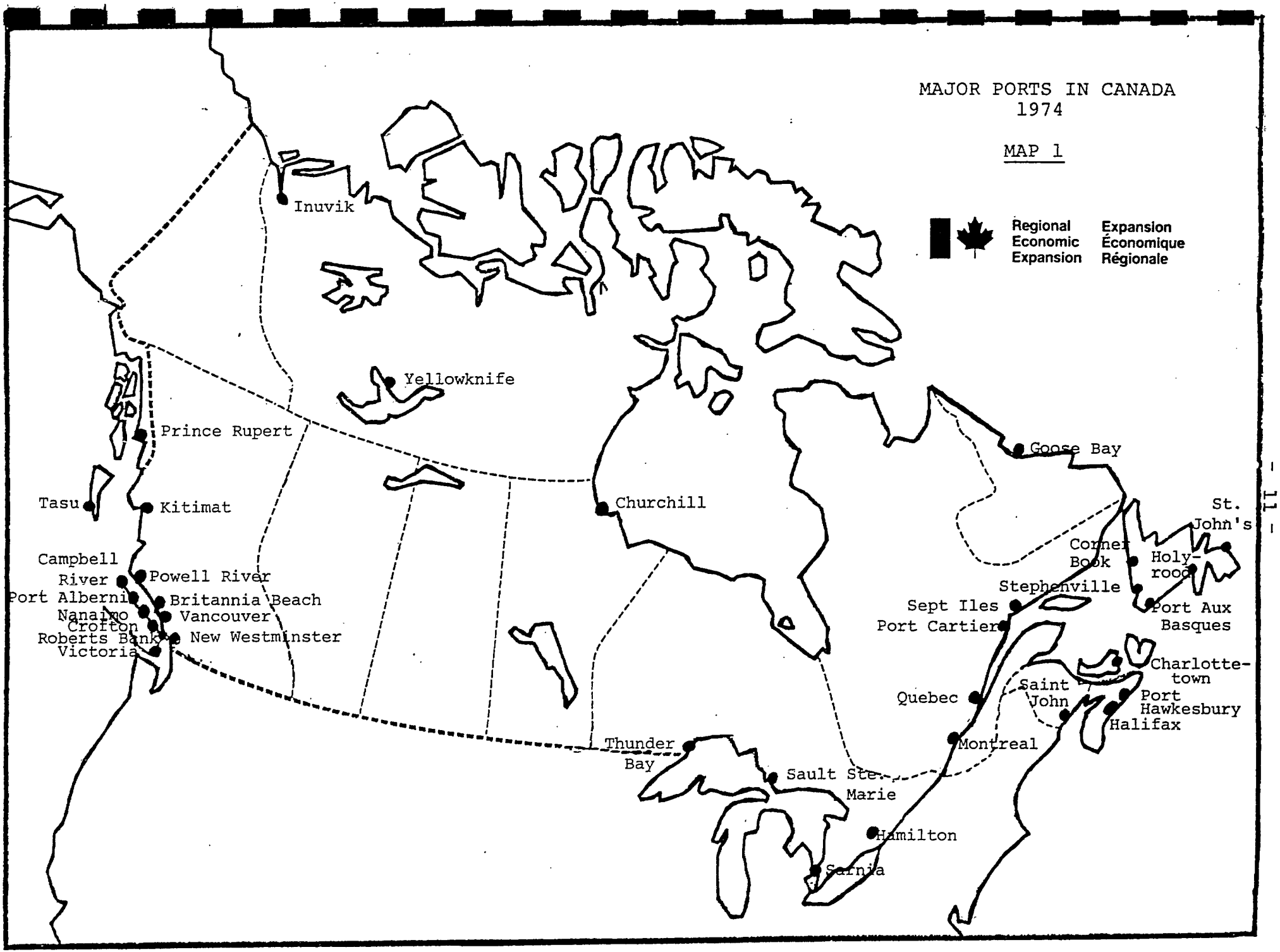

MAJOR PORTS IN CANADA
1974
MAP 1
Regional Economic Expansion
Expansion Économique Régionale
Inuvik
Yellowknife
Prince Rupert
Tasu
Kitimat
Campbell River
Powell River
Port Alberni
Britannia Beach
Nanaimo
Vancouver
Crofton
Roberts Bank
New Westminster
Victoria
Churchill
Thunder Bay
Sault Ste. Marie
Hamilton
Sarnia
Goose Bay
St. John's
Corner Book
Holy-rood
Stephenville
Sept Iles
Port Aux Basques
Port Cartier
Charlotte-town
Quebec
Saint John
Port Hawkesbury
Halifax
Montreal

TABLE 2

LOCATION OF MAJOR PORTS BY PROVINCE 1974

Port Location	Cargo Handled	Percent of Province
Newfoundland		
Corner Book	716,347	5.3
Goose Bay	356,292	2.6
Holyrood	1,051,913	7.8
Port Aux Basques	638,350	4.8
St. John's	1,017,773	7.6
Stephenville	1,037,062	7.7
Prince Edward Island		
Charlottetown	665,358	90.0
Nova Scotia		
Halifax	13,289,670	49.0
Port Hawkesbury	8,078,301	30.0
New Brunswick		
Saint John	9,997,900	80.0
Quebec		
Montreal	19,654,305	21.4
Port Cartier	15,430,379	16.8
Quebec	12,942,745	14.1
Sept Iles	25,597,555	28.0
Ontario		
Hamilton	11,869,371	16.0
Sarnia	8,553,312	12.0
Sault Ste. Marie	5,177,798	6.0
Thunder Bay	18,151,823	25.0
Manitoba		
Churchill	664,430	100.0
British Columbia		
Britannia Beach	2,145,290	3.2
Campbell River	1,700,907	3.0
Crofton	1,495,004	2.2
Kitimat	1,298,715	2.0
Nanaimo	1,757,122	3.0
New Westminster	3,772,755	5.6
Port Alberni	1,135,075	2.0
Powell River	1,537,288	2.0
Prince Rupert	1,439,018	2.0
Roberts Bank	9,334,319	14.0
Tasu	1,062,709	2.0
Vancouver	27,426,777	40.5
Victoria	1,796,477	2.0
Northwest Territories		
Yellowknife		
Inuvik		

SOURCE: Compiled from data in Table 3 of this report.

TABLE 3

TEN CANADIAN PORTS HANDLING THE LARGEST VOLUME OF CARGO LOADED AND UNLOADED IN INTERNATIONAL AND DOMESTIC SHIPPING FROM 1971 TO 1975

Ports	Tonnage 1975P	Rank in 1975	Rank in 1974	Rank in 1973	Rank in 1972	Rank in 1971
Vancouver	35,521,319	1	1	1	1	1
Sept Isles-Pointe Noire	30,195,159	2	2	2	3	2
Thunder Bay	20,027,820	3	4	4	2	4
Montreal (2)	18,632,938	4	3	3	4	3
Port Cartier	17,627,889	5	5	5	5	5
Hamilton	14,270,367	6	8	8	7	6
Quebec	12,496,009	7	7	6	6	8
Halifax	11,742,732	8	6	7	8	7
Saint John	10,850,676	9	9	9	9	-
Sarnia	9,090,425	10	10	10	-	9

(1) Includes Roberts Bank.
(2) Excludes Contrecoeur, Tracy, Varennes, Vercheres.
(3) Preliminary figures.

SOURCE: Adapted from Statistics Canada, Shipping Reports 1971-75.

TABLE 4

CARGOES LOADED AND UNLOADED BY PROVINCE
INTERNATIONAL SEABORNE & COASTAL SHIPPING

1974

('000 Tons)

	INTERNATIONAL		COASTLINE		TOTAL TONNAGE
Province	Loaded	Unloaded	Loaded	Unloaded	HANDLED
Newfoundland	3,414.9	4,745.4	2,151.5	3,111.4	13,423.2
Prince Edward Island	22.9	6.5	125.6	578.5	733.5
Nova Scotia	8,888.9	10,408.6	5,050.0	2,917.0	27,264.5
New Brunswick	2,958.0	6,195.8	2,014.0	1,427.4	12,595.2
Quebec	53,882.5	19,222.6	12,394.9	20,049.0	105,549.0
Ontario	11,254.9	20,742.7	23,748.7	18,295.7	74,042.0
Manitoba	616.1	32.2	16.1	18.0	682.4
British Columbia	35,928.1	5,575.8	13,618.7	12,618.9	67,741.5
Northwest Territories	---	0.6	1.0	122.5	124.1
TOTAL	116,966.3	66,930.2	59,120.5	59,138.4	302,155.4

Source: Derived from Statistics Canada, Shipping Report, Part II and Part III 1974;
Cat: 54203 and 54204

Cargoes handled at Canadian ports in coastwise shipping declined to 118,241,274 tons in 1974 from 121,946,588 tons in 1973. This decline was reported in all provinces except Newfoundland, Nova Scotia, New Brunswick, Manitoba and the Northwest Territories.

Domestic shipping at British Columbia's ports declined from 29,798,676 tons in 1973 to 26,237,592 tons in 1974. Traffic at New Westminster fell from 2,381,711 tons to 1,986,567 tons. A few of the other ports that showed decreases in tonnage handled in 1974 were: Campbell River from 1,383,095 tons to 988,700 tons, Powell River from 1,325,541 tons to 1,185,385 tons, and Vancouver from 7,957,417 tons to 7,901,225 tons. However, Britannia Beach handled slightly more tonnage in 1974, up from the 1973 figure to 2,078,681 tons. Excluded from these figures are crude oil shipments from Vancouver to Portland, Maine.

Coastal shipping in Churchill, Manitoba rose from 11,954 tons to 16,094 tons in 1974.

The Northwest Territories handled 123,564 tons in 1974, an increase of 28.2 percent from the 1973 tonnage of 96,354 tons.

A total of 106,529 vessel arrivals and departures were reported in 1974, an 8.6 percent decrease from the 116,510 accounted for in 1973. The average registered net tonnage per vessel was 1,610 tons.

During 1974, foreign registered vessels engaging in Canada's coastal trade carried 7,217,372 tons.

Foreign shipping at Canadian harbours declined from 196,645,527 tons in 1973 to 183,896,574 tons in 1974. This decline was evident in all provinces except Newfoundland, Manitoba and the Northwest Territories. The number of vessels engaged in the transportation of this merchandise declined from 47,091 in 1973 to 42,272 in 1974; the average net tonnage increased from 5,191 tons to 5,374 tons.

Traffic at Manitoba's ports increased to 648,336 tons in 1974 from 551,384 tons in 1973. Shipments of barley increased sufficiently to offset lesser loadings of wheat, which declined to 16,545 tons from 305,722 tons in 1973.

The volume of cargoes handled at British Columbia's ports in 1974 was 4.7 percent lower than the 43,530,854 tons handled in 1973. This decline was recorded at most of the major centres handling international shipping; Vancouver including the Roberts Bank complex declined by 4.5 percent or 1,362,880 tons. Smaller volumes of wheat 3,946,369 tons (5,667,723 tons in 1973), bituminous coal 9,334,319 tons (10,385,003 tons) and barley 865,807 tons (1,245,717 tons) accounted for most of the decrease. Such commodities as crude petroleum and potash recorded increased tonnages loaded, but these were insufficient to offset the decline. The following ports also recorded declines in total tonnage handled in 1974;

Crofton 876,855 tons (911,480 tons in 1973), Kitimat 1,002,232 tons (1,110,712 tons), Nanaimo 1,077,296 tons (1,400,487 tons), and Ocean Falls 5,517 tons (62,985 tons). Ports recording increases were: New Westminster 1,786,188 tons (1,174,153 tons in 1973), Quatsino 147,673 tons (143,766 tons), Port Mellon 50,843 tons (45,686 tons) and Sooke 321,510 tons (192,480 tons).

International cargoes handled at the port of Vancouver (including Robert's Bank) amounted to 28,859,871 compared to 30,222,751 tons in 1973. Loss of grain and coal shipments were the basic contributors to the decline.

Domestic cargoes at Vancouver totalled 7,901,225 tons, 26.3 tons of the loadings were destined to Canadian Eastern Ports (excludes shipments completed via the Portland Maine pipeline).

A. Western Ports

Table 5 gives the cargoes handled by the principal ports in Western Canada.

Because the port of Vancouver is the largest port in the west as well as handling the largest volume of cargo in Canada, a few pertinent statistics are relevant.

At the completion of the development of the new terminal facilities in Vancouver, the port of Vancouver will have the following operating terminals:

TABLE 5

CARGOES LOADED AND UNLOADED AT PRINCIPAL CANADIAN PORTS[1] FROM VESSELS IN INTERNATIONAL SEABORNE AND COASTWISE SHIPPING, 1973 WITH TOTAL FOR 1972 (tons)

PROVINCE AND PORT	INTERNATIONAL		COASTWISE		TOTAL 1973P	TOTAL 1972
	Loaded	Unloaded	Loaded	Unloaded		
MANITOBA	521,783	29,601	6,567	6,521	564,472	776.310
Churchill	521,783	29,601	6,000	6,521	563,905	776,310
BRITISH COLUMBIA	38,543,379	5,910,426	14,943,266	14,930,071	74,327,142	68,802,452
Vancouver[2]	27,200,884	3,913,455	3,031,598	4,979,190	39,125,127	34,897,731
New Westminster	750,979	412,152	1,183,884	1,192,750	3,539,765	3,020,225
Nanaimo	1,440,696	79,253	83,316	613,174	2,216,439	2,048,737
Duncan Bay-Campbell River	598,873	152,791	175,089	1,208,761	2,135,514	2,278,401
Britannia Beach	50,581	6,470	1,970,406	79,495	2,106,952	1,730,515
Victoria	1,157,568	189,099	259,848	439,092	2,045,607	2,509,214
Powell River	384,976	110,421	543,779	794,154	1,833,330	1,780,817
Crofton	884,428	29,551	49,134	761,748	1,724,861	1,690,811
Kitimat	425,907	684,805	377,568	43,904	1,532,184	1,353,657
Prince Rupert	1,011,329	16,774	83,447	255,706	1,367,256	1,559,560
Port Alberni	883,658	68,883	27,107	331,812	1,311,460	1,263,380
Tasu	1,010,879	-	-	9,668	1,020,547	675,127
Ladysmith	19,100	5,590	733,334	38,702	796,726	755,917
Chemainus	322,022	9,211	221,725	69,211	622,169	599,634
Vanguard	-	-	286,059	290,598	576,657	619,071
Quatsino	57,437	84,329	291,481	132,530	565,777	729,726
Marble Bay	392,325	-	121,547	1,000	514,872	691,059
Blubber Bay	299,969	-	82,367	172	382,508	527,352
NORTHWEST TERRITORIES	-	-	3,343	93,011	96,354	136,545
Total	124,545,231	73,513,404	61,191,855	61,191,855	320,442,345	299,449,540

[1] Only ports handling over 500,000 tons are listed
[2] Includes Roberts Bank.

SOURCE: Canada Year Book 1975.

- Centennial Terminal (Centennial and Ballantyne Piers)
- Vanterm (Vanterm and Lapointe Piers)
- Lynnterm (Terminal and Industrial Park)
- Roberts Bank (Five terminals and Industrial Park).

1. Port of Vancouver - General Facilities 1975

Berthing Facilities	Berths
General Cargo	32
Sugar (Bulk)	1
General & Grain Combined	1
Grain	10
Bulk (Potash, Coal, Sulphur, etc.)	6
Salt	1
Oil (Deep Sea)	5
Liquid Petroleum Gas	1

Grain Elevator Capacities		Belts	Average Rate Loading/Belt
U.G.G.	3,645,000 bu.	2	350 Tons per hour
Lapointe 1,2	5,243,100 bu.	4	350 Tons per hour
Lapointe 4	1,868,000 bu.	2	275 Tons per hour
Alberta	7,300,000 bu.	4	325 Tons per hour
Saskatchewan	5,400,000 bu.	2	500 Tons per hour
Burrard Term	1,500,000 bu.	2	275 Tons per hour

Labour Force - Longshore 1,748 registered

S.W.L. Cranes

Container	Vanterm	2 @	40 long tons	
Container	Centennial	1 @	40 long tons	
Stiff Leg	Centennial	1 @	300 long tons	
CPR		1 @	8 long tons	2 @ 5 long tons
Centennial		1 @	8 long tons	3 @ 5 long tons
Vanc. Wharves		1 @	7.5 long tons	
Burrard D/D		1 @	75 long tons	(Stiff Leg)

Dry Docks

2 with lifting capacity of		10,000 Tons
		12,000 Tons
	Length	480' - 556'

with depth of water over keel blocks of 25' and 24' respectively.

Area of water under Port of Vancouver jurisdiction - 200 square miles.

TABLE 6

TEN YEAR SUMMARY OF DEEP SEA VESSELS
AND CARGO TONNAGES AT THE PORT OF VANCOUVER

VESSELS			CARGO - SHORT TONS		
Year	Number	Tonnage (000)	Imports	Exports	Total Foreign Cargoes (000)
1966	1,788	10,471	1,869	10,703	12,572
1967	1,853	11,082	1,972	11,153	12,125
1968	1,957	11,782	1,777	12,113	13,890
1969	1,801	11,177	2,278	11,240	13,518
1970	2,103	13,885	1,847	16,931	18,778
1971	2,135	16,810	2,895	23,122	26,017
1972	2,029	17,266	2,601	24,985	27,596
1973	2,222	*31,640	2,523	29,943	32,466
1974	2,022	*31,393	2,462	30,404	32,866
1975	1,907	*30,721	1,975	27,692	29,667

* Gross Registered Tonnage

SOURCE: Port of Vancouver Authority 1976.

TABLE 7

TEN YEAR SUMMARY OF COASTWISE VESSELS
AND CARGO TONNAGES AT THE PORT OF VANCOUVER

	VESSELS		CARGO - SHORT TONS		TOTAL
Year	Number	Tonnage (000)	Imports (000)	Exports (000)	(000)
1966	19,200	8,930	4,575	4,556	9,131
1967	19,200	9,186	4,887	5,084	9,971
1968	19,100	10,566	5,195	5,088	10,283
1969	17,300	10,106	4,637	4,926	9,563
1970	15,200	10,069	3,462	4,917	8,379
1971	*21,400	34,854	4,238	5,047	9,285
1972	*21,100	46,616	4,366	4,761	9,127
1973	*20,960	39,211	4,671	4,953	9,624
1974	*20,800	47,507	4,603	4,431	9,034
1975	*19,318	49,597	4,028	4,762	8,790

* Includes B.C. Ferries at Tsawwassen Terminal.

SOURCE: Port of Vancouver Authority 1976.

TABLE 8

PRINCIPAL COMMODITIES MOVING THROUGH THE PORT
THREE YEAR COMPARISON IN SHORT TONS

	1973 (000)	1974 (000)	1975 (000)
EXPORTS			
Grain	8,132	5,319	5,936
Coal & Coke	12,247	12,167	13,252
Sulphur	2,733	3,139	2,321
Lumber & Logs	1,848	2,315	1,662
Woodpulp	468	652	835
Potash	2,270	3,034	2,465
Copper Ores	911	865	658
Fodder & Feed	286	265	231
Propane Gas	260	282	274
IMPORTS			
Raw Sugar	116	106	18
Phosphate Rock	1,027	1,126	1,139
Common Salt	319	211	189
Fuel Oil	168	46	10
Iron, Steel, Metals	252	170	133
CONTAINERS			
Numbers			
Foreign Inward	28,900	32,400	25,400
Outward	25,800	28,800	18,600
Domestic Inward	12,000	11,200	11,200
Outward	12,600	11,000	11,800
Total Harbour	79,300	83,400	67,000
Tons			
Foreign Inward	226,000	294,200	267,000
Outward	319,000	352,800	311,000
Domestic Inward	186,400	143,000	157,000
Outward	80,000	82,200	86,000
Total Harbour	811,400	872,200	821,000

SOURCE: Port of Vancouver Authority 1976.

Total tonnage handled by the Port of Vancouver in 1975 was 38,457,000 short tons, a decrease of 8.2 percent from record levels of 1973 and 1974, the Port reports in a year-end review. This was comprised of 29,667,000 tons of foreign cargoes and 8,790,000 tons of coastwise vessels.

Tables 6 and 7 give the growth patterns of both foreign and coastwise cargo movements. Table 8 summarizes the principal commodities moving through the port.

B. Secondary Water Routes in Canada

The Canso Canal in Nova Scotia is the only canal in Canada besides those in the St. Lawrence Seaway system that carries substantial commercial traffic (in 1973 it carried 2.4 million tons of cargo).

There are several other minor canals in Canada, all of which had at one time some commercial importance but are now used mainly for recreational purposes. The Trent Canal is a 240-mile long series of lakes, rivers and canals that serves as a short-cut for smaller vessels between Lake Ontario and Lake Huron.

The 123-mile long Rideau Canal connects the Ottawa River at Ottawa with Lake Ontario at Kingston. The Ste. Anne de Bellevue and Carillon Canals on the Ottawa River further connect the Rideau Canal through to Montreal.

The Chambly and St. Ours Canals on the Richelieu River, along with a canal in New York State, connect Montreal with New York City. Although they are no longer of commercial importance, recreational boating is creating a strong demand for their facilities.

The St. Peters Canal connects St. Peters Bay on the southerly side of Cape Breton Island with Bras d'Or Lake, the northerly end of which is open to the Atlantic Ocean. This route is used mainly by vessels going to or coming from Sydney, N.S., and seeking a more protected route than the open sea.

C. Northern Routes

The opening of Canada's vast Arctic regions, which may be termed, roughly, the mainland north of the 60th parallel and the islands of the Arctic archipelago, hinges principally upon the availability of transportation. The matter of providing transportation facilities for the opening of the north did not become of particular urgency, however, until the advent of World War II focused attention upon the need for defence installations in the north and upon the urgency of making the known oil and mineral resources of the Mackenzie River basin available to Canada and her allies.

In 1976, from mid July until late September and early October, a fleet of about 30 supply ships delivers

supplies to some 40 eastern Arctic settlements, including native villages, trading posts, defence outposts and weather stations. Because of the short season, the delivery is made by several convoys, each consisting of several cargo ships and an icebreaker or two, depending upon the severity of ice conditions.

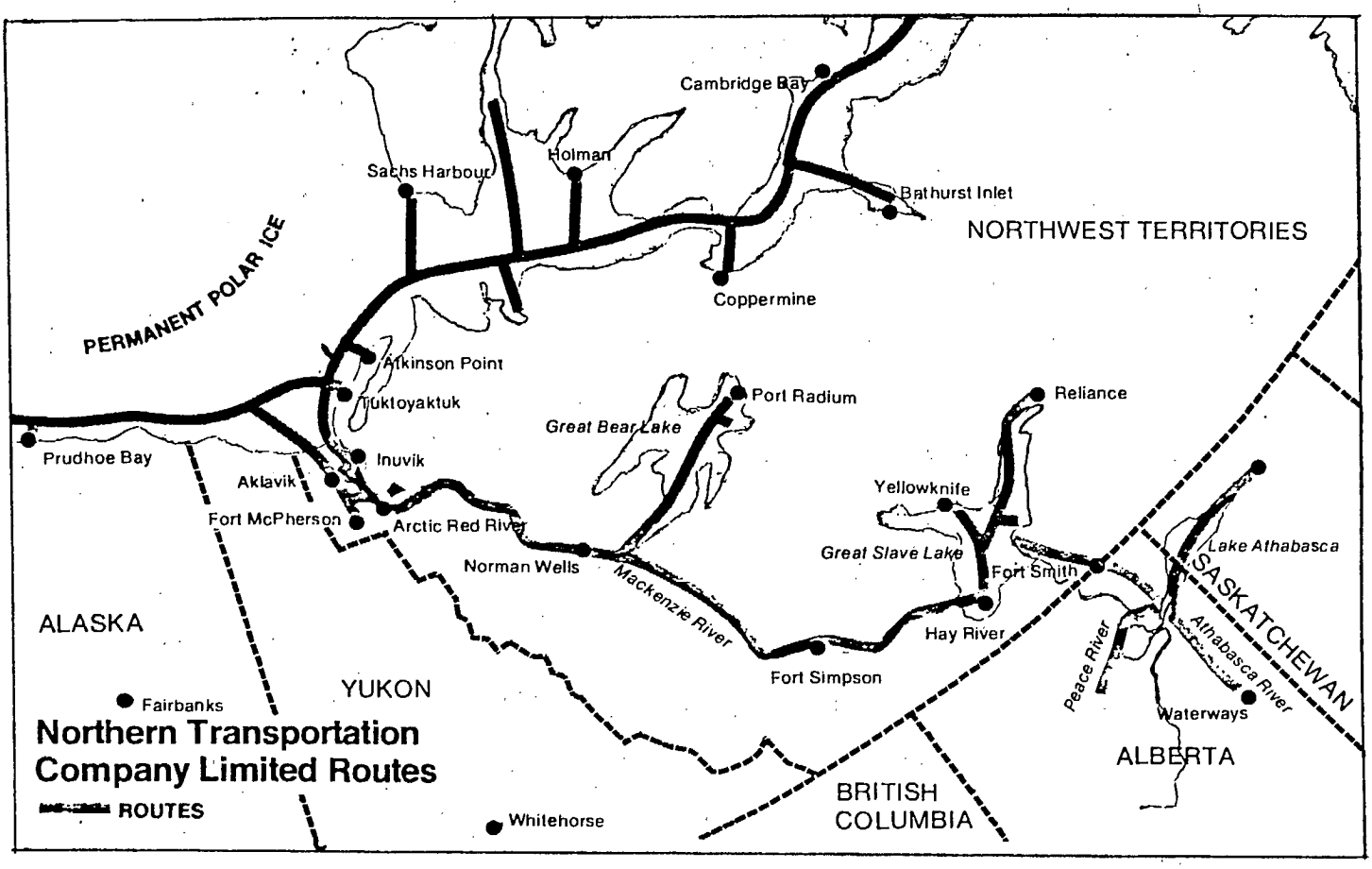
However, the major commercial navigation system in the north, indeed the only major commercial navigation system in Canada besides the Great Lakes-St. Lawrence system, is the Mackenzie River basin system (Map 2). Over 400,000 tons of general and bulk cargo were carried on this system in 1973, most of which originated from the Hay River, N.W.T. marine shipping terminal (the other rail terminal is at Waterways, Alberta). Bulk oil, the source energy for the north, accounts for 55 percent of the total water traffic.

The Northern Transportation Company Limited, a Crown Corporation, handles 85 percent of all marine traffic in the three general sectors of the system. In 1972, it operated a fleet of 28 diesel tugs, 145 all-steel, dual-purpose barges with capacities up to 1,500 tons, and three ocean-going ships. The fleet has a total capacity of 50,000 tons. With respect to traffic volumes, Northern Transportation Company Limited and other water carriers hauled a total of 402,777 tons of freight in 1973. Of this, 343,238 tons moved north while

only 59,539 tons moved south.

Because of a series of rapids at Fort Smith and on the Bear River, transportation services are divided into three general sectors; Athabasca, Great Bear Lake and Mackenzie River (Map 2).

MAP 2



SOURCE: Canada Water Year Book, 1975, Environment Canada.

1. The Athabasca sector is located in the southern part of the region and consists of approximately 800 miles of water routes serving the Athabasca River, Lake Athabasca, the Peace River and that part of the Slave River south of Fort Smith. Water transportation services a number of communities whose industries are basically lumber, mining, trapping and fishing. The navigation season extends for approximately five months starting in early May.

2. The Great Bear Lake sector consists of some 500 miles of water routes east of the Mackenzie River and caters principally to recreational fishing camps, some trading outposts and the mining industry. Navigation is generally possible from late July to early October.

3. The Mackenzie sector covers 3,500 miles of water routes including Great Slave Lake, the Mackenzie River from Hay River to Tuktoyaktuk (1,100 miles) and 1,500 miles of Arctic coastline extending from Colville River on the north coast of Alaska to Spence Bay on Boothia Peninsula. It also extends north to include some portions of Banks and Victoria Islands. The navigation season varies from 50 days in the Arctic to 130 days on the river.

IV FUTURE DEVELOPMENTS IN WESTERN CANADA

Port development at Prince Rupert, British Columbia is one possibility for increasing the capacity of Western Canada's west coast outlet to world markets. A major port development at Prince Rupert is currently one of several alternatives being looked at to overcome railway line and port congestion. A new port at Prince Rupert could make use of under-used rail capacity. Such a terminal could play an important role in the future development of North/East Coal in British Columbia.

Recently, pressure from the Manitoba government has generated some action by the federal government for port development in Churchill. A recent grant of $12.5 million for improvements to the port facilities and a loan for another $7.5 million to the Northern Transportation Company will certainly boost the northern shipping economy.

The shipping season at Churchill lasts only three months and very little traffic comes into the port. In fact, 93 percent of the shipping is for export. The port does have some real possibilities in the areas of increased grain, sulphur, potash and northern resupply shipments.

Because the port is closer to Liverpool than is Montreal and it has good rail and air connections with Western Canada, it might yet become significant as the only seaport in the prairies.

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INSERT 1

PORTS, PORT AUTHORITIES AND MAJOR CARGOES HANDLED
ALL REPORTING PORTS

1974

Province	Port	[1]Port Authority	Total Tonnage	Major Commodity Handled by Tonnage
Newfoundland	Argentia	D.O.T.	63,652	Passenger Autos & Chassis
	Bay Roberts	D.O.T.	11,191	Salt
	Bay Verte	None	41,550	Asbestos
	Bell Island	D.O.T.	6,133	Fuel Oil
	Botwood	D.O.T.	545,168	Newsprint & Minerals
	Burin	None	41,905	Fuel Oil
	Burgeo		17,403	Fuel Oil
	Carmanville	None	3,602	Fuel Oil
	Catalina	None	18,112	Fuel Oil
	Clarenville	None	55,499	Asphalt
	Corner Book[1]	D.O.T.	716,347	Newsprint
	Come-By-Chance		6,327	Crude Petroleum
	Fortune	D.O.T.	13,771	Fish & Fuel Oil
	Goose Bay	D.O.T.	356,292	Pulpwood
	Grand Bank	D.O.T.	26,631	Fish & Fuel Oil
	Harbour Breton	None	17,148	Fish & Fuel Oil
	Harbour Gracé	None	90,009	Fuel Oil
	Ramea		7,471	Fuel Oil
	Holyrood	D.O.T.	1,051,913	Crude Petroleum
	Lewisporte	None	202,089	Fuel Oil
	Little Bay	None	2,485	Copper Ore
	Lona Harbour		584,369	Phosphate Rock
	Long Pond (Manuels)	D.O.T.	75,944	Minerals
	Marystown		39,812	Fuel Oil
	Port Aux Basques	D.O.T.	638,350	Paper, Lumber & Timber
	Port Hope Simpson	None	475	General Cargo
	St. Albans		7,019	Fuel Oil
	St. John's	N.H.B.	1,017,773	Variety
	St. Lawrence	Newfoundland Fluorspar	189,564	Fluorspar
	Stephenville[2]	None	1,037,062	Gypsum, Pulpwood
	Tilt Cove	D.O.T.	26,393	Copper Ore
	All Other Ports	N/A	190,346	Variety, Fuel Oil
	GRAND TOTAL		13,423,206	

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(2) Includes St. George's, Flat Bay, Flat Point & Turf Bay

Province	Port	[1]Port Authority	Total Tonnage	
Prince Edward Island	Charlottetown	D.O.T.	665,358	Variety, Fuel Oil
	Souris	D.O.T.	5,881	Pulpwood
	Summerside (Borden)	D.O.T.	31,080	Fuel Oil, Potatoes
	All Other Ports	N/A	31,158	Pulpwood
	GRAND TOTAL		733,158	
Nova Scotia	Amherst		457	Fresh Fruits
	Baddeck	D.O.T.	11,345	Pulpwood
	Bridgewater	D.O.T.	20,345	Lumber & Timber
	Digby	None	22,631	Fuel Oil, Pulpwood
	Halifax	N.H.B.	13,289,670	Variety, Crude Pet. Gypsum
	Hantsport	None	1,675,505	Gypsum
	Little Narrows	D.O.T.	1,081,779	Gypsum
	Liverpool (Brooklyn)	D.O.T.	170,953	Newsprint
	Lunenburg		7,004	Explosives, Fuses & Caps
	Margaretsville	D.O.T.	43,537	Fuel
	Mulgrave	D.O.T.	25,351	Pulpwood
	North Sydney	D.O.T.	633,940	Foodstuffs
	Parrsboro	D.O.T.	555	Fresh Fruits
	Pictou	D.O.T.	69,199	Fuel Oil
	Port Hawkesbury[1]	D.O.T.	8,078,301	Crude Petroleum
	Pugwash	D.O.T.	257,168	Salt
	Shelburne		47,693	Fuel Oil
	Sydney (Pt. Edward)	D.O.T.	1,711,219	Iron Ore
	Walton	D.O.T.	37,246	Minerals, Barytes
	Weymouth	D.O.T.	8,720	Pulpwood
	Yarmouth	D.O.T.	28,413	Fuel Oil
	All Other Ports	N/A	43,541	Pulpwood
	GRAND TOTAL		27,264,572	

(1) Includes Point Tupper

Province	Port	[1]Port Authority	Total Tonnage	
New Brunswick	Bathurst	D.O.T.	111,350	Fuel Oil
	Belledune		656,373	Phosphate Rock & Sulphuric Acid
	Blacks Harbour		10,653	Plant & Sheet Steel
	Campbellton	D.O.T.	25,720	Fuel Oil
	Caraquet	D.O.T.	6,194	Pulpwood
	Chatham	D.O.T.	179,129	Fuel, Organic Chemicals
	Dalhousie	D.O.T.	802,858	Zinc, Ore, Newsprint
	Grand Manan	D.O.T.	22,528	Fish
	Newcastle	D.O.T.	629,683	Lumber
	Saint John	N.H.B.	9,997,900	Variety, Crude Petroleum
	St. Andrew	D.O.T.	22,683	Fish
	St. Stephen		96,340	Fuel Oil
	All Other Ports	N/A	33,734	Fuel Oil, Fish
	GRAND TOTAL		12,595,300	
Quebec	Baie Comeau	D.O.T.	4,093,624	Wheat
	Beloeil		3,368	Explosives, Fuses & Caps
	Blanc Sablon		13,128	Fuel Oil
	Black Cape		34,328	Fuel Oil
	Cap Chat	D.O.T.	5,950	Lumber
	Carleton	D.O.T.	21,937	Lumber
	Chandler	D.O.T.	125,047	Newsprint
	Chicoutimi	N.H.B.	655,936	Fuel, Salt
	Contrecoeur	N.H.B. (Montreal)	3,596,953	Iron Ore, Minerals
	Forestville	None	35,637	Fuel Oil
	Gaspe	D.O.T.	294,593	Sulphuric Acid
	Grande Vallee		11,552	Pulpwood
	Grindstone	D.O.T.	75,647	Fuel Oil, Variety
	Havré St. Pierre	None	3,064,612	Titanium Ore
	Les Escoumins		125,733	Pulpwood
	Matane	D.O.T.	131,959	Fuel Oil, Salt
	Mont Louis	None	57,952	Fuel Oil
	Montreal	N.H.B.	19,654,305	Variety
	New Richmond		109,143	Fuel Oil
	Paspebiac		32,639	Paperboard
	Pointe Au Pic	None	14,710	Aluminum, Explosives
	Pointe Noire	D.O.T.	4,729,897	Iron Ore

Province	Port	[1]Port Authority	Total Tonnage	Major Commodity Handled
Quebec (cont.)	Port Alfred	Saguenay Terminals Ltd.	4,640,426	Aluminum, Bauxite Ores
	Port Cartier	Quebec Cartier Mining Co.	15,430,379	Iron Ore, Wheat
	Port Menier	None	21,255	Pulpwood
	Quebec	N.H.B.	12,942,745	Variety
	Rimouski	D.O.T.	503,430	Fuel Oil, Lumber
	Rivière du Loup	D.O.T.	57,245	Pulpwood
	Sept Iles	D.O.T.	25,597,555	Iron Ore
	Sorel	D.O.T.	5,208,718	Titanium Ore, Wheat
	St. Jean Port Soli		13,350	Pulpwood
	St. Anne Des Monts	None	12,532	Pulpwood
	Trois Pistoles		64,650	Pulpwood
	Valleyfield		113,214	Zinc Ore, Sulphuric Acid
	Quebec North		289,016	Asbestos
	GRAND TOTAL		91,774,447	
Ontario	Amherstburg	D.O.T.	180,185	Metallic Salts
	Badgley Island		359,264	Stone
	Belleville	Belleville Harbour Commission	16,709	Organic Chemicals
	Britt	None	297,521	Fuel Oil
	Bying Inlet		14,133	Fuel Oil
	Cardinal	Canada Starch Company	165,677	Corn
	Clarkson	None	3,638,511	Limestone
	Cobourg	D.O.T.	40,668	Fuel Oil
	Colborne	None	2,404,873	Limestone
	Collingwood	D.O.T.	89,773	Grain
	Cornwall	D.O.T.	44,343	Fuel Oil
	Courtright	None	155,546	Limestone
	Cutler		25,820	Fuel Oil
	Depot Harbour	D.O.T.	723,024	Iron Ore
	Goderich	D.O.T.	1,463,628	Salt
	Hamilton	Hamilton Harbour Commissioners	11,869,371	Iron Ore, Coal
	Killarney		18,887	Sand & Gravel
	Kingston	D.O.T.	442,887	Fuel Oil, Grain
	Kingsville	D.O.T.	108,694	Limestone
	Lakeview		1,814,305	Bituminous
	Little Current	D.O.T.	845,222	Iron Ore
	Marathon	American Can of Canada Ltd.	325,988	Pulp, Coal
	Michipicoten Harbour	Algoma Central Railroad	673,165	Limestone, Iron Ore

Province	Port	Port Authority	Total Tonnage	Major Commodity Handled
Ontario (cont.)	Midland	D.O.T.	820,082	Wheat
	Morrisburg	None	93,426	Fuel Oil
	Oakville	None	449,949	Fuel Oil
	Oshawa	Oshawa Harbour Commission	407,949	Fuel Oil, Coal
	Owen Sound	D.O.T.	251,568	Grains
	Parry Sound	D.O.T.	611,121	Fuel Oil, Iron Ore
	Picton	None	1,446,475	Iron Ore, Cement
	Port Colborne	N.H.B.	2,308,267	Dolomite, Grain
	Port Credit	None	338,475	Crude Petroleum
	Port McNicoll	None	225,626	Grain
	Port Stanley	D.O.T.	171,384	Fuel Oil
	Prescott	N.H.B.	427,669	Grain
	Red Rock		18,838	Paperboard
	St. Catharines	St. Lawrence Seaway Authority	329,853	Fuel Oil, Gravel
	Sarnia	D.O.T.	8,553,312	Coal, Fuel Oil
	Sault Ste. Marie	D.O.T.	5,177,798	Coal, Iron Ore
	Serpent River		212,382	Limestone
	Sombra		157,790	Limestone
	Thorbold	St. Lawrence Seaway Authority	173,465	Inorganic Chemicals, Coke
	Thunder Bay		18,151,823	Wheat, Iron Ore
	Toronto	Toronto Harbour Commission	2,790,681	Variety
	Wallaceburg	D.O.T.	37,058	Grain
	Whitby	D.O.T.	33,099	Gasoline
	Windsor	D.O.T.	3,193,882	Variety
	All Other Ports	N/A	1,941,914	Cement, Grain
	GRAND TOTAL		74,042,080	
Manitoba	Churchill	N.H.B.	664,430	Grain
British Columbia	Alert Bay		27,868	Logs
	Andy's Bay	None	218,061	Logs
	Bamberton	None	377,373	Cement
	Beaver Cove	Canadian Forest Products	163,300	Logs
	Bedwell Sound		5,174	Logs
	Beecher Bay		90,400	Logs
	Bella Coola	None	144,327	Logs
	Blind Bay	None	94,074	Logs

Province	Port	[1] Port Authority	Total Tonnage	Major Commodity Handled
British Columbia (cont.)	Blubber Bay	None	254,990	Limestone
	Britannia Beach	Anaconda Company (Canada) Ltd.	2,145,290	Limestone
	Campbell River		1,700,907	Pulp
	Chemainus	D.O.T.	555,694	Lumber & Timber
	Clam Bay	None	8	Gasoline
	Clio Bay		97,120	Logs
	Coal Harbour	None	235	Gasoline
	Courtenay	None	102,819	Logs
	Cowichan Bay	None	103,345	Lumber
	Crofton	D.O.T.	1,495,004	Lumber
	Esquimalt	D.O.T.	174,106	Logs
	Gold River	None	392,838	Pulpwood
	Gowland Harbour	None	93,587	Pulpwood
	Howe Sound	N/A	885,043	Logs
	Jervis Inlet		108,814	Logs
	Kimsquit		54,665	Logs
	Kitkatla		521	Fuel Oil
	Kitimat	Aluminum Company of Canada	1,298,715	Alumina, Bauxite Ores
	Knight Inlet		48,380	Logs
	Ladysmith	D.O.T.	463,101	Logs
	Lake Bay		2,800	Logs
	Lt. Espinosa Inlet		84,959	Logs
	Long Bay		120	Gasoline
	Lough Borough Inlet		179	Fuel Oil
	Lyall Harbour		13,777	Limestone
	Mahatta River		2,527	Logs
	Marble Bay	None	106,525	Limestone
	Masset		6,529	Foodstuffs
	Menzies Bay		29,760	Logs
	Namu	None	4,621	Fuel Oil & Food
	Nanaimo	Nanaimo Harbour Commission	1,757,122	Lumber
	New Westminster	Frazer River Harbour Commission	3,772,755	Variety
	N. Arm Frazer R.		329,126	Logs
	Ocean Falls	D.O.T.	187,214	Pulpwood
	Port Alberni	Port Alberni Harbour Commission	1,135,075	Logs & Lumber
	Port Hardy		20,641	Fuel Oil
	Port Harvey		90,439	Logs
	Port McNeil		12,376	Logs

Province	Port	[1]Port Authority	Total Tonnage	Major Commodity Handled
British Columbia (cont.)	Port Mellon		250,192	Logs, Pulpwood
	Port Renfrew		21,081	Logs
	Powell River	D.O.T.	1,537,288	Newsprint, Variety
	Prince Rupert	D.O.T.	1,439,018	Logs, Grain, Variety
	Rupert Inlet		174,996	Pulp, Copper Ore
	Quatsino	None	392,921	Logs
	Ragged Island		5,134	Logs
	Roberts Bank		9,334,319	Coal
	Saanichton		64	Explosives
	Shannon Bay		137,501	Logs
	Siwash		4,557	Logs
	Skidegate		67,929	Logs
	Smith Inlet		74,780	Logs
	Sooke	None	359,078	Pulpwood
	South Bay		239,220	Pulpwood
	Squamish	D.O.T.	240,819	Pulpwood & Chemicals
	Tasu		1,062,709	Iron Ore
	Tahasis		226,811	Lumber
	Teakerine Arm	None	176,197	Logs
	Texada	None	218,131	Iron Ore
	Toquart	None	20,000	Logs
	Ucleulet	D.O.T.	171,512	Logs
	Vananda	None	356,617	Limestone
	Vancouver	N.H.B.	27,426,777	Variety
	Victoria	D.O.T.	1,796,477	Variety
	Watson Island	None	17,057	Chemicals
	Zeballos		3,631	Iron Ore
	Stewart		109,716	Copper Ore
	All Other B.C. Ports	N/A	2,455,106	Logs & Limestone
	GRAND TOTAL		67,741,488	

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ILLUSTRATIONS, cont'd

I STRUCTURE OF THE INDUSTRY

Railways in Canada handled a total of 282.0 million tons of revenue freight in 1975, down 10 percent from the 314.4 million tons hauled in 1974. These totals include domestic loadings, receipts from both Canadian and United States connections and traffic moved in intermediate switching services. These decreases were to a large extent caused by strikes at various railroads and ports across Canada along with a general decrease in the economy.

The kinds of activities normally carried on by railway establishments embrace the operation of freight and passenger service including commuter service (but not street railways), maintenance of equipment, dining car and sleeping car services, express service and the operating of railway terminal facilities. Road transportation services operated by railway establishments and providing pick-up and delivery for the freight or express services of the railway are included in this industry but long distance trucking operations owned by railway companies are usually set up as separate establishments classified to the trucking industry.

For statistical purposes common carrier railways are divided into four classes as follows:

Classification of Carriers

Class I	Canadian National Railways and Canadian Pacific Rail and their related operations.

Class II	Other carriers having average gross revenues of $500,000 or more annually from Canadian rail transportation operations.
Class III	Other carriers having average gross revenues of less than $500,000 annually from Canadian rail transportation operations.
Class IV	Other operations of a special nature such as terminal, bridge and tunnel companies.

In 1975, total ton-miles, the product of the weight of lading in tons and the distance hauled in miles totalled 135,081.9 million. Of that, 4.6 billion were freight car-miles. About 58 percent utilization was logged by loaded cars, while empty freight car-miles accounted for 42 percent of the total. Caboose traffic in 1975 accounted for 73.4 million car miles.

The average weight of a carload of freight, derived from total freight ton-miles and loaded freight car-miles, rose to 51.4 tons in 1975, up from 49.1 tons in 1974.

While the freight train-miles of all railways totalled 63.8 million, down 8.2 percent from 1974, the average number of cars comprising a freight train increased from 63.6 in 1974 to 67.6 in 1975. The average freight train speed (which included stops, switching, etc. enroute) was 22.1 miles per hour, the same as 1974.

Passenger traffic was down 2.3 percent in 1975 with a total of 23.6 million persons travelling by rail compared to

24.1 million a year earlier. Commuter traffic increased 0.8 percent while non-commuter traffic decreased 12.3 percent. Passenger-miles at 1.8 billion were 3.0 percent lower than 1974 and the average passenger journey was 77 miles compared with 78 miles in 1974.

In 1976 there were 34 railway companies reporting to the Canadian Transport Commission. This does not include small private lines either of a very short distance or a few that are small but within the boundaries of one province.

Table 1 provides a brief summary of the industry as of December 31, 1974.

TABLE 1

SYNOPSIS, 1973 and 1974

	1973	1974
At December 31		
Route miles of roadway (first main track)	44,232.0	44,265.8
Total miles of all tracks (including yard, etc.)	60,245.7	60,247.6
Diesel locomotive units in service	3,748	3,870
Electric locomotive units in service	14	14
Passenger cars in service	2,175	2,056
Freight cars in service	186,653	190,892
Fuel Consumed During Year By Motive Power Equipment		
Diesel oil ..... gal.	481,852,461	508,280,229
Other (crude oil) ..... gal.	17,132,245	26,988,514
Electric energy ..... kwh. - '000	12,180	12,853

SOURCE: Statistics Canada, Railway Transport Part III, 1974, Catalogue 52-209.

Railway investments in road and equipment property at December 31, 1974 totalled $9,202.7 million, up from $8,848.8 million the previous year. The greater part of this increase was due to investment in roadway property.

Railway operating revenues increased 52.9 percent between 1970 and 1974 to a total of $2,569.0 million in the latter year. Operating expenses, excluding taxes, were up 61.4 percent during the same period to $2,380.1 million, leaving net operating revenues at $188.9 million in 1974 down 8.0 percent from 1970. Net income, after taking into account, taxes, other income, fixed charges, etc., amounted to $14.3 million, the lowest recorded during the five year period.

TABLE 2

EMPLOYEES AND THEIR COMPENSATION
1974 - SUMMARY, ALL RAILWAYS

OCCUPATIONAL CLASSIFICATION	NUMBER OF EMPLOYEES (Average)	SERVICE HOURS PAID FOR	TOTAL COMPENSATION
SUMMARY			
General	15,362	32,492,256	191,475,846
Road Maintenance	22,265	51,731,118	257,361,297
Equipment Maintenance	30,905	66,482,373	355,536,358
Transportation	49,824	110,648,554	638,320,907
TOTAL	118,356	261,354,301	1,442,694,408
Express	122	245,809	1,245,283
Highway Transport (Rail)	2	2,288	15,021
Telecommunications	6,585	14,296,129	78,242,801
Outside Operations	6,843	15,230,850	71,395,394
TOTAL	13,552	29,775,076	150,898,499
GRAND TOTAL	131,908	291,129,377	1,593,592,907[1]
Number Of Female Employees (included above)	7,152	-	
Salaries & Wages Charged To Operating Expenses	-	-	1,381,161,839

[1] Includes $11,830,201 paid to 944 employees residing outside Canada charged to Canadian Lines.

SOURCE: Adapted from Railway Transport, Part VI, 1974; Catalogue 52-212.

In 1974 the industry employed a total of 131,908 people and paid out over $1.5 billion in wages and salaries (Table 2).

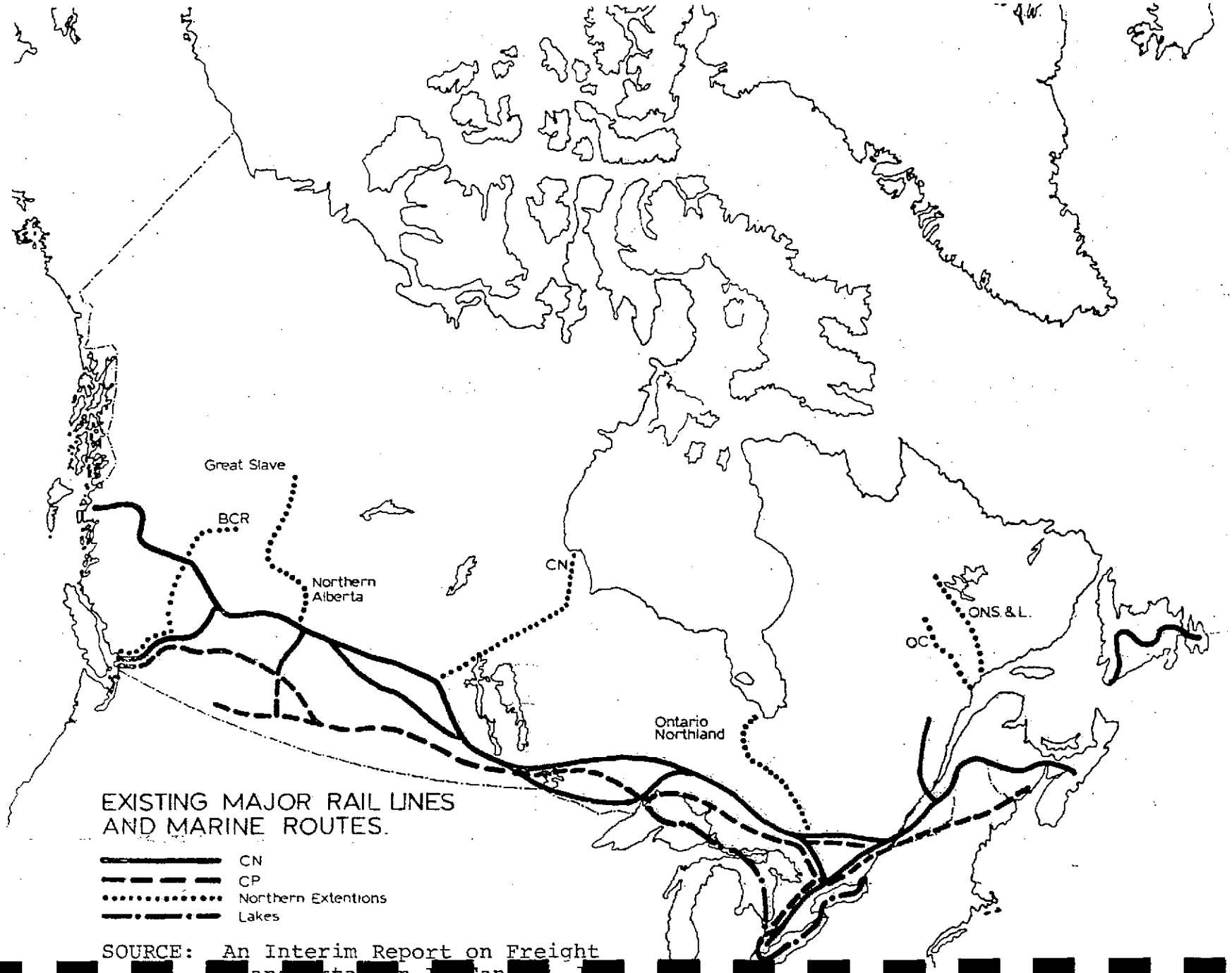
Canada's major rail network consists of the trans-continental main lines of the CPR and CNR which collectively comprise some 12,000 miles of which about 2,100 miles are double track. Map 1 illustrates these existing major routes. The major double track sections for both railways are located in the Quebec-Windsor corridor and between Winnipeg and Thunder Bay. Canadian Pacific has additional double track on the prairies and about 100 miles between Golden and Vancouver.

Of all the railroad companies in Canada, there are six major Class 1 and 2 railways that represent about 97 percent of the industry in terms of ton-miles, account for 95 percent of revenues, and operate 94 percent of first main track mileage. They are:

- Canadian National
- Canadian Pacific
- Ontario Northlands
- British Columbia Railway
- Quebec North Shore and Labrador Railway
- Chesapeake and Ohio.

Specific to Western Canada, there are 14 railroads in operation as indicated on the "Railroad Map of Western Canada and Alaska" inserted at the end of this report. The map depicts each branch line owned and operated by each railroad company as well as the location of railway stations and line junctions.

MAP 1



SOURCE: An Interim Report on Freight Transportation In Canada, June 1975, Ministry of Transport.

II EXISTING FACILITIES AND EQUIPMENT

A. Rail Line

Canada's total rail network consists of some 60,274 miles of track, including main tracks, yard tracks, sidings and industrial track. Table 3 breaks the railway companies down into Class I and II and details the breakdown of trackage by type. The CNR and CPR, being Class I railroads, own and operate almost 90 percent of Canada's rail roadbed.

There were 44,266 miles of first main track, or route miles, being operated by line-haul railways in Canada at the close of 1974. This main track mileage represents the aggregate length of roadway and is defined as single track extending the entire distance between terminals and kept clear for the passage of trains. It does not include the mileage of yard tracks and sidings nor does it reflect the fact that a mile of railway line may include two or more parallel tracks. Jointly used track is counted only once. This figure also includes about 396 miles of rail line operated by CP Rail and CN which extends into the United States.

Table 4 presents a geographic breakdown of the mileage of first main track in total and specific to major railroad companies.

Regionally, the Western Provinces account for 24,318.7 miles of first main track, or 55 percent of the Canadian total. The regional share of total trackage is

TABLE 3

MILEAGE OF TRACK OPERATED
@ December 31, 1974

Item	Class I		Class II								Grand[3] Total All Railways
	Canadian National	Canadian Pacific	Algoma Central	British Columbia Railway	Canada Southern	Chesapeake & Ohio	Northern Alberta	Ontario Northlands	Quebec North Shore & Labrador	All Other	
First main track (miles of roadway):											
Line owned	22,988.0	12,041.8	320.7	1,248.0	279.7	190.8	922.8	515.3	358.4	846.5	39,757.9
Line operated under lease	261.6	4,036.0	-	23.1	1.6	-	-	60.0	-	63.0	4,445.3
Line jointly owned	56.0	65.5	-	-	-	-	-	-	-	3.7	62.6
Total route miles[1,2]	23,305.6	16,143.3	320.7	1,271.1	281.3	190.8	922.8	575.3	358.4	913.2	44,265.8
Line of other roads operated under trackage rights	175.6	439.6	1.0	-	0.4	139.9	7.1	-	5.1	478.8	-
Total miles operated by individual roads	23,481.2	16,582.9	321.7	1,271.1	281.7	330.7	929.9	575.3	363.5	1,392.0	-
Second main track (where 2 or more tracks on same roadway):											
Route miles[1]	845.0	872.1	-	-	228.1	-	-	-	-	14.3	1,956.2
Miles operated (including trackage rights)	870.6	931.2	-	-	228.1	128.9	-	-	-	225.9	-
Third and other main track:											
Route miles[1]	47.0	6.2	-	-	-	-	-	-	-	-	63.1
Miles operated (including trackage rights)	53.2	31.1	-	-	-	-	-	-	-	23.3	-
Industrial track:											
Route miles[1]	280.4	1,035.2	18.8	76.3	31.5	24.4	4.7	28.4	4.4	71.4	1,562.2
Miles operated (including trackage rights)	1,851.5	1,128.6	18.8	76.3	31.5	24.4	29.3	43.3	4.4	72.9	-
Yard track and sidings:											
Route miles[1]	6,632.8	4,624.5	77.3	253.3	98.4	67.1	110.1	109.6	113.2	361.7	12,400.3
Miles operated (including trackage rights)	6,703.3	4,768.6	77.3	253.3	98.4	98.8	113.5	109.6	150.2	667.3	-
All tracks:											
Route miles[1]	31,110.8	22,681.3	416.8	1,600.7	639.3	282.3	1,037.6	713.3	476.0	1,360.6	60,247.6
Miles operated (including trackage rights)	32,959.8	23,442.4	417.8	1,600.7	639.7	582.8	1,072.7	728.3	518.1	2,381.4	-

[1]Grand totals adjusted to eliminate duplicate reporting of joint track.
[2]Narrow-gauge track included under route miles of first main track above = 57.7 miles of 3'0" gauge in Yukon: 32.6 miles of 3'0" gauge in British Columbia; 735.0 miles of 3'6" gauge in Newfoundland. Electrified mileage included under route miles of first main track above = 39.1 miles in province of Quebec.
[3]Includes mileage of Class III and IV railways.
SOURCE: Statistics Canada, Railway Transport Part III, 1974; Catalogue: 52-209.

TABLE 4

FIRST MAIN TRACK MILEAGE

BY PROVINCE

December 31, 1974

PROVINCE	CANADIAN NATIONAL	CANADIAN PACIFIC	BRITISH COLUMBIA RAILWAY	NORTHERN ALBERTA	ALL OTHER RAILWAYS	GRAND TOTAL ALL RAILWAYS	PROVINCIAL MILEAGE AS % CANADIAN TOTAL
Newfoundland	711.9	-	-	-	231.6	943.5	2.2
Prince Edward Island	253.7	-	-	-	-	253.7	0.6
Nova Scotia	951.3	261.1	-	-	34.2	1246.6	2.9
New Brunswick	1142.5	51617	-	-	5.4	1664.6	3.8
Quebec	3245.2	1541.0	-	-	622.8	5409.0	12.3
Ontario	5207.8	3205.8	-	-	1433.7	9847.3[1]	22.3
Manitoba	3078.7	1661.0	-	-	4.0	4743.7	10.8
Saskatchewan	4366.4	4194.4	-	-	-	8560.8	19.4
Alberta	2731.9	2625.6	-	895.9	-	6227.2[1]	14.1
British Columbia	1415.2	1813.8	1271.1	26.9	259.7	4786.7[1]	10.9
Yukon	-	-	-	-	57.7	57.7	0.2
Northwest Territories	129.3	-	-	-	-	129.3	0.3
United States	71.7	323.9	-	-	-	395.7	0.9
TOTAL ROUTE MILES	23,305.6	16,143.3	1271.1	922.8	2623.0	44,265.8[1]	

[1] Adjusted to eliminate duplicate reporting of joint track.

Source: Statistics Canada; Railway Transport, Part III, 1974; Cat. 52-209

about the same percentage. Again CN and CP lines account for almost 90 percent of total main trackage and claim a dominant share of trackage in Alberta, Manitoba and Saskatchewan. However, in B.C., the British Columbia Railway Company owns and operates 27 percent of B.C.'s rail. Figures for the latest year showing total miles of line by province, placed Ontario first with 9,847 route miles, Saskatchewan second with 8,561 miles and Alberta third with 6,227 miles. Quebec claimed fourth place with 5,409.0 miles while Manitoba and B.C. trailed closely with 4,743.7 and 4,786.7 miles, respectively.

Essentially all of the track in Canada is of the standard four feet eight inch gauge, with the following exceptions: 57.7 miles of three feet zero inch gauge in the Yukon, 32.6 miles of three feet zero inch gauge in British Columbia and 735.0 miles of three feet six inch gauge in Newfoundland. Electrified track mileage amounted to only 39.1 miles, all in Quebec.

Rails laid in new track, extensions and previously constructed track totalled nearly 2,571 miles in 1974. This estimate was calculated from the weight of a mile of track (estimated at 114 tons/mile).

B. Equipment

Canada's rail car inventory totalled 224,347 units at December 31, 1974. Table 5 presents a visual and statistical

breakdown of rail cars by type. Table 6 goes further by identifying the type of equipment owned or leased by each of the major railway companies.

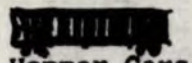
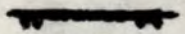
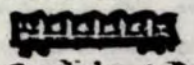
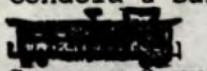
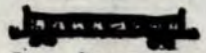
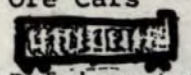
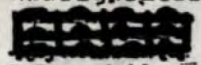
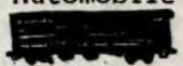
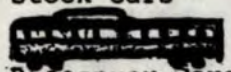
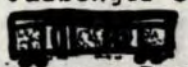
Freight cars in revenue service totalled 190,892, an increase of 4,239 units over the 1973 figure. The major increase in this category came from growth in the number of flat cars and covered hoppers. Box cars made up the largest portion, totalling 95,803 units, or 43 percent of the total number of rail cars (Table 5).

In addition to the above freight cars owned and leased by railways, there were 18,930 privately-owned rail cars registered in Canada by non-rail firms, a gain of some 1,200 over the earlier year. Another 707 foreign-owned units (817 in 1973) were being operated under lease by private companies at December 31, 1974.

Implied here is the fact that certain rail equipment is used for specific purposes only. This is evidenced by the fact that work cars and cabooses used in company (non-revenue) service number 13,139 and 2,181, respectively in 1974. Also, passenger cars aggregated 2,056 at the end of 1974. Of this total, 1,499 were passenger carrying cars while the remaining 557 cars were those used in baggage, express and mail services. Another specialized car type is the tank car where 14,462 cars or 76.2 percent of the total tank cars in service are owned by private non-rail firms.

TABLE 5

RAIL EQUIPMENT IN SERVICE
At December 31, 1974

TYPE	CARS OWNED OR LEASED BY RAILWAYS IN CANADA		PRIVATE CARS OF NON-RAIL FIRMS REGISTERED IN CANADA		GRAND TOTAL ALL CARS	
	Number	% Total	Number	% Total	Number	% Total
 Box Cars	95,538	46.5	265	1.4	95,803	42.7
 Hopper Cars	27,398	13.3	2,686	14.2	30,084	13.4
 Flat Cars	24,898	12.1	357	1.9	25,255	11.3
 Gondola & Ballast Cars	22,710	11.1	1,141	6.0	23,851	10.6
 Company Service Cars	15,320	7.5	-	-	15,320	6.8
 Ore Cars	7,151	3.5	-	-	7,151	3.2
 Refrigerator Cars	4,772	2.3	21	0.1	4,793	2.1
 Automobile Cars	2,617	1.3	34	0.2	2,651	1.2
 Stock Cars	2,463	1.2	-	-	2,463	1.1
 Passenger Cars	1,499	0.7	-	-	1,499	0.7
 Baggage-Postal-Express Cars	557	0.3	-	-	557	0.2
 Tank Cars	494	0.2	14,426	76.2	14,920	6.7
Total	205,417		18,930		224,347	

SOURCE: Statistics Canada, Railway Transport Part III, 1974; Catalogue: 52-209

TABLE 6

OWNED OR LEASED EQUIPMENT IN SERVICE

@ December 31, 1974

TYPE	CLASS I				CLASS II														Grand Total All Railways[1]
	Canadian National		Canadian Pacific		Algoma Central		British Columbia Railway		Canada Southern		Chesapeake & Ohio		Northern Alberta		Ontario Northland		Quebec North Shore & Labrador		All Other		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.
Box Cars	49,166	51.5	41,584	43.5	30	0.03	3,197	3.3	-	-	-	-	-	-	614	0.6	138	0.1	784	0.8	95,538
Hopper Cars, Total	13,263	48.4	11,588	42.3	700	2.6	194	0.7	3	0.01	3	0.9	-	-	158	0.6	41	0.2	1,448	5.3	27,398
-Open Top	4,690	39.7	4,913	41.6	700	5.9	135	1.1	-	-	-	-	-	-	87	0.7	3	0.03	1,279	10.8	11,807
-Covered	8,573	55.0	6,675	42.8	-	-	59	0.4	3	0.02	3	0.02	-	-	71	0.5	38	0.2	169	1.1	15,591
Flat Cars, Total	12,939	52.0	7,987	32.1	86	0.3	3,073	12.3	-	-	-	-	-	-	99	0.4	117	0.5	597	2.4	24,898
-Container Piggyback	1,948	60.4	903	28.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	374	11.6	3,225
-Trailer Piggyback	1,633	41.7	2,093	53.4	-	-	128	3.3	-	-	-	-	-	-	-	-	10	0.3	52	1.3	3,916
-Other	9,358	52.7	4,991	28.1	86	0.5	2,945	16.6	-	-	-	-	-	-	99	0.6	107	0.6	171	1.0	17,757
Gondola & Ballast	11,783	51.9	8,073	35.5	1,126	5.0	1,100	4.8	-	-	-	-	-	-	99	0.4	84	0.4	445	2.0	22,710
Company Service Cars	8,887	58.0	4,729	30.9	99	0.6	513	3.3	51	0.3	45	0.3	287	1.9	263	1.7	187	1.2	257	1.7	15,320
Ore Cars	2,088	29.2	1,139	15.9	-	-	-	-	-	-	-	-	-	-	-	-	3,417	47.8	507	7.1	7,151
Refrigeration Cars	3,919	82.1	815	17.1	-	-	27	0.6	-	-	-	-	-	-	-	-	10	0.2	1	0.02	4,772
Automobile Cars	1,685	64.4	923	35.3	-	-	-	-	-	-	-	-	-	-	-	-	6	0.2	3	0.1	2,617
Stock Cars	1,228	49.9	1,221	49.6	-	-	14	0.6	-	-	-	-	-	-	-	-	-	-	-	-	2,463
Passenger Cars	975	65.0	272	18.1	51	3.4	5	0.3	-	-	-	-	2	0.1	26	1.7	26	1.7	141	9.4	1,499
Baggage-Postal-Express	475	85.3	56	10.1	9	1.6	-	-	-	-	-	-	6	1.1	8	1.4	-	-	3	0.5	557
Tank Cars	25	5.1	176	35.6	-	-	42	8.5	-	-	-	-	-	-	-	-	170	34.4	81	16.4	494
Total	106,433	51.8	78,563	38.2	2,101	1,0	8,165	4.0	54	0.03	48	0.02	295	0.1	1,267	0.6	4,196	2.0	4,267	2.1	205,417

(1) Includes total of 28 cars, all types, of Class III & IV railways.

SOURCE: Statistics Canada, Railway Transport Part III, 1974; Catalogue: 52-209

The operating statistics of railways reflect an increase in overall freight car productivity. This, in part, is a result of a continuing trend toward heavier loading in larger cars and a longer average haul. The average carload rose to 49.14 tons in 1974, up from 45.48 tons in 1970, an increase of 8.0 percent. The average haul rose from 471 miles to 511 miles over the five-year period.

At the close of 1974 there were 3,884 locomotive units in service on common carrier railways, 122 more than at year end 1973. Except for 14 electric locomotives the 1974 fleet consisted entirely of diesels. Table 7 provides data on the locomotives in service at the end of 1974, broken down by the major Class I and Class II railways operating in Canada. To illustrate the superiority of modern diesel locomotive units over the older types used, the railways in 1974 with just slightly more than two-thirds the number of locomotive units, generated over three times the gross ton-miles reported in 1929.

In terms of energy reserves, (Fuel and Power Consumed By Motive Power Equipment - Table 8), the consumption of diesel oil by railways increased 5.5 percent in 1974 to 508.3 million gallons. Crude oil as a fuel was also higher, increasing to 27.0 million gallons from 17.1 million gallons, or by 57.7 percent. The average unit costs of these fuels rose 10.55 cents in the case of diesel oil and 8.17 cents in

TABLE 7

LOCOMOTIVES IN SERVICE

December 31, 1974

Item	Class I		Class II								Grand Total[8] all Railways
	Canadian National[1]	Canadian Pacific[2]	Algoma Central[3]	British Columbia Railway	Canada Southern[4]	Chesapeake & Ohio	Northern Alberta[5]	Ontario Northland	Quebec North Shore and Labrador[6]	All Other[7]	
Locomotives in service (owned or leased):											
Diesel locomotive units:											
Road units, with crew cab:											
Number	1,731	971	32	96	16	12	17	38	80	147	3,145
Horsepower	3,500,395	2,021,100	62,000	205,000	26,250	18,000	25,900	73,000	216,250	244,310	6,396,685
Road units without crew cab:											
Number	59	41	--	--	--	--	--	--	--	11	111
Horsepower	103,450	64,600	--	--	--	--	--	--	--	16,500	184,550
Yard Switcher units:											
Number	322	262	2	4	--	5	--	--	--	16	613
Horsepower	298,300	215,460	1,600	4,000	--	5,400	--	--	--	15,737	542,497
Electric locomotive units:											
Number	14	--	--	--	--	--	--	--	--	--	14
Horsepower	16,800	--	--	--	--	--	--	--	--	--	16,800
Other locomotive units:											
Number	--	--	--	--	--	--	--	--	--	1	1
Horsepower	--	--	--	--	--	--	--	--	--	123	123
TOTAL LOCOMOTIVE UNITS:											
NUMBER	2,126	1,274	34	100	16	17	17	38	80	175	3,844
HORSEPOWER	3,918,945	2,301,160	63,600	209,000	26,250	23,400	25,900	73,000	216,250	276,670	7,140,655

1 Includes 262 leased units with horsepower of 620, 250 and 30 units with steam generating capacity

2 Includes 107 units with steam generating capacity

3 Includes 9 leased units with a horsepower of 27,000

4 Includes 16 leased units with a horsepower of 26,250

5 Includes 12 units with steam generating capacity

6 Includes 61 leased units with a horsepower of 183,000 and 10 units containing robots

7 Includes 48 leased units with a horsepower of 94,090

8 Grand totals include units owned or leased by Class III and IV

Source: Statistics Canada, Railway Transport Part III, 1974; CAT: 52-209

in the case of crude. Of the total diesel oil consumed 2.6 percent or 13.0 million gallons were imported. All of the crude oil used was Canadian.

Electricity used by electric-powered locomotives was slightly higher in 1974, rising to 12.9 from 12.2 million kilowatt hours. The average unit cost of this energy was 1.96 cents in the year under review as compared with 1.74 cents in 1973.

TABLE 8

FUEL AND POWER CONSUMED BY MOTIVE POWER EQUIPMENT, 1974

	ELECTRIC ENERGY	DIESEL OIL	GASOLINE	OTHER (Crude Oil)
	kwh. - '000	gallons		
Transportation Service				
Freight	-	397,566,136	-	22,948,952
Passenger	10,405	66,340,301	-	3,511,992
Yard Switching	2,448	35,888,215	-	277,458
Work Train Service	-	8,485,577	-	250,112
Total	12,853	508,280,229	-	26,988,414
Cost at distributing point..$	251,671	144,828,128	-	5,843,202
Average unit cost.....¢	1.96	28.78	-	21.65

SOURCE: Statistics Canada, Railway Transport, Part III, 1974; Catalogue 52-209.

Train accidents in 1970 numbered 1,922 in comparison with 1,958 in 1974. Deaths resulting from these accidents were 180 and 188, respectively.

III CAPACITY CONSIDERATIONS

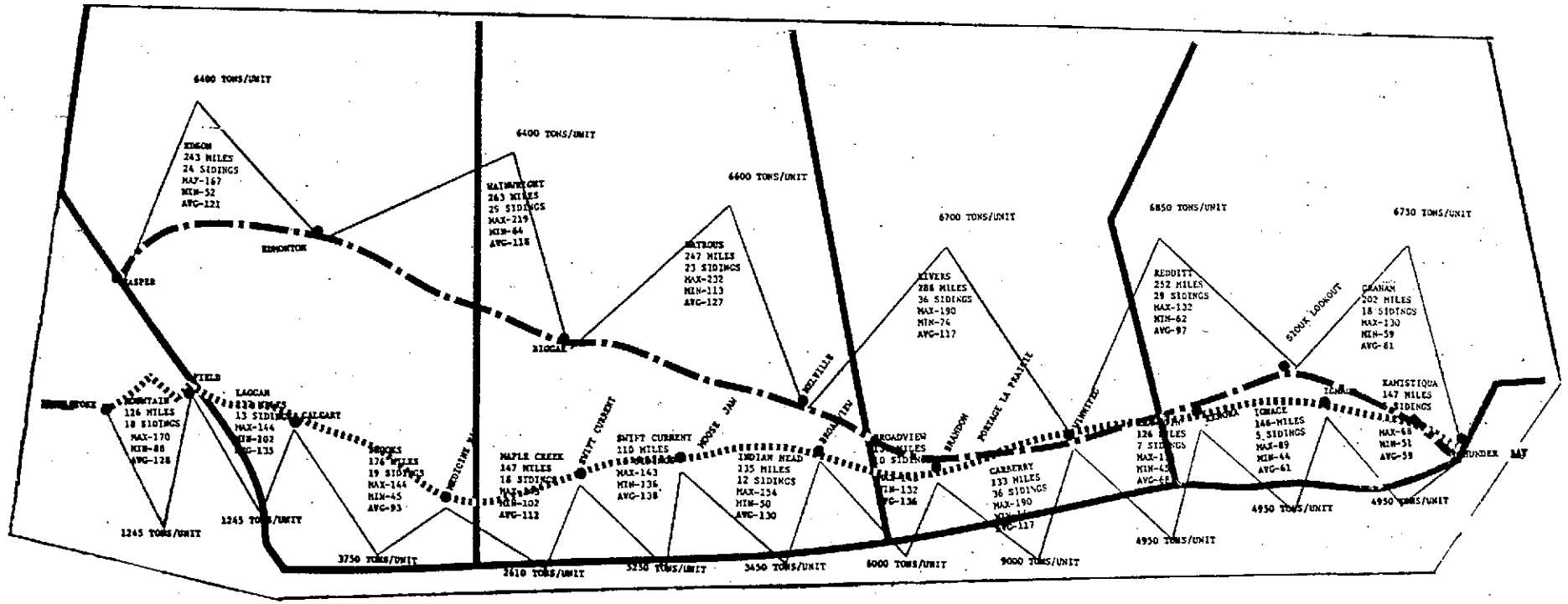
The capacity of a rail system is defined as "the number of gross tons that can be handled over a definitive segment of track by a definitive number of trains of a definitive mix of service and size within a given period of time". Capacity is therefore a function of several inter-related variables. The mix and volume of traffic, size and weight of cars, level of service, peaking of traffic flow, the condition of the track, existing facilities and equipment, signalling systems, and the seasonality of commodity flows are among the more significant variables that cause problems.

The concept of capacity can be considered in terms of supply and demand. On the supply side are the existing physical facilities such as rail cars and locomotives, single and double rail track, switching facilities and terminals. Demand would take the form of seasonal variations in commodity flow, mix of traffic and new markets or commodities necessitating additional car allocation.

It is generally recognized that an estimated 35 trains per day can be accommodated on a typical 100-150 mile railway subdivision. Beyond 35, it is normally necessary to begin double tracking segments of the line. Recently some studies undertaken by CN have suggested that the number of trains/day which could be accommodated on a typical 100-150 mile railway subdivision is higher than was previously estimated.

MAP 2

MAIN RAIL LINES AND OPERATING CONSTRAINTS
ALBERTA/BRITISH COLUMBIA TO THUNDER BAY, ONTARIO



LEGEND

CN Line

CP Line

Locomotive Capability

Subdivision Name

Distance (Miles)

No. Sidings

Siding Capacity (Cars)

Source: Adapted from data provided by Canadian Transport Commission, 1976

The new estimate is in the order of 45 trains/day. Map 2 was adapted from information obtained from the Canadian Transport Commission and presents the main rail lines and operating constraints by subdivision from the Alberta/British Columbia border to Thunder Bay.

Data covering the number and type of rail cars and locomotives as well as miles of track in the Canadian rail system has been previously supplied. What follows is a discussion of some of the major factors which directly affect Canadian rail capacity.

A. Availability Of Rail-Cars

Potential bottlenecks in railway capacity often originate with the shipper. The seasonality of demand for particular commodities and the consequent shortage of rail cars are the most frequent bottlenecks of this type. Perhaps the wider use of the unit train system (in which a specialized train set is dedicated entirely to the movement of a commodity on a continuous basis), would help alleviate this situation. In the case of major commodity flows from the West to B.C. ports, only coal moves in unit trains. Other traffic - sulphur, potash, grain - moves in fairly frequent trainload lots. One way to avoid car shortages for these commodities is to ensure an oversupply which, of course, would be a costly choice for both the railways and the shippers.

There has been a trend in urban areas to use rail cars as warehouses, particularly for grain transportation, because of low demurrage rates and high priced storage. This has proved an attractive alternative for many shippers but, it is clear that this practice not only clutters terminal facilities but also adds unnecessary equipment to a rail car fleet.

B. Seasonality and Peaking

Another characteristic of prime importance in transportation is peaking: that is, the manner in which shipments tend to fluctuate up and down during a typical year, season, month, week or day. For example, grain and agricultural volumes in the west show peaks in the summer and fall months, livestock in the fall months, fertilizer (potash) in the spring and fall, with other products displaying a more constant flow rate throughout the year. The winter peaks of grain in the east reflect closing of the Great Lakes system and diversion of grain shipments to rail. In general, the winter months, December, January and February, represent the low point for both the rail and canal modes. Climatic conditions are important in this regard, in particular for the canals which are closed between December and March; a lengthening of the shipping season by as little as one or two weeks can have a significant effect on the capacity of this mode. Major fluctuations are also caused by labour interruptions.

C. Ruling Grades

The question of railway right of way capacity is very complex. To use a familiar analogy, the capacity of a rail route is the capacity of the weakest rail link in that route. In terms of railway operations, the weakest link is the "ruling grade", that is the most severe grade a train must pass over on a given line. The tonnage limitations on a grade govern the dimensions of all trains on that route. In the case of CP traffic to B.C. ports, there are several severe grades in the mountains which require up to ten - 3,000 h.p. locomotives to move a 13,000 ton train. (This is compared with CN's requirement of four locomotives for a similar train on its route.

Movement by rail of commodities to the west coast cannot avoid the restrictions imposed by these existing rail grades. Critical controlling grades are those which are in excess of one percent, at which point the slope becomes too severe to permit efficient unit train operation. CN is relatively free of such ruling grades, with lines to Vancouver and northern ports being in the 0.7 percent range.

The CP rail line from Golden to Vancouver however has four critical grades. They are located at Stephen, Beavermouth, (2.2 percent), Clanwilliam (1.5 percent) and Notch Hill (1.6 percent). CP recently proposed a limited amount of double tracking at these four locations in an effort

to overcome these capacity restraints. Estimates for the cost of this construction have been well in excess of $60 million. It has been suggested that upon completion of this work and with the use of robot locomotives, the capacity of the Golden-Vancouver section could be increased by as much as 70 percent.

Solutions other than double-tracking have also been considered, especially electrification. CP Rail's A.F. Joplin, Vice-President of operation and maintenance, commenting on the probability of electrification says:

> "We recognize the major technical advantages it offers, particularly on severely graded routes such as CP Rail's route between Vancouver and Calgary. The current price tag for the electrification of this route is nearly $300 million at 1975 value. Although electrification would help our trains to climb to the top of our four major inclines, this price tag has prevented it from quite reaching the top of our scale of priorities! However the impending shortage of liquid fuels and the current price have made a profound adjustment in the attitude of railways to electrification. Further, as the cost of labour escalates, so do the economics of electrification improve. Five years ago many of us were saying "why"? Now many of us are wondering "when"?"

Controlling grades on the provincially-owned BCR are as high as 2.2 percent and although estimates are not available as to the capital expenditures which would be required to reduce them to unit train levels, they would no doubt be very large.

D. Switching Facilities and Double/Single Track

Rule of thumb estimates by MOT for the volume of traffic which can be handled on single or double track lines utilizing various switching systems are as follows:

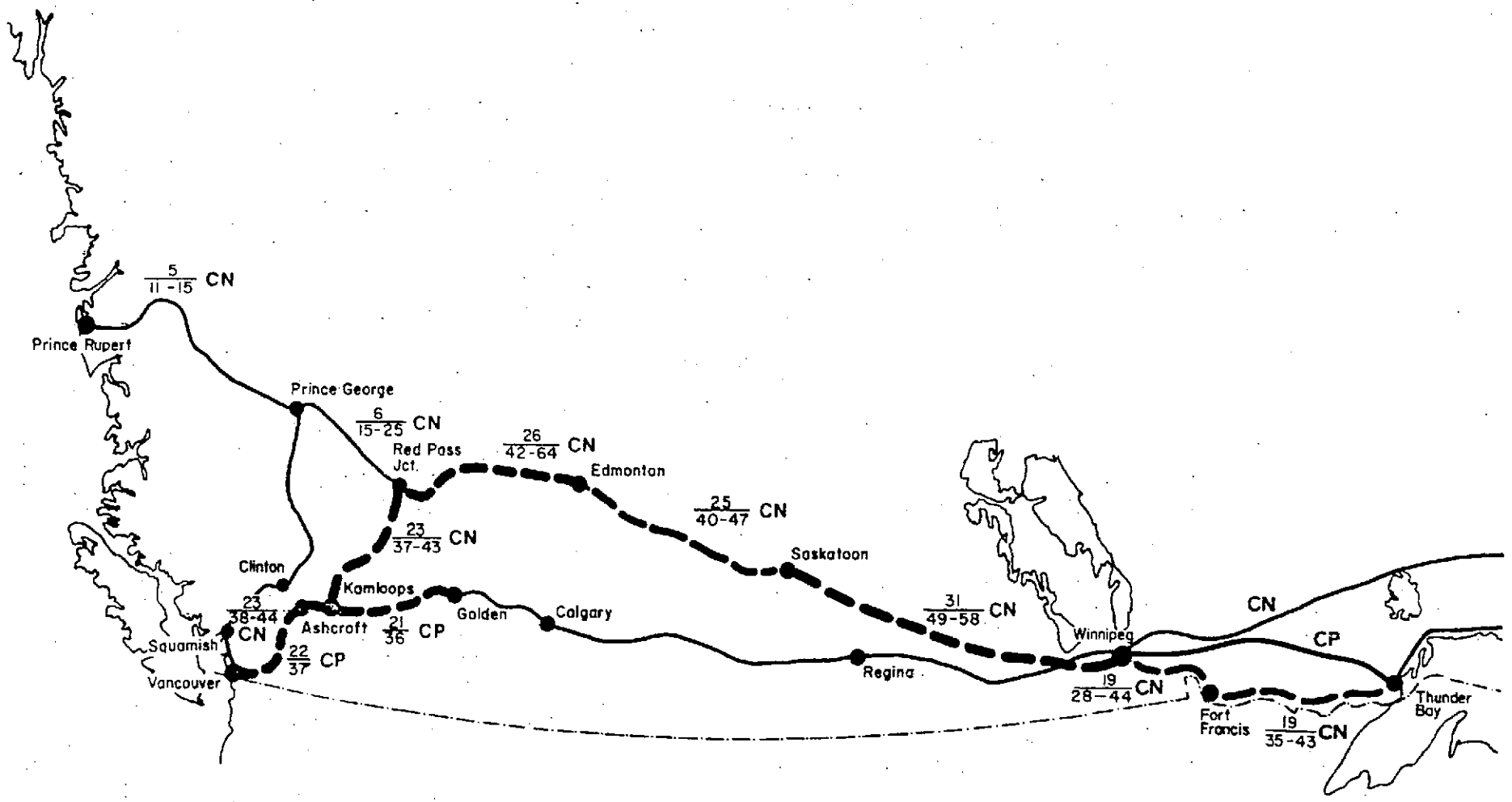
TRAFFIC CAPACITY, TRAINS PER DAY

	Block Signalling	Central Traffic Control
Single Track	20 - 25	35 - 40
Double Track (with cross-overs)	45 - 50	60 - 70

The double track segments in the western rail system are between Winnipeg and Thunder Bay on both the CN and CP lines, with CP having additional double track segments on the prairies and about 100 miles of the mountain link between Golden and Vancouver. Map 3 on the following page indicates the 1972 volume of traffic in trains per day for sections of CN and CP's primary western lines. At the present time, the CN line between Winnipeg and the west coast is very nearly operating at capacity. As well, sections of the CP line are also being put under severe pressure. Map 3 also provides estimates of the 1990 traffic volumes, based on forecasts prepared by the Transportation Development Agency.

Based on these calculations, it becomes very evident that within the next few years, significant improvements will be required in the western rail system. Obviously the construction

MAP 3



CRITICAL RAIL LINKS BY 1990

1972/1990 TRAINS PER DAY

SOURCE: An Interim Report on Freight Transportation In Canada, June 1975, Ministry of Transport.

of additional double track with several cross-overs will be needed. Combined with possible new river crossing the costs are expected to reach into the realm of about $6.5 billion for CN, and $1.5 billion for CP.

These estimates do not include segments with capacity-restricting grades, nor do they include costs for double-tracking the two main lines between Kamloops and Vancouver. Such improvements have nearly been excluded from the equation due to the prohibitive expenses which would be involved. It has been suggested however that perhaps the two main lines between Kamloops and Vancouver could be operated jointly by CN and CP.

In his address to the Canadian Transportation Research Forum held in Vancouver in June of this year, R. Bechamp, Director General, Railway Transportation, Transport Canada, made the following statement:

> "The Canadian Railway System has historically been developed by competing private entrepreneurs. This has resulted in many lines parallelling each others and operated as separate entities. It has been conceived by many transportation planners in the country that the joint use of some of the lines could provide a distinct advantage since they could possibly be operated as a double track railway even if these lines are in certain cases quite a few miles apart."

E. Track Repair and Maintenance

The limitations of track life and the resulting time required to replace the track is another factor reducing

rail line capacity. It is estimated that the standard 130 lb./yd. rail track has a life of 800 million gross ton-miles per mile over straight stretches. Curved track, on the other hand, has a life of 80 - 200 million GTM/mile. The movement of large volumes of traffic in heavily loaded rail cars is resulting in a much shorter life span for the average track. Thus, if the track is carrying 50 million GTM's per year, the track would have to be replaced every four to eight years. The time and money involved in this required maintenance becomes a major capacity limitation, particularly if the track being replaced is not part of a double track section with several cross-overs.

IV COMMODITY FLOWS

The ability of Canada's transportation system to respond and adapt to changes in the volume, direction and type of commodity movement has received considerable attention of late from both governments and the private sector. Studies to date have concentrated on forecasting future commodity flows and the system capacity required to meet the anticipated demand. Rail transport has received most of the attention since the majority of Canada's and particularly the Western Region's, long-distance bulk freight movement is by this mode. Although freight handled by the trucking industry is increasing, the region's geography, settlement structure and natural resource base suggests that in the foreseeable future, little inter-modal competition can be expected to develop.

Table 9 is provided to indicate the magnitude of freight being transported by rail in Canada by province. The table summarizes, by province, the rail car loadings and unloadings within each commodity group. This data is recorded by Statistics Canada from the 24 common railway carriers operating in Canada and is purported to provide 100 percent coverage for all railway movement of the 239 commodities receiving either initial or final haul.

It is not possible to construct an origin and destination matrix from this data since each province is considered in isolation, and loadings and unloadings are

TABLE 9

REVENUE FREIGHT RECEIVING INITIAL OR FINAL RAIL HAUL[1] BY PROVINCE, 1974

PROVINCE	LIVE ANIMALS	FOOD, FEED, BEVERAGE, & TOBACCO	CRUDE MATERIALS, INEDIBLE	FABRICATED MATERIALS, INEDIBLE	END PRODUCTS, INEDIBLE	SPECIAL TYPES OF TRAFFIC
	- in tons -					
NEWFOUNDLAND						
Loaded	60	24,561	19,788,542	504,861	15,787	9,453
Unloaded	1,041	231,584	644,549	1,196,851	109,552	54,694
PRINCE EDWARD ISLAND						
Loaded	904	235,663	10,374	14,044	1,544	2,531
Unloaded	1,971	70,007	175,161	158,224	9,529	22,879
NOVA SCOTIA						
Loaded	2,648	113,674	7,225,164	1,662,963	168,253	931,928
Unloaded	2,716	926,572	6,779,820	1,352,718	170,238	978,732
NEW BRUNSWICK						
Loaded	1,900	492,559	2,163,262	2,447,281	104,504	273,064
Unloaded	2,531	966,257	2,350,366	2,691,881	373,312	346,646
QUEBEC						
Loaded	1,716	1,137,422	33,590,217	13,084,561	871,857	3,283,422
Unloaded	20,664	4,185,168	54,132,599	10,309,635	1,446,655	2,876,223
ONTARIO						
Loaded	15,474	4,553,463	30,600,713	15,384,750	4,073,993	3,281,116
Unloaded	140,992	14,992,923	31,594,291	15,116,079	3,179,701	2,651,898
MANITOBA						
Loaded	46,611	3,546,863	3,782,235	1,959,607	144,223	558,536
Unloaded	23,788	1,417,374	3,401,101	2,169,886	469,717	824,082
SASKATCHEWAN						
Loaded	65,344	13,039,826	1,705,403	12,640,086	24,238	114,033
Unloaded	14,599	484,286	1,503,655	1,551,925	323,499	271,136
ALBERTA						
Loaded	74,134	6,004,999	12,151,479	6,875,348	91,869	463,926
Unloaded	1,643	965,844	4,206,704	3,894,591	720,523	853,535
BRITISH COLUMBIA						
Loaded	10,218	629,922	18,452,596	11,381,341	313,099	489,960
Unloaded	1,491	7,499,702	25,027,411	10,530,631	570,094	812,960
YUKON & NORTHWEST TERRITORIES						
Loaded	-	451	1,118,224	264	926	2,166
Unloaded	-	8,328	8,353	99,585	11,836	9,454
TOTAL, CANADA						
Loaded	219,009	29,779,403	130,588,209	65,955,106	5,810,293	9,410,135
Unloaded	211,436	31,748,045	129,824,030	49,072,006	7,384,656	9,701,942

(1) It cannot be deduced from the data if the freight originated in the province in question or if it was transported interprovincially by some other mode of transport. Also, any freight which either originated in or was transported to a given province and was unloaded for the purpose of further processing or fabrication will then enter a new commodity group, and if loaded onto a rail car, for either intra- or interprovincial transport will be recorded as new loading for that commodity.

SOURCE: Derived from Statistics Canada, Railway Freight Traffic, 1974; Cat. 52-205.

not linked. However, the net provincial and regional movements for selected commodites can be calculated. For a detailed account of the movement of the 81 commodities in the live animals and the food, feed, beverage and tobacco categories, see Food Processing in Western Canada, An Overview Study; DREE, Regional Analysis, Saskatoon, January 1976, (Unpublished). Further analysis on the movements in the other categories is underway in the Regional Analysis Branch.

The majority of commodities shipped to and from the west are shipped in huge quantities such as grain, coal, potash, lumber, sulphur, chemicals, etc. Because of the specialized nature of these commodities and forced by an economic squeeze, the railway companies have gone to specialized equipment.

Earlier this year, CN placed orders for 1,400 new freight wagons, to be delivered late in 1976. Included in the $C 33 million deliveries will be 300 bulkhead flat wagons for forest products, 300 open wagons for steel industry use, 82 piggyback flat wagons, 125 ordinary flat wagons, 135 double-hitch piggyback flat wagons, 21 container carriers and 500 box wagons. The new wagons will increase CN's fleet capacity by 8 percent.

In another order, CP Rail will take delivery of 30 diesel locomotives of 3,000 h.p. output from General Motors of Canada. Fifteen robot units are also to join the new diesels. They will be equipped with 'Locotrol' remote control electronic equipment.

It has been a long-standing challenge that, in an energy-short world, Alberta's coal, gas and tar sand deposits had one major drawback: geographically they lie 600 miles from a seaport and some 1,400 miles from most major markets. Only future pipelines seemed the solution. However, it appears that "super" rail cars will help develop Alberta's petrochemical wealth. The "Super-Jumbo" is a 30,000 gallon tank car made by Procor Limited and the 242 "super-jumbo" cars ordered from Procor will provide a total carrying capacity of more than seven million gallons of gas chemicals.

In the very near future, the railroads are expected to reach or exceed an annual replacement or addition of 100,000 freight cars. The average new capacity will be 85 tons per car as contrasted to the 55 ton capacity of the average car retired.

Specialized freight cars include high-cube boxcars, "all-door" cars, and many kinds of "supers" and "jumbos". There are special cars to transport one kind of auto part; some care for groceries and nothing else; cars for salt, sugar, ground coal, melted butter, concrete, lumber, etc. - the specialties are endless, as mentioned above.

This diversity of special cars however, involves a penalty: the cars are not versatile and usually make the return trips empty. The advantage of these specialty cars

is in being designed for rapid loading and/or unloading by pipe, hose, pump, dumping, conveyor, or fork lifts.

With freight cars as with so much else, railroads must move in two directions simultaneously; while specializing, they must, at the same time, develop versatile and universal equipment. So they are designing flatcars and boxcars that can be specialized with various accessories, yet become plain cars again when necessary.

One last type of specialty car that particularly affects the west is grain cars. Recently the Canadian Wheat Board acquired 2,000, 100-ton covered hoppers for grain service. These covered hoppers which are designed to replace the boxcar were assigned to both the Canadian National and Canadian Pacific Railways.

As indicated these changes will help minimize long-haul transport costs and in the future, we can expect even further gains in productivity. These gains will result from the introduction of more unit trains, more containerization and piggyback operations, more widespread use of large ships, rail cars and trucks, by the possible introduction of rail electricification and other means of increasing motive power, and related technological developments. Of course, this will cost money and an increased level of investment will be required for both capital and infrastructure expansion in the rail industry as modal substitution is not really an option in the west for most of the critical commodities.

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RAILROAD MAP of WESTERN CANADA

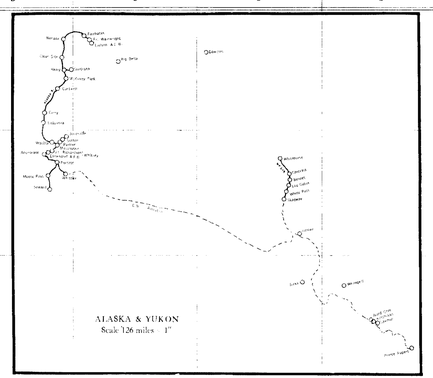
AND ALASKA

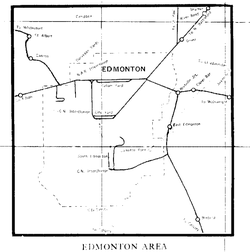
ISSUED BY

CANADIAN FREIGHT ASSOCIATION

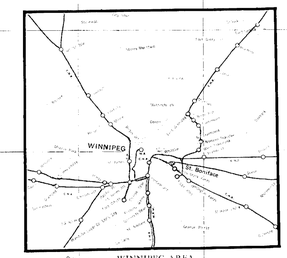
WESTERN LINES

Scale 47 Miles = 1 Inch





EDMONTON AREA
Scale 4½ miles = 1"



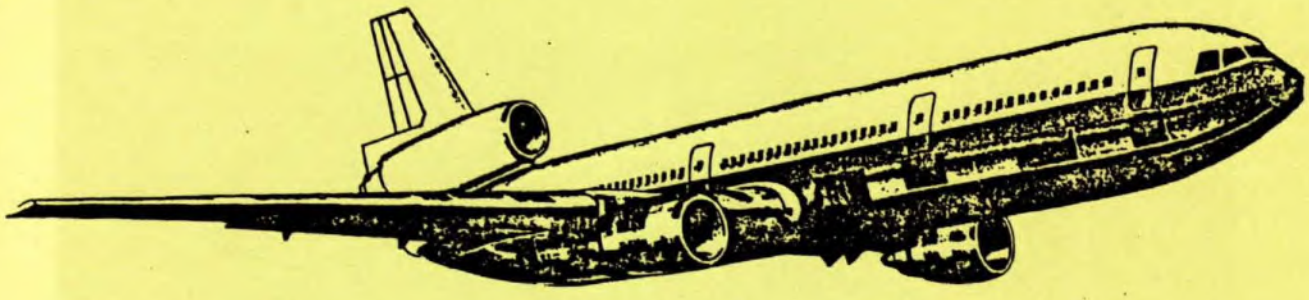
WINNIPEG AREA
Scale 8 miles = 1"

VANCOUVER AREA
Scale 6 miles = 1"

LEGEND

- ALASKA RY.
- ALBERTA RESOURCES RY.
- BRITISH COLUMBIA HYDRO & POWER AUTHORITY
- CANADIAN NATIONAL RYS.
- CANADIAN PACIFIC RY.
- DULUTH, WINNIPEG & PACIFIC RY.
- ESQUIMALT & NANAIMO RY.
- GREAT NORTHERN RY.
- GREAT SLAVE LAKE RY.
- GREATER WINNIPEG WATER DISTRICT RY.
- MIDLAND RY. CO. of MANITOBA
- NORTHERN ALBERTA RY.
- BRITISH COLUMBIA RAILWAY
- WHITE PASS & YUKON RY.

Connecting Lines in Duluth-Superior
C.N.W., N.P., L.S.T.&T.,
M.St.P., D.M.&I.R., G.N.Ry.



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ILLUSTRATIONS, cont'd Page

INSERTS

I AIR ROUTES

There is a clear hub and spoke pattern to Canada's air routes as indicated on the "Road Map of the Air" inserted at the back of this section. This map illustrates the major air routes north of 49^{o} and lists the airline carrier providing the service. The hub and hinterland pattern can be clearly seen in all provinces of Canada.

Although there were over 1,100 air carriers licensed in Canada in 1975, seven account for approximately 85 percent of revenues and expenses reported by all Canadian carriers. These seven major airlines are: Air Canada, CP Air, Pacific Western Airlines, Transair, Nordair, Quebecair and Eastern Provincial Airways.

The hub of activity for Canada's air traffic is centered around 10 international airports in Canada. At this time, international service is available at the following cities: Vancouver, Victoria, Edmonton, Calgary, Winnipeg, Toronto, Ottawa, Dorval, Mirabel and Halifax. Transport Canada officials have confirmed that shortly, international service will be added to St. John's, Newfoundland and Saskatoon. There is also speculation that Regina may be added to the list.

II TYPE AND CLASSES OF AIR SERVICES

In 1975 there were approximately 1,100 air carriers licensed by the Air Transport Committee of the Canadian Transport Commission (CTC) that provided one or more types of commercial air services into, within, or out of Canada. Approximately 640 of these carriers were located in Canada with the remainder being foreign based, 90 percent in the United States.

Canadian air carriers can broadly be considered to be in two major groups. One group, consisting of about 230 carriers are engaged solely in specialty flying activities such as aerial photography, forest fire suppression and flying training.

The other group consisting of about 410 carriers, constitute a very diverse group in terms of their geographical locations, areas served, size and type of aircraft, and kinds of services offered. However these carriers do have a common factor in that they are each licensed to provide at least one of the following two basic types of commercial air service:

1. Unit Toll Commercial Air Service is a service operated in accordance with a license to provide public transportation of persons or goods by aircraft between specified points at a toll per unit of traffic.

2. Charter Commercial Air Service is a service operated in accordance with a license to offer public transportation

of persons or goods from a specified base point in Canada at a toll per mile or per hour for the charter of the entire aircraft.

In addition to authorizing a commercial air service and the points between which, or from which, the service may operate, the license usually limits the carrier to operating aircraft within certain weight ranges.

A. Categories of Air Carriers Licensed

There are four major categories of Canadian air carriers licensed to provide unit toll and/or charter commercial air services. They are:

1. Transcontinental Service

   Air Canada and CP Air are the two Transcontinental air carriers in Canada. They provide unit toll passenger and freight air services within Canada and between Canada and other countries. They are also licensed to provide charter commercial air services within Canada and between Canada and other countries. The points in North America served on a unit toll basis by these carriers are shown in Maps 1 and 2.

2. Regional Service

   Eastern Provincial Airways, Quebecair, Nordair, Transair and Pacific Western Airlines are the five Regional air carriers designated by the Minister of Transport to provide regional and northern air services. Each of these carriers provides passenger and freight unit toll commercial air services within Canada. Nordair and Pacific Western Airlines each operate a unit toll service between a point in Canada and a point in the United States. These five carriers are also licensed to operate charter commercial air services within Canada and

MAP 1

Am Canad


Whitehorse
Watson Lake
Fort Nelson
Terrace
Fort St. John
rince
upert
Grande Prairie
Prince
George
Edmonton
Calgary
Vancouver
Winnipeg
Ottawa
Montréal
Toronto
San Francisco
Los Angeles
Guadalajara
Puerto Vallarta
Mexico City
Acapulco

MAP 2

CP Air

between Canada and other countries. The North American points served on a unit toll basis by or for these carriers are identified for each carrier in Maps 3 and 4.

3. Local Service

This category consists of about 75 carriers who are licensed to provide domestic unit toll air services. The majority also hold licenses to operate charter commercial air services within Canada and from Canada to other countries. The operating areas for the unit toll operations of these carriers are generally smaller and more concentrated than those of the seven other carriers providing domestic unit toll services.

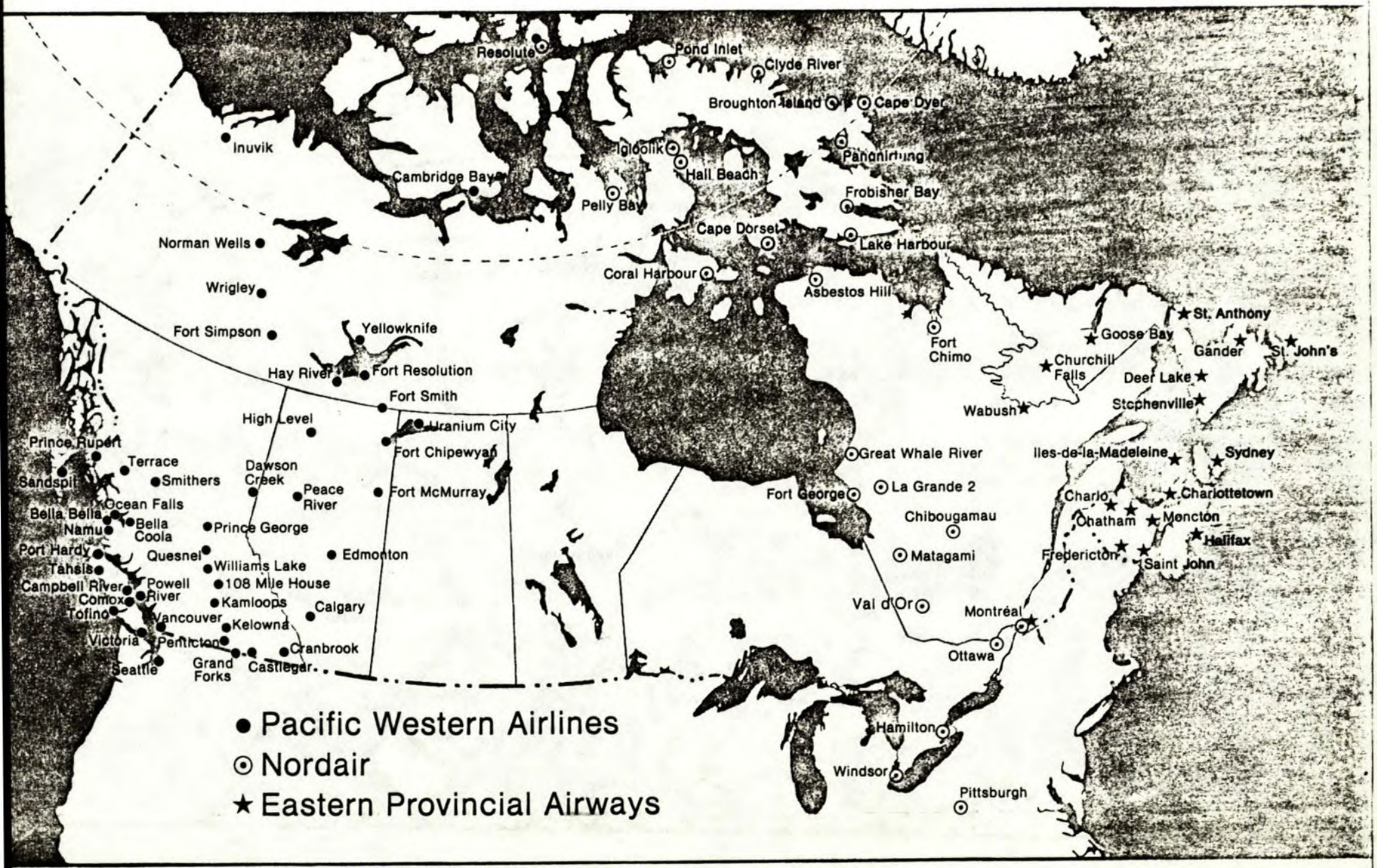
4. Charter Service

By far the largest number of Canadian air carriers are not authorized to operate domestic, transborder or international unit toll services. However, they are licensed to provide passenger and/or freight charter commercial air services. Several of these 328 Charter Service carriers offer charters within and into remote and partially-developed areas where alternate forms of transportation, such as road or water services, are not available. Many are also authorized to operate charters between Canada and other countries.

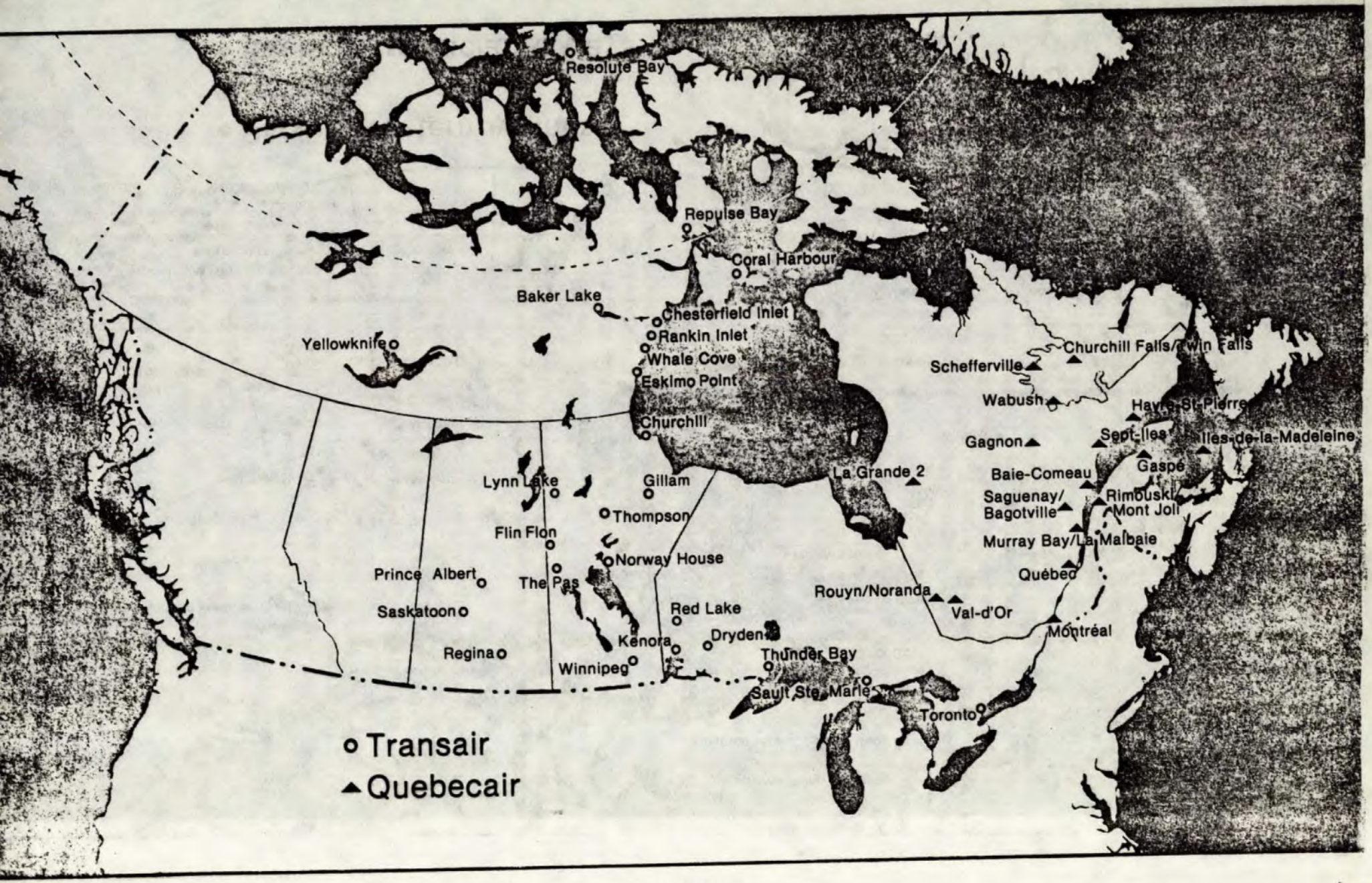
Besides the above mentioned air carriers, there are a considerable number of U.S.A. air carriers that operate between Canada and the United States. At the present time, approximately 400 air carriers based in the United States are licensed to operate unit toll and/or charter services into Canada.

B. Classification of Air Service

The following class definitions are taken straight out of the 1976 - Directory of Canadian Commercial Air Services


Resolute
Pond Inlet
Clyde River
Broughton Island
Cape Dyer
Inuvik
Igloolik
Pangnirtung
Hall Beach
Cambridge Bay
Pelly Bay
Frobisher Bay
Norman Wells
Cape Dorset
Lake Harbour
Coral Harbour
Asbestos Hill
Wrigley
Fort Simpson
Yellowknife
Fort Chimo
St. Anthony
Goose Bay
Gander
St. John's
Churchill Falls
Deer Lake
Hay River
Fort Resolution
Fort Smith
Stephenville
Wabush
High Level
Uranium City
Prince Rupert
Fort Chipewyan
Great Whale River
Iles-de-la-Madeleine
Sydney
Terrace
Dawson Creek
Sandspit
Smithers
Peace River
Fort McMurray
Fort George
La Grande 2
Charlo
Charlottetown
Ocean Falls
Bella Bella
Chatham
Moncton
Bella Coola
Namu
Prince George
Chibougamau
Halifax
Port Hardy
Quesnel
Edmonton
Matagami
Fredericton
Saint John
Tahsis
Williams Lake
Campbell River
Powell River
108 Mile House
Comox
Kamloops
Calgary
Val d'Or
Montréal
Tofino
Vancouver
Kelowna
Victoria
Penticton
Cranbrook
Ottawa
Seattle
Grand Forks
Castlegar
Hamilton
Windsor
Pittsburgh
• Pacific Western Airlines
⊙ Nordair
★ Eastern Provincial Airways

MAP 3


Resolute Bay
Repulse Bay
Coral Harbour
Baker Lake
Chesterfield Inlet
Rankin Inlet
Yellowknife
Whale Cove
Eskimo Point
Churchill
Lynn Lake
Gillam
Thompson
Flin Flon
Norway House
Prince Albert
The Pas
Saskatoon
Red Lake
Regina
Kenora
Dryden
Winnipeg
Thunder Bay
Sault Ste. Marie
Toronto
Montréal
Rouyn/Noranda
Val-d'Or
Québec
Murray Bay/La Malbaie
Saguenay/
Bagotville
Rimouski
Mont Joli
Baie-Comeau
Gaspé
Sept-Iles
Gagnon
La Grande 2
Wabush
Schefferville
Churchill Falls/Twin Falls
Transair
Quebecair

MAP 4

and list the nine classes of air service provided in Canada. It should be recognized that the class and type of service offered at any one airport is varied. Each air carrier may provide more than one class of service depending on the equipment it operated and the license granted for points served.

> Class 1: Scheduled commercial air service, being a service that is operated wholly within Canada and that is required to provide public transportation of persons, goods or mail by aircraft, serving points in accordance with a service schedule at a toll per unit of traffic;
>
> Class 2: Regular Specific Point commercial air service, being a service that is operated wholly within Canada and that is required to provide, to the extent that facilities are available, public transportation of persons, goods or mail by aircraft, serving points in accordance with a service pattern at a toll per unit of traffic;
>
> Class 3: Specific Point commercial air service, being a service that is operated wholly within Canada and that offers public transportation of persons, goods or mail by aircraft, serving points consistent with traffic requirements and operating conditions at a toll per unit of traffic;
>
> Class 4: Charter commercial air service, being a service that is operated wholly within Canada and that offers public transportation, on reasonable demand, of persons or goods from the base specified or the protected base denoted in the license issued for that commercial air service at a toll per mile or per hour for the charter of an entire aircraft, or at such other tolls as may be allowed by the Committee, and includes recreational flying;
>
> Class 5: Contract commercial air service, being a service that is operated wholly within Canada from the base specified in the license issued for that commercial air service, that offers transportation

of persons or goods solely under contracts of carriage with users with whom the air carrier has a substantial relationship through corporate structure or financial control and that does not hold out to the general public, or a class or segment thereof, the offer of transportation by air;

Class 6: Flying Club commercial air service, being a service that is operated wholly within Canada from the base specified in the license issued for that commercial air service and that provides flying training and recreational flying to members of a flying club incorporated as a non-profit organization;

Class 7: Specialty commercial air service, being a service that is operated from the base specified in the license issued for that commercial air service for any purpose not provided for by any other class of service and, without limiting the generality of the foregoing, for any of the following purposes:

(i) "aerial application and distribution", being the application of chemicals or distribution of other materials from aircraft to,

(a) inhibit and destroy insect life and other forms of organism injurious to plants, crops and forests, or
(b) foster the growth of crops, forests or fish;

including agricultural flying, aerial pest control spraying, seeding and reseeding, forest cultivation and fish cultivation;

(ii) "aerial construction", being the use of rotating wing aircraft in construction work, including aerial hoisting, mountain tram line construction, aerial pole setting and aerial power line construction;

(iii) "aerial control", being fire suppression, fire or frost prevention or altering the normal processes of weather, including aerial fire control, forest fire protection, firefighting, forest firefighting, forest protection, water pumping, forest control, hail suppression, aerial frost control, rain making, fog dispersal and cloud seeding;

(iv) "aerial inspection, reconnaissance and advertising", being,

(a) the reporting from aerial observation upon events, natural phenomena related to man-made objects, or
(b) the providing of visual messages in the atmosphere;

including aerial patrol and inspection, ice reconnaissance, seal spotting, forest inspection and administration, forest patrol, pipeline patrol, powerline patrol, news service and aerial advertising;

(v) "aerial photography and survey", being,

(a) the taking of photographs or the recording in other tangible form of phenomena on, under or above the earth's crust by a carrier using a camera or other measuring or recording device mounted in or attached to the carrier's aircraft and under the carrier's control, and
(b) the eventual delivery of the photograph or other record to the client in finished, semi-finished or other tangible form;

including aerial photography, scintillometer survey, aerial prospecting and geophysical survey;

(vi) "aerial photography restricted to scenics", being the recording of scenes only and not involving any interpretive services or the creation of maps of any kind;

(vii) "flying training", being an air service for the purpose of instructing a person in the art and science of pilotage and the operation and navigation of aircraft; and

(viii) "recreational flying", being flights that originate and terminate at the same place without landing at any other place for the purpose of taking on or discharging passengers and that are,

(a) flown over a standard course that has been advertised by the carrier,
(b) conducted for the sole purpose of the recreation of the passengers, and

(c) charged for at a rate per seat per unit of time;

including sightseeing, barn storming and parachute jumping;

Class 8: International Scheduled commercial air service, being a service that is operated between points in Canada and points in any other country and that is required to provide public transportation of persons, goods or mail by aircraft, serving such points in accordance with a service schedule at a toll per unit of traffic;

Class 9-2: International Regular Specific Point commercial air service, being a service that is operated between points in Canada and points in any other country and that is required to provide, to the extent that facilities are available, public transportation of persons, goods or mail by aircraft, serving such points in accordance with a service pattern at a toll per unit of traffic;

Class 9-3: International Specific Point commercial air service, being a service that is operated between points in Canada and points in any other country and that offers public transportation of persons, goods or mail by aircraft, serving such points consistent with traffic requirements and operating conditions at a toll per unit of traffic;

Class 9-4: International Charter commercial air service, being a service that is operated by an air carrier using,

(a) Group A, B or C aircraft, or
(b) subject to obtaining a permit as required by Part IV, Group D,E,F,G or H aircraft;

from the base specified in the license issued for that commercial air service and that offers public transportation, on reasonable demand of persons or goods between places in Canada and places in any other country, at a toll per mile or per hour for the charter of the entire aircraft, or at such other tolls as may be allowed by the Committee; and

Class 9-5: International Contract commercial air service, being a service that is operated between Canada and any other country from the base specified in the

license issued for that commercial air service, that offers transportation of persons or goods solely under contracts of carriage with users with whom the air carrier has a substantial relationship through corporate structure or financial control and that does not hold out to the general public, or a class or segment thereof, the offer of transportation by air.

III AIRCRAFT GROUPS

The groups for commercial air services are based on the weight of the aircraft used in the operation of the service. There are eight groups of commercial air services operated with fixed wing aircraft and six groups operating with rotating wing aircraft. A complete listing of maximum and minimum take-off weights can be found in the 1976 "Directory of Canadian Commercial Air Services".

Table 1 is a summary of Canadian Commercial Aircraft by type of power plant. It is significant to note that in 1976 the bulk of planes listed were piston engine. This points out that 76 percent of Canada's commercial air fleet is non-jet-propelled and therefore, operate in a short geographic radius.

For a complete listing of aircraft in Canada, by weight group, aircraft type and carrier name, refer to the "1976 Fleet Report Inventory of Commercial Aircraft in Canada" published by the Aviation Statistics Center, Statistics Canada.

TABLE 1

CANADIAN COMMERCIAL AIR CARRIER FLEET BY TYPE OF POWER PLANT

Year	FIXED-WING AIRCRAFT				HELICOPTERS			
	Turbo Jet	Turbo Prop	Piston Engine	Total	Turbine	Piston Engine	Total	Total A/C In Fleet
1970(1)	98	97	2,395	2,590	84	305	389	2,979
1971(1)	130	115	2,354	2,599	101	315	416	3,015
1972(1)	139	124	2,462	2,725	200	284	484	3,209
1973(1)	151	126	2,593	2,870	285	274	559	3,429
1974(1)	182	144	2,765	3,091	355	226	581	3,672
1975(July)	209	134	2,945	3,288	405	190	595	3,883
1976(April)	217	139	3,114	3,470	436	169	605	4,075

(1) Figures are as of July 15.

Source: Aviation Statistics Centre - Statistics Canada, May 1976.

IV FINANCIAL STRUCTURE

As a brief summary of air carrier financial operations in 1975, they reported total operating revenues of $1,833 million. The 1974 revenues of $1,552 million represented a 27 percent increase over the $1,214 million earned in 1973. The 1975 revenue showed an increase of 18.4 percent over 1974 (Table 2). However, total operating expense rose about 30 percent from $1,133 million in 1973 to $1,481 million in 1974, and in 1975 rose an additional 19.5 percent to $1,766 million. These increases were representative of significant increases in both fuel and fares.

It is interesting to note that 70 percent of the 1974 total operating revenues came from transporting passengers. Express, freight, express baggage and mail collectively account for only 10 percent of revenues and charter transport added another 15 percent to total operating revenues. In 1975 the mix changed slightly as passenger revenues accounted for only 67 percent of revenues.

The apparent huge decrease in net income after taxes is self explanatory from the operating expense information in Table 2.

Table 3 is a balance sheet for all Canadian carriers and reveals that collectively they hold less than a 10 percent equity position of over $2 billion worth of assets.

TABLE 2

STATEMENT OF INCOME, CANADIAN CARRIERS - ALL SERVICES

No.		1974 GRAND TOTAL	1975 GRAND TOTAL
		DOLLARS	
	OPERATING REVENUES:		
	UNIT TOLL TRANSPORTATION		
1	Passengers	1,084,538,780	1,229,110,590
2	Express	15,738,971	24,642,266
3	Freight	104,669,907	119,330,541
4	Excess Baggage	4,962,278	5,788,973
5	Mail	36,298,070	37,045,367
6	Total Unit Toll Transportation	1,246,208,006	1,415,917,737
7	CHARTER TRANSPORTATION	235,681,851	337,223,063
8	TOTAL TRANSPORTATION	1,481,889,857	1,753,140,800
9	OTHER FLYING SERVICES	24,953,638	26,165,169
10	TOTAL FLYING SERVICES	1,506,843,495	1,779,305,969
11	NON-FLYING SERVICES (NET)	45,800,425	53,900,878
12	TOTAL OPERATING REVENUES	1,552,643,920	1,833,206,847
	OPERATING EXPENSES:		
13	Flying Operations	483,301,650	593,148,728
14	Maintenance	230,679,621	271,896,306
	GENERAL SERVICES & ADMINISTRATION:		
15	Passenger Service	..	..
16	Aircraft & Traffic Servicing	..	..
17	Promotion & Sales	..	..
18	General Administration	..	..
19	Total	626,257,737	740,918,167
20	Depreciation & Amortization	141,439,202	160,741,341
21	TOTAL OPERATING EXPENSES	1,481,678,210	1,766,704,542
22	OPERATING INCOME (LOSS)	70,965,710	66,502,305
	NON-OPERATING INCOME-NET:		
23	Capital Gains & (Losses)	5,759,385	8,253,314
24	Interest & Discounts	11,876,726	7,516,035
25	Miscellaneous Non-Operating Income	4,166,716	1,338,846
26	TOTAL NON-OPERATING INCOME-NET	21,802,827	17,108,195
27	Income Before Interest Expense Loss	92,768,537	83,610,500
28	Interest Expense	91,267,165	107,586,991
29	Income Before Income Taxes (Loss).	1,501,372	(23,976,491)
30	Provision for Income Taxes (Refund)	(1,616,995)	(15,426,243)
31	Net Income After Income Taxes (Loss)	3,118,367	(8,550,248)

Source: Air Carriers Financial Statements, 1974 and 1975, Statistics Canada.

TABLE 3

CANADIAN CARRIERS BALANCE SHEET

Years ending December 31

ASSETS	1974	1975
Current Assets	$ 414,458,153	$ 554,542,106
Investment & Special Funds	37,927,865	39,152,804
Project & Equipment	1,519,926,890	1,572,050,012
Deferred Charges	29,031,152	23,550,779
Total Assets	2,001,344,060	2,189,295,701
LIABILITIES		
Current Liabilities	$ 458,771,070	$ 532,133,454
Non-Current Liabilities	1,273,422,777	1,411,883,842
Deferred Credits	52,048,441	38,143,360
Reserves	33,322,143	31,870,271
Capital Stock & Supplies	183,779,629	175,264,769
Total Liabilities	$ 2,001,344,060	$ 2,189,295,701

SOURCE: Air Carrier Financial Statements, 1974 and 1975, Statistics Canada.

As mentioned earlier, the activities of Canada's seven major airlines - Air Canada, CP Air, Pacific Western Airlines, Transair, Nordair, Quebecair and Eastern Provincial Airlines, account for approximately 85 percent of the revenues and expenses reported by all Canadian carriers.

While the total industry recorded an after-tax net income of $3,118,367 in 1974, the seven major carriers collectively lost $2,633,920. It is interesting to note that all of the seven made money except Air Canada which recorded an after-tax net loss of $9,224,757. In 1975 the picture changed dramatically. The total industry lost $8,550,248 in 1975, while the seven major carriers collectively lost $19,642,833. Air Canada was the largest loser with $12.5 million, and CP Air adding a loss of $6.4. From a position of only one company losing money in 1974, 1975 showed five of the major seven losing money. Only Nordair and Pacific Western Airlines showed positive returns. Caution should be exercised in making any conclusions at this point as a more detailed analysis of costs and revenues would have to be undertaken to explain the gigantic change from a net increase of $19 million in 1973 to a net loss of $19.5 million in 1975 for these seven major companies.

Table 4 is a selection of summary statistics concerning these seven major carriers. While the statistics on this table are self explanatory, Table 5 is an extension of

TABLE 4

SUMMARY STATISTICS OF THE MAJOR AIR MODE OPERATORS

Carrier	Gross 1974 Operating Revenues (millions)	Domestic Unit Toll Revenues as Percentage of Gross	Unduplicated Route Mileage of Domestic Network 1975	Domestic Unit Toll Traffic Statistics 1974			Average Employment in 1974	1976 Fleet Statistics As Of April 15, 1976	
				Passengers in millions (Pass-Miles) in billions	Percent Of Total	Seat Miles (billions)[1]		No. of Aircraft[2]	Jet Aircraft
Air Canada	$ 849	51	44758	7.56 (4.10)	70 (40)	6.48	21,000	117	34 DC-8's; 53 DC-9's; 14 B-727's; 10 L-1011's; 6 B-747's
CP Air	$ 277	36	17265	1.45 (1.46)	63 (37)	2.44	7,000	29	12 DC-8's; 4 B-747's; 7 B-737's; 6 B-727's
Eastern Provincial Airlines	$ 29	92	9473	0.60 (0.24)	95 (83)	0.18	700	11	6 B-737's
Nordair	$ 37	53	7400	0.25 (0.13)	55 (34)	0.16	800	20	6 B-737's; 1 DC-8
Quebecair	$ 24	77	4966	0.52 (0.14)	87 (56)	0.24	600	10	3 BA-111's; 1 B-727; 2 B-707
Transair	$ 28	67	8992	0.37 (0.17)	78 (51)	0.30	600	11	4 B-737's; 1 B-707
Pacific Western Airlines	$ 85	69	9071	1.86 (0.44)	95 (67)	0.80	2,000	25	12 B-737's; 2 B-7C7's; 2 B-727's 1 L-100's

Notes: 1) Seat mile statistics are restricted to services operated under Class I licenses.
2) Statistics represent aircraft either owned or leased.

SOURCE: - Aviation Statistics Centre, Statistics Canada.
- Intercity Passenger Transport in Canada, Canadian Transport Commission, December 1975.

TABLE 5

JET AIRCRAFT EITHER LEASED OR OWNED
As Of April 15, 1976

CARRIER	AIRCRAFT TYPE	TOTAL JET AIRCRAFT IN FLEET	OWNED	LEASED
Air Canada	DC-8's	34	34	0
	DC-9's	53	52	1
	B-727's	14	7	7
	L-1011's	10	2	8
	B-747's	7	6	1
		118	101	117
CP Air	DC-8's	12	0	12
	B-747's	4	0	4
	B-737's	7	7	0
	B-727's	6	0	6
		29	7	22
Eastern Provincial Airlines	B-737's	6	1	5
Nordair	B-737's	6	5	1
	DC-8's	1	1	0
		7	6	1
Quebecair	BA-111's	3	3	0
	B-727's	1	1	0
	B-707's	2	1	1
		6	5	1
Transair	B-737's	4	3	1
	B-707's	1	1	0
		5	4	1
Pacific Western Airlines	B-737's	12	6	6
	B-707's	2	0	2
	B-727's	2	0	2
	L-100's	4	1	3
		20	7	13

SOURCE: Compiled from Inventory of Commercial Aircraft in Canada 1976, Statistics Canada.

the mix of jet aircraft either leased or owned by the seven major carriers.

These seven air carriers collectively operate 191 jet aircraft but, only 131 or 68.5 percent of them are owned. It is interesting to note that Air Canada owns almost as many as they lease, but CP Air and Pacific Western Airlines lease more than they own by a 3:1 and 2:1 margin, respectively. It has been suggested that perhaps Air Canada could also make a profit if it would lease rather than buy.

V AIR SERVICE NORTH OF 60°

Commercial aviation has played an important role in opening up Northern Canada and continues to provide access throughout this region. While population distribution and resource development patterns are the key components of the socio-economic environment in Northern Canada, there are other factors that also influence the transportation needs of the North.

Many carriers have been attracted to the Northern market for resource development and Government contract work, but four carriers have established overall dominance. They are: CP Air, Nordair, Pacific Western Airlines and Transair.

The role of air transportation in Northern Canada is predominantly the continuous support of socio-economic activity and the maintenance of communications between settlements and the rest of Canada. The air transportation system operates within these roles but is still 'underdeveloped'. This underdeveloped condition is due to the size and distribution of settlements and to the rapidly fluctuating pattern of seasonal demand. There are six distinct types of settlements in Northern Canada that require air service. The basic functions of these six settlement types are described as follows:

1. Regional Centres have become the main population growth poles in the North. They contain the dominant service and administrative functions for their individual regions. The two main

regional centres are Yellowknife and Whitehorse and are the capitals for their respective Territories.

2. Area Centres are settlements which generally possess a Co-op, some retail outlet and a handicraft industry. Government officials such as RCMP and Health Authorities are located in these settlements.

3. Subsistence Settlements have hunting and fishing as the primary industry. They possess minimal community facilities such as a school and power plant.

4. Mining Towns are company settlements developed for the purpose of mineral extraction.

5. Defence Sites include the DEW line radar installations.

6. Weather Stations are set up and maintained for the purpose of gathering meteorological data.

Due to the distances involved and the general lack of surface access passenger travel is usually by aeroplane. This includes emergency evacuations, Government officials' inspection tours and the transporting of children to their regional schools. The single-engined piston aircraft maintains an important role as 'air-taxi' for the more isolated settlements.

The basic pattern of the air transport system network for Northern Canada is shown by the identification of established terminals and airways as indicated on the "Road Map of the Air" inserted at the back.

In terms of remote area landing strips in Canada's North, consult Insert No. 2 at the back of this section. It contains detailed information on landing strips, location,

geometrics, the aircraft operators providing service, where the service is provided and specific information on aircraft by type including capacity load limits, flight range and landing capability.

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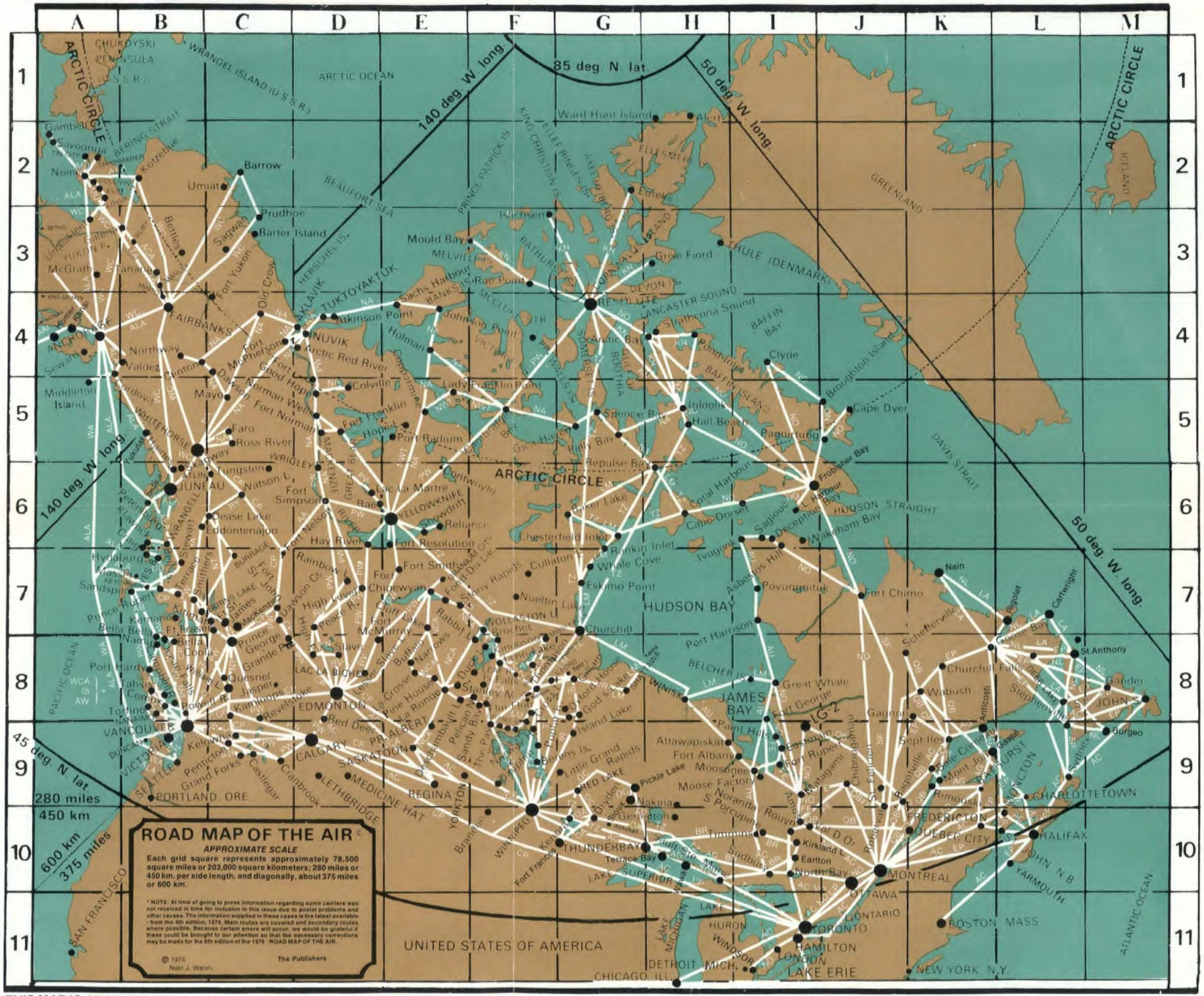
ARCTIC and northern development DIGEST

Established 1969

Alert	H-1	Geraldton	H-10	PORTLAND, ORE	B-9
Amos	I-10	Germanson Landing	C-7	Port Radium	E-5
ANCHORAGE, ALASKA	A-4	Gillam	G-8	Povungnituk	I-7
Antigonish	G-10	Goba Haven	G-5	Powell River	B-8
Arctic Bay	H-4	God's Lake	G-8	PRINCE ALBERT	E-9
Arctic Red River	D-4	Gosport	A-2	Prince George	C-8
Asbestos Hill	I-6	Goose Bay	K-8	Prince Rupert	B-7
Atikokan	K-10	Grand Forks	C-9	PRUDHOE BAY, ALASKA	C-2
Atkinson Point	D-4	Grand Rapids	F-9	QUEBEC CITY	K-10
Attin	C-6	Grande Prairie	C-8	Quesnel	C-8
Attawapiskat	H-9	Great Whale	I-8	Rabbit Lake	F-8
Bagotville	J-9	Grise Fiord	H-3	Rae	D-6
Baie Comeau	K-9	Haines, Alaska	B-8	Rae Point	F-3
Baker Lake	G-6	HALIFAX	L-10	Rainbow Lake	D-7
BARROW, ALASKA	C-2	Hall Beach	H-5	Rankin Inlet	G-6
Barter Island	C-3	HAMILTON	I-11	Red Deer	D-8
BATHURST	K-8	Hay River	D-8	Red Lake	G-10
Bear Lake	B-7	High Level	D-7	REGINA	E-9
Bella Bella	B-8	High Prairie	D-8		
Bella Coola	B-8	Holman	E-4	RESOLUTE	G-4
Bell Island	B-6	Homer	A-4	Repulse Bay	H-6
Berens Island	F-9	Hope Lake	E-5	Reliance	E-6
Bettles	B-3	Hydraburg, Alaska	B-7	Revelstoke	C-8
BOSTON, MASS	K-11	Igloolik	H-5	Rigolet	L-7
Brandon	F-10	Ile-A-La-Crosse	E-8	Rimouski	K-9
Brochet	F-8	Ilford	F-8	Roberval	J-9
Broughton Island	I-5	INUVIK	D-4	Ross River	C-5
Buffalo Narrows	E-8	Isachsen	F-3	Ruby	B-3
Burgeo	M-9	Island Falls	F-8	Sachs Harbour	E-4
Burns Lake	B-7	Island Lake	G-9	Saglouc	I-6
Burrage	C-7	Ivugivik	I-6	Sagwon	C-3
CALGARY	D-9	Jasper	C-8	SEATTLE, WASH	B-9
Cambridge Bay	F-5	Jen Peg	F-9	Sandy Bay	F-8
Campbell River	B-8	Johnson Point	E-4	Shattawa	G-8
Cape Dorset	I-6	JUNEAU, ALASKA	B-8	Shushmarer	A-2
Cape Dyer	J-5	Kamloops	C-8	St. Anthony	L-8
Carterright	L-7	Kaska	G-6	St. Felicien	J-9
Castlegar	C-9	Kelowna	C-9	Sandspit	B-7
CHARLOTTETOWN	L-9	Kemano	B-7	SAN FRANCISCO, CAL.	A-11
Chesterfield Inlet	G-6	Kenai	A-4	SASKATOON	E-9
Chibougamau	J-9	Kenora	G-10	Sault Ste. Marie	H-10
CHICAGO, ILL.	H-11	KETCHIKAN, ALASKA	B-7	Savoonga, Alaska	A-2
Churchill	G-7	Kinoosoo	F-8	Schefferville	J-8
Churchill Falls	K-8	Kirkland Lake	I-10	Sept-Iles	K-9
Clinton	B-4	Kitimat	B-7	Seward, Alaska	A-4
Cluff Lake	E-7	Klawock, Alaska	B-6	Sitka, Alaska	B-6
Clyde	I-4	Kotzebue, Alaska	B-2	Sioux Lookout	G-9
Colville	D-5	Koyuk	A-2	Skagway, Alaska	B-8
Comox	B-8	Lac La Biche	D-8	Slave Lake	D-8
Contwoyto	E-6	Lac La Martre	D-6	Smithers	B-7
COOpermine	E-5	Lac La Ronge	E-8	Snowdrift	E-6
Coral Harbour	H-6	Lady Franklin Point	E-5	So. Indian Lake	F-8
Cordova, Alaska	A-4	Lake Harbour	I-6	Southend	E-8
Craig, Alaska	B-6	Leaf Rapids	F-8	South Porcupine	I-10
Cranbrook	C-9	LETHBRIDGE	D-9	Spence Bay	G-5
Cross Lake	F-8	Lesser Slave Lake	D-8	Spirit Lake	G-8
Cullaton Lake	F-7	Little Grand Rapids	G-9	Stanley Mission	E-8
Dauphin	F-9	LONDON	I-11	Stephenville	L-9
Dawson	C-4	Lynn Lake	F-6	Stewart	B-7
Dawson Creek	C-7	Mackenzie	C-7	ST. JOHN, N.B.	L-10
Dease Lake	C-6	Manley	B-3		
Deception Bay	I-6	Matagami	I-9	ST. JOHN'S, NFLD.	M-8
Deer Lake	L-8	Masset	B-7	Stony Rapids	E-7
Deschambault Lake	E-8	Mayo	C-5	Strathcona Sound	H-4
DETROIT, MICH	I-11	McGrath, Alaska	A-3	Sudbury	I-10
Dryden	G-10	MEDICINE HAT	D-9	Sydney	L-9
Duck Lake	F-8	Middleton Island	A-5	Tahsis	B-8
Duncan	B-9	Minto	B-4	Takla	C-7
Earlton	I-10	Moosonee	F-8	Tanana	B-3
Easterville	B-9	MONCTON	L-10	Terrace	B-7
Eastmain	I-9	Mont-Joli	K-9	Terrace Bay	H-10
Eddontenajon	B-6	MONTREAL	J-10	The Pas	F-9
EDMONTON	D-8	Moose Factory	I-9	Thompson	F-8
Elim	A-2	Moose Lake	F-9	THULE, (DENMARK)	H-3
Eskimo Point	G-7	Nanaimo	B-8	THUNDERBAY	Gn-10
Eureka	G-2	Moosonee	I-9	Timmins	I-10
FAIRBANKS, ALASKA	B-4	Mould Bay	F-3	Tin City	A-2
Faro	C-5	Mount Hope (See Hamilton)		Torhino	B-8
Fin Flon	F-8	Nain	K-7	TORONTO	I-11
Fond-Du-Lac	F-7	Nakina	H-9	Tungsten	C-6
Fort Albany	I-9	Namu	B-8	TUKTOYAKTUK	D-4
Fort Chimo	J-7	Nelson House	F-8	Umiat, Alaska	C-3
Fort Chipewyan	E-7	NEW YORK, N.Y	K-11	Unalakleet, Alaska	A-3
Fort Francis	G-10	Nome, Alaska	A-2	Uranium City	E-7
Fort Franklin	D-5	Norlanda, Rouyn	I-10	Valdez, Alaska	B-4
Fort George	I-6	Norman Wells	D-5	Val D'Or	I-10
Fort Good Hope	D-5	North Bay	I-10	VANCOUVER	B-9
Fort McPherson	C-4	Northway, Alaska	B-4	VICTORIA	B-9
Fort McMurray	D-8	Norway House	F-9	Wabush	K-8
Fort Nelson	C-7	Nuetlin Lake	F-7	Wakeham Bay	I-6
Fort Fraser	C-7	Ocean Falls	B-8	Ward Hunt Island	H-1
Fort Norman	D-5	Old Crow	C-4	Watson Lake	C-6
Fort Reliance	E-6	OTTAWA	J-10	Wawa	H-10
Fort Resolution	E-6	Oxford House	G-8	Whale Cove	G-7
FOrt Rupert	I-9	Paint Hills	I-9	WHITEHORSE	B-5
FOrt St. James	C-7	Peace River	D-7	Williams Lake	C-8
FOrt St. John	C-7	Pagnirtung	J-5	WINDSOR	I-11
Fort Simpson	D-6	Pelican Narrows	F-8	WINISK	H-8
Fort Smith	E-7	Petty Bay	G-5	WINNIPEG	F-10
Fort Yukon	C-4	Penticton	C-9	Wollaston Lake	F-7
FREDERICTON	K-10	Petersburg, Alaska	B-6	Wrangell	B-6
Frobisher Bay	I-6	Pickle Lake	G-9	Wrigley	D-6
Gagnon	K-8	Pine House	E-8	Wrangel Island	B-1
Galena	B-3	Poplar River	F-9	YELLOWKNIFE	E-6
Gambell, Alaska	A-2	Pond Inlet	H-4	Yes Bay	B-6
Gander	M-9	Port Hardy	B-8	Yorkton	E-9
Gaspé	K-9	Port Harrison	I-7	Yukutat	B-5

AIRLINE CODES

AIR CANADA	AA	KENTING	KN
AIR DALE	AD	LABRADOR AIRWAYS	LA
AIG GASPÉ	AG	MUNZ NORTHERN	MU
AIRWEST	AW	NFLD/LABRADOR	NL
ALASKA AERO	AAI	NORCANAIR	NCA
ALASKA AIRLINES	ALA	NORDAIR	NO
ALASKA CENTRAL	ACA	NORTH THUNDERBIRD	NT
ALERT BAY AIR	AB	NORONTAIR	OA
ARCTIC AIR	AA	NORTHWARD	NA
AUSTIN	AU	NORTHWEST TERR.	NWT
BAYVIEW AIR	BV	ONTARIO CENTRAL	OC
B.C. YUKON	BY	PACIFIC WESTERN	PW
BRADLEY	BR	PTARMIGAN	PT
CALM AIR	CA	QUEBECAIR	QB
CANADIAN PACIFIC	CP	ST-FELECIEN	SF
COAST AIR	CO	TRANSAIR	TZ
EASTERN PROVINCIAL	EP	VICTORIA FLYING	VF
A FECTEAU AERIEN	FE	VOYAGEUR	VO
HARRISON AIR	HA	WEST COAST AIR	WCA
ILFORD-RIVERTON	IR	WESTERN	WA
ISLAND AIR	IS	WEIN-AIR ALASKA	WC



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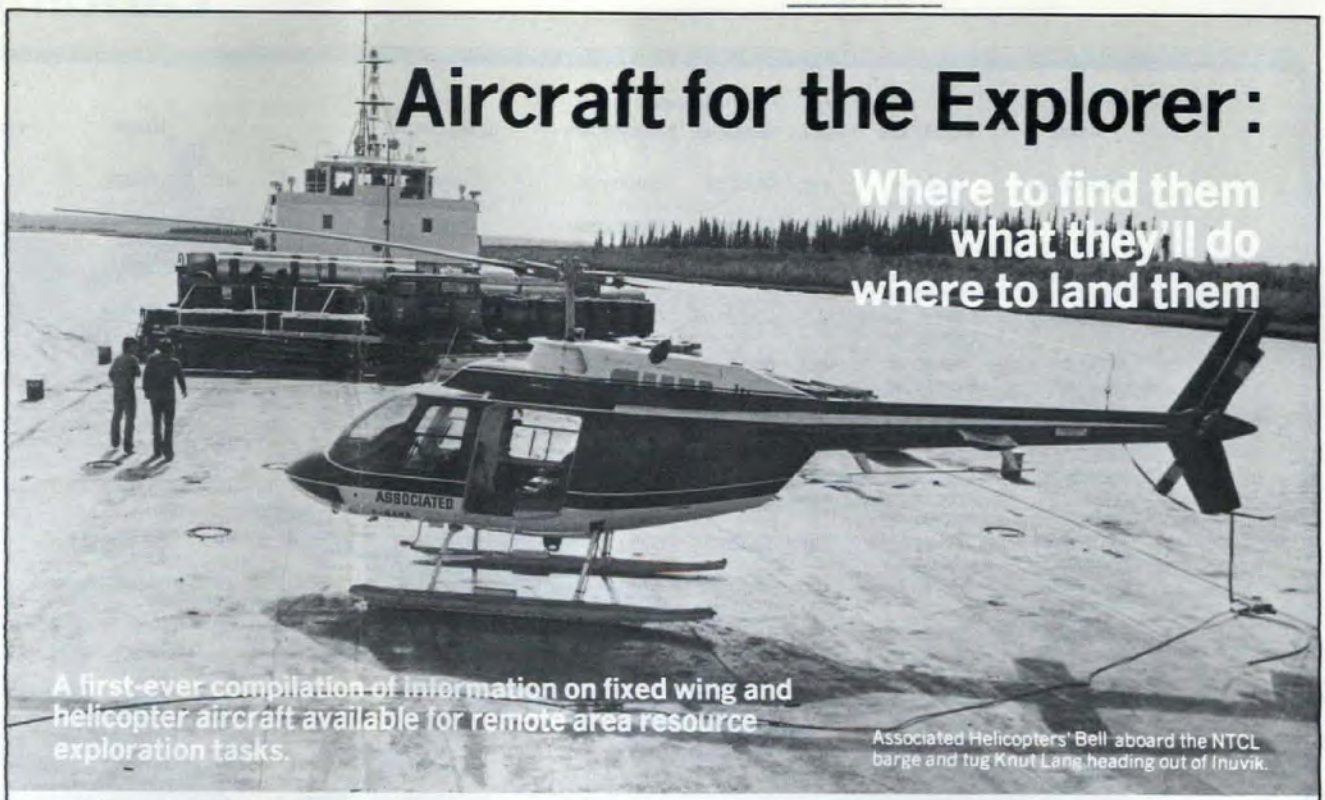
	1 COMPANY	2 ADDRESS	3 ZONE/ZIP PHONE TELEX	4 THREE KEY PERSONNEL	5 TYPE AND NUMBER OF AIRCRAFT	6 CLASS-IFICATION	7 SPECIAL SERVICES OFFERED	8 BRANCH OFFICES OR OPS. POINTS
48—	**A. Fecteau Transport Aérien Ltée**	C.P. 220, Senneterre, Qué.	J0Y 2M0 011-7858 (819) 737-2262	A Rodrigue General Manager Robert Parent Operations Manager C. Alarie Controller	(7) DHC - 3 Otter (10) DHC -2 Beaver (3) Cessna 180	3-4	Bush Patrol Contract	Fort George, Matagami, Chibougamau Tamiscamie
49—	**Fox Air Service**	P.O. Box 95 Haines, Alaska, 99827, U.S.A.	Tel (907) 766-3491	John C. Fox Owner/Chief Pilot	Cessna 185 with Robertson STOL Hughes 269A Helicopter Taylorcraft BC-12D-85	9-4	Alaska and Canada-Haines & Skagway	Skagway
50—	**Frontier Flying Service Inc.**	Box 514, Fairbanks Alaska, 99707, U.S.A.	(907) 452-2369	Richard McIntyre President	(3) Cessna 185 wheel/skiis/floats (2) Piper Super Cubs-wheels (1) Cessna 206 wheels only (1) Beech C-33A-wheels		Charter	Alaska only
51—	**Frontiers Helicopters Ltd.**	P.O. Box 10, Watson Lake, Yukon	Y0A 1C0 036-88517 (403) 536-7766	S.H. (Sid) Baird President	(2) Bell 206A (1) Bell 47G 3B2 (2) Bell 206B (2) Bell 47G 3B1	4-7AC		Fort Simpson N.W.T.
52—	**Gateway Aviation Ltd.**	Hanger 11, Edmonton Industrial Airport Airport	T5G 2Z3 Telex 037-3494 455-2196	R.D. Wager President J.D. Rae Director of Flight Operations R.A. Russel Director of Marketing	(1) 48 P56R-HS 748 (4) DHC Twin Otters (4) DC-3 (2) Otters (1) MU-2 (2) Cessna 402 (2) Cessna 310 (2) Beaver (1) of ea.: Aztec, C-337, C-185, C-206, C-172	4	Charter Service	Calgary, Fort Smith, Yellowknife Norman Wells, Inuvik
53—	**Gay Airways Inc.**	Box 6003 Anchorage, Alaska	Zip 99502 Tel. (907) 279-3411	Alfred E. Gay President Ross R. Scott, Chief Pilot James W. Quakenbush Maintenance Chief	(6) Bell 206-B (2) Bell 206-A (1) Bell 205-A1	Air Taxi Helicopter & fixed wg	All types charter	Deadhorse, Cordova Bethel Prudhoe, Alaska
54—	**Gem Air Ltd 4239 Main St., Winnipeg, Man.**	Box #10, Group 28, R.R. 1, Winnipeg, Man. 4239 Main St.	R3C 2E4 (204) 334-6741	G.E. McArthur President H.J. McArther Sect/Tres.	(1) Bell 206B (1) Bell 47AJ2A (1) Taylorcraft BC12D	4-7APS 7AC-7A Const		
55—	**Georgian Bay Airways Ltd.**	55 Great North Rd, Parry Sound, Ontario	P2A 2N9 (705) 746-2175	Bruce D. Powell Operations Manager Stanley M. King Chief Pilot Ross McEwen Chief Engineer	(5) Piper PA 23-250 Aztec (1) Cessna 180 (3) de Havilland DHC-2 Beaver (1) Piper PA 18-150 Super Club (1) Cessna 185	4	Charter, Contract, Leasing	South Porcupine, Ontario: Timmins, Ontario
56—	**Globe Air Services Ltd**	Hangar "A" Airport, Box 1125 Whitehorse, Yukon				4		
57—	**Harrison Airways Ltd.**	479 Bell-Irving Van. Airport	(604) 273-3131	J. Haldeman Gen. manager A. Thiessen Controller D. Spence Ops Manager	(1) Convair 440 (2) DC3 (5) Seaplanes (4) Light Twin (4) Training	3-4-7APS-7AC 7A Const		
58—	**Heli-Lift Inc.**	P.O. Box 6432 Anchorage, AK 99502, U.S.A.	(907) 277-1691	Vernon A. Watts Area Mgr. Beverly H. Morris Dir. Maint. Victor C. Frase Gen. Mgr	(1) Bell 47G2 (1) Bell 205 A1 (1) Bell 206B	Charter	State contract Carrier, FAA Air Taxi, Commercial operator, FAA external load certificate, Passenger/cargo transport, External sling loads, seismic-petroleum support (offshore)	Entire state of Alaska, Ops and maint. Base Anchorage
59—	**Highland Helicopters Ltd.**	424 Agar Drive, Vancouver Int'l Airport, BC	V7B 1A3 273-6161	Edward C. Dunn Managing Director Gordon R. Askin Chief Engineer John D. Anderson Chief Pilot	(6) Bell 206B Jet Rangers (3) Bell 206A Jet Rangers	4	Charter	Agassiz, B.C.: Kamloops, B.C.: Quesnel, B.C.: Williams Lake, BC

	1 COMPANY	2 ADDRESS	3 ZONE/ZIP PHONE TELEX	4 THREE KEY PERSONNEL	5 TYPE AND NUMBER OF AIRCRAFT	6 CLASS-IFICATION	7 SPECIAL SERVICES OFFERED	8 BRANCH OFFICES OR OPS. POINTS
37—	**Channel Flying Inc.**	R.R. 3, Box 3577 Juneau, Alaska	Zip 99801 Tel.: 586-3331	Ken Loken President Ray Landingham Vice President Mickey Pusich Sec.-Treas.	(2) De Havilland Turbo Beavers (3) De Havilland Standard Beavers (4) Cessna 180's	4	All Charter - All Aircraft on floats Have Canadian Auth.	Sitka, Alaska Phone 747-8636
38—	**Chinook Air Ltd.**	Hanger 57, Calgary International Airport	T2P 2G3 038-21870 (403) 277-0711	Victor Houlgate President Bob Merritt Vice-President Rae Audette Vice President Operations	(1) DH125 Jet (2) Piper Navajo (1) Lear 25B Jet (2) Piper Aztec (1) Lear 35 Jet (on order) (1) Beaver (15) others (School Aircraft)	4	Executive Jet Charter, Air Ambulance	Aviation School, Springbank, Alberta
39—	**Coast Air**	P.O. Box 2226, Ketchikan, Alaska	99901 (907) 225-6118	Bill Clapp President/Gen. Mgr. Art Hack Ass't Mgr. Pam Morrison Head Dispatcher/ reservationist	(2) Grumman G21A Goose (3) de Havilland Beaver DHC-2 (2) Cessna 180	4	Charter, COD; Agents - Trans Provincial Airlines (scheduled Prince Rupert - KTN)	Craig, Klawouk, Hadabury, Alaska
40—	**Columbia Airlines Limited**	Box 1565: Prince George, B.C.	963-7034; 963-7831	W.I. Hall General Manager A.T. Mudryil Administrator E. Harrison Base Manager	(1) Grumann American TR2 (3) Cessna 150 (1) Cessna 180 (wheels & skiis) (1) Beaver DHC 2 (Floats) (1) Cessna 172 (1) Beaver DHC-2 (Wheel Skiis) (1) Apagche PA23 (1) Beech 18 on Floats	4	Aerial Photography, Aircraft Rental & Training. Reconnaissance. Recreational Flying, Advertising, Aerial Inspection	St. James B.C.
41—	**Contact Airways Ltd.**	Box 5175, Fort McMurray, Alberta	T9H 3G2 (403) 743-2391 24 hours	Jack Bergeron President Al Furneaux Vice-President Graeme Milne Director	(1) Navajo PA 31 (1) Cessna 337 (3) Aztec PA23-250 (1) Dornier DO 28B (3) Cessna 185	4	Wildlife and Enviromental Studies Charters	None
42—	**Cross Canada Flights Ltd**	P.O. Box 827 RR5 Ottawa, Ont.	K1G 3N3 Tel. 613-521-2666	Evan G. Jones President T. Manne Sect. Tres. P. Peden	(5) Cessna 150 (4) Cessna 172 (1) Cessna 180 (1) Cessna 421 (1) Piper Twin (1) Commancar (1) Beaver (1) Cessna 182	4	Aircraft Modification and overhaul	
43—	**Dominon-Pegasus Helicopters Ltd**	P.O. Box 340 King City, Ontario	L0G 1K0 (416) 832-2203	J.R. Plaxton President V. Scheibler Operations Manager A.E. Pokotylo Marketing Manager	(38) Bell 206 Jetrangers (4) SA341 Gazelles (2) Bell 205 (1) Bell 204 (1) Bell 212 1FR (13) Bell 47G4/G4A	4-7APS-7AC 7A Const	Instrument Flight Helicopters	Inuvik (403) 979-3262 Owned by Okanagan Helicopters, Vancouver B.C.
44—	**Don's Safair Flying Service**	Box 93, Kotzebue, Alaska	99752	Donald J. Ferguson Owner, Pilot, Manager Ray E. Ferguson Pilot Carrie M. Ferguson Bookkeeper	(2) Cessna 172 (1) Aero Commander 680-F (1) Cessna 180 (1) Beechcraft Twin C-50 (1) Piper P-28 Comanche (1) Skyservant D0-28	Charter	none	none
45—	**Eru Helicopters**	Box 762, S.E. Cor. Merrill Field Dr., Anchorage, Alaska. U.S.A.		Carl Brandy President	S-64E Sky Crane 10 ton capacity		Charter	
46—	**Eastern Provincial**	Airport, Gander, Nfld	(709) 256-3941	Keith Miller President W.F. Gaudet V.P./Mktg G.P. Primmer General Sales Mgr		1-4		
47—	**Evergreen Helicopters of Alaska Inc.**	P.O. Box 578, Anchorage, Alaska	99510 090-26-470 (907) 277-1671	Delford M. Smith President C.R. Gallagher Vice President R.W. Randall Manager of Administration	(10) Bell 205 A-1 (2) Sikorsky S-61 (5) Hiller 12E (2) Sikorsky S-64E (3) Alouette II (4) de Havilland Twin Otter		On demand passanger and cargo - Fixed and Rotary Wing	

Insert 2

Aircraft for the Explorer:

Where to find them what they'll do where to land them



A first-ever compilation of information on fixed wing and helicopter aircraft available for remote area resource exploration tasks.

Associated Helicopters' Bell aboard the NTCL barge and tug Knut Lang heading out of Inuvik.

Today, aircraft have replaced the dog-team and canoe as the mainstay of remote air transportation for resource development jobs which require getting crews and equipment in and out quickly over Canada's thousands of miles of mountains, forests, and tundra.

The helicopter, with its potential of dropping loads passengers and cargo into thick bush, muskeg, or mountainside, has made enormous strides in the past couple of decades as the personal "cayuse" of the working geologist and geophysicst.

As well as a means of transportation, the aircraft can also mount such survey tools as cameras, mangetometers, or radar, to overview the enormous stretches of our virgin land still only partially explored.

In surveying the field of remote area transportation, **Canadian Petroleum** has provided an information package intended to be a permanent reference source for everyone involved in organizing exploration, drilling, or development activities in Canada's north.

The two main components of the package are a map showing all known airstrips in the regions of Canada above the Arctic Circle, not only those currently operated by the Ministry of Transport, but the over 100 others developed in the past decade of Arctic exploration mainly by Canada's oil and gas exploration teams.

While not all of these strips are currently usable, they provide a basis for today's northern explorer to see what sites for landing strips have already been developed in what areas, and to relate them, via the latitude and longitude references given, to the areas in which he is interested. He can also tell, from the description of the strip, whether it will be adequate, or what further development it would require, to service the activity he is planning.

He can then contact the original developer of the strip as to its history, present condition, and what arrangements he would need to make for its use.

The second part of the package comprises the tables on the reverse of the map, indicating the actual experience by air charter companies, of the performance of the various aircraft and helicopters composing their fleets.

To compile this information, **Canadian Petroleum** circulated questionaires to companies known to be in the aircraft charter business. The great majority of the companies in this field (some 28) participated in this survey. In all, they represent a combined fleet of 168 fixed wing aircraft, single and multi-engine, and 267 helicopters. A complete listing of participating companies, their equipment is given on page 34.

These operators reported the actual speed, payload, range, and fuel capacities and runway requirements of their wide range of operating aircraft, ranging from four engine Hercules to light reconnaissance aircraft. The data has been organized with an eye to actual use. We differentiate, for instance, between helicopter airspeed with internal load and sling load.

The main value of the tables is that they represent an industry composite of experience with actual aircraft in use, rather than a manufacturers' specification based on prototype tests.

To our knowledge, such a body of information on availabilities and capabilities of aircraft for charter in Canada has never been provided in one place in a simple, easy-to-use format.

The information package has been produced in four page fold - out form, so that you can conveniently detach it either for filing or wall display. We hope it will be of use to you.

It is only the first in a series of reference materials for oil and gas explorers, field operating staff, pipeliners, and processors, which **Canadian Petroleum** will be bringing you from time to time.

H.C.M.

Remote Area Landing Strips in Canada's North

A Canadian Petroleum Service Supplement to September 1976 edition.

Map Editor: Herb Spear
Artwork: Wagner/Warren Ltd.,
Map Sponsor: Johnson & Higgins Willis Faber Ltd.

For additional copies Circle Number 340 on the Reader Service Card.

ARCTIC OCEAN

NORTHWEST TERRITORIES

ELLESMERE ISLAND

AXEL HEIBERG ISLAND

ELLEF RINGNESS ISLAND

PRINCE PATRICK ISLAND

MELVILLE ISLAND

BANKS ISLAND

VICTORIA ISLAND

BATHURST ISLAND

DEVON ISLAND

SOMERSET ISLAND

PRINCE OF WALES ISLAND

BYLOT ISLAND

BORDEN PENINSULA

Landing Strip Co-ordinates

	NAME	LOCATION	ELEV.	RUNWAY HEADING	RUNWAY DIMENSIONS	DEVELOPER
1	ABLE CREEK	73° 25' N 120° 05' W	433	093-273	5500 x 50	PAN
2	ALERT	82° 31' N 62° 17' W	95	048-228	5500 x 200	*MOT
3	ALLISON RIVER	75° 12' N 99° 25' W	680	035-215	5000 x 200	SUN
4	AMAGUK	69° 36'30" N 130° 58' W	SL.	030-210	5000 x 150	ELF
5	APOLLO	75° 33' N 111° 52' W	607	068-248	7500 x 200	PAN
6	MUND RINGNESS	78° 19' N 96° 16'30" W	210	176-356	5000 x 150	PAN
7	BAR HARBOUR	74° 17' N 123° 54'30" W	160	126-306	5000 x 200	PAN
8	BENT HORN	76° 19'30" N 104° 06' W	100	088-268	5000 x 200	PAN
9	BIG RIVER RIVER	72° 24' N 122° 35' W	331	127-307	5200 x 200	
10	BORDEN IS. 110° 55' W	78° 33' N	100	030-210	6000 x 170	PAN
11	BJORNE PENINSULA	77° 26' N 85° 48' W	45	159-339	5000 x 150	PAN
12	BROCK ISLAND	77° 51' N 114° 08' W	45	159-339	5050 x 200	PAN
13	BROUGHTEN ISLAND	67° 33' N 64° 02' W	20	049-229	3500 x 100	*MOT
14	BYRON BAY	68° 45' N 109° 04' W	302	058-238	4500 x 100	*MOT
15	CAMBRIDGE BAY	69° 06' N 105° 08' W	90	127-307	5000 x 150	MOT
16	CAPE DYER	66: 36' N 61° 35' W	1288	020-200	5000 x 150	*MOT
17	CAPE FLEETWOOD	76° 32'30" N 103° 34' W	10	092-272	5000 x 200	PANARCTIC
18	CAPE HOOPER	68° 28' N 66° 50' W	68	102-282	3000 x 100	MOT
19	CAPE ISACHSEN	79° 17' N 105° 18' W	10	168-348	6100 x 250	PAN
20	CAPE NOREM	77° 27' N 110° 55' W	100	140-320	6600 x 150	ELF
21	CAPE OBRIEN	77° 29' N 95° 23' W	SL.	090-270	5000 x 150	SUN
22	CAPE PARRY	70° 10' N 124° 42' W	57	037-217	5000 x 150	*MOT
23	CAPE YOUNG	68° 56' N 116° 56' W	52	126-306	4660 x 150	*MOT
24	CASTEL BAY	74° 07' N 120° 50' W	494	142-322	5300 x 200	PAN
25	CHAD CREEK	76° 26'32" N 109° 59'32" W	162	148-328	5000 x 200	PAN
26	CLINTON POINT	69° 35' N 120° 44' W	45	161-341	4500 x 100	*MOT
27	CORNWALLIS	75° 09' N 94° 45' W	625	256-076	5500 x 150	PAN
28	CROOKED LAKE	72° 35' N 98° 15' W	200	105-285	5000 x 150	KERR MAGE
29	DEPOT POINT	79° 24' N 86° 07' W	350	038-218	5000 x 200	PAN
30	DEWAR LAKES	68° 37' N 71° 07 W	504	023-203	4000 x 100	MOT
31	DOME CROCKER	80° 06' N 98° 57' W	10	154-334	5000 x 200	DOME
32	DOME SUTHERLAND	77° 44'30" N 102° 11'30" W	100	098-278	5000 x 200	DOME
33	DOME WALLIS	77° 53' N 102° 22' W	20	012-192	5000 x 200	DOME
34	DRAKE POINT	76° 28' N 108° 40' W	150	030-210	5000 x 200	PANARCTIC
35	DRAKE THREE	76° 23' N 108° 16' W	10	115-295	5000 x 200	PANARCTIC
36	DUMBELL	78° 27' N 99° 58' W	150	175-355	5000 x 200	PAN ARCTIC
37	DUNDAS PENINSULA	74° 39' N 113° 23' W	789	107-287	5400 x 200	PANARCTIC
38	DYER BAY	76° 08' N 121° 49' W	80	098-278	6000 x 200	PANARCTIC
39	EAST AMUND	78° 19' N 95° 10' W	20	143-323 158-338	5300 x 200 5100 x 160	PHEONIX
40	ELDRIGE BAY	75° 59' N 109° 31' W	20	011-191	5200 x 200	PAN
41	EMERALD ISLAND	76° 44' N 113° 40' W	17	142-322	5000 x 200	PB OIL & GAS
42	EUREKA	79° 59' N 85° 49' W	256	108-288	5200 x 200	MOT
43	FOSHEIM	79° 39' N 84° 47' W	2350	005-185	6000 x 200	PANARCTIC
44	FREEMANS COVE	75° 06' N 97° 53' W	50	173-353	5300 x 200	SUN
45	GARNIER BAY	73° 41' N 90° 37' W	1218	080-260	3500 x 100	PANARCTIC
46	GLADMAN POINT	68° 40' N 97° 48' W	46	138-318	4700 x 100	*MOT
47	GRAHAM ISLAND	77° 20' N 90° 51' W	80	055-235	5000 x 200	PAN
48	GRIFFEN INLET	72° 02' N 91° 57' W	780	036-216	6300 x 200	I.O.L.
49	HALFMOON BAY	75° 54' N 101° 30' W	700	040-220	5000 x 200	PAN
50	HALL BEACH	68° 47' N 81° 15' W	26	124-304	5000 x 150	*MOT
51	HECLA	76° 22' N 110° 21' W	10	052-232	5400 x 200	PAN
52	HELICOPTER BAY	78° 42' N 100° 58' W	140	050-230	5700 x 200	PAN
53	HOLMAN ISLAND	70° 44' N 117° 40' W	20	105-285	3000 x 150	CO-OP
54	HOODOO RIVER	78° 15' N 99° 48' W	60	072-252	5000 x 200	I.O.L.
55	INTREPID BAY	76° 56' N 118° 15' W	239	040-220	5800 x 200	PAN
56	INUVIK	68° 18' N 133° 29' W	223	040-220	6000 x 150	MOT
57	ISACHSEN	78° 47' N 103° 33' W	198	048-228	4800 x 150	*MOT
58	JAMESON BAY	76° 33' N 116° 53' W	40	150 - 330	5000 x 200	BP OTG
59	JENNY LIND	68° 39' N 101° 44' W	60	099-279	4500 x 100	*MOT
60	JOHNSON POINT	72° 40' N 118° 31' W	30	054-234	5500 x 200	ELF
61	KING CHRISTIAN ISLAND	77° 45' N 101° 02' W	100	009-189	5400 x 150	SUN
62	KING POINT	75° 30' N 108° 50' W	45	150-330	5800 x 200	TEXACO
63	KIMAKUK	69° 36' N 140° 11' W	24	090-270	3500 x 100	*MOT
64	KRISTOFFER BAY	78° 16' N 102° 27' W	SL.	042-222	5000 x 200	PAN
65	LADY FRANKLIN	68° 29' N 113° 13' W	52	089-269	4500 x 100	MOT
66	LONG POINT	76° 11' N 112° 35' W	79	092-272	6000 x 200	PANARCTIC
67	LONGSTUFF BLUFF	68° 50' N 75° 17' W	47	142-322	4000 x 100	MOT
68	LOUISE	78° 47' N 103° 22' W	10	199-019	5800 x 200	PAN
69	MALLOCH DOME	78° 13' N 101° 03' W	40	171-351	6000 x 200	PAN
70	MACKER INLET	68° 21' N 85° 45' W	114	072-252	3800 x 100	*MOT
71	MEIGHAN ISLAND	80° 02' N 100° 00' W	SL.	112-292	5000 x 200	PAN
72	MIDDLE FIORD	79° 55' N 95° 08' W	662	123-303	5500 x 200	DRILL ARCTIC
73	MOKKO FIORD	79° 03' N 87° 15' W	SL.	017-197	6745 x 200	PAN
74	MOULD BAY	76° 14' N 119° 20' W	40	092-272	5400 x 200	*MOT
75	NANUK	73° 05' N 123° 23' W	450	105-285	5000 x 150	ELF
76	NICHOLSON PENINSULA	69° 57' N 128° 54' W	SL.	142-322	3550 x 100	MOT
77	NOICE PENINSULA	78° 17' N 104° 16' W	45	175-355	5100 x 200	PAN ARCTIC
78	OKSE BAY	77° 06' N 88° 25' W	10	048-228	5000 x 200	PANARCTIC
79	PAT BAY	77° 26' N 105° 27' W	134	166-346	5000 x 200	PANARCTIC
80	PEDDER	75° 34' N 118° 52' W	10	132-312	5000 x 200	PANARCTIC
81	PELLY BAY	68° 26' N 89° 36' W	318	156-336	3500 x 100	MOT
82	PELLY MISSION	68° 31' N 89° 48' W	100	048-150	5000 x 150	CO-OP
83	POLLUX	79° 10' N 104° 59' W	175	179-359	5000 x 200	PAN
84	PRINCE OF WALES	73° 35'40" N 98° 23' W	190 190	132-312 132-312	5200 x 200 5200 x 200	PAN PAN
85	PYM POINT	76° 24' N 104° 191' W	20	060-240	5000 x 200	PAN
86	RAT STRIP	64° 06'18" N 134° 30' 58" W	25	073-253	7000 x 200	PAN
87	REA POINT	75° 22' N 105° 44' W	50	153-333	6300 x 200	PANARCTIC
88	RESOLUTE BAY	74° 43' N 94° 57' W	220	167-347 104-284	6500 x 150 4000 - 150	MOT MOT
89	ROMULUS LAKE	79° 52' N 84° 34' W	475	172-352	5000 x 200	PAN
90	RUSSELL ISLAND	73° 53° N 99° 13' W	500	135-315	5000 x 200	SUN OIL
91	SACHS HARBOUR	72° 00' N 125° 16' W	281	084-264	4000 x 150	MOT
92	SANDY POINT	76° 25' N 115° 18' W	75	090-270	5000 x 150	PANARCTIC
93	SATELLITE BAY	77° 17' N 116° 57' W	50	137-317	5200 x 200	BP O.G.
94	SEA OTTER	72° 31' N 125° 12' W	SL.	115 - 295	5600 x 250	PAN
95	SHADOW "J"	76° 58' N 118° 45' W	250	165-345	5200 x 200	PAN
96	SHEPHERD BAY	68° 48' N 93° 25' W	139	027-207	4500 x 100	*MOT
97	SHEPHERD BAY	76° 05' N 108° 30' W	40	090-270	5000 x 200	PANARCTIC
98	SHINGLE POINT	68° 56' N 137° 14' W	123	130 - 310	3780 x 100	*MOT
99	SKY BATTLE BAY	77° 14' N 105° 06' W	100	100 x 280	5400 x 200	SUNOIL
100	SOUTH AMUND	77° 49' N 96° 55' W	10	135-315	6000 x 25	PAN
101	SOUTH SABINE	75° 25' N 109° 59' W	525	148-328	5000 x 200	PAN
102	SPENCE BAY	69° 32' N 93° 31' W	SL.	040-220	5000 x 150	CO-OP
103	THOR ISLAND	78° 08' N 103° 15' W	170	141-321	5000 x 200	PANARCTIC
104	TUKTOYAKTUK	69° 26' N 133° 02' W	15	126-306	3522 x 100	MOT
105	TWO CRATERS	70° 20' N 92° 15' W	SL.	042-222	5200 x 200	I.O.L.
106	UPLUK	69° 20' N 135° 21' W	SL.	090-270	5000 x 200	PAN
107	VANIER ISLAND	76° 08' N 104° 02' W	565	071-251	5300 x 200	BP O.G.
108	VICTORIA	72° 44' N 117° 20' W	680	015-195	5200 x 200	MURPHY OIL
109	WILKINS STRAIT	77° 58' N 111° 15' W	60	148-328	5000 x 150	ELF
110	WINTER HARBOUR	74° 48' N 110° 30' W	75	360 - 180	1800 x 100	BAWDEN DRILLING
111	WEST AMUND	78° 23' N 97° 54' W	56	023-263	5000 x 150	PANARCTIC
112	YOUNG BAY	72° 36' N 97° 06' W	10	023-203	6000 x 200	PAN
113	YOUNG INLET	75° 20' N 98° 42' W	700	155-335	5400x 200	SUN
114	ZUES	75° 46'30" N 113° 37' W	132	095-275	5000 x 200	PAN

NOTE

There are or have been airstrips at these locations.

This information is a guide only & there is no suggestion that all or any of these are useable without close inspection.

* Prior permission is required from DND - unsupported activities only.

Fixed Wing Data

AIRCRAFT TYPE	NORMAL CRUISE SPEED M.P.H.	MAXIMUM PAYLOAD 100 MILE MISSION (200 mi. ret.)	MAXIMUM PAYLOAD 500 MILE MISSION (1000 mi. ret.)	MAX. ENDURANCE HOURS	PASS SEATS	FUEL ** IMP. GALLONS CAPACITY	FUEL ** IMP. GALLONS CONSUMPTION	MINIMUM RUNWAY LENGTH	UNDER CARRIAGE W- Wheels S -Skiis F - Floats	ENGINES T. TURBINE R. RECIP. J -JET
Lockheed Hercules	340	52,000 lbs.	52,000 lbs.	12	N/A	8,000	600 per hr.	5,000'	W	4 T
Lockheed Electra	380	26,000 lbs.	26,000 lbs.	8	70 - 94	5,400	600 per hr.	5,000'	W	4 T
Boeing 727	520	42,500	42,500 lbs.	7	118	6,000	800 per hr.	6,000'	W	3J
Boeing 737	480	30,000 lbs.	30,000 lbs.	6	117	4,000	600 per hr.	5,000'	W	2J
Boeing 707	545	70,000 lbs.	63,000 lbs.	15	182	19,864	1,279 per hr.	5,000'	W	4 J
YS-11	260	11,500 lbs.	6,000 lbs.	5	46	1,560	275 per hr.	3,600'	W	2 T
HS 748	260	11,000 lbs.	7,000 lbs	6	48	1,400	230 per hr.	4,000'	W	2 T
F-27	280	11,000 lbs.	7,000 lbs.	5	40	1,100	200 per hr.	4,000'	W	2 T
DC-6	250	26,000 lbs.	17,000 lbs.	14	88	4,600	320 per hr.	5,000'	W	4 R
DC-3	160	7,000 lbs.	4,000 lbs.	7	28	670	85 per hr.	3,500'	WS	2 R
Bristol Freighter	155	10,500 lbs.	5,500 lbs.	11	44	1,172	110 per hr.	3,000	W	2 R
Twin/Otter	165	3000-3800 lbs.	*	4½	17-20	315 - 360	65-75 per hr.	1,200'	WSF	2 T
Single Otter	115	2,300 lbs.		6	10	178	28 per hr.	2,000'	WSF	1 R
Turbo Beaver	140	1,400 lbs.		5	8	155	30 per hr.	1,500'	WSF	1 T
Std. Beaver	120	1,200 lbs.		5	6	115	21 per hr.	1,500'	WSF	1 R
MU-2	300	1,600 lbs.		4½	6	305	66 per hr.	2,800'	W	2 T
Piper Navajo	200	1,200 lbs.	600 lbs.	4	7-8	158	36 per hr.	1,500'	W	2 R
Piper Cheyenne	280	2,400 lbs.	1,200 lbs.	5½	6	320	55 per hr.	2,500'	W	2 T
Piper Aztec	185	1,200 lbs.	600 lbs.	5	5	117	22 per hr.	1,500'	W	2 R
Piper Seneca II	190	900 lbs.		4	6	80	20 per hr.	2,000'	W	2 R
Cessna 402	210	1,700 lbs.	800 lbs.	5½	8-9	175	30 per hr.	2,500'	W	2 R
Cessna 310 L	200	1,100 lbs.	*	4½	5	116	24 per hr.	2,000'	W	2 R
Cessna 337	165	1,100		6	5	133	20 per hr.	2,000'	W	2 R
Cessna 185	150	650 lbs.		4	3	65	15 per hr.	1,000'	WSF	1 R
Travel Air	180	800 lbs.		5	4	85	15 per hr.	2,500'	W	2 R
King Air	265	2,195 lbs.	600 lbs.	5	8	304	60 per hr.	1,500'	W	2 T
Queen Air										
Lear Jet 35	525	3,000 lbs.	2,100 lbs.	6	8	775	120 per hr.	5,000'	W	2 J
DeHavilland 125 1A	360	1,100 lbs.	1,100 lbs.	3½	6	1,025	275 per hr.	5,000'	W	2 J

—* Range under 1000 mi. **Jet & Turbine operators use JP 1 and 4. Piston engines use 100&130 Avgas.

Aircraft Data Charts:

These charts are presented as a general information guide only. The data was compiled from information provided by many aircraft operators in Canada.

There can be a wide variation in different models of the same type of aircraft and those noted do not necessarily coincide with the manufacturer's specification.

Compensation for temperature altitude must also be made.

Endurance rather than range in miles has been used because of the great difference that exist if IFR (Instrumental Flight) rather than VRF (Visual Flight) rules are being followed, what weather conditions and alternatives exist.

For detailed information contact the appropriate operator listed.

On aircraft that can be equipped with floats, a reduction of 10% to 15% in cruising speed is averaged.

Helicopter Data

AIRCRAFT TYPE	CRUISE SPEED M.P.H.	GROSS WEIGHT lbs.	OPERATIONAL EMPTY WEIGHT INCLUDES PILOT AND 20 min RESERVE FUEL	MAXIMUM LIFT lbs.	MAXIMUM PAYLOAD 25 mile Mission (50 mi. return)	MAXIMUM PAYLOAD 50 mile Mission (100 mi. return)	PASS SEATS	FUEL IMP. GALLONS ** CAPACITY	FUEL IMP. GALLONS ** CONSUMPTION PER HOUR	ENDURANCE HOURS NO RESERVE	ENGINES T. TURBINE R. RECIP. S. SUPER-charged	HOVERING CEILING Gross Weight ISA IGE	HOVERING CEILING Gross Weight ISA OGE
AREOSPATIALE													
ALOUETTE II	95	3,650	2,300	1,350	1.238	1,100	4	125	31	4	1T	5.000'	2,700'
LAMA	110	5,070	2,640	2,430	2,250	2,080	4	125	45	2.6	1T	9,000'	5,000'
ALOUETTE III	100	4,850	2,800	2,050	1,875	1,700	6	125	45	2.7	1T	7,000'	5,000'
BAZALLE	150	3,970	2,400	1,570	1,470	1,370	4	125	35	3	1T	9,000'	7,000'
PUMA	160	16,300	8,950	7,350	6,950	6,550	20	340/496	140	2.4/3.5	2T	7,500'	6,200'
BELL 206L	130	4,000	2,513	1,487	1,400	1,310	6	81 gal	28 gph	2.6	1T	6,400 ft.	1,200 ft
47G4A	75	2950	2,100	850	770	690	2	46	15	2.8	1R	4,500'	3,000'
47G3B-1/2	75	2,950	2,200	750	670	590	2	46	15	2.8	1RS	8,000	6,000'
47 AJ2	85	2,850	2,150	700	640	580	3	39	15	2.4	1RS		
206B	120	3,350	1,950	1,400	1320	1240	4	62	22	2.5	1T	7,000'	—
204B	110	9,500	5,200	4,000	3,500	3,300	10	200	65-70	2.7	1T	5,000	—
205A	120	10,500	5,770	4,730	4475	4,200	14	180	75	2.3	1T	6,500	700
212	125	11,200	6,400	4,800	4,520	4,250	14	180	85-90	2	2T	11,000'	—
214	160	16,000	8,000	8,000	7,630	7,260	15	180	130	1.2	1T	8,400'	SL
BOEING													
105C	140	5,070	3,050	2,020	1,890	1,760	4	127	45	2.8	2T	7,800'	5,000
HILLER													
12E *	80	3,100	1,900	1,000	945	885	2	38	16	2.1	1R	6,000	4,000
FH1100	100	2750	1,870	880	780	680	4	56	19	2.5	1T	8,500'	5,500'
HUGHES 500C	140	2,550	1,320	1,230	1,174	1,118	4	51	20	2.5	1T	—	—
SIKORSKY													
S55T	90	7,200	4,600	2,600	2,400	2,000	11	140	43	3	1T	7,500	5,500'
S58	110	12,700	8,730	3,860	3,800	3,265	14	220	75-80	2.7	1R	32,000	1,000'
S58T	115	13,000	8,000	5,000	4,700	4,400	16	235	85	2.3	2T	10,000'	8,000'
S61N	140	19,000	12,600	6,400	6,000	5,650	28-32	535	130	4.1	2T	8,700	3,800'
S61L	140	19,000	11,000	8,000	7,475	7,050	28 - 32	535	130	4.1	2T	—	—
S64E	100	42,000	22,000	20,000	18,500	17,000	—	1,120	335	3	2T	—	—

*higher gross weight possible if sling load check with operators.

Some helicopters have a higher gross weight if load is on the sling. Data on this chart lists the greatest permissable. Exception is Hughes 500C where an additional 450 lbs is approved on sling operation.

Helicopters equipped for IFR (Instrumental Flight) have additional equipment and systems on board reducing the payload. Check with operators of Bell 212, Sikorski S 58T and S 61 series for details.

Use of floats usually increased empty weight and reduces airspeed and on some models reduces the gross weight allowable, e.g. Bell 206.

Payloads over mission distances on chart is calculated at normal cruise speed. Sling load speeds vary between 50 - 90 mph, so payload over the mission distances would be reduced by the extra fuel required for the additional flying time necessary.

This data has been compiled from charter operators in Canada. There are often variations between models of the same machine due to special equipment on board for different operating environments. The figures are averages and do not necessarily coincide with manufacture specification.

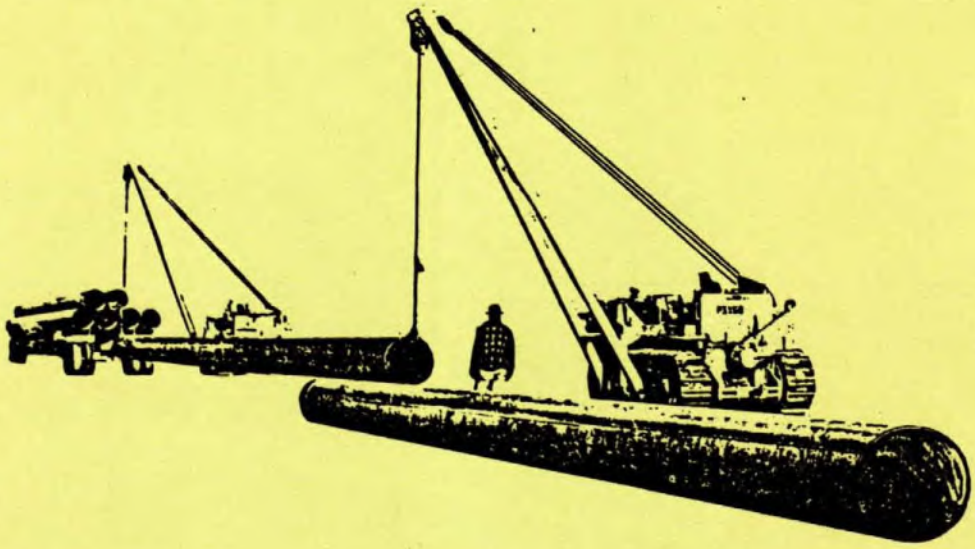
Remote area aircraft charter operators

Fixed wing

Co. Name	Address	Operating Base(s)	Region Served	(No.) & Type of A/C Op.
Arctic Air	Box 5570, Stn. L Edmonton, Alta.	Fort Nelson, B.C.	Northwest Canada	(1) DC-3, (2) Aztec PA23, (1) Navajo PA 31, (1) Cessna 185. Total: 5
Athabasca Airways	Box 100, Prince Albert Sask.	Prince Albert, Lac La Ronge, Buffalo Narrows, Sask.	Northern Sask. Northern Man. NWT	Twin Otters, Single Otters, DHC Beavers. Total: 26
Chinook Air	Hangar 57, Calgary Int'l Airport	Calgary	Northern Canada	(2) Piper Aztec, (1) Beech B90 (1) Learjet 35 (1) DeHavilland 125. Total: 5
Contact Airways	Box 5175, For McMurray, Alta.	Fort McMurray, Alta.	Northern & Central Canada	(3) C-185, (3) Aztec, (1) Navajo, (1) Dornier, (1) C-337. (1) DC-3. Total: 10
Gateway Aviation	Municipal Airport, Edmonton	Calgary, Edmonton, Norman Wells, NWT, Inuvik, Fort Smith, Yellowknife.	Western & Arctic Canada	(1) Cessna 185, (1) DH Beaver, (1) Aztec, (1) DH Otter, Total: 4
International Jet Air (NW Div)	PO Box 380, Stn. B., Calgary, Alt.	Calgary, Edmonton	Western Canada and NWT	(1) Lockheed Electra L-188
Ken Borek Air Ltd.	1249 - 38th Ave N.E. Calgary, Alta.	Resolute Bay, Inuvik, Frobisher Bal (all NWT) & Dawson Creek, B.C.	B.C., Arctic Islands	(6) DHC - 6 Twin Otter, (2) DHC-2 Beaver, (3) DC-3 Douglas, (1) Cessna 150, (1) Cessna 172, (1) Cessna 185. Total: 13
Norcanair	Box 850, Prince Albert, Sask.	Prince Albert, La Ronge, Uranium City, Stony Rapids, Sask.	Prairie Provs. & NWT	Bristol Freighter, F-27, DC-3 Single Otter, Std. Beaver, Piper Aztec, Cessna 185. Total: 30
Nordair	Box 4000, Dorval, Que.	Montreal, Toronto, Frobisher Bay	Arctic & Eastern Canada	(1) DC8 61CF, (6) B737 (3) Lockheed 188 Electras, (3) FH227. Total: 13
Northwest Territorial Airways	Box 9000, Northwest Hanger, Yellowknife, N.W.T.	Yellowknife	Western Canada & NWT	(2) DC-6 A/B. (4) DC-3 Pax-Freighter, (1) DC-3 Executive. Total: 7.
Pacific Western Airlines	9th Floor, Edmonton Inn Tower, Edmonton	Edmonton, Stanstead, England	Canada & Europe	(4) Hercules L100-20, (2) B727, (12) B737, (2) CV640. Total: 20
Transair	Winnipeg Int'l Airport, Winnipeg, Man	Winnipeg, Toronto	Manitoba, NWT, Yukon, NW Ontario (to Toronto)	(1) Boeing 707/351C, (3) Boeing 737/200C, (2) Fokker F-28, (2) Nihon YS-11, (3) DHC Twin Otter, (2) HS Argosy. Total: 16.
Transnorth Turbo Air	Box 4338 Whitehorse, Y.T.	Whitehorse, Mayo, Ross River, Dawson Y.T.	Yukon, NWT, Northern B.C.	(1) DHC6, (1) C402, (1) PA34 200 T, (2) B95, (1) DHC3. (2) Turbo Beaver, (1) DHC2. (1) C185E. Total: 10.
Wardair X Canada	Box 610, Yellowknife, NWT	Yellowknife	Northern Canada	(1) Bristol Freighter, (6) Twin Otter, (1) MU-2. Total: 8.

Helicopters

Co. Name	Address	Operating Base(s)	Region Served	(No.) & Type of A/C Op.
Agro Copter Enterprises	3926 - 4th St. N.W. Calgary, Alberta	Red Deer, Springbank Whitecourt	Alberta, NWT, YUKON B.C.	(3) Hiller 12E (Bell & Hughes machines leased as required).
Alpine Helicopters	Bldg. #13, McCall Field, Calgary	Calgary, Hinton, Alta., Kelowna, Burns Lake, McKenzie, B.C., Norman Wells, NWT	All of Canada	(6) Bell G3B-1, (6) Bell 206B, (2) S55T (1) Bell 204B. Total: 15.
Associated Helicopters	#10 Hangar, Industrial Airport Edmonton, or 309 - 603 - 7th Ave. S.W. Calgary, Alta.	Edmonton, Ft. McMurray, Norman Wells, Inuvik	Western & Northern Canada	Bell 212, Bell 204, Bell 206. Toal: 24.
Athabasca	——— see under "Fixed Wing" Listing ———			Bell 206B, S55T, Bel 47. Total: 12.
Canwest Aviation	#4 Hangar, Int'l Airport, Calgary	Calgary & Hay River, NWT	Western & Northern Canada	(3) Allouette III Gazelle
Highland Helicopters	424 Agar Dr. Vancouver Int'l Airport, B.C.	Vancouver, Chetwynd Nelson, Quesnel, Williams Lake, Kamloops Castlegar, Agassiz, B.C.	Western Canada	(3) Bell 206 A, (9) Bell 206 B. Total: 12.
Klondike Helicopters	#3 Hangar, Calgary Int'l Airport, Calgary	Calgary, Resolute Bay, NWT	All of Canada	(2) Bell 205A-1, (2) Sikorsky S-58,)10) Bell 206 B, (2) FH - 1100, (2) Bell G-2. Total: 18.
Nahanni Helicopters	4193-104 St. Delta, B.C.	Vancouver, Fort Simpson NWT	Canada	(2) Bell 205A-1 (1) Hughes 500 C (1) S-58, (1) S-55T. Total: 5
Okanagan Helicopters	493 Agar Dr., Int'l Airport South, Vancouver, B.C.	21 Western Canada bases, five summer bases in north, one eastern base plus 3 subsidiaries*** and bases in Bangkok, Los Angeles, Surinam, and Singapore	Canada and abroad	(81) Bell 206 Jet Ranger, (15) Alouette II, (5) Bell 205A, (7) Bell 212 (IFR) (6) Sikorsky S58T, (1) S-55 (1) S61L (IFR). (4) S61N (IFR). Total: 130.
Shirley Helicopters	#3 Hangar, Municipal Airport Edmonton, Alta.	Edmonton, Inuvik	Canada	(2) Bell46GZ, (2) Bell 47 G3B1. (2) Hiller UH12E (2) Bell 206A, (6) Bell 206B, (5) Gazelle S4341G, (2) Alouette II, (2) Hughes 500C. Total: 23.
Transair	——— see under "fixed wing" listing ———			(11) Bell 206
United Helicopters	206-2003 McKnight Blvd. N.E., Calgary	Calgary, Vancouver, Fort Smith, Norman Wells, NWT	Northern & Western Canada	(7) Hughes 500C, (5) Bell 47. Total: 12.
Vancouver Is. Helicopters	Box 2095 Sidney, B.C.	Victoria, Port Hardy, Prince Rupert, Stewart, Terrace, B.C.	B.C. and Yukon Terr.	(6) Bell 206 B, (5) Bell 47. Total: 11.



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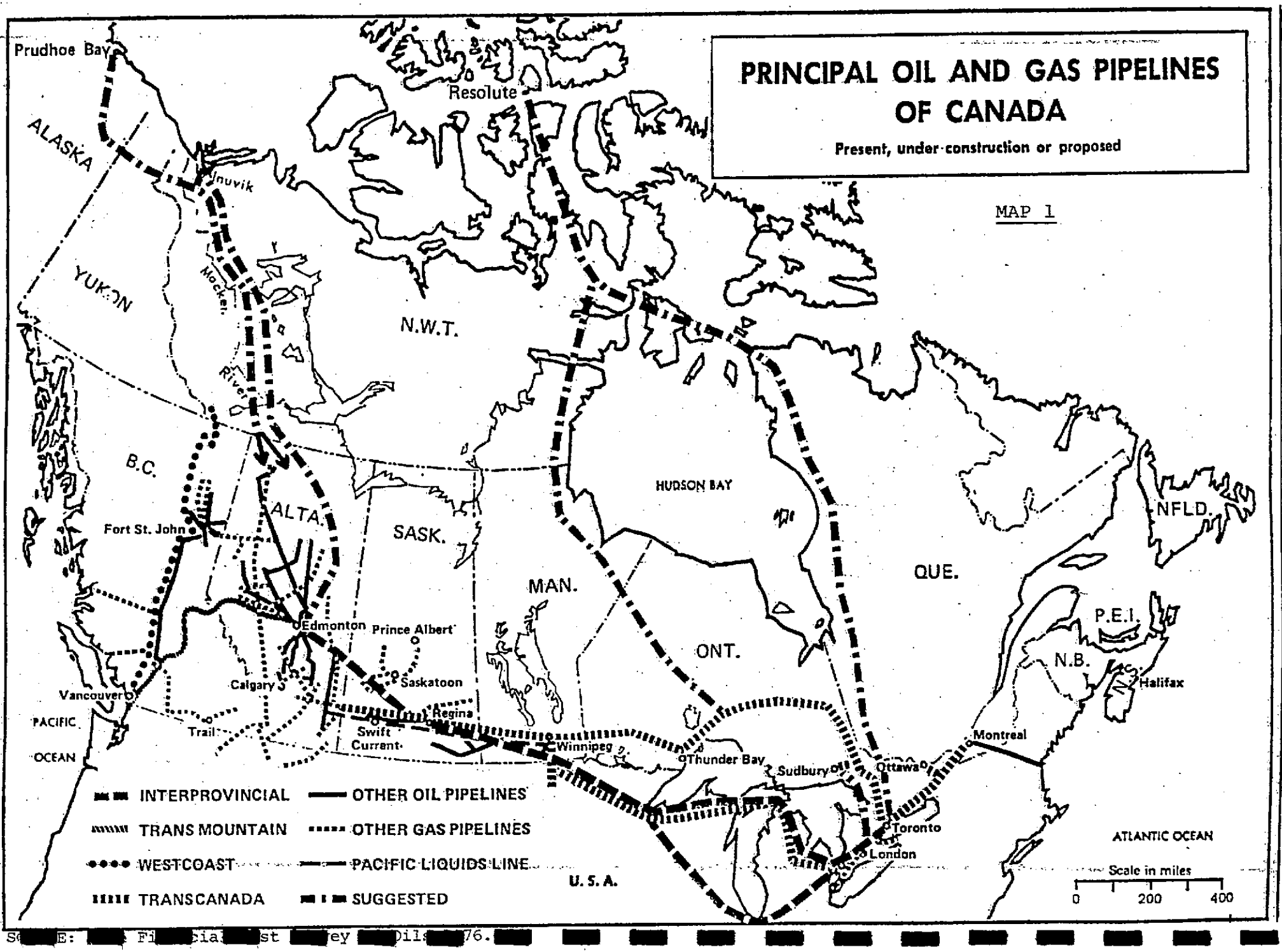
I PIPELINE TRANSPORTATION

The transportation of oil and gas and their products forms a link between the various stages of crude oil and natural gas exploration and production, refining and marketing. In view of the vast distances between traditional production and consuming areas and the need to localize refining for more efficient production, there has developed, in Canada, a large transportation network for petroleum and its products. In general, the economics of petroleum transportation are such that for the long hauls between sources of supply and the major marketing areas, pipelines are used while distribution of products is by truck and rail. However, there are three petroleum product pipelines in Ontario and Quebec. Natural gas moves through field gathering pipelines to main trunk pipelines for long-distance transmission and in distribution lines to points of consumption.

Map I illustrates the principal oil and gas pipelines of Canada including graphically those presently built, and those either under construction or proposed. Enclosed at the back of this section are two additional maps that contain a much greater degree of detail. The first map prepared by the Bank of Montreal is an "Oil and Gas Map of Canada". This map illustrates the oil and gas fields, the location of refineries (proposed and in place), the location of gas processing



SOURCE: Financial Post Survey Oils 1976.

plants and the various pipelines in Western Canada (gas, oil and product lines). Included in the insert on this map is the total 1975 production for both oil and gas for all of Canada broken down by province.

The second map enclosed at the back is prepared by Oilweek and is the "1976-77 Pipeline Wall Map". This map displays for most of North America, the existing and proposed pipelines in Canada, the upper U.S.A., Alaska and the Northwest Territories. Also included are the names of the pipeline sections, the pipe size, and product carried.

II PIPELINE STRUCTURE

The Canadian oil and gas pipeline network had a combined system mileage of 92,436 miles at December 31, 1974. Petroleum pipelines contributed 19,425 miles and natural gas 73,011 miles. The dominance of the natural gas system can be explained partly by the extensive network of distribution lines providing commercial and residential users with consumable product. These distribution lines account for over 39,000 miles.

To adequately describe each system, we will deal with them separately. This is not to imply that pipeline transportation is used exclusively for large quantity movements of oil and gas, nor that only oil and gas move by pipeline. Several coal slurry pipelines are presently in operation, and producers of various commodities are more currently giving consideration to pipeline transport for their products. Such developments and applications will be discussed later in this report.

Table 1 is self explanatory, giving a summary of pipeline movements in the years 1973-74-75 by commodity groups. As well as total volume data, this table shows the point of receipt and disposition of the various products.

A. Oil Pipelines

The Canadian oil pipeline network consists mainly of the trunk lines of the Interprovincial Pipe Line Company

TABLE 1
SUMMARY OF PIPE LINE MOVEMENTS, BY COMMODITY GROUPS

	TOTAL		
	1973	1974	1975
	- in barrels -		
RECEIPTS			
Crude oil and equivalent:			
Net receipts:			
From fields	619,390,863	585,607,577	495,822,492
From other carriers	8,196,681	10,155,194	9,056,455
From processing plants	90,863,780	83,579,862	78,598,733
Imports	169,225,700	151,630,033	161,059,191
From other	302,382	12,088,152	2,269,430
Total net receipts	887,979,408	843,060,818	746,806,401
Transfers	1,910,179,871	1,814,073,038	1,519,788,307
Total gross receipts	2,798,159,279	2,657,133,856	2,266,594,708
LPG's and products:			
From processing plants	54,692,470	56,063,907	59,805,398
From bulk plants and refineries	109,940,270	124,579,558	134,122,885
Imports	-	991,794	2,865,240
From other carriers	5,915,109	5,063,693	10,526,140
From other	-	984,899	1,007,050
Total net receipts	170,547,849	187,683,851	208,326,713
Transfers	130,265,255	141,638,741	186,612,048
Total gross receipts	300,813,104	329,322,592	394,938,761
Total net receipts - All commodities	1,058,527,257	1,030,744,669	995,133,114
DISPOSITION			
Crude oil and equivalent:			
Net deliveries:			
To refineries	462,942,553	484,537,832	477,086,417
To other carriers	919,318	659,442	899,940
To bulk plants and terminals	512,079	1,049,043	7,751,722
For export	413,930,687	330,399,526	255,210,786
To other	8,646,546	25,693,981	5,430,245
Total net deliveries	886,951,183	842,339,824	746,379,110
Transfers	1,910,179,871	1,814,073,038	1,519,788,307
Total gross deliveries	2,797,131,054	2,656,412,862	2,266,167,417
Pipe line fuel and use	221,183	164,035	88,806
Line losses and unaccounted for	346,380	875,235	504,880
Inventory changes	460,662	-318,276	-166,395
Total disposition	2,798,159,279	2,657,133,856	2,266,594,708
LPG's and products:			
To refineries	8,149,007	8,961,292	16,700,166
To other carriers	-	-	-
To bulk plants and terminals	133,855,347	140,935,390	148,185,337
For export	9,873,774	19,617,118	23,334,924
To other	18,292,027	16,950,595	18,580,613
Total net deliveries	170,170,155	186,464,395	206,801,040
Transfers	130,265,255	141,638,741	186,612,048
Total gross deliveries	300,435,410	328,103,136	393,413,088
Pipe line fuel and use	12,727	1,365	1,365
Line losses and unaccounted for	-25,670	261,002	105,812
Inventory changes	390,637	957,089	1,418,496
Total disposition	300,813,104	329,322,592	394,938,761
Total net deliveries - All commodities	1,057,121,338	1,028,804,219	953,180,150

SOURCE: Statistics Canada, Oil Pipeline Transport, 1975, Catalogue: 55-201.

and the Trans Mountain Oil Pipe Line Company. The bulk of domestic crude oil used by Canadian refineries moves through these systems. The Interprovincial system carries crude oil east from Edmonton to Montreal, while the Trans Mountain system sends crude west from Edmonton to Vancouver. A number of gathering pipeline systems in Alberta, Saskatchewan, Manitoba and British Columbia deliver crude oil to the trunk lines.

Map 2 illustrates the main oil pipeline corridors including carrying capacity in barrels per day as well as where they connect to major refining centres with their refinery capacity. Table 2 further breaks these lines down by company, type of pipeline capacity and distance.

The Interprovincial Pipe Line Company system is Canada's longest oil pipeline. It includes a wholly-owned subsidiary in the United States, Lakehead Pipe Line Company Incorporated, and has a right-of-way length of 2,747 miles including a 95 mile lateral to Buffalo, New York. The Lakehead system follows two routes: one via the Straits of Mackinac and the other via Chicago. The pipeline is capable of delivering 30 grades of crude oil and the main trunk of the system between Edmonton and Superior has a capacity in excess of one million barrels of crude oil per day.

The Trans Mountain Oil Pipe Line Company system extends from Edmonton to Vancouver via Jasper and has a right-of-way length of 780 miles, including a section of 57 miles

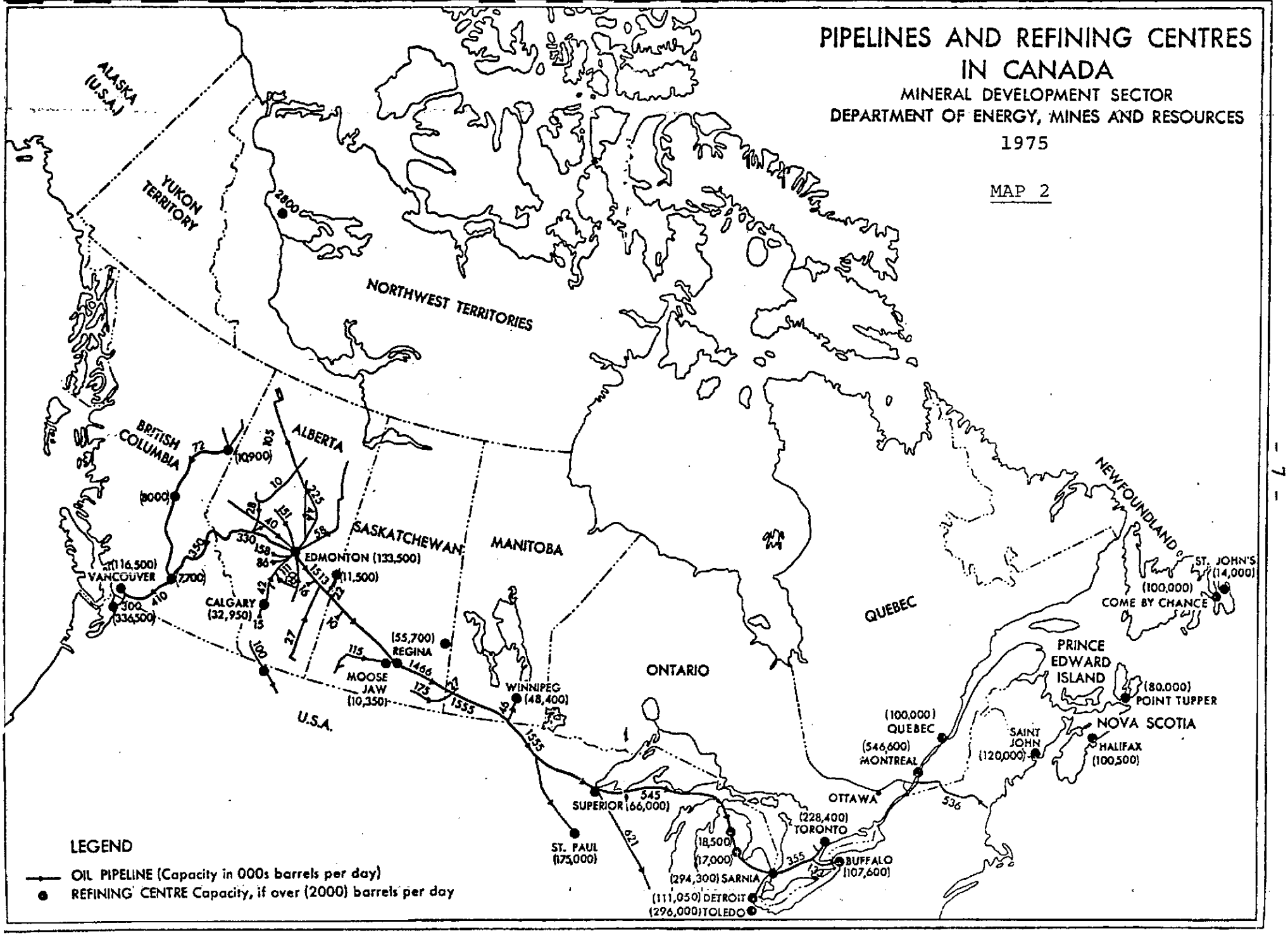

PIPELINES AND REFINING CENTRES IN CANADA
MINERAL DEVELOPMENT SECTOR
DEPARTMENT OF ENERGY, MINES AND RESOURCES
1975
MAP 2
ALASKA (U.S.A.)
YUKON TERRITORY
NORTHWEST TERRITORIES
2800
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NEWFOUNDLAND
PRINCE EDWARD ISLAND
NOVA SCOTIA
U.S.A.
VANCOUVER (116,500)
(8000)
(10900)
EDMONTON (133,500)
CALGARY (32,950)
(11,500)
(7700)
300 (336,500)
REGINA (55,700)
MOOSE JAW (10,350)
WINNIPEG (48,400)
SUPERIOR (66,000)
ST. PAUL (175,000)
(294,300) SARNIA
(111,050) DETROIT
(296,000) TOLEDO
(228,400) TORONTO
BUFFALO (107,600)
OTTAWA
(546,600) MONTREAL
(100,000) QUEBEC
SAINT JOHN (120,000)
HALIFAX (100,500)
(80,000) POINT TUPPER
ST. JOHN'S (14,000)
(100,000) COME BY CHANCE
LEGEND
OIL PIPELINE (Capacity in 000s barrels per day)
REFINING CENTRE Capacity, if over (2000) barrels per day

TABLE 2

OIL PIPE LINE RATED CAPACITY & MILEAGE

@ December 31, 1974

	GATHERING LINE	TRUNK LINE		PRODUCT LINE		TOTAL MILES
	MILES	RATED CAPACITY (bbls/day)	MILES	RATED CAPACITY (bbls/day)	MILES	
Alberta Products Pipe Line Ltd.	---	---	---	41,000	196.7	196.7
Aurora Pipe Line Co.	---	56,000	1.0	---	---	1.0
B.P. Canada Ltd.	23.0	8,300	55.0	---	---	78.0
Blueberry Taylor Pipelines	28.7	23,500	65.0	---	---	93.7
Bow River Pipe Lines Ltd.	160.0	44,000	228.0	---	---	388.0
Cochin Pipe Lines Ltd.	---	40,000	94.0	---	---	94.0
Dome Petroleum Ltd.	90.0	62,000	321.3	50,000	92.9	414.2
Federated Pipe Lines Ltd.	316.2	450,000	350.5	---	---	666.7
Gibson Petroleum Ltd.	69.2	---	---	---	---	69.2
Great Canadian Oil Sands Ltd.	---	68,000	266.9	---	---	266.9
Green River Exploration Co.	---	---	---	33,600	44.4	44.4
Gulf Oil Canada Ltd.	256.8	151,600	392.8	---	---	649.6
Home Oil Co. Ltd. (Cremona Division)	143.9	94,900	164.6	---	---	308.5
Hudson's Bay Oil & Gas Co. Ltd.; Rangeland Pipe Line Div.	459.0	331,500	450.0	---	---	909.0
Husky Pipe Line Ltd.	137.5	67,000	216.0	---	---	353.5
Imperial Oil Enterprises Ltd.						
- Que. So. Shore Pipe Line	---	---	---	33,000	63.6	---
- Sarnia Products Pipe Line	---	---	---	100,000	243.0	306.6
The Imperial Pipe Line Co. Ltd.	160.0	180,000	31.0	---	---	191.0
Interprovincial Pipe Line Co.	---	5,070,000	2,990.2	---	---	2,990.2
Key Pipe Line Co. Ltd.	19.1	---	---	---	---	19.1
Montreal Pipe Line Co. Ltd.	---	550,000	212.6	---	---	212.6
Nisku Products Pipe Line Co. Ltd.	---	---	---	36,000	108.8	108.8
Peace River Oil Pipe Line Co. Ltd.	163.6	428,000	820.1	---	---	983.7
Pembina Pipe Line Ltd.	686.8	185,000	115.7	---	---	802.5
Petroleum Transmission Co.	---	---	---	75,700	579.6	579.6
Producers Pipe Lines Ltd.	1,014.6	---	---	---	---	1,014.6
Rain Bow Pipe Line Co. Ltd.	211.3	247,000	478.2	---	---	589.5
Rimbey Pipe Line Co. Ltd.	---	37,000	65.5	---	---	65.5
South Saskatchewan Pipe Line Co.	227.9	72,975	160.7	---	---	388.6
Sun-Canadian Pipe Line Co. Ltd.	---	---	---	100,000	400.0	400.0
Sun Pipe Line Co.	---	---	---	18,000	2.2	2.2
Tenneco Oil & Minerals Ltd.	12.2	---	---	---	---	12.2
Texaco Exploration Canada Ltd.	40.8	232,000	141.8	---	---	182.6
Trans Mountain Oil Pipe Line Co.	4.6	780,000	825.0	---	---	829.6
Trans-Northern Pipe Line Co.	---	---	---	972,000	484.0	484.0
Trans-Prairie Pipe Lines Ltd.	618.2	---	---	---	---	618.2
Wascana Pipe Line Ltd.	---	55,000	107.5	---	---	107.5
Westcoast Petroleum Ltd.	---	72,000	505.0	---	---	505.0
Westspur Pipe Line Co.	108.8	371,000	189.6	---	---	298.4
Winnipeg Pipe Line Co. Ltd.	---	54,000	76.0	---	---	76.0
Yukon Pipelines Ltd.	---	---	---	3,300	90.5	90.5
TOTAL	4952.2	---	9324.0	---	2305.7	---
Total Gathering Pipe Lines of Producing Companies	2843.5		---		---	
GRAND TOTAL	7795.7		9324.0		2305.7	19,425.4

SOURCE: Statistics Canada, Oil Pipe Line Transport, 1974; CAT: 55-201

in the United States which belongs to a wholly-owned subsidiary. The capacity of the pipeline is approximately 400,000 barrels of crude oil per day.

The refineries in the Montreal area are served by a 236-mile pipeline, a joint pipeline system of the Montreal Pipeline Company in Canada and its wholly-owned subsidiary in the United States, Portland Pipeline Corporation. This line takes delivery of tanker-borne crude from Venezuela, the Middle East and Africa at Portland, Maine. The capacity of the system is approximately half a million barrels of crude oil per day. Two petroleum product pipelines operate between Sarnia and Toronto and between Montreal and Toronto.

Total oil pipeline mileage in Canada as of the end of 1974 was 19,425 miles of which 7,796 miles represented gathering lines, 9,324 miles represented trunk lines and 2,306 miles represented product lines. Table 3 gives these oil pipeline mileages by province.

B. Natural Gas Pipelines

The authorization of large-volume gas removal from Alberta and British Columbia, beginning in the mid-1950's, led to the development of the first major gas transmission pipelines in Canada. These major lines provided the framework for the development of the extensive pipeline network which now serves most centres of population from Vancouver to

TABLE 3

OIL PIPELINE MILEAGE BY PROVINCE

December 1974

LINE TYPE	YUKON	BRITISH COLUMBIA	ALBERTA	SASKATCHEWAN	MANITOBA	ONTARIO	QUEBEC	CANADA
Gathering		525.8	4904.1	2149.1	198.9	17.8		7795.7
Trunk		1090.9	4822.3	2033.2	731.5	443.5	212.6	9324.0
Product	55.5	35.0	351.0	384.0	194.5	1143.1	142.5	2305.6
TOTAL	55.5	1651.7	10077.4	4556.3	1124.9	1604.4	355.1	19425.3

Source: Statistics Canada, Oil Pipe Line Transport, 1974; Cat: 55-201

Montreal, and transports gas for export at seven points along the Canada-United States border.

Natural gas pipelines are usually categorized under three headings -- gathering lines, trunk or transmission lines and distribution lines. The gathering lines are those that take gas from the producing wells or separators to the field gate or some other delivery point. Transmission lines are normally the large-diameter trunk lines that take gas from gathering lines and transport it to the distributors for delivery to the ultimate consumer.

In total, there were an estimated 73,012 miles of gas pipeline in operation at the end of 1974, of which 8,613 miles were gathering, 25,107 miles were transmission (trunk) and 39,292 miles were distribution. Table 4 provides a breakdown of these pipeline types by size of pipe for each province.

Unlike oil pipeline companies, which are common carriers that transport oil for a fixed charge, gas pipeline companies, with few exceptions, own the gas that is transported. The principal exception is the Alberta Gas Trunk Line Company which delivers virtually all of the gas exported from Alberta to the provincial boundary where main transmission companies accept delivery. The Alberta Gas Trunk Line system has 4,030 miles of pipeline.

There are two trunk lines serving Canada. One is the TransCanada Pipe Lines Limited system and the other is

TABLE 4

NATURAL GAS PIPE LINE MILEAGE

December 31, 1974

	Total Natural Gas Industries (1)						
	Outside Diameter of Pipe in Inches						
	0-2.9	3-5.9	6-8.9	9-12.9	13-20.9	21 and over	Total
GATHERING:							
New Brunswick	6.4	-	-	-	-	-	6.4
Quebec	-	0.5	0.8	-	-	-	1.3
Ontario	766.9	225.0	88.4	18.9	21.1	13.8	1134.1
Manitoba	-	-	-	-	-	-	-
Saskatchewan	56.1	299.8	285.9	71.3	32.8	4.8	750.7
Alberta	541.8	2517.9	1810.1	461.3	255.3	21.2	5607.6
British Columbia, Yukon, Northwest Territories	59.2	270.5	217.1	198.2	137.2	196.4	1078.6
Canada	1430.4	3313.3	2402.3	749.7	446.4	270.4	8612.9
TRANSMISSION:							
New Brunswick	-	4.2	0.2	9.0	-	-	13.4
Quebec	-	-	65.4	23.2	59.1	-	147.7
Ontario	70.5	398.0	978.1	880.4	525.1	2888.7	5740.8
Manitoba	40.8	311.0	128.2	88.7	12.5	1063.4	1644.6
Saskatchewan	1682.8	1230.7	739.0	879.4	568.0	1493.0	6532.9
Alberta	544.5	1094.8	1584.7	1298.9	1674.5	1789.8	7987.2
British Columbia	121.5	360.3	384.9	647.8	13.0	1513.0	3040.5
Canada	2400.1	3399.0	3880.5	3827.4	2852.2	8747.9	25,107.1
DISTRIBUTION:							
New Brunswick	6.3	14.0	11.0	1.0	-	-	32.3
Quebec	335.8	452.2	629.1	157.2	136.9	6.7	1717.9
Ontario	8950.4	4498.7	2787.3	570.7	141.5	73.9	17,022.5
Manitoba	1365.0	278.5	140.4	17.6	23.2	-	1824.7
Saskatchewan	2035.5	568.1	208.4	28.1	17.9	-	2868.0
Alberta	8417.5	1148.4	502.1	137.3	61.9	0.2	10,267.4
British Columbia	3721.9	1168.2	407.2	110.4	100.0	51.0	5588.8
Canada	24832.4	8128.1	4685.5	1032.3	481.4	131.8	38,291.5
TOTAL	28662.9	14840.8	10968.3	5609.4	3780.0	9150.1	73,011.5

(1) Includes pipe line mileage of producing, gathering, processing and utility companies. Some size categories include estimated figures.

Source: Statistics Canada, Gas Utilities, 1974, Catalogue: 57-205

that of Westcoast Transmission Company Limited.

The TransCanada pipeline, originating at the Alberta border near Burstall, Saskatchewan follows a route eastward to a point near Winnipeg, where it branches into two lines. One continues eastward into Ontario and to Montreal. There is a branch line to the United States border at Niagara Falls. The second line from Winnipeg goes south to the United States boundary at Emerson where it connects with the Great Lakes Gas Transmission Company Limited system, which is jointly owned by TransCanada and an American company. This pipeline follows a route south of Lake Superior through the Straits of Mackinac and east of Lake Michigan to re-enter Canada at Sarnia, Ontario. The TransCanada system is Canada's longest pipeline, having a total length of 4,878 miles including loop lines.

The supply of gas for the Westcoast comes mainly from fields in northeastern British Columbia but significant quantities are gathered in northwestern Alberta. The main line from Fort St. John runs in a southerly direction to Vancouver and to the United States border at Sumas, B.C. An extension to its system from the Fort St. John area to the Fort Nelson area permits the pipeline system to pick up gas from the main areas stretching from Dawson Creek to the Kotcho Lake area, northeast of Fort Nelson. Total pipeline in the Westcoast system is nearly 2,000 miles and the rated

capacity is 1.3 billion cubic feet per day.

Although the Alberta Natural Gas pipeline is only 107 miles long, it forms a vital link in a major gas export scheme which carries Canadian gas as far south as California. The pipeline connects with Alberta Gas Trunk pipeline at Crowsnest Pass on the Alberta border and extends across southeastern British Columbia to the international border near Kingsgate where it meets the Pacific Gas Transmission Company system, which transports the gas in the United States.

There are many other natural gas pipelines operating in Canada. Some systems are devoted exclusively to gathering gas in producing fields, while others receive gas from the main transmission lines and distribute it to gas customers. Several large systems combine elements of gathering, transmission and distribution. Among the larger systems, Inland Natural Gas Co. Ltd. distributes gas to a number of centres in interior and southern British Columbia. In west-central British Columbia, the Pacific Northern Gas Ltd. pipeline services communities and industries along a 435-mile route between the Westcoast main line at Prince George and the Pacific Coast city of Prince Rupert; and Northwest Utilities Limited, serve markets in central and southern Alberta with a total of more than 8,200 miles of pipeline. The Saskatchewan Power Corporation delivers all gas sold in Saskatchewan; the 6,483-mile system transports and distributes gas to most of

the populated areas of Saskatchewan. Northern and Central Gas Company Limited has probably the most geographically widespread distribution system in Canada, as it distributes gas to industries and communities adjacent to the TransCanada system from Winnipeg as far east as the Montreal area.

Two large utility companies serve the highly populated and industrialized areas of southern Ontario. The Consumers' Gas Company operates in the Toronto area, the Niagara peninsula and eastern Ontario while the Union Gas Company of Canada Limited, serves the southwestern corner of the province. Northern and Central Gas Company Limited serves Winnipeg (through its subsidiary Greater Winnipeg Gas Company), Northern Ontario, and Montreal (through its subsidiary Gaz Métropolitain, Inc.). These and other systems make up the growing network of gas pipelines which serves domestic, commercial and industrial customers in all provinces except Prince Edward Island, Nova Scotia and Newfoundland.

C. Capital and Operating Expenditures

Statistics Canada reported that capital expenditures for the total petroleum and natural gas industries increased 17.6 percent from $943,601,000 in 1973 to $1,109,759,000 in 1974. Exploratory and development drilling accounted for 56.0 percent of the total capital expenditures in 1974; natural gas processing plants 12.5 percent; tangible well and lease equipment 14.4 percent; other buildings and machinery 2.1

percent; secondary recovery facilities 2.3 percent; pipe lines and related equipment 1.4 percent. Land sites purchased for construction purposes and land acquisition (includes permit fees, bonuses, legal fees, and filing fees) accounted for 11.3 percent of the total capital expenditures, but are not considered as part of "Capital formation" for National Accounts purposes.

Alberta and the northern parts of Canada accounted for the bulk of capital expenditure (about 80 percent).

III FUTURE PROSPECTS

A. Pipelines From the North

As recently as 1973-74, many Canadians doubted Canada needed natural gas from the Mackenzie River Delta in the 1980's, or even the 1990's. The pipeline proposed by Canadian Arctic Gas Pipeline Ltd. - a consortium including Canada's major oil and gas producers and largest gas distributors - seemed designed more to satisfy U.S. needs for gas from the Delta and Alaska. Since then Canadian utilities have been warning of shortages here in Canada before 1980.

The National Energy Board has before it a number of applications from competing companies to transport gas from the north. One proposal from the Delta is Canadian Arctic Gas and Foothills Pipe Lines Ltd., headed by Alberta Gas Trunk Line Co. Ltd., which is proposing an "all-Canadian" route.

The Arctic Gas pipeline - the more ambitious project - is planned to carry gas from the Delta area to Canadian consumers and U.S. gas from the North Slope of Alaska to U.S. consumers through a single transportation system. Arctic Gas argues that moving gas from both sources through one pipeline will make Delta gas available earlier at less cost and will generate substantial foreign exchange earnings for Canada for transporting U.S. gas.

At present, the big hurdle facing Canadian Arctic Gas Pipeline is the raising of about $6 billion to pay the initial cost of what will be a $7.5 billion project. The pipeline cannot be financed without tentative government approval, and the official go-ahead cannot be given without a financing agreement.

As with every capital project, the cost of a gas line down from the Mackenzie River Delta has soared and the ballpark figures now used are twice those mentioned five years ago.

Slowly but surely the lengthening list of natural gas discovery wells in the Arctic Islands is pushing total indicated reserves closer to the threshold quantities required for the construction of the proposed Polar Gas pipeline.

One of the several pipeline options being considered by the Polar Gas group would require a proven gas reserve of about 19 tcf. This would be a 42-inch diameter, 2,200-mile line to Winnipeg moving a minimum of 2 billion cubic feet daily. There is a strong belief now among petroleum experts that the required reserves for such a line are there and will be proven within the next 12 to 18 months.

Expert witnesses for Canadian Arctic Gas Pipeline Ltd. of Toronto have told the National Energy Board's northern natural gas pipeline hearings that a 48-inch-diameter, larger-than-necessary connecting pipeline to Alaska from the Mackenzie

River Delta is justified, especially if Alaskan deliveries have to be increased in the future.

According to their calculations, a 48-inch pipeline to carry 2.25 billion cubic feet of gas a day would be only 4 percent more expensive than a 42-inch line.

But if Alaskan deliveries have to be increased to 4.5 billion cubic feet a day - that is, the currently proposed maximum throughput for the mainline along the Mackenzie River Valley carrying both Alaskan and Mackenzie Delta gas - then the 48-inch pipeline would be 21 percent cheaper than a 42-inch one, which would have to be expanded by looping.

The consortium reiterated its contention that building the overcapacity into the Alaskan lateral would also minimize environmental disturbances and damage later if Alaskan deliveries are increased.

Foothills Pipe Lines Ltd. of Calgary, proponent of an all-Canadian pipeline, has criticized this policy, complaining that the costs of the overcapacity to serve only U.S. customers would have to be shared by Canadian consumers.

In anticipation of a pipeline decision, a number of companies are making plans to supply pipe and pipeline equipment. There have been rumours of federal pipeline guidelines specifying that a certain proportion of pipe must be manufactured in Canada, but so far, none have been published. Possible suppliers are the IPSCO plant in Regina, which has geared up

its capability to produce pipe to the required specifications, and the new STELCO plant in Welland, which could use a combination of German made steel plating and Canadian plate from STELCO's Hamilton plant.

Most of the additional machinery - compressors, trenchers, excavators and so on - will probably come from the United States, and possibly some from the U.S.S.R. or Japan where Caterpillar has a plant.

There has also been talk of an oil terminal at Prince Rupert with a pipeline to Edmonton which would connect with the Interprovincial Pipe Line systems and the U.S. mid-west refineries.

A group of companies has agreed to carry out an investigation of the project, including marine, environmental, engineering, financial, socio-economic and other matters to support the preparation and filing of an application to the National Energy Board.

British Columbia's concern over tanker traffic into Puget Sound with the concurrent risk of a major oil spill in those treacherous waters would be somewhat relieved by this proposal as a reduction in the traffic would occur by a shift of tanker traffic to Prince Rupert. The deep waters off Prince Rupert presumably would be less risky for larger tanker movements.

B. Future Developments in Oil and Gas Transportation

Perhaps the most spectacular chapter in the history of oil and gas production in Canada lies ahead in the potential of the Arctic archipelago. In view of the distance between these areas and major world markets as well as the severe climatic conditions and fragile nature of the ecology in the Arctic, careful consideration must be given to the most efficient methods of transportation. Proposals for northern transportation have included methods by sea (surface tanker and submarine), land (pipeline and railway), and air (fixed wing aircraft and dirigible).

The method most favoured for the transportation of natural gas from the Arctic remains the pipeline. Two systems are being considered: one from the Mackenzie Delta area via the Mackenzie Valley to southern markets, and the other south from Cornwallis Island down along either the western or eastern side of Hudson Bay to southern markets. All of the groups of companies investigating the feasibility of building gas pipelines from the Canadian Arctic are concerned with solving the ecological and environmental problems of constructing and operating pipelines in permafrost areas.

The Canadian Arctic Gas Study Limited (CAGSL) is seeking to bring Mackenzie Delta and Alaska gas to market and has already spent about $50 million in economic, engineering and environmental studies related to its proposed line. The

results of the studies showed that chilled natural gas could be transported by pipelines without damage to the permafrost.

While existing technology appears sufficient for the building of the Mackenzie Valley gas pipeline, in the case of a line from the eastern Arctic the problems posed by underwater branch crossings requires further research such as the Polar Gas Project which is researching the feasibility of constructing a 48-inch pipeline to deliver natural gas from the Arctic Islands. The major engineering challenge of this project is the laying of about 540 miles of pipeline underwater between the Arctic Islands at depths as great as 900 feet. An additional problem is the danger of ice scour from the bottom of large ice packs which gouge the ocean floors even at considerable depths. By the end of 1974 research had verified the facts that, although construction of the line would be difficult, technologically it would be possible.

C. Future Developments in Other Commodity Transportation

Over the years there has been a growing but low-key interest in a new form of pipelining - for transportation of solids. For example, recognition of the benefits of coal slurry pipeline technology has surged in recent years as the need for increased coal transportation becomes evident.

The Soviets have been working on compressed air pipelines and have made tests transporting people, gravel, garbage and sand. In fact, a pipeline 2.2 km long and one meter in

diameter has been operating quite successfully for some years carrying sand and aggregate to building sites.

Last year, in Mexico, ore began flowing under 28 miles of Mexican countryside through the world's first iron concentrate gravity flow slurry pipeline. Each year the 8-inch pipeline will transport 1.8 million tons of magnetite from the minesite near Minatitlan, Colima, to the pelletizer plant in Tapeixtles, near the seaport of Maxzanillo, Mexico.

The only other iron slurry pipeline in the world is the 53 mile Savage River pipeline in Tasmania, that has been in operation since 1967.

In the United States, at least five multimillion dollar coal slurry pipelines may be edging closer to a construction start as the chances improve for passage of legislation granting the routes eminent domain. But one committee member who strongly opposes the measure says one of the proposed systems, a planned $750 million, 1,030 mile slurry line from Wyoming to Arkansas, would siphon off too much of Wyoming's water.

In Canada, feasibility studies are under way for a pipeline, more than 800 miles long, that would carry coal in a water slurry from the Rocky Mountain area to the Pacific Northwest.

The world's largest capacity long-distance slurry pipeline built in Brazil, connecting a major new iron ore mine to pelletizing and ocean shipping facilities 403 km (250 mi)

away. The project is known as SAMARCO Mineracao. The mine is located about 300 km (190 mi) north of Rio.

Initial iron ore concentrate production is scheduled to be about 7,000,000 metric tons (7,700,000 tons) per year, which will be transported in slurry form to ocean shipping facilities through a 20-in.-dia (50-cm) carbon steel pipeline. The concentrator is scheduled to begin operations in 1977.

The SAMARCO pipeline will have more than twice the capacity of the Black Mesa Coal Slurry line in Arizona, which is 440 km (270 mi) long, and nearly five times the capacity of the Savage River Iron Ore Slurry line in Tasmania. Black Mesa is the longest slurry line and Savage River is the largest capacity iron ore slurry line.

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OILWEEK

PIPELINE WALL MAP

1976-77

EXISTING OIL LINES
OIL LINES PROPOSED OR UNDER CONSTRUCTION
PRODUCT LINES
EXISTING GAS LINES
GAS LINES PROPOSED OR UNDER CONSTRUCTION
LPG LINES
LPG LINES PROPOSED

PRUDHOE BAY
FAIRBANKS
VALDEZ
INUVIK
WHITEHORSE
POINTED MOUNTAIN
FORT NELSON
FORT ST. JOHN
PRINCE RUPERT
KITIMAT
PRINCE GEORGE
EDMONTON
CALGARY
EMPRESS
VANCOUVER
SEATTLE
PORTLAND
SASKATOON
REGINA
GREAT FALLS
BISMARK
WINNIPEG
THUNDER BAY
DULUTH
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CHICAGO
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C A N A D A

U. S. A.

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OIL PIPELINE
PROPOSED OIL PIPELINE
GAS PIPELINE
PROPOSED GAS PIPELINE
PRODUCE LINE
OIL FIELD
GAS FIELD
REFINERY
PROPOSED REFINERY
GAS PROCESSING PLANT

SCALE
30 15 0 30 60 90 120
MILES MILES

YUKON TERRITORY
NORTHWEST TERRITORIES
ALBERTA
BRITISH COLUMBIA
SASKATCHEWAN
MANITOBA
WASHINGTON
IDAHO
MONTANA
NORTH DAKOTA
PACIFIC OCEAN
CANADA
UNITED STATES OF AMERICA

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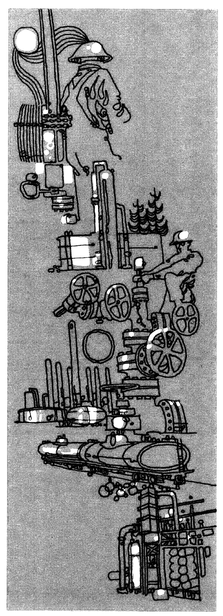

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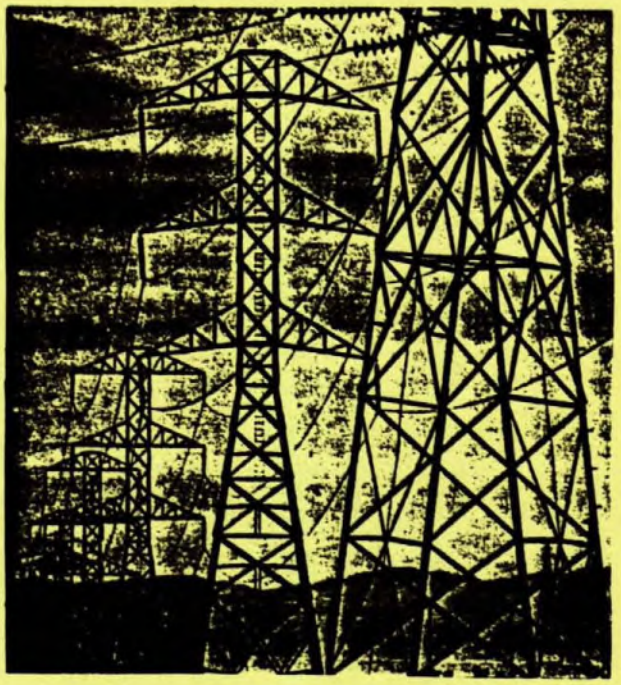
OIL GAS



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ILLUSTRATIONS, cont'd Page

I ELECTRIC POWER IN CANADA

In the past 50 years, electricity and particularly hydro-electricity has played a significant role in meeting Canada's total energy needs. Canadian interest in electricity was first prompted by the country's vast expanse and by the slowness of communications. However, it was not until after the dynamo or generator was developed in 1870 that electricity became commonplace.

Much of the first electricity developed was obtained from fossil-fueled plants located near the points of demand, since transmission of electricity at this time was confined to a radius of a few miles. The first long-distance transmission of electricity in Canada was undertaken in 1897, following the development of the electric transformer. Of course, a rapid expansion in the use of hydro-electric power followed throughout the country as Canada's water resources are widely distributed throughout the country whereas fossil fuels were not.

A real boost in electrical generation came in 1904 when the Canadian Niagara Power Company at Niagara Falls came into operation commencing a significant era of energy interchange between Canada and the U.S.A.

In general, ownership and responsibility for the control and development of water resources in Canada has been

vested in the government of the province in which they are located. The Territories, which are administered by federal statute, are the principal exceptions, however, until 1930 the water resources of the three prairie provinces were also administered by the federal government. Over the years, ownership of the resources has enabled the provincial governments to determine the direction which hydro-electric and thermal-electric power development in their respective provinces would take.

Public ownership of electrical power generation had its start in Ontario in 1903 when manufacturers in many southern Ontario centres became convinced that power generated from hydro-electric sources could be distributed and sold at a much lower cost than the power sold by private companies.

By 1920, the total of installed generating capacity in Canada had grown to about 2,000 MW. Although a few private industries and municipalities chose to produce power for their own use, the desire to capitalize on economies of scale encouraged the development of large generating and distribution networks operated as public utilities. Canada's total installed generating capacity rose to 4,700 MW in 1930, more than double the figure for 1920.

The depression of the early 1930's did not affect electric power development much; however, there was a reduced installation rate from 1935-1939. The outbreak of war in

1939 brought a pressing need for electricity which could not be met by existing capacity.

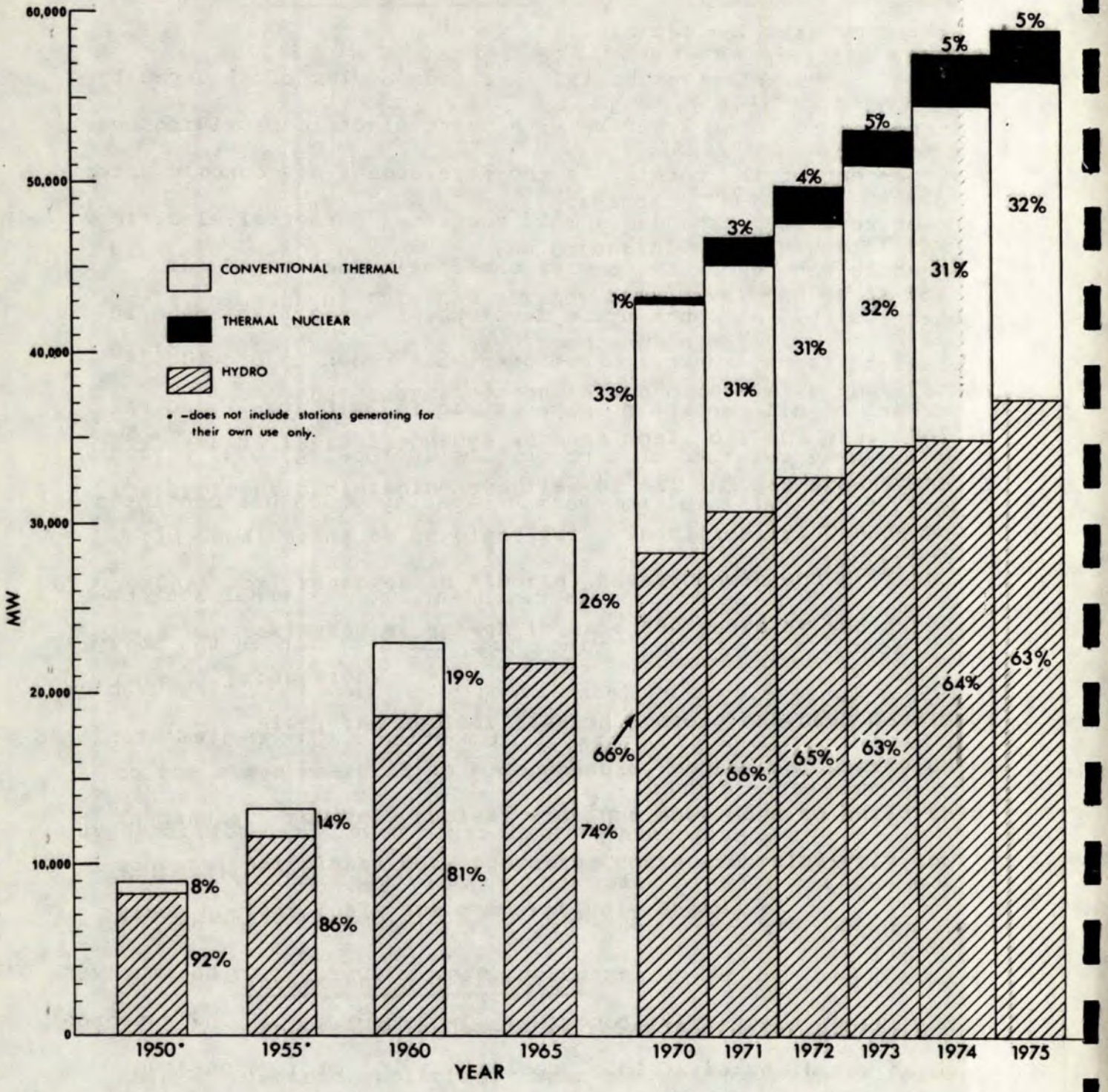
On entering the 1950's Canada's electrical capacity increased to about 9,800 MW with hydro-electric providing over 90 percent of the total. As the development of economic water power resources expanded a much accelerated thermal-electric schedule was necessary to meet the continuing demand for electricity. Although hydro development has set the pace in absolute terms, thermal development has grown to provide 34 percent of all generating capacity in 1970 (Chart 1) and has pretty well retained that proportion increasing to 37 percent in 1975 against total generating capacity which has continued to rise.

Because Ontario is dependent upon external sources for fossil fuels, the province made the decision in the early 1950's to develop a nuclear alternative, thus utilizing uranium, a fuel indigenous to Ontario, and meeting environmental standards to a remarkable degree.

New developments in electric power transmission have played a key role in helping to meet electric energy demands in Canada. As hydro power sites in proximity to demand centres have been used up, transmission methods have had to be improved to make distant sites economical for development. The research which was directed at this problem has led to a successive stepping-up of transmission voltages and has resulted in the

CHART 1

INSTALLED GENERATING CAPACITY IN CANADA 1950-1975



Source: Adapted and inserted from Electric Power in Canada - 1975.

economical transmission of large blocks of power.

Although the growth in Canada's electrical industry since the turn of the century has been outstanding, the prospects for future growth are equally staggering.

In 1970, electrical energy provided about 31 percent of Canada's total energy demand and it has been estimated that by the year 2000, some 50 percent of the projected energy market is expected to be in the form of electrical energy.

The large map inside the back cover shows the main transmission systems and electric power generating stations in Canada as of December 1975. Early hydro power sites had to be close to the main areas of use; but today improved transmission techniques make distant sites economical to develop. As indicated on the large Power Transmission Map at the back, in most provinces, neighbouring electrical systems are being connected to form interlocking grids so that the size of generators can be increased with resultant cost saving. These grids allow major electric utility systems to share facilities and to help each other in the event of a power shortage. Computerized control and communication systems are also being used more extensively to ensure the most effective use of energy sources.

II STRUCTURE OF THE INDUSTRY

To date, Canada's main source of electricity has been hydro power. To produce power, water must fall from one level to another but, most of Canada's water does not have a great enough fall over a short distance. Therefore, Canada has less than 3 percent of the potential hydro power of the world and much of this has already been developed or is too distant from users to be developed economically.

Another source of generating electricity that Canada utilizes is thermal sources such as coal, oil and gas. Unlike the apparent diminishing supplies of oil and gas around the world, coal seems to be plentiful. Specifically, Canada has immense coal reserves in Alberta, Saskatchewan and British Columbia estimated at enough to last 600 years at the current rate of production.

Also, the nuclear fission process has been developed to the stage where it is a dependable, economical energy source in Canada. However, nuclear stations cost more to build than conventional plants but, operating costs are relatively low since nuclear fuels are comparatively cheap.

A. Investment and Financing

The trend in Canada is towards greater public ownership of electric utilities. Over the years provincial governments have taken over investor-owned electric utilities, mainly on the basis that electric power is such an important element

in the industrial development of the province. In all provinces except Ontario and Newfoundland, the major utilities which generate electricity also transmit and distribute it. In Ontario, most distribution is handled by the 353 municipally owned utilities. Investor-owned utilities provide most of the electricity in Alberta and Prince Edward Island. In Alberta, there are two investor owned power utilities and several municipal utilities. However, a central planning body is responsible for coordinating generation and transmission facilities for the province.

TABLE 1

CAPITAL INVESTMENT BY ELECTRIC UTILITIES
(Millions of Dollars)

	CONSTRUCTION					
	GENERATION	TRANSMISSION DISTRIBUTION	OTHER STRUCTURES	SUB TOTAL	MACHINERY EQUIPMENT	TOTAL
1965	397	331	28	756	193	948
1966	468	296	23	786	356	1,142
1967	561	325	29	916	382	1,298
1968	493	332	64	889	443	1,332
1969	478	305	72	856	484	1,340
1970	581	449	28	1,057	554	1,610
1971	572	472	36	1,079	668	1,747
1972	636	449	50	1,135	619	1,754
1973	926	502	71	1,499	695	2,194
1974	976	647	105	1,728	975	2,703
1975(estimated)	-	-	-	2,465	1,436	3,901
1976(estimated)	-	-	-	2,778	1,592	4,370

NOTES: The totals may not correspond with the sum of the elements due to rounding.

SOURCE: Inserted from Electric Power in Canada, 1975.

The electrical supply industry is capital intensive, accounting for nearly 8 percent of total capital investment in Canada in the period 1972 to 1974. In the same period, capital expenditure by the electric utilities was greater than any other sector of the economy except manufacturing, government and housing which account for 15 percent, 13 percent and 20 percent of the total, respectively. Table 1 is self explanatory, breaking down capital investment into operating costs, construction and equipment. The total estimated investment for 1976 is $4,370 million.

Electric utilities in Canada are using an increasing amount of debt to finance their expansion. Whereas their debt: equity ratio was 67:33 in 1960, by 1974 it was 77:23 and showing a steady trend to a higher ratio of debt. The total debt (long term plus short term debt): equity (reserves plus total capital and surplus) ratio is, of course, indicative of conditions in each individual province. In the western provinces, the total debt:equity ratio in 1974 was:

	DEBT	EQUITY
Manitoba	96	4
Saskatchewan	74	26
Alberta	54	46
British Columbia	93	7

B. Canadian Electric Power Capacity

In Canada, electrical energy is derived from private and public utilities, and from industrial establishments. Most of the industrial establishments generate energy for their own use, but some sell energy to others and, in general, they use more energy than they generate.

Of these industrial establishments, 52 percent were in forest products, 18 percent in mining, 12 percent in metals processing, 9 percent in chemicals and 9 percent in other industries. Although industrial establishments accounted for 59 percent of the number of electric generating systems in 1973, they accounted for just 11 percent of the installed capacity and 14 percent of the energy generated.

TABLE 2

INSTALLED GENERATING CAPACITY IN CANADA (MV)

	THERMAL				
YEAR	CONVENTIONAL	NUCLEAR	TOTAL	HYDRO	TOTAL
1920	300	-	300	1,700	2,000
1930	400	-	400	4,300	4,700
1940	500	-	500	6,200	6,700
1950	900	-	900	8,900	9,800
1960	4,392	-	4,342	18,657	23,049
1970	14,283	240	14,523	28,293	42,816
1975	18,982	2,666	21,648	37,090	58,738

SOURCE: Compiled from data in Electric Power in Canada - 1975.

In 1974 the amount of energy generated by private utilities as a percentage of total energy generated was 16 percent, public utilities account for 70 percent and industrial establishments 14 percent.

Table 2 illustrates the growth of generating capacity for selected years.

The following three tables are inserted directly from Electric Power in Canada - 1975. They show:

Table 3 - The breakdown of electric power generating capacity between public and private utilities and industrial establishments.

Table 4 - The breakdown of electric power generating capacity by fuel type.

Table 5 - The breakdown of electric power generating capacity by percentage and type of equipment utilized.

TABLE 3

INSTALLED GENERATING CAPACITY OF UTILITIES AND INDUSTRIAL ESTABLISHMENTS — 1974
(MW)

Province/Territory	UTILITIES							INDUSTRIAL ESTABLISHMENTS		
		Public			Private					
	Total	Hydro	Thermal	Total	Hydro	Thermal	Total	Hydro	Thermal	Total
Newfoundland	6,662	460	370	830	5,682	66	5,748	64	20	84
Prince Edward Island	118	—	7	7	—	111	111	—	—	—
Nova Scotia	1,203	155	958	1,113	—	—	—	5	86	91
New Brunswick	1,333	635	542	1,177	31	1	32	14	110	124
Quebec	14,814	10,496	926	11,422	681	—	681	2,622	88	2,711
Ontario	18,361	6,423	10,780	17,203	332	8	340	253	564	818
Manitoba	2,973	2,475	491	2,966	—	—	—	—	7	7
Saskatchewan	1,774	448	1,176	1,623	107	—	107	12	32	44
Alberta	3,436	—	882	882	718	1,693	2,411	—	143	143
British Columbia	6,625	3,627	1,117	4,744	49	—	49	1,428	404	1,832
Yukon	66	24	25	50	2	7	9	—	8	8
Northwest Territories	114	32	65	97	—	8	8	3	6	9
Canada	57,480	24,775	17,339	42,114	7,601	1,894	9,495	4,403	1,467	5,870

Note: The totals may not correspond with the sum of the elements due to rounding.

TABLE 4

ELECTRIC POWER PLANT CAPACITY IN CANADA — 1975 (MW)

Province	Conventional thermal plant capacity — fired with												
	Coal	Oil	Gas	Coal/ Oil	Coal/ Gas	Coal/ Oil/ Gas	Oil/ Gas	Unspecified Fuel Type*	Total Conv. Thermal	Nuclear	Total Thermal	Hydro	Total
Newfoundland	—	454	—	—	—	—	—	—	454	—	454	6,206	6,660
P.E.I.	—	118	—	—	—	—	—	—	118	—	118	—	118
Nova Scotia	181	443	—	415	—	—	29	—	1,068	—	1,068	160	1,228
New Brunswick	99	520	—	33	—	—	—	—	652	—	652	680	1,332
Quebec	—	713	—	—	—	—	4	10	727	266	993	13,831	14,824
Ontario	7,295	411	410	—	870	—	146	5	9,137	2,400	11,537	7,008	18,545
Manitoba	50	55	—	132	—	237	4	13	491	—	491	2,475	2,966
Saskatchewan	130	17	158	—	582	171	193	—	1,251	—	1,251	567	1,818
Alberta	1,577	257	367	—	66	—	581	—	2,848	—	2,848	718	3,566
British Columbia	—	416	32	—	—	—	1,090	159	1,698	—	1,698	5,353	7,051
Yukon	—	40	—	—	—	—	—	—	40	—	40	56	96
N.W.T.	—	87	—	—	—	—	—	—	87	—	87	35	122
Total by Prov.	9,332	3,532	967	580	1,518	408	2,047	187	18,570	2,666	21,236	37,090	58,326
Plants not listed by Prov.									412	—	412	—	412
Canada Total									18,982	2,666	21,648	37,090	58,738

NOTE: The totals may not correspond with the sum of the elements due to rounding.

*Unspecified fuel type refers to those plants fired with wood refuse, waste heat and black liquor.

TABLE 5

INSTALLED GENERATING CAPACITY AT DECEMBER 31, 1975 (MW)

Province/Territory	Steam		Internal Combustion	Gas Turbine	Total Thermal	Hydro	Total
	Conventional	Nuclear					
Newfoundland and Labrador	355	—	64	36	454	6,206	6,660
Prince Edward Island	70	—	7	41	118	—	118
Nova Scotia	1,012	—	1	55	1,068	160	1,228
New Brunswick	621	—	8	23	652	680	1,331
Quebec	665	266	62	—	993	13,831	14,824
Ontario	8,722	2,400	14	400	11,537	7,008	18,545
Manitoba	447	—	20	24	491	2,475	2,966
Saskatchewan	1,070	—	31	149	1,250	567	1,817
Alberta	2,621	—	36	191	2,848	718	3,567
British Columbia	1,275	—	130	293	1,698	5,353	7,051
Yukon	—	—	40	—	40	56	96
Northwest Territories	1	—	85	2	87	35	122
Provincial Total	16,859	2,666	498	1,213	21,236	37,090	58,326
Total Plants Not Listed by Province	239	—	46	127	412	—	412
Canada Total	17,098	2,666	544	1,340	21,648	37,090	58,738
Net Additions 1975	802	—	10	134	947	311	1,258
Percentage Increase Over 1974	4.9	—	1.9	11.1	4.6	0.8	2.2
Percent of Total Capacity End 1975	29.1	4.5	0.9	2.4	36.9	63.1	100.0

*Battle River Rating Change 4 MW reduction

Insert I from Electric Power in Canada - 1975, is a detailed list of installed generating capacity expansion in Canada listing major additions and proposed plant capacity to the year 1988.

Specifically in Western Canada the current major electric activities and expansions by province are:

Manitoba

During 1975, there were no major generation additions by Manitoba hydro. The total energy generated in the province was 14,812 GWh, 96.8 percent of which was from hydro sources.

Manitoba has an extensive external trade in electricity with net exports to other provinces representing 11 percent of generation and net exports to the United States amounting to 8 percent.

In terms of work in process, work is actively proceeding at the Long Spruce hydro site, the second major development on the lower Nelson River. This is being developed to an ultimate capacity of 980 MW in ten units by 1979, the first two units being scheduled for 1977. Work is also proceeding on the Jenpeg station located in the diversion channel between Lake Winnipeg and the Nelson River comprising six 28 MW low head bulb type units; three units are planned for service in 1976 and the remaining three in 1977.

The next major development will be a 1,100 MW station at Limestone, downstream from Long Spruce tentatively scheduled

INSERT I

INSTALLED GENERATING CAPACITY EXPANSION IN CANADA BY STATION
MAJOR 1974 AND 1975 ADDITIONS AND PROJECTED 1976-1988

Province/Station	Type	Additions in 1974 (MW)	Additions in 1975 (MW)	Proposed Additions (MW)	Proposed Plant Capacity (MW)
Newfoundland					
Grand Falls	H	—	—	16 (1976)	42 5
Churchill Falls	H	4 x 475	—	—	5225
Baie D'Espoir	H	—	—	154 (1977)	613
Stephenville	GT	—	—	50 (1976)	50
Burin	GT	—	—	25 (1976)	25
St. John's	GT	—	—	50 (1976) 70 (1978)*	152.5[1]
Holyrood	S	—	—	150 (1979)*	450
Flowers Cove	GT	—	—	15 (1978)*	15
Unspecified	GT	—	—	15 (1980)	15
Prince Edward Island	—	—			—
Nova Scotia					
Cape Breton	S	—	—	150 (1979) 150 (1981)	300
Tuft's Cove	S	—	—	150 (1976)	350
Victoria Junction	GT	—	30	30 (1976)	60
Dartmouth	GT	—	—	4 x 30 (1976)	120
Wreck Cove	H	—	—	100 (1977) 100 (1978)	200
New Brunswick					
Mactaquac	H	—	—	2 x 110 (1978)	637.8
Coleson Cove	S	—	—	3 x 320 (1976)	960
Dalhousie	S	—	—	200 (1979)	300
Point Lepreau	N	—	—	630 (1980)	630
Quebec					
Manic 3	H	—	—	6 x 197.5 (1976)	1185
Outardes 2	H	—	—	3 x 151.3 (1978)	454
Première Chute	H	—	31.05		124
La Grande: LG-1	H	—	—	2 x 91 (1983) 6 x 91 (1984) 2 x 91 (1985)	910
LG-2	H	—	—	6 x 333 (1980) 6 x 333 (1981) 4 x 333 (1982)	5328
LG-3	H	—	—	3 x 192 (1982) 7 x 192 (1983)	1920
LG-4	H	—	—	7 x 254 (1984) 254 (1985)	2032
Cadillac	GT	—	—	3 x 60 (1976)	180
Gentilly 2	N	—	—	637 (1979)	637
Cap aux Meules	IC	7.14	—	—	23
Ontario					
Arnprior	H	—	—	2 x 39 (1976)	78
Andrew's Falls	H	—		24 (1976)	40.2
St. Mary's	H	—	—	2 x 7.5 (1981)	15
Smooth Rock Falls	S	—	—	12 (1977)	12

INSERT I (continued)

Province/Station	Type	Additions in 1974 (MW)	Additions in 1975 (MW)	Proposed Additions (MW)	Proposed Plant Capacity (MW)
Thunder Bay (Ft. William)	S	—	—	34 (1976)	86
Nanticoke	S	500	500	2 x 500 (1976) 500 (1977)	4000
Lennox	S	—	—	3 x 573.75 (1976) 573.75 (1977)	2295
Wesleyville	S	—	—	2 x 573.75 (1981) 2 x 573.75 (1982)	2295
Bruce	GT	3 x 12	—	12 (1976)	48
(A)	N	—	—	800 (1976) 800 (1977) 800 (1978) 800 (1979)	3200
(B)	N	—	—	800 (1983) 800 (1984) 800 (1985) 800 (1986)	3200
Pickering (B)	N	—	—	540 (1981) 2 x 540 (1982) 540 (1983)	2160
Darlington	N	—	—	800 (1986) 2 x 800 (1987) 800 (1988)	3200
Atikokan	S	—	—	200 (1983) 2 x 200 (1984) 200 (1985)	800
Thunder Bay	S	—	—	150 (1980) 150 (1981)	300
Manitoba					
Jenpeg	H	—	—	3 x 28 (1976) 3 x 28 (1977)	168
Long Spruce	H	—	—	2 x 98 (1977) 4 x 98 (1978) 4 x 98 (1979)	980
Kettle	H	3 x 102	—	—	1224
Saskatchewan					
Boundary Dam	S	—	—	300 (1977)	882
Poplar River	S	—	—	300 (1979)	300
Landis	GT	—	70	—	70
Alberta					
Sundance	S	—	—	2 x 375 (1976) 375 (1978) 375 (1980)	2100
Clover Bar	S	—	—	165 (1976) 165 (1978)	660
Battle River	S	—	150	375 (1981)	737
Fort McMurray	GT	—	5.8		20.22[2]
British Columbia					
Gordon M. Shrum	H	300	—	—	2116
Kootenay Canal	H	—	2 x 125	2 x 125 (1976)	500
Mica	H	—	—	2 x 435 (1976) 2 x 435 (1977)	1740
Site 1 (Peace)	H	—	—	2 x 175 (1979) 2 x 175 (1980)	700
Seven-Mile	H	—	—	3 x 175 (1980)	525
Burrard	S	—	152.0	—	912.50
Keogh	GT	40.5	—	40.5 (1976) 53.9 (1976)	134.9
Prince Rupert	GT	—	28.6	—	52.2

INSERT I (continued)

Province/Station	Type	Additions in 1974 (MW)	Additions in 1975 (MW)	Proposed Additions (MW)	Proposed Plant Capacity (MW)
Yukon Territory					
Aishihik	H	—	30	—	30
Whitehorse Rapids	H	—	—	20 (1978)	39.39
Various Communities	IC	3.6	—	—	—
Northwest Territories					
Snare Forks	H	—	—	2 x 5 (1976)	10
Snare Cascades	H	—	—	4 (1977)	4
Twin Gorges Talston R.	H	—	—	4 (1976)	22
Various Communities	IC	4.0	10.2	—	—

* Tentative, subject to approval.

1974 Installed Capacity per Statistics Canada 57,480 MW

1975 Additions 1,258 MW Increase of 2.2%

December 31, 1975 Installed Capacity 58,738 MW

1976 Scheduled — 8,663 MW — 16.12% Increase (H2521 — T6142)

December 31, 1976 Installed Capacity 67,401 MW

1 St. John's, Newfoundland — present installed generating capacity — 32.5 MW of which 30 MW are from steam and 2.5 MW are from internal combustion.

2 Fort McMurray — 14.42 MW IC and 5.8 MW GT.

for first power in 1982 with completion in 1985. Beyond Limestone plans are more tentative, but another 1,100 MW site at Conowapa could follow Limestone with first power in 1985. A capability is also being developed to commence the addition of nuclear generation in Manitoba during the latter half of the 1980's but timing of nuclear capacity will depend on its economic comparison with additional hydro electric capacity on the Nelson River system.

Manitoba hydro is also planning to extend its interconnections with the United States which will augment the current 230 kV connection with the Northern States Power Company in Minnesota.

Saskatchewan

Total electrical energy generated in the province in 1975 declined by about 4 percent to 7,060 GWh. Of this, about 62 percent came from thermal production and 38 percent from hydro.

A 70 MW gas turbine was added at Landis in 1975. Future plans for new generation capacity include an additional 300 MW unit in 1977 at the Boundary Dam lignite fuelled station to be followed in 1979 by the first 300 MW unit of the new Poplar River lignite fired plant which is located near Coronach, in south central Saskatchewan, where a new mine is being developed; this site has a potential for 1,200 MW. Consideration is also being given to a 400 MW hydro development on the Saskatchewan River at Nipawin to provide peaking capacity and targeted for 1984.

Alberta

In the province of Alberta, over 90 percent of the 1975 electrical supply was generated in coal or gas fuelled thermal stations. Because Alberta has large resources of mineable subbituminous coal, they have opted to develop this resource as fuel for thermal power stations and most new thermal capacity in the province to the year 2000 will likely be based on coal.

While additional capacity in 1975 was limited to the second 150 MW unit in Alberta Power's Battle River coal-fired thermal station, work is actively proceeding on several generation projects. Calgary Power expects to commission two 375 MW units in 1976 at its Sundance coal-fired thermal station on Lake Wabamum, west of Edmonton. A further 375 MW unit is to be completed in 1978 and the fourth such unit in 1980.

Calgary Power have also applied to the Energy Resources Conservation Board of Alberta for approval to construct a 2,250 MW coal-fired generating station in the Camrose-Ryley area. This plant is projected for service between 1982 and 1986.

Edmonton Power is continuing construction of additions to its Clover Bar gas fired thermal station which will add a 165 MW unit in 1976 and another in 1978.

British Columbia

British Columbia, with substantial water resources, has derived over 90 percent of its electricity needs through hydro generation. Only a small portion is thermal involving oil and some gas. Current planning indicates that hydro development will continue through the year 2000, thermal generation will be important by the mid-1980's and nuclear generation is not likely to be undertaken prior to 1990.

Of the approximately 3.2 TWh generated in British Columbia, about 9 percent was exported. Over 90 percent of these exports went to the U.S.A. and the remainder (less than 1 percent of generation) were exported to Alberta.

New generating capacity in 1975 totalled 181 MW thermal and 250 MW of hydro. However, a number of major additions to hydro generation are under construction and during the period 1976-80, 3,215 MW of new hydro capacity will be added to the system. Specifically, work is progressing on the Mica project where two 435 MW units are scheduled for completion in 1976 and two more in 1977. Also, on the Peace River, 14 miles downstream from the G.M. Shum generating station, a 700 MW station is expected for completion in 1979-80.

Active planning related to a major hydro development on the Columbia River near Revelstoke is also underway.

1. Installed Capacity Exceeding 1,000 MW

Chart 2 lists the generating stations in Canada with installed generating capacity exceeding 1,000 MW. While there are 15 stations currently installed and more planned for completion, it is interesting to note that 1,000 MW can provide electrical generation for the needs of about 500,000 Canadians.

C. Production and Sources of Electrical Energy

Table 6 breaks down Canada's total 1974 energy generation by province and by type of generation station, either public or private utilitiy and industrial establishment.

TABLE 6

ENERGY GENERATED BY UTILITIES AND INDUSTRIAL ESTABLISHMENTS - 1974

($\times 10^6$kWh)

PROVINCE/TERRITORY	TOTAL	UTILITIES			INDUSTRIAL ESTABLISHMENTS
		PUBLIC	PRIVATE	TOTAL	
Newfoundland	28,808	2,778	25,620	28,398	411
Prince Edward Island	383	1	382	383	-
Nova Scotia	5,433	4,932	-	4,932	501
New Brunswick	5,571	4,824	133	4,957	614
Quebec	84,179	60,037	4,321	64,358	19,821
Ontario	82,645	76,891	1,868	78,758	3,887
Manitoba	14,522	14,422	-	14,422	100
Saskatchewan	7,388	6,548	636	7,184	204
Alberta	14,372	3,236	10,402	13,639	733
British Columbia	36,256	23,421	329	23,750	12,506
Yukon	308	258	23	281	27
Northwest Territories	391	332	23	355	36
Canada	280,256	197,680	43,737	241,417	38,839

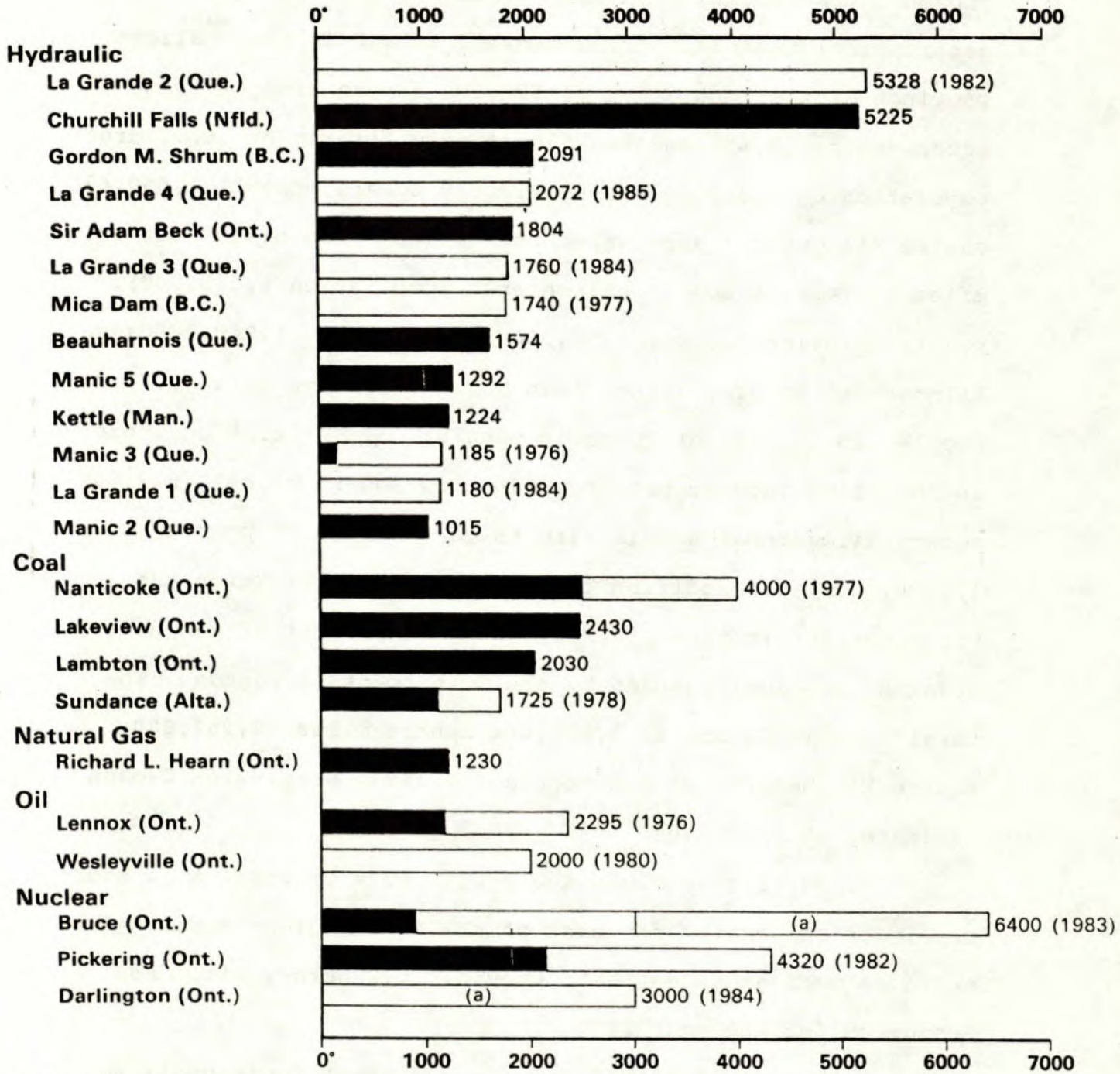
NOTE: The totals may not correspond with the sum of the elements due to rounding.

SOURCE: Electric Energy in Canada, Energy, Mines and Resources, 1975.

CHART 2

INSTALLED GENERATING CAPACITY OF STATIONS IN CANADA EXCEEDING 1000 MW

(Stations capable of multi-fuel firing are shown under their primary fuel source)



Installed capacity 1975.

(a) Tentative, subject to approval.
Date completion shown in brackets.

Note: 1000 MW provides electrical generation for the needs of about 500,000 Canadians.

SOURCE: Electricity in Canada - Demand and Resources, Energy, Mines and Resources, 1975.

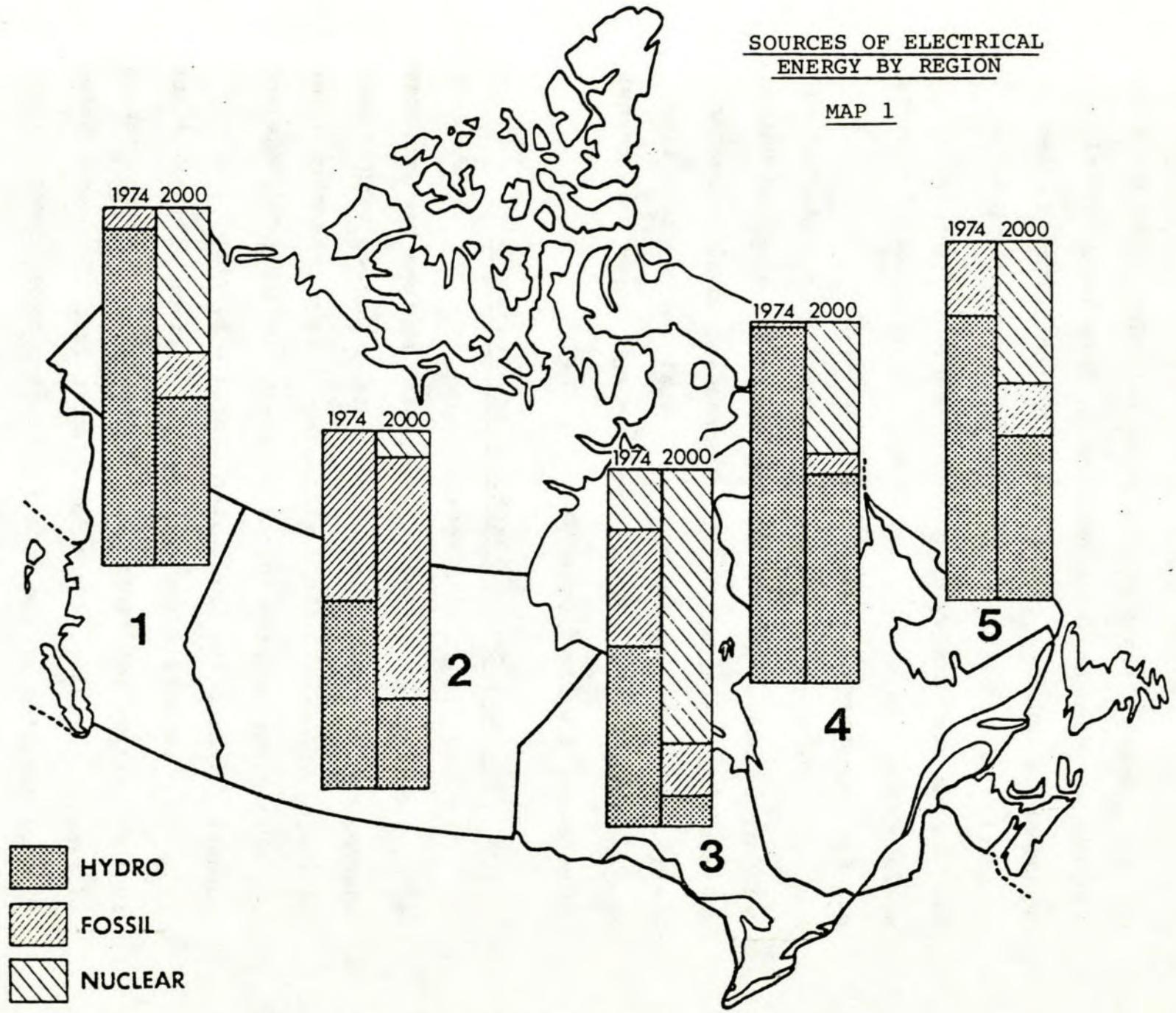
Canada's 10 provinces vary widely in size, population and energy potential. This is illustrated on Map 1 by 5 major geographical regions. Prince Edward Island is the smallest province with a population of 120,000 and an area of 2,184 square miles (5,657 square kilometers); Ontario has the largest population of 8,315,000 (area 413,000 square miles) (1,069,670 square kilometers) and Quebec the largest area of 595,000 square miles (1,541,050 square kilometers) (population 6,235,000). The prairie provinces cover (758,000 square miles (1,940,000 square kilometers) an area larger than Quebec but have only 3,775,000 people, about half of Quebec's population. British Columbia is the third largest province (366,000 square miles) (937,000 square kilometers) and is also third in terms of population (2,486,000). In addition to the provinces, the Yukon and Northwest Territories comprise about 40 percent of Canada's area and are administered by the Government of Canada. The total area in Canada is 3,852,000 square miles (9,967,680 square kilometers) with a population (1976 Statistics Canada Estimate) of 23,063,000.

Map 1 also gives the actual 1974 proportion by source of electrical energy for each of the five regions explained above as well as an estimate provided by Energy, Mines and Resources for the year 2000.

Viewed in the light of security of fuel supplies, the situation of Canadian power utilities is, briefly, as

SOURCES OF ELECTRICAL ENERGY BY REGION

MAP 1



SOURCE: Electricity In Canada - Demand Resources, E.M.R., 1975

follows: west of the Manitoba-Ontario border, generation is from either hydro or indigenous fuels; Ontario is heavily dependent on imported coal from the United States; Quebec generation is almost 100 percent hydro; New Brunswick and Nova Scotia are heavily dependent on imported oil; and Newfoundland uses a small but increasing fraction of imported oil for the generation of electric energy.

The above situation has aroused fresh interest in reinforced Ontario-Quebec inter-ties and has prompted Ontario to look at an expanded nuclear program and to give greater consideration to the use of Ontario coal and supplies from Western Canada. In the Maritimes, it has caused New Brunswick to commence a nuclear program.

D. Regional Interconnections and Transfers

The growth of electrical power systems and development of high voltage electrical transmission systems has encouraged increasing interconnection of generating sources within each region of Canada and the development of interconnections between electric power systems in the adjacent regions of Canada and between Canadian and the United States utilities.

The motivation for the construction of large intra-regional interconnections has, in general, been the integration of remote hydraulic generating sources into the power system. The map inserted at the back illustrated these remote areas

and the main electric transmission systems. Interconnections between regions have also been developed and constitute the elements of a National Grid.

As indicated on the map, existing Canada inter-regional interconnections include: British Columbia - Alberta (230 kV); Manitoba - Saskatchewan (230 kV); Manitoba - Ontario (138 kV and 230 kV); Quebec - New Brunswick (69 kV AC and HVDC); New Brunswick - Nova Scotia (138 kV AC); and Newfoundland (Labrador) - Quebec (735 kV AC). In addition, there are a number of ties between Quebec and Ontario, but these are of limited capacity or involve isolation of certain generation units in Quebec for connection to the Ontario system.

With regard to international interconnections, there are at present 12 main inter-ties between the provinces of New Brunswick, Ontario, Manitoba, British Columbia and the United States, ranging in voltage from 230 kV to 500 kV, with a total transfer capability of some 5,200 MW. In addition, there are over 50 minor interconnections.

For a number of years, Federal policy has been aimed at the encouragement of both intra and inter-regional interconnections and federal financial support has been provided in a number of cases including the Nelson River transmission system, the Quebec - New Brunswick and Nova Scotia - New Brunswick interconnections. The government has also stated its willingness to provide financial assistance to the first

MAP 2

INTERNATIONAL AND INTERPROVINCIAL TRANSFERS
OF ELECTRICITY FOR 1974

NOTE: GWh is a Gigawatthour, which is a million kilowatthours.

SOURCE: Adapted and inserted from National Energy Board Annual 1975.

nuclear generating unit in any province and to consider assistance on a second where the energy would serve the needs of more than one province.

In Western Canada, further interconnections between British Columbia - Alberta, Alberta - Saskatchewan, Saskatchewan - Manitoba and Manitoba - Ontario are under consideration, diversity of electrical generating sources being a major motivating factor. Of these, the Alberta - Saskatchewan interconnection, representing as it would the closing link of the interconnected Western Canadian systems would present special technical problems and would likely require the use of an asynochronous (HVDC) tie.

E. Energy Demand and Consumption

Under the impact of the growth in population, a rising standard of living and the displacement of oil and gas by electricity, the demand for electricity in all aspects of life is continuing in an ever increasing spiral. By the year 2000 we can expect the demand for electricity to be more than 5 times the 1974 rate. In 1975, the major Canadian consumers of electricity by major sector were:

Industrial	-	56.7 percent
Homes and Farms	-	28.0 percent
Commercial	-	14.5 percent
Lighting	-	1.0 percent.

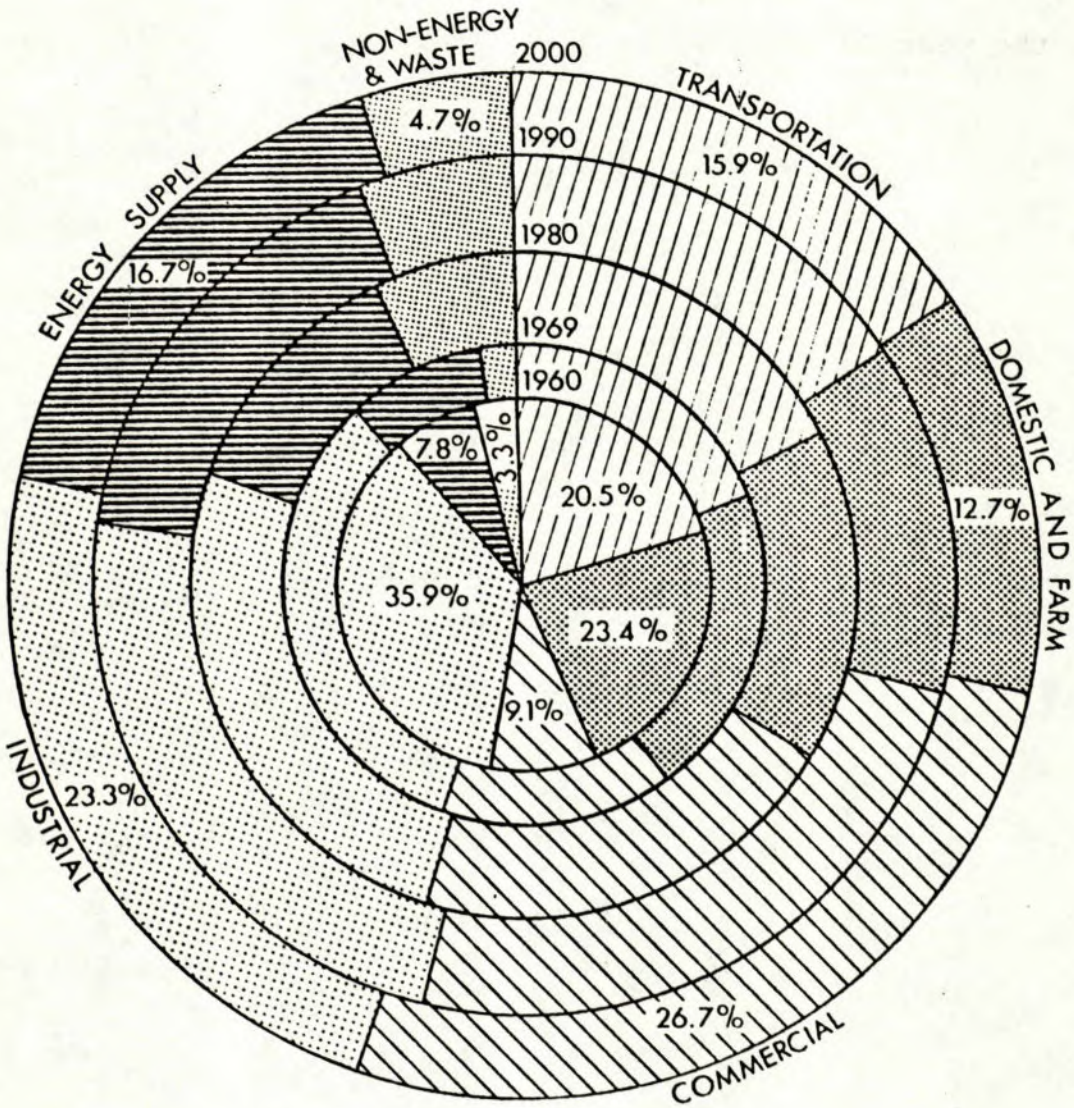
Figure 1 illustrates the estimated change in consumption over the period 1960 to the year 2000 as provided by Energy, Mines and Resources. The data also breaks down primary energy demand in Canada by the major market sectors.

Estimates of future energy supply and demand are subject to many variables such as cost and availability of fuels, and changing technology in extraction, conversion and utilization. Canada is fortunate, however, in having considerable flexibility in choice of energy from domestic sources. Canada's geography and climate together provide reasons for rather intensive use of energy for transportation over long distances and for comfort and survival in a cold winter climate. These factors are likely to lead to a continued growth in energy demand to the end of the century. In a recent Government of Canada energy policy paper, the total energy demand in Canada was forecast to grow from 6.0×10^{15} BTU (6.33×10^{18}J) in 1969 to 28.2×10^{15} BTU (29.75×10^{18} J) in 2000.

Within the framework of this forecast, electrical energy was expected to grow from 31 percent of primary supply in 1970 to about 40 percent in 2000, thus somewhat sustaining its historical pattern of growing faster than total energy demand. Because of the recently experienced and prospective future relative price increases for oil and for fossil fuels generally, and the concern over availability of future supplies, together with the evolving trend to more use of electricity as

FIGURE 1

PRIMARY ENERGY DEMAND IN CANADA
BY MARKET SECTOR



SOURCE: Electricity In Canada - E.M.R. - 1975

an economic choice of energy end use, an electrical fraction of 50 percent of primary energy is now considered more likely in the year 2000.

III ELECTRICITY AND OUR ENVIRONMENT

All the techniques available for the generation, transmission and distribution of electricity bring about irreversible changes in the environment. The construction of dams, tunnels and storage reservoirs necessary for hydro-electric development can have adverse effects on both the existing terrestrial and aquatic ecosystem. The combustion of fossil fuels for conversion into electricity produces air pollution. All thermal stations, especially nuclear, discharge heat into surrounding rivers and lakes, which creates thermal pollution. Furthermore, generating stations and power lines cover huge tracts of land and are often considered unsightly.

In recent years, the above concerns regarding the effects on the environment have radically changed construction procedures and costs. A few examples are:

1. In the core of the James Bay project, over 40 different environmental studies are completed or in process and are expected to cost over $10 million.

2. In Alberta, expenditures for all environmental protection devices at two stations (Sundance and Wabamum) are expected to exceed $80 million.

3. In Ontario, as a means of getting rid of waste products, the Lakeview Generating Station is converting waste fly-ash into valuable marketable goods.

4. In terms of land use and aesthetic beauty, both Ontario Hydro and Hydro-Quebec are experimenting with new techniques designed to transmit large amounts of power into dense city centres

underground and unseen. These will save the many acres of real estate being consumed by today's overhead power lines and improve the appearance of the landscape.

IV RESEARCH AND DEVELOPMENT

Like other sectors of the energy industry, the electric power industry is facing a number of constraints in meeting its customers' supply demands. The pressures of increased costs of capital equipment, higher cost of fuel and services, environmental constraints in siting new facilities, as well as limited undeveloped hydroelectric resources close to load centres, all reflect the difficulties facing the industry.

These pressures demand that every possible economy of scale be achieved. However, it must be done without reducing reliability of service which happened in previous attempts to increase the scale of equipment size. In addition, the industry is beginning to push against increasingly difficult limits in terms of the mechanical and electrical strength of materials for both generation and transmission equipment.

The challenges summarized above demand a more complete understanding of the factors and limitations which apply to present technology as well as the search for new and better technologies. Therefore, a well-organized research and development activity is essential.

Important R & D underway to meet electrical energy requirements include the nuclear energy program carried out by Atomic Energy of Canada and by the electric utilities; also

consultants and suppliers have participated in the research and development for more than 20 years. Other organizations involved are hydro-companies, the Canadian Electrical Association, National Research Council, Industry, Trade and Commerce, various universities as well as others.

To meet the future demands for electricity, scientists and engineers around the world are testing new techniques that promise to use existing fuels more effectively. They are also seeking new economic conversion processes from existing sources of energy. A few examples are as follows:

1. Magnetohyrodynamics

   Even the best fossil-fuel plants operate at about 40 percent efficiency and only that portion of the fuel's energy is converted into waste heat, however, a more efficient power-generation scheme, magnetohydrodynamics, or MHD, that creates an electric current by passing a stream of hot, ionized gas at high speed through a powerful magnetic field is currently being researched by the Russians. It is hoped that MHD plants will be able to operate at nearly 60 percent efficiency.

2. Fuel Cells

   Fuel cells are battery-like devices that produce an electric current from an electro-chemical reaction such as using the carbon and hydrogen in natural gas. Although fuel cells are being used in spacecraft, they are not yet suitable for the large-scale generation needed in Canada. Nevertheless, Hydro-Quebec's research labs are exploring the possibility of using them to supply electricity to isolated areas.

3. Geothermal Power

Underground reservoirs of steam and water have long been tapped in Iceland, New Zealand, Italy and Japan. Canada may soon be added to the list with the development of geothermal power in British Columbia and the Yukon. Nuclear blasting techniques might also be used to make steam beds deep in the earth available for geothermal power.

4. Solar Energy

The ultimate source of energy to which man may turn is the sun. Its potential is so great that it could satisfy more than 500 times the world's total energy needs forecast for the year 2000. Many universities and governments have been researching this area for a number of years including experimental solar houses and facilities. Test results are positive and we expect to hear more in the near future.

5. Winds and Tides

Although the earth's winds are too irregular to serve as a major power source, Canada's National Research Council is developing wind-driven generators for small-scale use in remote areas. The old idea of tidal power is also attracting attention. By harnessing the daily rise and fall of the tides in the Rance River estuary in Brittany, the French are producing 240 megawatts of electricity. Canada's Bay of Fundy is one of the most promising tidal sites in North America. While technically feasible, the power that this site might produce may not be worth the high cost of developing it, but studies are still proceeding in an attempt to find an economic application.

6. Nuclear Fusion

Most scientists believe the long-range answer to man's energy needs may lie in thermonuclear fusion. The fission technique employed in existing atomic reactors splits heavy atoms like uranium to produce energy.

7. Coal Gasification

There are a number of pilot projects now in progress carrying out actual in-situ or underground experiments to convert coal into low British thermal unit synthetic gas. Basically, the process is one of burning a generally low-grade of coal using underground fire combustion techniques and trapping the resulting converted synthetic gas for recovery. There are huge reserves of low-grade coal in Western Canada that are presently uneconomical to mine. It is thought that coal gasification techniques will make the recovery of this energy source economically viable.

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