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A Look Back From the Year 2000
Un regard en arrière à partir de l'an 2000



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of the 28th Annual Meeting of
The Canadian Transportation Research Forum

"A Look Back from the Year 2000"

Fredericton, New Brunswick
June 1st to 4th, 1993

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de la 28ième Conférence Annuelle
du Groupe de Recherches
sur les Transports au Canada

"Un regard en arrière à partir de l'an 2000"

Fredericton, Nouveau Brunswick
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Edited and Compiled
by
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Vice President, Program and Publication

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President's Message

Contained in this book are the research papers of the presenters at CTRF's 1993 Annual Conference, June 1st through 4th, in Fredericton, New Brunswick. With these papers as their foundation, Barry Bisson (VP Programs) and Don Good (VP Meetings) have crafted a comprehensive set of sessions and events.

This book of Proceedings then represents a permanent testimonial to the collective volunteer efforts of these authors, Barry and Don. Conference attendees and those who read its contents will naturally be enriched. It is a job well done, and thanks go to each and every one for their contributions.

T.W. Phillips
President

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Message du président

Ce document contient les textes des présentations qui seront faites lors du Congrès annuel du GRTC qui se tiendra du 1er au 4 juin 1993 à Fredericton au Nouveau-Brunswick. C'est en se basant sur ces textes que MM. Barry Bisson (vice-président, Programmes) et Don Good (vice-président, Réunions) ont élaboré le programme du Congrès et des événements spéciaux s'y rattachant.

Ces textes réunis témoignent de l'effort collectif et généreux des auteurs et de MM. Bisson et Good. Ils profiteront à tous ceux qui assisteront au Congrès ainsi qu'à toute autre personne intéressée. Enfin nous remercions tous ceux qui ont participé à l'organisation de ce Congrès.

Le président,
T.W. Phillips

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ROLE OF AIR MODE IN THE TRANSPORTATION OF GOODS TO/FROM ONTARIO, 1990

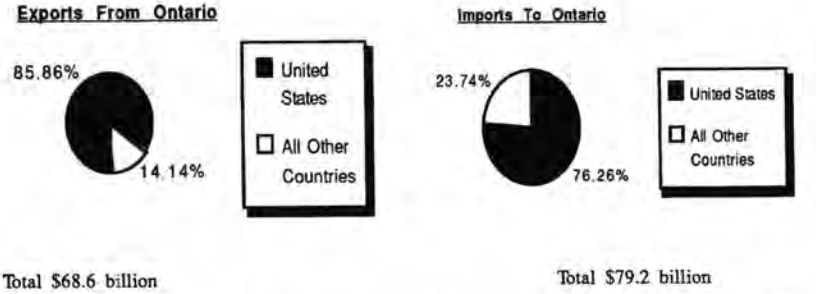
Introduction

The transportation of goods by air is an integral part of the Ontario trade freight network. The intent of this paper is to document those key air trade relationships between Ontario and foreign jurisdictions. The data is drawn from Statistics Canada international trade division files for the year 1990 largely reflected in Catalogues 65-202 and 65-203 which in turn is provided from Canada Customs. Export values cited represent Province of Origin information, while import values reflect Province of Clearance information.

Trade Relationships

The total value of Ontario's imports and exports in 1990 amounted to $148 billion. The US accounted 85.9% of the exports from Ontario and 76.3% of the imports to Ontario. In turn, Ontario accounted for 49% of Canada's exports and 58% of Canada's imports in that year. (Figure 1)

FIGURE 1
Ontario's International Trade Relationship, 1990



Total $68.6 billion

Total $79.2 billion

Ontario is a net importer of goods (ie., $79 billion imports versus $69 billion exports). This is partly a function of its geographic role as a gateway, particularly for the United States. Ontario's trade with the United States amounted to $119 billion, or 81% of its total trade value; the U.S. accounted for 86% of Ontario's export market and 76% of its import market. (Table 1) In contrast, the next two largest traders -- Germany & the United Kingdom, together only accounted for $5 billion or 3.4% of its total trade value.

TABLE 1
ONTARIO'S INTERNATIONAL TRADE VALUE, 1990
($ BILLIONS)

	Total	To the USA	USA Percentage
Imports	79.177	60.433	76.3%
Exports	68.564	58.878	85.9%
Total	147.741	119.311	80.8%

Ontario clearly dominates Canada's trade to its southern neighbour, accounting for 58% of Canada's exports to the United States, and 69% of Canada's imports from the United States. (Figure 2)

FIGURE 2
Ontario vs Canadian Trade to US, 1990



Total: $101.5 billion

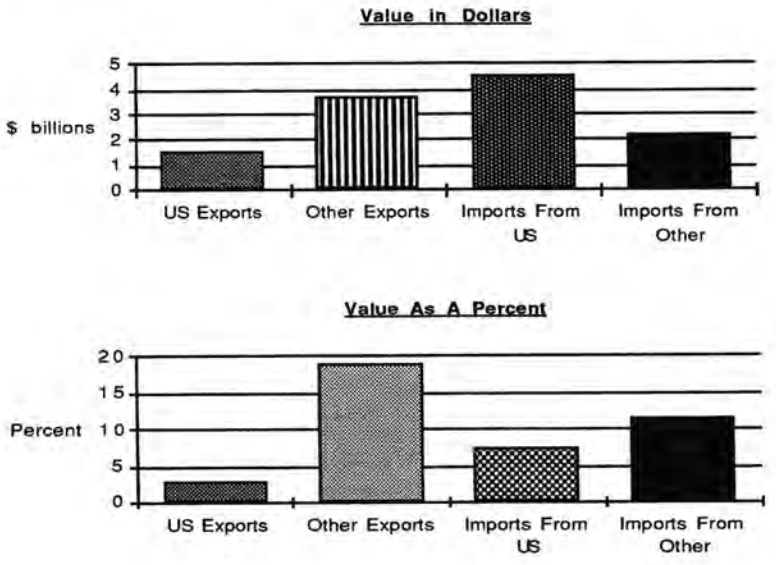
Total: $87.5 billion

Modal Share

The highway mode is the most prominent means of transporting Ontario's trade, because of the strength of Ontario's US trade relationship, and due to the extent and location of Ontario's highway infrastructure. The highway mode accounted for the transportation of 66% of Ontario's export value and 67% of its import trade value.

In contrast, the air mode accounted for 7.7% of Ontario's export trade value and 8.4% of its import trade value (8.1% overall). There was considerable differences in modal share depending on the country of origin & destination. For imports to Ontario, 7.4% ($4.5 billion) of US imports were moved by the air mode, compared to 11.7% of imports from all other countries. (Figure 3) For exports from Ontario, 2.8% ($1.6 billion) of exports to the United States were transported by the air mode, compared to 18.9% of exports to the rest of world.

FIGURE 3
Air Mode Share of Ontario's International Trade, 1990



Approximately one-half of the value of Ontario's trade that was transported by the air mode was directed to/from the United States. The value of Ontario's export to the US transported by air amounted to 30.7% of its total value of exports moved by air. In contrast, the value of Ontario's imports from the US amounted to 67.3% of its total value of imports.

The value of Ontario's trade with some US states was considerably greater than was found to be the case with most countries. This was also evident in an examination of the value of Ontario's trade transported by the air mode. The state of California was the most prominent air origin/destination for Ontario trade with a value of some $1.06 billion, largely a result of its imports. New York State was next with a total of $869 million (Table 2).

TABLE 2
VALUE OF ONTARIO'S TRADE TO U. S. STATES BY THE AIR MODE

(TOP 10, IN MILLIONS OF DOLLARS)

EXPORTS			IMPORTS		
Rank	State Value	Rank	State	Value	
1.	New York	484	1.	California	810
2.	California	252	2.	Michigan	763
3.	Colorado	128	3.	New York	385
4.	Maryland	66	4.	Texas	226
5.	Mass	61	5.	Florida	181
6.	Connecticut	59	6.	Mass	172
7.	Texas	53	7.	Illinois	162
8.	Washington	51	8.	Arizona	160
9.	Arizona	49	9.	Washington	131
10.	Penn	47	10.	New Jersey	119
	Total U.S.	1,620	Total	U.S.	4,489
	Overall Total	5,280	Overall Total		6,673

Twelve US states had an imported value of in excess of $100 million transported to Ontario by the air mode; the principal states were California, Michigan, New York, Texas and Florida. California accounted for 18% of the US Ontario import total, and 12% of the overall total. (Table 2)

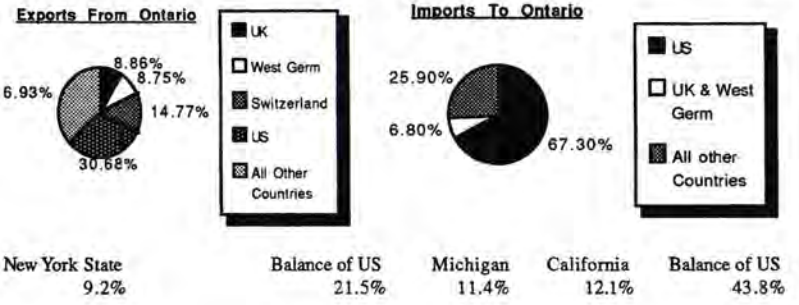
In contrast, only 3 states received in excess of $100 million of Ontario's exports by air -- New York, California, and Colorado. New York accounted for 30% of the Ontario's US export total, and 9% overall. (Table 2)

The movement of Ontario's exports by air to countries other than the United States was concentrated in fewer countries than was found to be the case with imports to Ontario; European countries dominated. Switzerland was the principal export destination -- $780 million, or 22% of the Ontario total to all other countries, followed by the United Kingdom, Germany, Norway and France. Switzerland was the recipient of 15% of all of Ontario's export trade value transported by air. (Table 3 and Figure 4)

TABLE 3
VALUE OF ONTARIO'S TRADE TO COUNTRIES OTHER THAN THE UNITED STATES TRANSPORTED BY THE AIR MODE (TOP 10, IN MILLIONS OF DOLLARS)

EXPORTS			IMPORTS		
Rank	Country	Value	Rank	Country	Value
1.	Switzerland	780	1.	United Kingdom	243
2.	United Kingdom	468	2.	West Germany	208
3.	West Germany	462	3.	Italy	96
4.	Norway	103	4.	France	81
5.	France	98	5.	Netherlands	80
6.	Italy	70	6.	Switzerland	68
7.	Austria	60	7.	Belgium	64
8.	Mexico	47	8.	Eire	47
9.	Kenya	42	9.	Sweden	43
10.	Bermuda	27	10.	Brazil	39
Total: Other Countries		3,600	Total: Other Countries		2,184
Overall Total		5,280	Overall Total		6,673

FIGURE 4
Origin/Destination of Value of Ontario's International Trade Transported by the Air Mode, 1990



Commodities

For most commodity groups examined, North American destinations dominated only one group -- primary metals with 56%. The principal commodities exported by the air mode were the minerals and related, and the machinery and equipment groups, which accounted for 90% of the North American total, and 82% of the rest of the world total (Table 4).

TABLE 4
VALUE OF ONTARIO'S INTERNATIONAL EXPORT
BY THE AIR MODE, 1990

	To North America	To Rest of World	North America % as Part of Total Export
Food, Feed, Beverages and Tobacco	0.2%	2.7%	5.3%
Minerals and Related	34.2%	45.1%	30.6%
Primary Metal and Related	1.7%	0.8%	56.2%
Paper and Wood	0.5%	0.6%	34.1%
Chemicals and Related	3.4%	2.5%	43.9%
Machinery and Equipment	56.4%	36.8%	47.0%
Vehicles and Parts	0.9%	0.9%	37.9%
Other Manufactured Goods	2.7%	10.6%	12.4%
	100.0%	100.0%	--

For Ontario imports, the relationship was somewhat different. North American locations dominated in five of the eight categories, but the principal commodities imported by the air mode were the minerals and related, and machinery and equipment groups, which accounted for 78% of the North American total, and 63% of the rest of the world total (Table 5).

TABLE 5
VALUE OF ONTARIO'S INTERNATIONAL
IMPORT BY THE AIR MODE, 1990

Imports	From North America	From Rest of World	North America % as Part of Total
Food, Feed, Beverages and Tobacco	0.6%	3.1%	31.9%
Minerals and Related	11.2%	11.3%	69.4%
Primary Metal and Related	2.5%	3.2%	64.4%
Paper and Wood	1.3%	1.0%	75.0%
Chemicals and Related	4.6%	11.8%	46.9%
Machinery and Equipment	66.5%	51.5%	74.6%
Vehicles and Parts	7.8%	1.4%	92.7%
Other Manufactured Goods	5.5%	16.7%	42.8%
	100.0%	100.0%	--

U.S. Gateway Role

The modal share information captured by Statistics Canada, provides useful data on an interesting aspect of air cargo relationship -- i.e., how much of Ontario's trade is channelled through U.S. gateways. This can be derived by examining how much of the value of Ontario's trade to countries such as France, or Japan, crosses Ontario borders (and is thus noted by customs) via the highway or rail mode.

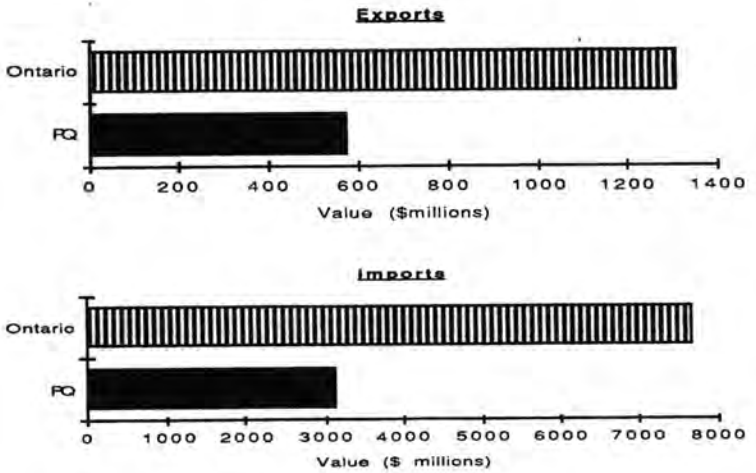
With respect to exports, about 14% of Ontario's exports to countries other than the United States, were transported by the highway and rail modes, rather than the air or water mode. A comparable statistic for the Province of Quebec was 10%. (Table 6) The air mode was more important to Ontario than was found to be the case for Quebec. This information suggests that Ontario and Quebec gateways were reasonable commencement points for the transportation of Canadian trade. (Refer to Figure 5)

TABLE 6
EXTENT OF USE OF AMERICAN GATEWAYS
ONTARIO AND QUEBEC
(IN TERMS OF VALUE)

	Highway	Rail	Water	Air	Total
IMPORTS					
Ontario	42.7%	14.5%	26.6%	16.2%	100.0%
Quebec	21.0%	5.6%	59.5%	13.9%	100.0%
EXPORTS					
Ontario	12.8%	1.0%	48.7%	37.5%	100.0%
Quebec	8.1%	1.5%	65.9%	24.5%	100.0%

NOTE: The above exclude the "other" or not elsewhere stated category, which accounts for less than 1% of the export total but which can account for up to one-quarter of the import total.

FIGURE 5
Value of Ontario & Quebec International Trade Transported Via American Gateways, 1990



The situation was very different with regards to imports. On the order of 57% of the value of imports to Ontario, and 27% of that to Quebec, from countries other than the United States, entered those provinces from the United States via the highway and rail mode.

To some countries, the amount of Ontario's export trade transported by the highway mode exceeds that of the air or water mode combined, for example Jamaica ($30 million versus $16 million) and Ireland ($44 million versus $27 million). In other cases, while the highway proportion is small compared to the air total, for example, West Germany ($60 million versus $460 million), the actual value is quite large.

In the transportation of Ontario's imports, in only a handful of countries was the air mode found to be the most dominant mode -- Ireland, Trinidad and Tobago, Soviet Union, Israel, UAE, Bahamas, and Barbados. For most European countries, the highway mode transported a trade value greater than the air mode, but not the water mode; to South America, the highway mode was most dominant, period.

DISCUSSION

The share of the total value of Ontario's trade with other countries that was transported by the air mode has been increasing over the last decade and one-half, from about 2% in 1977, to 4% in 1987, to 8% in 1990.

This has occurred because the need to move time sensitive goods more expeditiously, as well as because the quantity of such lighter goods with a higher intrinsic value has, over time, increased. In addition, the Ontario transborder and international air cargo markets have become increasingly sophisticated and competitive with the addition of large American firms specializing in that field (such as Federal Express and UPS). This is expected to continue in the near term, until airline rationalization resulting from deregulation has run its course.

Earlier papers on the subject summarised the reasons for the significant use of American gateways, among them the predatory pricing practices of foreign carriers that encourage the trucking of goods to US gateways, the absence of sufficient scheduled air carrier traffic from Canada's principal air gateway, Pearson Airport at Toronto, and congestion at that airport. [1]

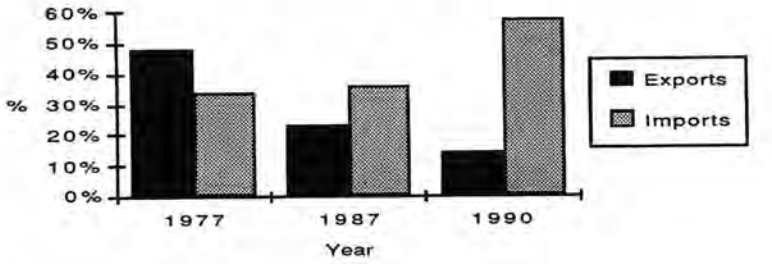
With respect to the last assertion, the Canadian Industrial Transportation League, reporting to an environmental assessment committee studying proposals to add three new runways to that airport, stated that deteriorating service and delays at the airport conflict greatly with the mission statements of businesses which focus their efforts on greater efficiencies in price, service, reliability and speed. [2]

Confirmation of one of the earlier assertions can be found in an examination of flight frequencies to South American destinations. For example, Canadians wishing to ship goods to Venezuela from Pearson by that country's national air carrier "Viasa" are afforded that opportunity only on Sundays; otherwise goods have to be trucked to New York City, from where daily service is provided. [3]

This is not to say that Canadian air carriers have not attempted to address such matters. For both national airlines, about 10% of their annual revenues are derived from cargo operations, representing a value of some $650 Million (combined). Both airlines have upgraded their fleets with newer planes providing greater cargo holding capabilities [4] and are tapping into international air partnerships to reach markets where they cannot fly. [5] However, Air Canada recently decided to eliminate from its fleet, its dedicated cargo freighters.

It had been identified in a previous paper that the use of American gateways between 1977 and 1987 had been increasing for imports but decreasing for exports.[6] This analysis suggests that the trend is continuing for the reasons described previously. The use of American gateways to import goods from the US to Ontario has gradually increased from 34% in 1977 to 57% in 1990. In contrast, Ontario exports have decreased from 48% in 1977 to 14% in 1990. (Figure 6)

FIGURE 6
Use of American Gateways To Transport Ontario's International Trade, 1990



It is possible to recapture some of that import traffic with the provision of additional service to other continents from Pearson, and the construction of further runways at that airport. It is recognized though that it is the more challenging part of the trade transportation equation given a natural propensity to use more familiar freight forwarders and airlines from one's own country or cheaper/more frequent services to the United States in order to access Ontario and Canada.

The end result of this factor has been increases in the amount of truck traffic on Ontario's provincial highway network and at border crossing points. For example, on parts of Highway 401, in Toronto, truck volumes exceed 30,000 daily. This contributes to congestion for other users of the system. While beneficiaries of American gateway use incur cost savings, there are commensurate penalties/costs realized by normal intra, inter provincial and transborder goods movement operation.

CONCLUSIONS

This paper has identified that a considerable proportion of Ontario's international trade to countries other than the United States, is in fact transported through American gateways due to shortcomings in the Canadian travel network vis a vis nearby American gateways that can access much of Ontario's industrial and consumer base by truck. It appears that, all things considered equal, the current trends will continue because of compensating factors.

While the prospects to move goods through Toronto's Pearson Airport will be enhanced through the addition of further runways, and the removal of hourly flight caps, this may be effectively mitigated because of airline rationalization. Canadian carriers continue to withdraw from certain routes or do not exercise their landing rights. Over the next decade, however, it is reasonable to expect that as much as 10% of Ontario's trade could be handled by the air mode compared to 8% now. A considerable proportion will remain and may always be directed through American gateways particularly imports. The impending partnership relationships between Canadian Airlines and American Airlines, and Air Canada and Continental may serve to increase the air proportion of the total, if they continue to be competitive with the Federal Express/U.P.S. brand of airline transport.

Successful diversion of America's gateway traffic to the air mode offers obvious advantages, the most important being congestion relief on the provincial highway network, particularly near border crossing points, and likely greater use of Canadian flag carriers (and the retention of Canadian jobs) in the transportation of such trade.

Use of America's gateways would also be somewhat more beneficial if there was greater use of the underutilized rail mode, which has experienced a gradual erosion of its transborder traffic.

Clearly, there are opportunities to redress the current imbalance. It is hoped that by documenting the present relationship and identifying the trends that exist, that this paper provides a useful starting point for action.

[1] Julius Gorys, "The Highway Mode & Ontario's Exports", Transportation Quarterly, Vol 42, No 3, July 1988 (417-428).

[2] "In Mode, Air", Canadian Transportation Logistics, March 1992, p. 16.

[3] Ian Stalker, "Viasa Cargo Up", Cargo Express, Volume 14, Number 1, December 1992-January 1993, p. 14.

[4] Cecil Foster, "Air Monopoly Games", Canadian Transportation Logistics, September 1992, p. 48.

[5] Cecil Foster, "Air Cargo Battles Back", Canadian Transportation Logistics, April 1992, p. 27.

[6] Julius Gorys, "The Role of U.S. Gateways in Transporting Ontario's Trade", Transportation Quarterly, Vol 44, No 1, January 1990 (-)

COURIERS IN CANADA: AN INDUSTRY PROFILE

Andrea Mathieson, Transportation Division, Statistics Canada
Jean Leduc, Business Register Division, Statistics Canada

This is the first of a series of Statistics Canada studies on the services sector of the Canadian economy. This approach yielded a snapshot of a $1.9 billion industry that employs over 64,000 people across the country.

For purposes of this study, the courier industry is defined in the Standard Industrial Classification as, "establishments primarily engaged in providing a delivery service for letters and small mail-type parcels." [1]. In this paper, the term "courier activity" will refer to any delivery of small parcels, and "courier industry" will refer to those carriers classified to SIC 4842.

BACKGROUND

The courier industry is classified as a service to business. Nonetheless, transportation is an integral part of small parcel delivery. The principal feature of courier activity is the size of parcel carried, although speed of delivery and premium service, such as track and trace features also characterize this service. This paper will focus on the financial and operating characteristics of the courier industry, in terms of province of domicile (headquarters) and markets served.

This study had two major objectives:

1 - to provide statistical compilations for a targeted service industry by the end of fiscal year 1992/1993 and at the same time establish a well-founded frame which could be used for the subsequent implementation of a new service industry survey;

2 - to create a prototype project which, if successful, could be used as a generalized approach to compile statistics for other identified data gap industries.

METHODOLOGY

In order to meet the two objectives described above, the frame for the survey was derived using three administrative files from Revenue Canada, Taxation: the Payroll Deduction (PD) based register; the T2 Corporations tax file and the T1 Individuals tax file.

The new Business Register was used as the frame to collect industry related operating data that would normally not be obtainable from administrative sources. All establishments coded to the courier industry (SIC = 4842) on the Register were selected and contacted by telephone in order to review their frame characteristics and to complete a short supplementary questionnaire (SQ).

The TY90[2] T1 and T2 tax files were used to select all courier related tax records in order to transcribe a predetermined set of financial variables[3] tailored to the need of this project using

information available on their financial statements. The SQ was collected for the reference period 1991.

In summary, while the tax sources were used as the main frame to derive industry related estimates, the Register was used as a frame to select courier establishments that were directly surveyed in order to obtain additional information.

Data Collection

The data collection process was split into two separate activities: the capture of information from the tax source documents and a telephone survey for a portion of the in-scope records.

Data Capture

Using the T1 and T2 administrative sources, copies of all tax documents related to an individual or a corporate tax filer classified to the Industry group 48 on the tax files were requested from Revenue Canada. The selection was made at the two digit level in order to minimize the problems associated with the assignment of accurate third and fourth digits of an SIC.

Once identified, the selected records were microfilmed (T1) or photocopied (T2) and sent to Statistics Canada. The transcription of the required financial information and the review of classification were done in the Business Register's Tax Application Section using a slightly modified version of their current data capture system.

The transcription activity was conducted during the summer of 1992. Of the 5,000 T1 and T2 tax records requested, approximately 3,000 were classified to the courier industry. The transcribed and edited file was then weighted to account for the missing records. The misclassified records on the universe file were accounted for using the portion of the Annual tax sample file[4] which represents records coded to the industry during transcription but coded elsewhere on the universe file.

Telephone Survey

In parallel to that activity, all establishments coded to SIC 4842 on the Business Register were selected for the direct survey process. In order to refresh the frame information on the base, an existing form, the Business Register Form 800[5], was used. Also, to obtain industry related information (not available from the tax documents), a supplementary questionnaire (SQ) was developed in consultation with Transportation Division and System of National Accounts (SNA) staff, including input from key players in the industry through the Canadian Courier Association, based in Toronto[6].

The Form 800 and SQ information was collected and captured by the regional offices. A total of 1,132 establishments coded to SIC 4842 were found on the Register. Of that total, 686 complete or partial responses were obtained. Another 213 establishments were classified to a different industry while the rest were either "dead" or refused to answer.

The direct survey activity took place in the fall of 1992. Once completed, the results were transmitted to Statistics Canada, where the Form 800 information was used to update the Register. In addition, Transportation Division spent some time reviewing and performing additional edits on the supplementary questionnaire fields.

Once all the required work was completed on both sources of information, the two were matched on tax account numbers where available, and direct match key (DMK) on names for the remaining unmatched records.

Approximately two thirds of the SQ were matched to their respective tax records. The success rate was much better on the corporation side than for the unincorporated companies. This can be explained partly by the unavailability of the T1 number on the Register as well as by the difficulty to match on names since the T1 legal entity name coincides with the owners' names and matching on personal names is more difficult due to the extent of duplication among names.

Imputation

Since a supplementary questionnaire was not completed for every tax record coded to the courier industry and, in order to account for the refusals and the partial responses, an imputation module was added to the project using the Generalized Edit and Imputation System (GEIS).

All the matched SQ-Tax records were used as donors as well as 150 of the 200 unmatched SQ. The latter ones were made useable by constructing synthetic gross revenue and net income (key variables for the imputation) for each record using a regression model.

Finally, since the Register only covers businesses with employees, it was necessary to limit the scope of the records to be imputed to those tax records for which a PD number was transcribed and/or salary and wages were present.

LIMITATIONS

Due to the limited amount of resources available and because of the prototype nature of this project, it was not possible to include in the SQ sample, records on the tax file that were not found on the Register (mostly non-employers).

Therefore, the data collected on the supplementary questionnaire only applied to establishments with employees. However, using the tax estimates, it was possible to derive an estimate of the universe (including non-employers) for the cost and expense items. The results of this analysis will be presented in a separate study.

Financial data that were transcribed from financial statements were subject to interpretation on the part of the analyst performing the transcription. Since companies report with varying degrees of precision, it was not uncommon to see fuel expenses listed either as "fuel", "vehicle expenses", "purchases", or simply under "other". The aggregate financial variables (total expenses, total revenues) are reliable, however, the completeness of the individual expense items is difficult to quantify.

Details on the methodology or additional tabulations can be obtained by contacting the authors.

INDUSTRY OVERVIEW

There were an estimated 2,433 courier companies operating in Canada in 1990. They generated operating revenues of $1.9 billion. Since the transportation sector contributes approximately $30 billion annually to Canada's Gross Domestic Product (GDP), couriers make up about 6% of the total. The reader should note that the carriers in this study were placed in the province in which the company

headquarters is located. No attempt was made to allocate business on a province of activity basis.

Couriers were located across the country, although the greatest concentration was in Ontario and Quebec. Ontario was the base of operations for 767 carriers earning over $1.3 billion in 1990. The average revenue for an Ontario courier company was $1.8 million, whereas British Columbia' and Quebec companies averaged $660,000 and $369,000, respectively.

Table 1 **Canadian Courier Industry, 1990**

Province	Carriers	Operating Revenue	Operating Expenses	Net Operating Revenue
	no.		dollars	
Newfoundland	23	4,404,624	4,051,633	352,991
Prince Edward Island	x	x	x	x
Nova Scotia	56	10,668,753	9,328,501	1,340,252
New Brunswick	37	2,091,267	1,362,940	728,327
Quebec	421	155,182,678	148,853,414	6,329,264
Ontario	767	1,347,873,120	1,334,936,554	12,936,566
Manitoba	167	28,974,521	25,533,664	3,440,857
Saskatchewan	195	14,911,439	11,285,370	3,626,069
Alberta	359	70,699,882	61,311,439	9,388,443
British Columbia	408	269,124,415	257,344,933	11,779,482
Yukon	x	x	x	x
Northwest Territories	x	x	x	x
CANADA	**2,433**	**1,903,930,699**	**1,854,008,448**	**49,922,251**

Confidential data for Prince Edward Island have been included with Newfoundland; Yukon and the Northwest Territories have been included with British Columbia

Employment

Some 54,693 persons were employed (full- and part-time) by the Canadian courier industry in 1990. The wage bill of over $826 million does not include those working owners who drew their salaries from company earnings. In addition, 9,460 owner-operators offered services to the tune of $135 million. There may be duplication among owner-operators, in that an independent driver may offer his services to more than one courier, especially in remote areas. Many courier companies use owner operators in addition to their own drivers, or exclusively. This practice occurs anywhere from major cities to remote areas.

Table 2 **Canadian Courier Industry, 1990 - Labour Force**

Province	Company Employees	Owner-Operators	Total
	number		
Newfoundland	89	44	133
Prince Edward Island	x	x	x
Nova Scotia	180	117	297
New Brunswick	60	0	60
Quebec	7,195	1,939	9,134
Ontario	35,157	3,592	38,749
Manitoba	377	500	877
Saskatchewan	335	159	494
Alberta	850	776	1,627
British Columbia	10,450	2,333	12,784
Yukon	x	x	x
Northwest Territories	x	x	x
CANADA	**54,693**	**9,460**	**64,153**

Ontario, with 64% of employees, accounted for 82% of remuneration paid, followed by British Columbia (8%) and Quebec (5%). Overall, salaries accounted for 44% of operating expenses at the national level. Purchased transportation accounted for a further 7%.

Markets Served

The majority of courier revenue earned came from the domestic market. Domestic activity generated 83% of revenues in 1990, while US and international markets accounted for 14% and 3%, respectively. In 1990 there were 506 million shipments delivered, containing 660 million packages. These ranged anywhere from a letter or other type of document to parcels of up to 32 kilograms. The main clientele is the business community, although government and, to a lesser extent, household clients contribute to total revenue. Specialized markets, such as medical and on board couriers were not examined separately in this study.

Some provinces reported operations that were almost exclusively domestic. Ontario carriers served 66% of the domestic market, amounting to $1.0 billion. British Columbia and Quebec accounted for a further 25%, or $404 million. Deliveries between Canada and the United States totalled $267 million and overseas business earned a further $49 million. Transborder business represented 14% of industry revenues, most of which (92%) was generated by Ontario companies. The remaining 3% from international activity was again earned mostly by Ontario companies, who accounted for 96% of receipts.

Table 3 **Canadian Courier Industry, 1990 - Markets Served**

Province	Domestic	Canada-US	International	Total
		dollars		
Newfoundland	4,302,902	101,722	0	4,404,624
Prince Edward Isl	x	x	x	x
Nova Scotia	10,647,304	19,195	2,254	10,668,753
New Brunswick	2,082,099	7,566	1,602	2,091,267
Quebec	142,572,246	11,511,221	1,099,212	155,182,678
Ontario	1,055,414,477	245,325,900	47,132,744	1,347,873,120
Manitoba	28,827,459	146,771	291	28,974,521
Saskatchewan	14,782,285	118,086	11,069	14,911,439
Alberta	68,550,382	1,727,805	421,695	70,699,882
British Columbia	261,273,744	7,603,287	247,385	269,124,415
Yukon	x	x	x	x
Northwest Territo	x	x	x	x
CANADA	**1,588,452,897**	**266,561,552**	**48,916,250**	**1,903,930,699**

Table 4 **Canadian Courier Industry, 1990**
Packages and Shipments Delivered

Province	Packages	Shipments
	number	
Newfoundland	1,040,040	812,771
Prince Edward Island	x	x
Nova Scotia	3,586,051	2,036,414
New Brunswick	1,150,467	849,165
Quebec	78,381,356	61,335,798
Ontario	382,084,539	307,853,536
Manitoba	10,784,878	7,150,703
Saskatchewan	8,946,377	7,801,679
Alberta	21,267,305	14,317,741
British Columbia	152,652,419	103,966,520
Yukon	x	x
Northwest Territories	x	x
CANADA	**659,893,432**	**506,124,326**

FINANCIAL SUMMARY

Readers are advised that caution is warranted in using the financial data presented here. This information was taken from an administrative file which was not prepared for statistical purposes. Please refer to the Methodology section for further explanation.

In 1990, couriers posted operating revenues of $1.9 billion which slightly exceeded operating expenses, resulting in an operating ratio of 97.4% (before interest). Competition has been fierce among the couriers as well as between couriers and the Canada Post

Priority Courier system. Added to this are the economic factors such as lower demand resulting from companies rationalizing their use of courier services, free trade fallout, or the economic slowdown in general.

At the national level, salaries and wages were by far the largest expense item, accounting for 44% of the total. Purchased transport followed, with 7%. Vehicle expenses reported as such accounted for 2% of the total. The detail on the remaining expenses is buried in the residual. Fuel is a major expense item for any transportation company, however, two factors are masking the value of this input: the use of owner-operators removes fuel from the books, since the contractor bears that expense; and the nature of the reporting for tax purposes (e.g., fuel may show up as a vehicle expense, or it may be in the residual).

Table 5 **Canadian Courier Industry, 1990 - Selected Expense Items**

Province	Labour Cost	Purchased Transport	Vehicle Expenses	Depreciation
		dollars		
Newfoundland	1,926,621	469,592	805,759	126,874
Prince Edward Island	x	x	x	x
Nova Scotia	3,922,844	2,164,863	842,349	242,200
New Brunswick	416,528	0	371,104	105,637
Quebec	42,744,473	22,366,781	6,496,568	3,445,503
Ontario	678,293,476	81,248,657	17,484,997	27,679,149
Manitoba	11,497,596	5,773,938	1,792,754	475,491
Saskatchewan	4,388,807	810,498	1,499,428	853,398
Alberta	15,244,672	10,648,906	4,078,077	1,928,552
British Columbia	67,644,365	11,065,050	4,681,756	5,379,753
Yukon	x	x	x	x
Northwest Territories	x	x	x	x
CANADA	**826,079,383**	**134,548,285**	**38,052,791**	**40,236,556**

Provincially, operating costs were distributed differently, but the major items remained wages and purchased transport. Wages accounted for nearly half the total in many provinces, topping 40% of expenses in Newfoundland, Nova Scotia, Ontario and Manitoba.

The largest share of interest payments amounting to $48.7 million were made by Ontario carriers ($43.6 million), although Quebec accounted for $2.1 million in mortgage and other interest. Depreciation amounting to $40 million was paid in 1990. Not surprisingly, 69% of this was paid in Ontario. British Columbia and Quebec concerns paid a further 13% and 9% of total depreciation, respectively.

Equipment

Information was collected on company equipment, so the analysis that follows does not include owner-operator vehicles. One may assume, for analysis purposes, that an owner-operator has on average one car or small truck. There were instances of some inner city couriers reporting no equipment, as those companies used "walkers" exclusively. Bicycles were reported under "other"; no count of these is available.

Couriers reported 5,852 cars and 36,879 step vans in service in 1990. Other equipment reported included tractor-trailers, aircraft and specialized equipment in remote areas (snowmobiles, dog sleds). Many couriers purchase space on commercial aircraft, and do not report planes per se, although they may report significant air business.

Table 6 **Canadian Courier Industry, 1990 - Equipment in Service**

Province	Cars	Step Vans	Other	Total
		number		
Newfoundland	77	41	17	135
Prince Edward Is	x	x	x	x
Nova Scotia	92	72	47	212
New Brunswick	28	21	5	54
Quebec	1,459	2,503	1,592	5,555
Ontario	2,174	24,548	4,007	30,729
Manitoba	254	214	286	754
Saskatchewan	123	165	65	353
Alberta	682	492	302	1,476
British Columbia	963	8,822	1,986	11,770
Yukon	x	x	x	x
Northwest Territories	x	x	x	x
CANADA	**5,852**	**36,879**	**8,307**	**51,037**

CONCLUSIONS

A note on "industry" versus "activity":

While the courier industry described in this paper accounts for $1.9 billion in revenue, there are many other companies which perform the same functions as a minor portion of overall company business. Trucking companies, especially those engaged in the delivery of less-than-truckload (LTL) freight, also deliver small parcels. Other types of business performing this function include bus lines and air cargo companies. The former are important players in rural areas, and the latter figure prominently in the international marketplace. Of course, there is the post office which offers a wide range of letter and parcel delivery services to Canadians. Although Canada Post Corporation is classified to a different SIC (4841-postal services), the CPC participation in the "courier" market is significant, and Priority Courier competes head-to-head with courier companies across the country. Table 7 below summarizes the parcel delivery revenue accruing to other transportation companies.

Table 7 **Estimated Canadian Courier Activity, 1990**

Revenue Source and SIC	Estimated Revenue
	$
Courier (4842)	1,903,930,699
Trucking (4561)	46,070,163
Bus (4572)	88,593,630
Total	**2,038,594,492**

A major difficulty in measuring the courier industry stems from the wide-open definition quoted at the outset. Since the 1980 Standard Industrial Classification was developed, there have been significant developments in the methods of moving expedited material. Many trucking companies and (most air cargo companies) now promise rapid delivery as well as track and trace features. The blurring of the threshold between small parcels and LTL freight is a real issue for carriers on both sides, as competition for markets withered by recession continues to be fierce.

IMPLICATIONS

The upcoming review of the Standard Industrial Classification by Statistics Canada will provide the opportunity to revisit concepts and to make working definitions that result in a framework for collecting more meaningful statistics in the courier industry.

The use of mini-surveys such as the one for updating the courier industry benchmark will probably grow as resources continue to

dwindle. The use of administrative files has its drawbacks, but the methodology used for the courier survey has proved to be cost-effective and manageable. Improvements in collection through the use of computer-assisted telephone interviewing will boost data quality, and speed survey turnaround.

Footnotes:

1 Statistics Canada, 1980 Standard Industrial Classification Manual, cat. no. 12-501

2 Tax Year 1990 was the latest complete year for which this type of data was available.

3 Principal variables on the tax file were: gross business income; net operating profit; salaries and wages; fuel; vehicle expenses; purchased transportation; interest paid; and depreciation. Total operating expenses were calculated as the difference between gross business income and net operating profit.

4 The Business Register draws an annual sample of tax records to produce estimates of economic production for small businesses.

5 Forms used for data collection can be obtained from the authors upon request:

Form 800 used for updating the Business Register

Tax transcription card used for recording key variables from selected income tax files

Supplementary Questionnaire developed by Statistics Canada for this survey with the cooperation of members of the Canadian Courier Association

6 Principal variables in the supplementary questionnaire included: proportion of revenue generated from same/next day or later service; number of packages and shipments; proportion of revenue generated from domestic, transborder and international business; and detail on equipment and employees by category.

7 The results of the study for carriers in certain provinces or territories could not be released since they were confidential. These were combined with results of another province in the same region of the country.

The opinions expressed in this paper are solely those of the authors, and in no way reflect the views of Statistics Canada or of Revenue Canada, Taxation.

Recessionary Impacts on Business and Leisure Aviation Markets

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Introduction

Transportation analysts looking back from the year 2000 will see Canada as having weathered (at least) two major recessions in the previous twenty years. They will see an industry where, during the early 1990's, over one million dollars a day were being lost by Canadian air carriers alone. It is crucial in such a climate that the right markets are served. Passenger loads (at acceptable yields) affect not only carrier profitability but impact on the revenue base of airports and other supporting industries.

This paper examines the stability of business and the volatility of leisure aviation markets in Canada during the recessions of the 1980's and the 1990's. Similarities and differences in the markets' growth and contraction are outlined. Some of the implications for carrier behaviour and route planning and some of the implications for airport authorities are briefly reviewed.

Business Markets

At first glance, it would seem easy to define a business market. It is, presumably, a market where the majority of the passengers carried are travelling for the purpose of business rather than personal or leisure travel. This has been greatly complicated, however, by the change to hub and spoke traffic system. Travellers, whether for business or pleasure, increasingly must fly to hub cities such as Vancouver, Toronto or Montreal before flying to their ultimate destination. This makes the identification of business markets more difficult since the passenger loads on feeder flights will increasingly also contain leisure travellers flying to hub cities. This would be apparent in a market such as Ottawa-Toronto.

For the purpose of this study, five markets were examined: Toronto-Montreal, Toronto-Ottawa, Toronto-New York, Montreal-New York and Toronto-Chicago. These are all routes between key business or government centres. They also are amongst the most travelled origin-destination city-pairs.[1] The data source was Statistics Canada's Revenue Passenger Origin Destination Survey. This is a 10% sample of all lifted flight coupons for scheduled services by the major Canadian scheduled service air carriers. For Canada-United States markets, these data are supplemented from the United States origin and destination data for travel where only American carriers are involved in the ticketed journey.[2]

The use of non-discounted air fares could be considered as a sign of a business market. With the exception of Toronto-Montreal, all of these markets had a higher proportion of full fare utilization than the Canadian average in 1991.[3] [The use of discounting in the Toronto-Montreal market was described in Air Canada's 1990 Annual Report: "Primary factors included intense competition from Intair, and increased pressure from Montreal's St. Hubert airport, and the Toronto satellite airports at Hamilton and Buttonville. Yields were consequently under pressure...". [Air Canada, 1990, p. 19]

Leisure Markets

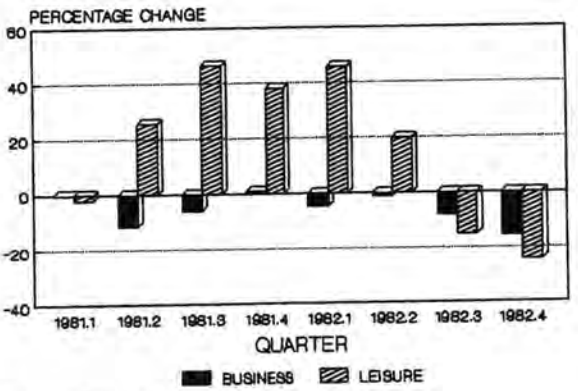
With respect to leisure travel, five markets were examined: Toronto-Orlando, Vancouver-Hawaii, Montreal-Fort Lauderdale, Calgary-Reno, Toronto-Atlantic City. These markets were chosen as a function of their size while attempting to get a suitable mix of long-haul and short-haul markets.[4] Toronto-Orlando, Vancouver-Hawaii and Montreal-Fort Lauderdale are all high volume markets. Calgary-Reno was chosen as the purpose of travel was assumed likely to be recreational. The Toronto-Atlantic City market was chosen because of its short haul. The markets were classified as leisure markets because the traffic is predominately charter.[5]. There was also a subjective categorization based on the status of these destinations as either sun destinations or gambling/entertainment centres.

With one exception, the data used were from Statistics Canada's Charter On-Flight Origin and Destination Survey. This is a census survey of large aircraft charter operations.[6] For the Vancouver-Hawaii market, both scheduled and charter passenger travel were included. It seems obvious that the charter passenger traffic is leisure traffic. The scheduled traffic could be a composite of business and leisure travel although more leisure than the five other markets examined earlier. This market has shown very great shifts between charter and scheduled services. Charter traffic of Wardair was to a large extent diverted onto excursion fares on Canadian Airlines International Ltd's scheduled flights after the take over of Wardair by Canadian Airline's parent PWA Corp.

Recession 1981-82

What happened to the scheduled passenger traffic in these business and leisure markets during the period 1981-1982? The economy was in decline from the third quarter 1981 and throughout 1982. [Statistics Canada, Catalogue 10-294] Figure 1 shows that the scheduled passenger traffic for the business markets was also in decline during this period. Of the eight quarters, six showed decreases in passenger traffic with respect to the previous year. One quarter showed an increase of 0.9%. The largest decline was in the fourth quarter of 1982 when the passenger volume was down over 15% from the previous year.

Figure 1 **Passenger Traffic, Selected Business and Leisure Markets, Percentage Change in Passenger Traffic With Respect to the Same Quarter Previous Year, 1981-82**



Source: Aviation Statistics Centre, STC

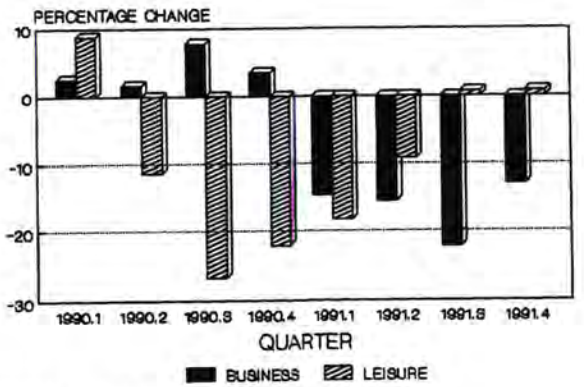
The leisure markets showed growth during most of the recession. Of the eight quarters examined, only the first quarter 1981 and the fourth quarter 1982 showed declines in passenger volumes with respect to the same quarter of the previous year. Much of the growth can be explained by Nordair's initiation of daily charter flights from Toronto to Florida in 1981 and daily Montreal-Fort Lauderdale flights which were started in 1982.[Nordair, p.9] While the Florida market grew, there was a decline in 1981-82 in the Canada-Mexico/Caribbean market. While the Montreal-Fort Lauderdale market was growing, Montreal-Acapulco declined 16,000 passengers (32%) in 1981 and a further 8,000 passengers (24%) in 1982. [Statistics Canada, Catalogue 51-501, p. 80-81]

Recession 1990-91

The passenger declines in the selected business and leisure markets during the latest recession were more severe than those experienced in 1981-82. While the economy was in decline from the third quarter of 1990 until the fourth quarter of 1991 [Statistics Canada, Catalogue 11-010], passenger volumes on the business markets declined as much as 22%. The passenger declines are shown in Figure 2.

The leisure markets also experienced much more severe declines in the latest recession. Five of the eight quarters showed declines, and these were in the range of 9% to 27%. Two of the quarters showed passenger growth of less than one per cent.

Figure 2 **Passenger Traffic, Selected Business and Leisure Markets, Percentage Change in Passenger Traffic With Respect to the Same Quarter Previous Year, 1990-91**



Source: Aviation Statistics Centre, STC

How to Explain the Market Results in the Two Recessions?

At first glance, there appears to be two very different reactions to recessions in the same markets in 1981-82 and 1990-91. There are, however, some common elements and possible explanations.

The business markets showed more stability than the leisure markets. The swings, whether up or down were more muted than those found in the leisure markets. There are several possible reasons for this behaviour:

(a) The business market is larger and therefore larger shifts in passengers are required to generate similar percentage changes;
(b) Demand for business travel is less elastic than vacation or leisure travel;[7]
(c) Markets with higher business traffic also have higher margins which could more easily be cut to try to maintain customers during a recession;
(d) Especially for long-haul markets, business travellers can use discounted fares during recessionary times leading to more stability in passenger volumes for long-haul business markets.

The same factors above help explain the volatility of the leisure markets as well. Shifts in passenger volumes are easier in the smaller markets with more elastic demand and where margins are less able to be cut to stimulate demand in poor economic times. It is also probably easier to substitute one leisure destination for another. One could, for example, divert leisure travel from Mexico to Florida if costs were lower. Rather than cancelling the leisure travel, the destination can be changed. For business travel, the locations are likely more fixed by the locations of the business activity.

Leisure/Business or Long/Short Haul?

Is it a difference between leisure and business markets that we are seeing in Figures 1 and 2? One factor that supports this is an examination of the short haul versus the long haul. The city-pairs selected for the business markets are predominately short haul and the leisure markets identified are predominately long-haul. The great circle distance between the city-pairs is shown in Table 1.

Table 1 Great-Circle Distance Between City-Pairs

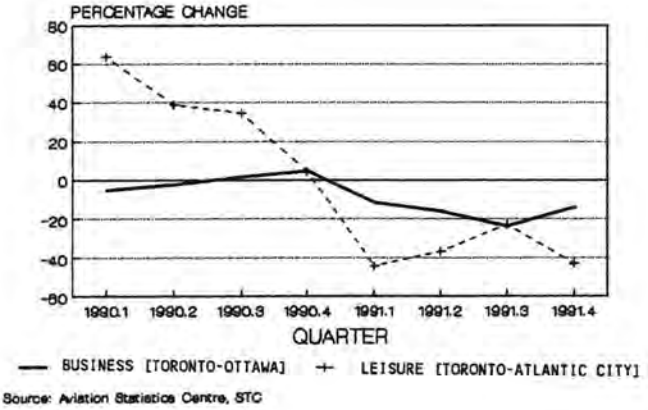
City-Pair	Distance (kilometres)
Business Markets	
Toronto-Montreal	506
Toronto-Ottawa	363
Toronto-New York	589
Montreal-New York	536
Toronto-Chicago	700
Leisure Markets	
Toronto-Orlando	1 701
Vancouver-Hawaii	4 350
Montreal-Fort Lauderdale	2 230
Calgary-Reno	1 366
Toronto-Atlantic City	630

Source: IATA Air Distances Manual

Short haul markets should be more susceptible to diversion to other modes than long haul markets. When times are tough, businesses can try to pare down travel expenses by reducing all but the most essential travel. Another means to reduce their costs is by using cheaper alternative forms of travel. Since most of the business markets examined are relatively short-haul, this could have meant that some of the passenger decline was due to the switch from air to automobile, bus and train for business travel. While it can be dangerous to generalize on the basis of one market, within the five business market city-pairs, Toronto-Chicago, the longest distance city-pair, showed the smallest decrease in traffic.

There was only one short haul city-pair in the leisure markets that were examined. Toronto-Atlantic City showed declines as high as 44% during the 1990-91 recession. The highest decline in the short haul business markets was a 23% decline in the third quarter 1991 in the Toronto-Ottawa market (see Figure 3). The short haul leisure market declined more than the long haul leisure and the business markets during 1990-91. This supports the hypothesis that there is a difference between leisure and business travel. [The possibility that the demand for gambling is more elastic than the demand for the sun during a Canadian winter will have to be studied elsewhere.]

Figure 3 Passenger Traffic, Short Haul Business and Leisure Markets, Percentage Change in Passenger Traffic With Respect to the Same Quarter Previous Year, 1990-91



Source: Aviation Statistics Centre, STC

Implications

What are the implications of the differences in the stabilities of the two market types? If business markets are less affected than leisure markets by economic downturns, this gives yet another reason for air carriers to target these markets. They are already attractive in that the business flyer is the higher yield passenger. Flying fewer of them generates higher revenues. The business traveller also tends to be the more frequent flyer. A customer that purchases your product more frequently and at a higher price is the kind of customer that a firm would most like to attract.

For carriers already in a leisure market, the stability of business travel might be yet another incentive to attempt to attract more business clientele to their service. This could be found in such initiatives as one way charter fares, very regular service patterns, "business class" service amenities. As stated earlier, this also helps to explain Canadian Airline International Ltd.'s decision to serve the Hawaii market using excursion fares on its scheduled flights. In 1988, Vancouver-Hawaii was a charter market of 91,342. This declined to 12,198 in 1990 when Wardair's service was merged into Canadian's scheduled flights. The scheduled service market during the same period went from 58,960 in 1988 to 110,850 in 1991. By operating scheduled flights with excursion fares, Canadian Airlines International was still able to attract business travellers at higher yields on the scheduled flights.

The benefits of attracting both leisure and business passengers were seen by Canada's major scheduled carriers and attempted with such initiatives as the Charter Class Canada Fare (1977), Seat Sales (1979), Skybus (1980). [Grieg, Duffy, Berlinguette, 1984, p.101-105] Pursuit of both kinds of markets was given as the reason for Wardair's entry into the scheduled service market. In Wardair's 1986 Annual Report Max Ward states "Accordingly, we continue to restructure our services to attract revenues from every market: leisure travel, business travel, travel for any reason...". [Wardair, p.5] More recently Nationair has supplemented its charter activity with entry into the international and domestic scheduled market.

For airport authorities, Transport Canada, Local Airport Authorities or municipalities operating airports, market stability is a factor in revenue forecasting and demand forecasting. They also would be interested in a large proportion of "business" flights or passengers from their airport if this would mean a more stable market and therefore more predictable airport revenues. There are other factors at play, however. While landing fees and terminal charges are significant sources of revenue for the facility, there are other areas to raise funds. A determination of who spends more at the airport facility, business or leisure travellers, on items such as parking, retail outlets, restaurants and bars would also be factors.

Conclusion

An examination of some major Canadian business and leisure markets performance during the 1981-82 and 1990-91 recessions suggest that business markets are more stable in terms of passenger volumes during recessionary periods. This provides another reason that both airlines and airport authorities should encourage the establishment of good business air links between communities of interest. It also helps to explain why there has been a blurring of the distinction between leisure services and business services in Canadian domestic and international aviation markets. Given the reasons for the stability of business travel: the elasticity of demand, the ability to cut prices on business fare products, "fixed" destinations based on centres of business activity, carriers will continue to try to blur the distinctions between the two markets in the period to the year 2000 and beyond.

Note

The views and opinions expressed in this paper are those of the author and do not necessarily reflect those of Statistics Canada.

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1. In 1991, for domestic markets, Toronto-Montreal ranked first and Ottawa-Toronto ranked second in terms of passengers carried on an origin-destination basis. These two city-pairs alone accounted for approximately 16% of the domestic origin- destination traffic in 1991 [Statistics Canada, Catalogue 51-204, 1991 issue, p. 7]. For Canada-United States markets, Toronto-New York ranked first, Montreal-New York ranked second,

Toronto-Chicago ranked third and Vancouver-Hawaii ranked thirteenth. These four markets alone accounted for approximately 18% of the Canada-United States origin-destination traffic in 1991 [Statistics Canada, Catalogue 51-205, 1991 issue, p. 11].

2. For a more complete description of the survey methodology and limitations, please see Statistics Canada, Catalogue 51-205, Air passenger origin and destination, Canada-United States Report.

3. This is shown in internal listings of the Fare Basis Survey of Statistics Canada. For a description of this survey see Di Pietro/Baldwin, CTRF, 1991, p.516.

4. In 1991, Montreal-Fort Lauderdale ranked first and Toronto-Orlando ranked third in terms of passenger volume on an origin-destination basis for Canada-United States charters.

5. This approach was also used in "Janes Airport Review" description of flights to Cuba as "unscheduled leisure flights". [Janes Airport Review, September 1991, p. 16]

6. For a more complete description of the survey methodology and limitations, see Statistics Canada, Catalogue 51-207, Air Charter Statistics.

7. This has been supported in several works. See for example "the demands for business trips for all modes is inelastic (less than unity) with respect to own price, with air travel exhibiting the highest price elasticity of demand. Personal travel demand appears to be more elastic with respect to own price than business travel for all modes except bus transportation". [Meyer & Strasheim 1971, p. 141]

Leadership and the North American Trucking Industry
"A Look Back From the Year 2000!"

Presented to the 28th Annual CTRF Conference
Fredericton, New Brunswick
June 1993

by Lloyd L. Ash,
General Manager, Trimac Consulting Services

"When the ground game doesn't work, take to the air!" In 1993, this football strategy was needed in the North American trucking industry. A new leadership style was evolving for those players struggling for effective Canadian motor carrier participation in the Americas (North, Central, and South).

The period from 1985 through 1993 had seen more conflict than leadership among the various players -- government, carriers, shippers, unions, owner-operator associations, and "inter" - modes such as rail, water and air. The adversarial approach impeded partnerships and team spirit as conflicts erupted about:

- entry (de)regulation,
- taxation and subsidy variations between modes and nations,
- economic recession and transportation rate erosion,
- jurisdictional (in)equity and (in)efficiencies,
- international competition in all markets for commodities, motor carriage, and labour pools headquartered in Canada and the U.S.,
- safety and environmental issues.

In 1993, the "ground game" was clearly not working for this industry, and those touched by it. For those who survived, and thrived, to the year 2000, a new leadership style was needed to deal with unsustainable trends and significant system restructuring.

Challenges Faced From 1993 through 2000

Although it was not articulated specifically for this industry, or formalized as a government policy, a Leadership Model became apparent among those who were successfully adjusting to the new continental economy and facing the challenges for 1993 through 2000. These challenges included:

- efficiency requirements to do more with less,
- emerging delineation of service requirements and standards,
- investment requirements to permit an adequate rate of return for cash investors,
- needs to deal with new technologies, expanding (North American and North-Central-South American) trade zone opportunities,
- needs for more sophisticated training requirements for employees of transportation enterprises as they learn increasingly demanding and specialized roles,
- imperatives for government to harmonize regulations, minimize regulatory inefficiency, and effectively promote equity and business opportunities for the other players,
- recognition of the shipper -- carrier relationship and its extension to include all the other players.

The Challenge to Do More With Less

Following Figure 1 illustrates underlying trends in the revenue-cost squeeze that faced the trucking industry in the early 1990's.[1] As shown in the graph, truck operating costs for specific configurations had escalated approximately 50% over 12 years since 1980.

Yet the industry's revenue index had not increased by more than 20% and had dramatically decreased back to par in the 1990 - 1992 recession. The situation was so difficult that equipment capital investment was slowing. This was hurting suppliers and there were significant discounts available for equipment purchase. Figure 2 illustrates the revenue side when indexed into constant dollar terms.[2] Note that while some industry advocates searched for a villain to blame, others saw this situation as a carry-over from the carriers' customers, who were themselves coping with recession and a continental realignment of market competitiveness. Nobody was found "hoarding" a pot full of money that was needed to better pay the carriers for their services.

Figure 1: Escalation of Truck Operating Costs and Revenues In Canada (Base Year 1980 = 100)

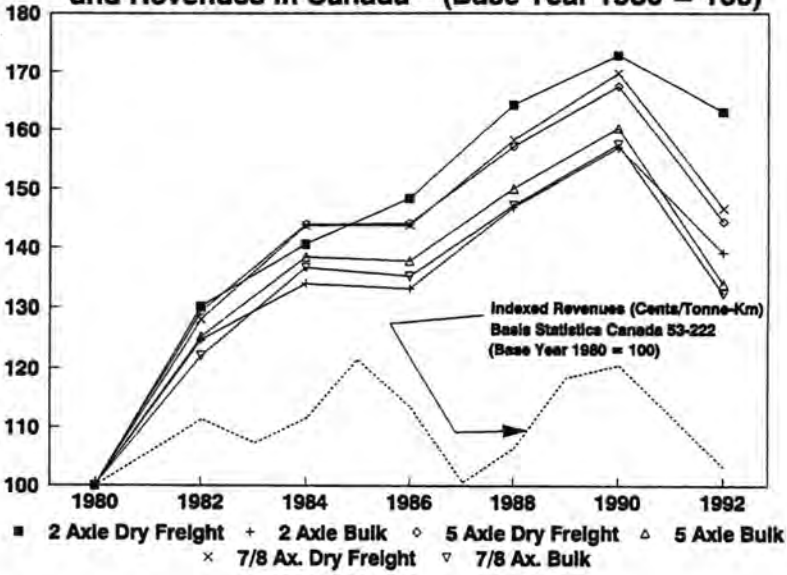
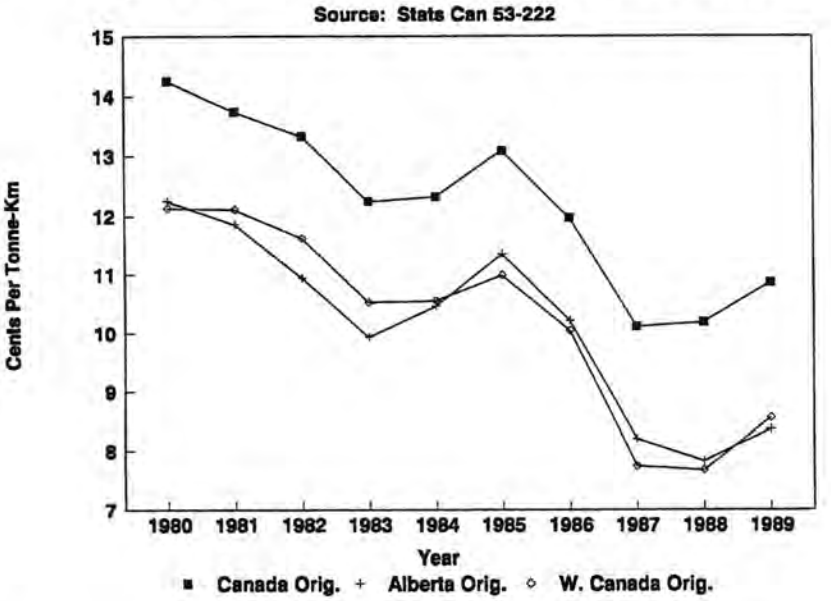


Figure 2: Trucking Revenues in $1992



Prepared by: Trimac Consulting Services

1992

Declining Margins

These trends challenged Canadian trucking industry management as never before. Whereas a norm for a well managed truck operation's pre-tax profit had been 10% (termed a 90 operating ratio, representing 90 cents of costs for every dollar of revenues), by 1992 the norm was closer to 2% profit, or a 98 operating ratio. This left little margin for inefficiency, or pricing error. Carriers that survived and prospered in this environment were those who knew their costs, managed by monitoring productivity, communicated better with their customers and were unwilling to discount rates below their costs. Many strove to develop closer partnerships with shippers--with a view to enhancing efficiency of the trucking operation and together promoting the shipper's goods in the North American marketplace.

The Conveyor Belt

Figure 3 illustrates the truck delivery movement as a conveyor belt. This was an emerging image, within the shipping community, for the role of truck distribution in the firm's business.[3] In this view, the truck was seen as the final conveyor belt in the production process--and one of the very important conveyors. Unlike much of what happens within the factory, many shippers recognize that their customers' most frequent, and important contact with the shipper was the carrier's delivery truck and the driver of that truck. An on-time delivery, in a clean/well maintained vehicle, by a well-groomed, courteous driver, was desired. It was not necessarily the cheapest trucking service that was appropriate--but the shipper needed to become cost aware so as to understand and assure that appropriate trucking services were being secured, at an appropriate price.

The foregoing did not necessarily mean that all sectors of the trucking industry became highly valued. Rather, what resulted was an increasing delineation of service requirements and standards, according to the shippers' customers' needs. The quality of service, from the standpoint of on-time delivery, is much different for an auto parts hauler, serving factories on a just-in-time basis, than it is for a carrier moving hay to feedlots.

Figure 3: The Expanded Shipper Perspective

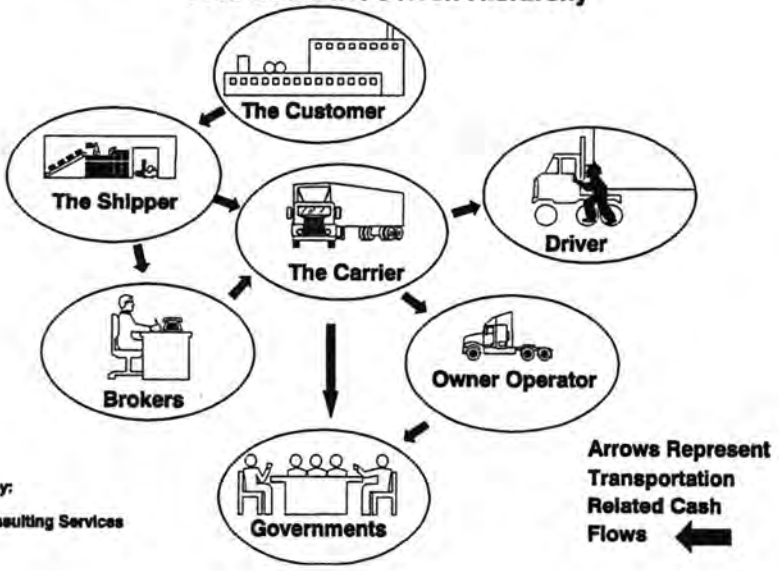


The Money Pipeline

A helpful consideration is to view the money flow in all of the commercial and regulatory transactions associated with the trucking industry. Figure 4 illustrates the principal cash flows that take place.[2]

In considering where the money comes from, each of the involved parties can better appreciate who their customers are and how their role fits within the larger system. Thus, the trucking company derives revenue only because a shipper and customer are doing business. Drivers and owner-operators are paid by carriers. Governments, who regulate the system are financed by taxes paid through the earnings of others involved in the process. This relationship to economic production underscores the imperative for government to harmonize regulations, minimize regulatory inefficiency, and effectively promote equity and opportunities for the other players. Out of this framework, 1993 through 2000 saw a new focus by Canadian provincial and federal regulators on having a regulatory system that industry could afford. The biggest innovation was the introduction of meaningful and comprehensive safety regulations, nationally, and the development of a single multi-province authority for trucking, similar to the U.S. Interstate Commerce Commission's 48 state authorities. Another leadership model was for government to concentrate on efforts to promote better skills and efficiency for the trucking industry.[4,5]

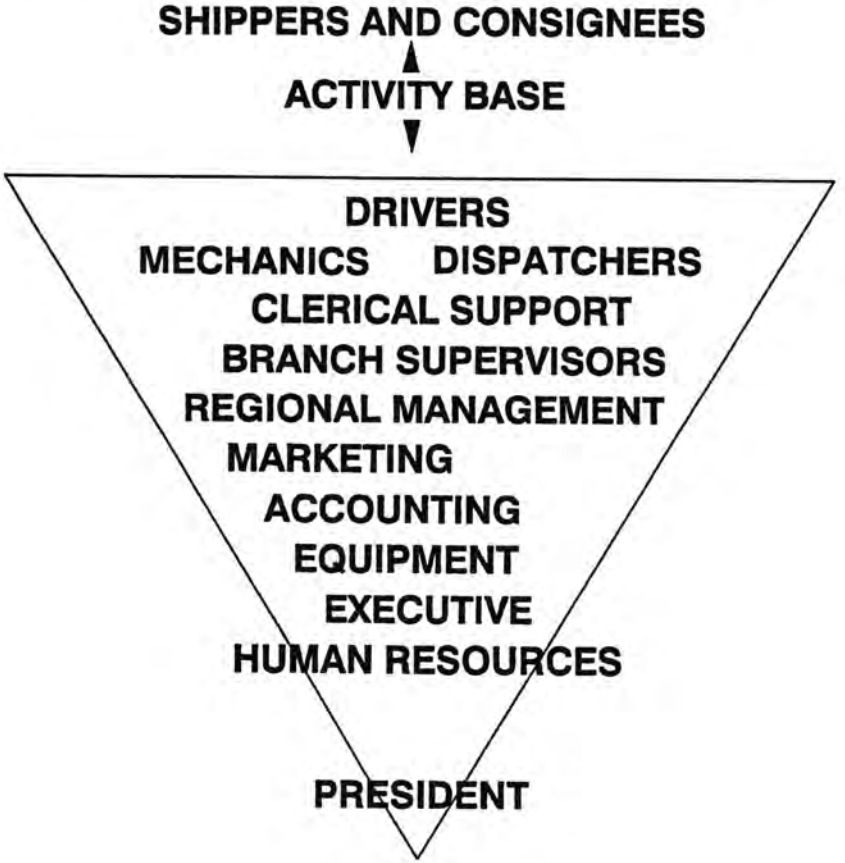
Figure 4: Truck Transportation As a Cash Flow And Customer Driven Hierarchy



The Inverted Pyramid

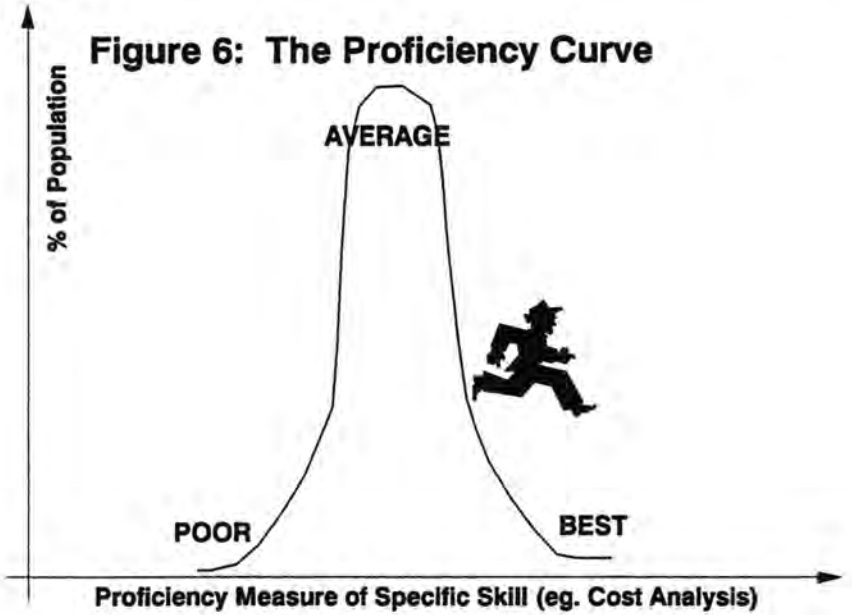
Government was not alone in needing to view the world differently. Figure 5 illustrates the "inverse pyramid model" of a large trucking firm. In the late 1980's, there was a recognition within the more successful firms that most of the company's contacts with customers (both shippers and consignees) is by the firm's drivers. All of the vital, revenue generating activity of the firm is directly performed by these drivers. About 75% or 80% of the employees are drivers. These key employees' are "served" by the rest of the employees of the firm. The role of the rest of the management and supervisory layers in the firm is to assist these drivers perform their important tasks. As one moves down the inverse pyramid, the service roles are more indirect. Thus, a "head office" employee's job is to facilitate and support branch management's needs. Ultimately, the firm's president, least removed from operations, is leading/supporting/coaching the rest of the team. Note that this leadership model was not restricted to the trucking industry. Many firms that survived and prospered in 1993 through 2000 adopted this same management focus. The concept may have originated, in modern business, by the writings of R.K. Greenleaf [6], formerly of A.T.&T., concerning "The Leader as Servant".

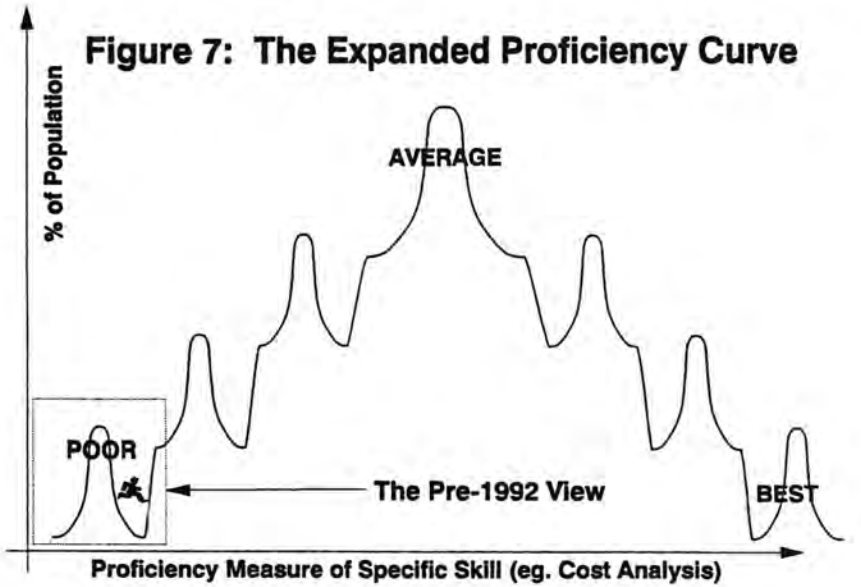
FIGURE 5: THE INVERTED ORGANIZATIONAL PYRAMID



Enhancing Skills: Moving Up the Bell Curve

The 1980's placed increasing demands on trucking industry management to develop better understanding of costs, enhanced technologies, especially in respect of computerization and information systems. As trucking firms operate on smaller margins, there is less margin for error. Figures 6 and 7 illustrate the need for improved skills, as experienced by a typical firm which had previously considered its performance to be "above standard". After adopting an expanded viewpoint, the firm was directing it's efforts to improvement, as opposed to maintaining the status quo. This became especially important during the continentalism of the North, Central, and South American economies during the 1990's. Not only had competitive factors changed, but there were market opportunities for those firms having the analytical and management expertise to identify and cultivate them. Everybody, however, needed to sharpen their skills and try to "move up the bell curve".





The Leadership Issues and Tools Recognized By the Survivors: 1993 - 2000

As noted previously, the firms who survived adopted leadership philosophies that were not articulated specifically for the trucking industry. Traditional ways of thinking were challenged by many environmental variables and issues. Some of these issues, which deserve consideration by historians seeking to understand the significant changes that impacted the industry, in this period, include:

- integration of environmental policy and interests of non-participants in managing the trucking enterprise (especially as some public agencies advocated "carbon taxes" on emissions),
- conflict resolution methods and models to deal with labour and owner-operator concerns, international disputes, and trade issues,
- linguistic and cultural plurality issues involving English - Spanish - Portuguese cultures, working in a Hemispheric Economic Unit,
- economic development, social mobility, and equity issues among nations and groups within society.

Perhaps, based on a historical view of the period 1993 through 2000, the agents of trucking policy need to consider their roles in a different light. The market forces, trade and socio-economic factors which drive "trucking policy" are largely exogenous to the industry and government regulators directly involved. Who are the real policy makers? What are their policy choices?

Can government, carriers, shippers, and those employed within the industry adopt new leadership approaches? Can these policy agents "take to the air" to overcome the bruising and combative ground game seen in the 1980's and early 1990's? What new order is emerging for this important transportation sector -- the trucking industry of the America's in the year 2000?

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COMPETING EFFECTIVELY WITH AMERICAN COMPANIES ON THEIR OWN TURF

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A Division of GSW Inc.

INTRODUCTION

It is a primary concern of any company that, when competing in any foreign market, all costs, including transportation, be as low, or "level" as possible. This paper will examine methods on how to utilize deregulated American carriers and our own resources in Canada to effectively compete against companies located in the states.

CUSTOMS - EXPORT SHIPMENTS

The import/export customs area is one which seems to get no more than a cursory glance by most Traffic Managers. The reasons are obvious; it is a difficult subject to learn with few, if any, courses available. Everyone is aware that duty rates can not be changed, therefore little time is scheduled for cost-cutting forays. However, there are some steps that should be considered to ensure that you are maximizing your company's dollar.

The first consideration is whether or not your harmonized system numbers are correct. For example, a shipment of domestically made monochrome (black & white) televisions are duty exempt. If, however, you declare only that the shipment consists of televisions, chances are the broker will apply a duty rate for colour televisions. This illustrates the importance of describing the product fully so that the correct classification can be made. Your harmonized number classification should be on all your pro forma invoices to avoid any errors in the application of the duty rate. Schedule a meeting with your sales representative and their classification expert and take a walk through your warehouse, examining your product along the way. Ask if there is any minor changes that you could make to your product, or your product description, that would change your H.S. number and thereby lower your duty rate.

If you are importing, ask the Canada Customs office closest to you on their opinion of your imported goods. Arrange to make samples available. I have asked their opinion not only on imports, but have also requested help on classifications on our exports. My company recently had our duty rate raised by U.S. Customs. I conferred with Canada Customs informally which helped me a great deal. My company went through the various steps, resulting in a binding decision in our favour. The process was long and costly, but it more than paid for itself by duty savings. I have found Canada Customs to be expert in the

harmonized system, helpful and fair whenever they have been approached.

SURETY BOND

Secure a surety bond. It is amazing how many companies do not have one. A surety bond, once obtained, is renewed by your company once a year so that you do not have to use your custom brokers bond. Very simply, if your customs broker's invoice includes a "bond charge" that means that you are using your custom broker's bond to ensure that the U.S. government will receive the duties owing from your shipment. While a nominal fee, it can quickly add up. A company can save thousands of dollars a year, dependant on the number of shipments, and the bond fees charged. The best way to determine if this bond is suitable for you is to examine your broker's invoice to determine what your present bond charges are, multiplied by the number of shipments you have in one year. Your customs broker can get you started by recommending an insurance company specializing in this type of bond. The cost will vary from company to company, dependent on how much security U.S. customs will need. If you are a member of a multidivisional company, all the companies can be listed for the same price, providing that they are related to each other. The cost of the bond, while already inexpensive, can be reduced further by apportioning the charge amongst the various divisions.

FREE TRADE ACCELERATION

We are now half way through the time period for total elimination of all duties on goods manufactured in Canada or the United States.

The free trade agreement between Canada and the U.S.A. allowed the review of some products for an acceleration of duty free status. The list was put forth by the respective governments for consideration in a series of formal meetings. I understand that there is not be a meeting this year, however, with the ongoing talks with Mexico, I would not be surprised to find another one scheduled in the very near future as both governments try to tie up loose ends with each other before turning their attention to Mexico. Regardless, this information will be as pertinent in our future dealings with Mexico.

Free trade acceleration is a double edged sword. The duty rate

is much higher on imports into Canada than exports into the United States. If you currently have fierce competition from American companies in the Canadian marketplace, the elimination of duty will only exacerbate the problem, since the elimination of duty works both ways. Request that your broker forward all information on free trade acceleration, including the products being considered for duty free status. If competitors' products are included, broach the subject with the Canadian government. The same would apply for free trade acceleration with Mexico, if allowed. Insist that your broker keep you informed. If he can not, find a broker who can. On the other hand, duty free acceleration may be beneficial to your company. If so, make sure that your product is on any future list for consideration of duty free acceleration. To make sure that only your product, and not a Canadian or American competitor's product, is allowed duty free status, ensure that the product specification is such that only your product would qualify. If you do not, your competitors' product will also be allowed duty free status through your efforts.

EXPORTER'S CERTIFICATE OF ORIGIN

Is your Exporter's Certificate of Origin current? If not, you will pay full duty rate. Any new product lines introduced by your company through the year should also be added immediately to the list. Remember, only the product listed is allowed the reduced duty rate. The upkeep of the Certificate is of the utmost importance, yet takes so little time.

Our current customs broker supplies pro forma invoices which has a separate field on the invoice for the exporter's certificate of origin. The clerk filling out the pro forma only has to sign and date the applicable field.

If you are paying the duty on inbound shipments from the states, it is of some importance that all imports from the United States should have an Exporter's Certificate of Origin if the goods qualify for FTA treatment. Our company policy is to include a copy of the certificate with all our purchase orders. Should the American supplier have any questions, he is instructed to contact us for information. We have even helped determine the correct H.S. number for his product so that we will pay the correct duty rate, and not a higher rate of duty. A supplier has no excuse for not filling out the export documentation properly, therefore we are able to charge back the supplier any excess charges paid to Customs through their negligence.

FREIGHT CLASSIFICATION

The perceptions of what happens when our freight is classified by the transport company could not be more different from the reality.

Many companies do not seem to worry about the product description on their bill of lading. The attitude has been that "someone" will check and ensure that the proper freight classification will be applied. Nothing could be further from the truth. Fifteen years ago there were rate clerks stationed at all the major transport terminals to rate all the shipments going through their terminal. It was not unknown at that time for the rate clerks to venture out on the dock to try to ascertain the correct description to enable them to apply the proper classification. Those days are over. Most transport companies, through their Electronic Data Interchange, have central traffic departments which do all the rating for the various terminals across the country. It is therefore impossible to examine the freight. If the shipment is not described fully, the product will receive the highest freight classification. Even if the shipment is described properly, rate audit personnel are only human and can make errors. Yes, auditing these classification errors can result in enormous freight savings - but at what cost? It is reasonable to expect that a carrier can request that you substantiate your classification by providing copies of the customer's invoice, product catalogues and a revised bill of lading. The headaches involved do not justify the work, especially since it is not necessary.

Every company should have the complete description of every product, it's respective National Motor Freight Classification (NMFC) item number and freight classification preprinted on their bills of lading.

The National Motor Freight Traffic Association (NMFTA), which issues the NMFC 100 Freight Classification Tariff, is made up of thousands of participating motor common carriers located in the states, and in Canada. The intent of the NMFTA is to "establish, publish and maintain a tariff of reasonable classifications of property transported by truck." Every carrier in Canada is cognizant of the NMFC 100 tariff and accepts the freight classification within.

It is important to have the correct freight classification for your product lines. Companies have been known to pay thousands of dollars in excess freight charges because inaccurate freight classifications have been applied against their shipments.

A number of criteria is involved in deciding a freight

classification, such as handling characteristics and valuation, but the most important factor taken into consideration is the density of the product.

If you feel your company's products may have too high a freight classification, there are ways to remedy the situation. The National Classification Committee can be approached regarding the change in classification by filling out a "Proposal to Change" form.

My company is in the process of having their freight classification reviewed by the National Classification Committee. The process is somewhat involved, but the necessary steps are clearly illustrated and we have found the NMFTA to be helpful with any questions we have had.

One lesson learned during the classification review that is of prime importance, is how imperative that your company be aware of any prospective changes to your freight classification. An American carrier proposed the changes that affected my freight classification. The changes were not directed specifically at my company or our product, but were intended to affect a similar product, also using the same freight classification, from an American manufacturer.

The proposed change would have increased my freight classification from a Class 85 to a Class 125, therefore our freight costs would have increased proportionately. My company became involved and, through our efforts, it seems that we will have no change in our classification. Our competitor will.

The NMFTA makes every effort to contact any company that would be affected by a proposed revision, however, this is no guarantee that your company will not be overlooked.

To avoid this possibility, your company should consider either subscribing to the NMFC 100, or the newsletter "Transport Topics", or the 1993 NMFC docket.

Handouts on the above noted publications will be made available.

INTERNATIONAL VERSUS DOMESTIC FREIGHT RATES

In Ontario the International or Niagara Frontier Tariff Bureau (NFTB) rates (between Canada and the United States) have always been extremely high when compared to the Canadian or American domestic rates for the same mileage. Theoretically, the carrier's cost per mile is the same regardless of where the shipment is shipped. Therefore, the freight charges should be

identical for two shipments travelling an equal distance no matter what the location.

We all know this to be nonsense: a shipment to Northern Ontario or Newfoundland will incur a much larger freight bill than a shipment moving an equal distance within the Ontario - Quebec corridor. The reason, stated simply, is because the carrier's expenses are greater; backhauls are almost non-existent for the carrier, therefore the rates must cover his expenses both in, and out, of the remote area with the assumption that no backhaul will be available.

This explanation does not explain why the NFTB rates are so high. There is an imbalance of freight but the traffic is very heavy both ways. The large variance between the rates may be explained by the rates being based on what the market will bear.

My company started to consolidate less-than-truckload shipments into truckload shipments (with a truckload carrier) to an American carrier's dock approximately twelve years ago for two reasons: to avoid the Niagara Frontier Tariff Bureau (NFTB) rates; and to expedite customs clearance. At the time the Americans had not yet deregulated and our rates were the domestic tariff bureau rates, such as the Southern Motor Carrier, Rocky Mountain Bureau, and the Atlantic Conference tariff rates less a discount. The cost was much less per shipment then if we had shipped direct from our plant facilities in Canada. Our customs clearance was expedited compared to regular service offered by an LTL carrier. As you are aware, the LTL carrier will take your shipment back to their terminal and consolidate your shipment with shipments from other customers going to the same destination terminal. Normally, there is nothing that can occur that could slow down your delivery. The same can not be said for cross-border shipments. Should one of the shippers have improper documentation, or if customs have decided to examine one shipment in particular, the rest of the shipments in the trailer will also be delayed. We avoided this problem by consolidating our shipments into truckloads. This expedited the border crossing since we ensured that the paperwork was in order, and that our shipments conformed to the customs requirements. We saved a great deal of time, and money, by doing our distribution through our carriers' terminals in Detroit, Michigan and Buffalo, New York. The system worked well, and we would have continued to use it, except that approximately ten years ago we bought a company in St. Louis, Missouri which started doing the U.S. distribution of the Canadian product lines. St.

Louis "bought" our product from us and sold it to their customers. Our plant in Canada, in turn, did the distribution of the American manufactured product in the same manner.

INTERDIVISIONAL RECIPROCITY

This may be an avenue to explore in your ongoing search for ways to reduce your distribution costs without a reduction in customer service. If your company is owned by a multinational company who has locations in the states, it may be worth your while to approach your counterpart and suggest an exchange of cross-docking privileges. If the volume of shipments would warrant the arrangement, you could consider consolidating your LTL shipments into a truckload which would be forwarded to your sister company. They would "explode" the trailer, then cross-dock your shipments to their carriers. Negotiations between you and your sister company on the one hand, and her existing contract carriers on the other, could result in the designated carriers protecting the existing negotiated discount on your shipments while ensuring that the freight bills would be sent direct to your company in Canada. The same courtesy would, of course, be extended to your sister company. The pitfalls associated with this type of arrangement are many. First, the plant location in the states should be central to your customer base. Second, you should feel confident that the negotiated rates, and the contracts entered into by your counterpart, are equal to, or better, than what you could have accomplished on your own. Third, and perhaps most importantly, it is imperative that the partnership fashioned between the two divisions is such that internal politics do not play a part. Last, but not least, reciprocity is important. It is reasonable to expect that the one division will weary of doing the majority of the work if the volume of shipments is unequal. Another alternative to consider is using your sister company's carriers and rate agreements even though you do not ship out of their facility. Our sister company in St. Louis now warehouses in Toronto since crossdocking is not feasible in our situation. They are, however, party to all our commodity rates. All the GSW traffic managers meet for interdivisional traffic meetings every quarter. Every division takes turns "hosting" the meeting, since we are all on an equal basis. We discuss any problems we are having with various carriers, our shipment volumes, and decide at these meetings if we wish to tender jointly on various lanes. If any division, for any reason, decides to abstain from a joint tender there are no questions

asked. We also set policies and procedures. When St. Louis and my division had to set up a distribution system within each other's country, we both decided to "flag in" to the current rate agreements of each location until we could determine what our individual requirements were.

PARETO'S LAW

Two years ago we were informed that the Canadian product line would no longer be routed through the St. Louis facility since both plants had exceeded their respective warehouse capacity and could no longer capably distribute their sister company's product. Both divisions had to start from scratch to set up a distribution network.

It had been ten years since we had shipped direct to an American customer, except for a few truckload shipments routed from St. Louis. We could not be certain that our customer base, and therefore our traffic lanes, had remained static over that period of time. We therefore could assume nothing and had to gather the required data before we could make informed decisions.

Pareto's Law, otherwise known as the ABC Analysis, states that your customers can be grouped in three categories: group A would consist of 10% of your accounts, yet account for 70 - 80% of your sales; group B would be the next 10 - 20% of your total accounts and would represent another 10 - 15% of total sales. Group C would be the remaining 70 - 80% of your accounts, yet, for all their large number, would only generate the last 10 -20% of your sales.

Our "A" customers order, and are serviced, in truckload lots only, and were therefore eliminated from the distribution analysis since all shipments would be direct shipped from our facilities in Hamilton.

We had a limited amount of time to set up a viable distribution network for our remaining "B" and "C" customers, and therefore had to work out a number of shortcuts that would still result in accurate data.

We examined a total of 12,000 bills of lading generated from the St. Louis plant in 1989. Due to time constraints, only the field on the bill of lading used for the core product manufactured in Canada was examined. All fittings and accessories were excluded. We felt comfortable with targeting only the one product since all the other product shipped was dependant on the primary product line being sold.

We determined the number of less-than-truckload shipments of

our product line, and total tonnage, for each state on the continental U.S.A., excluding Alaska, and prorated the percentage of business for each. Approximately 40% of our tonnage, and therefore our LTL sales, were within 500 miles of Hamilton; 70% were within 1,000 miles.
It is an old rule of thumb that, to estimate a shipment's transit time by a LTL highway carrier, 500 miles a day was used. Another day would be added for border clearance. Therefore, 70% of our customers were within three working days of our facility.
A map was utilized with each state's respective tonnage to better visualize our customer requirements.

PUBLIC WAREHOUSING VS. CROSSDOCKING AT A CARRIER TERMINAL

It is our job to ensure that customer service levels are maintained while keeping our distribution costs as low as possible. It is a real balancing act to try to satisfy both requirements to everyone's satisfaction.
Examine consolidating your LTL orders into a truckload, then shipping by a truckload carrier direct to your American LTL carrier as an alternative to public warehousing, or using a sister company's facilities. The carrier will explode the trailer, then crossdock your shipments at their terminal for furtherance to destination.

ACCELERATED TRANSIT TIMES

Our contract with our carriers states that a "window" of approximately six to eight hours must be specified by our LTL carrier. If our truckload carrier delivers within the time frame specified, then our freight is guaranteed to move on to the next hub that night. The LTL carrier faces a financial penalty for not moving our freight if the truckload carrier makes the "window". LTL shipments between Canada and the U.S.A. normally take one day for customs clearance. Compare this to truckload shipments which clear in a matter of hours. Shipping consolidated shipments actually improved our transit times.

BROKERAGE FEE REDUCTION

Consolidation of LTL shipments can result in savings on brokerage fees. Instead of a pro forma invoice made for each shipment, one master pro forma is issued for all the

consolidated shipments. The master pro forma combines all the customer shipments, listing the total number of pieces shipped for each product, as well as the total sales for each line.
We invoice each customer prior to shipment. Our computer then sorts each customer's invoice by product and H.S. number and provides a master list. We then issue the master pro forma invoice, using the numbers supplied by the master list, and consign the shipment to the carrier. Copies of all the customer invoices are also attached to the pro forma so that customs can see how we arrived at the figures on the master invoice.
Our negotiated brokerage rate is a flat fee of $11.50 per each master pro forma, regardless of the value. Each additional customer invoice attached to the pro forma has an additional fee of $3.50. The rate is all-inclusive and no other charges are applicable, except of course the duties and the Merchandise Processing fees. Remember, everything is negotiable, including your brokerage fee.

SHIPMENT ANALYSIS

Based on the data gathered, we had enough volume to support two different distribution networks. The map illustrated that Buffalo and Detroit were logical breakbulk centres although Buffalo and Chicago was an equally strong possibility. A rate analysis was performed on sample shipments, comparing both the Detroit, and Chicago, rates. It was found that Chicago was a better choice as a breakbulk centre, based on freight rates as well as its proximity to our customer base. The most important consideration in choosing the breakbulk centre was its location; it had to be located in a major "hub" city to ensure a broad selection of carriers. We consolidated our shipments into truckloads and shipped by a truckload carrier to the LTL highway carrier's terminal in either Chicago or Buffalo. We used a truckload carrier, such as Schneider or J.B. Hunt, for the linehaul. In this manner we not only avoided the NFTB rates, but we paid a truckload rate, instead of an LTL rate, on a portion of the trip, resulting in additional freight savings.
There was insufficient time for rate negotiations. We therefore "flagged in" to the existing St. Louis carrier contracts, adding Buffalo and Chicago to the St. Louis origin point. We guaranteed six months business to the carriers in return for access to their contracts with our sister company. It was pointed out to the carriers involved that they were actually better off with the new arrangement since the freight was now being delivered right to their terminal, and P&D costs are a

major expense with any carrier.
We benefited as well. The short-term contract gave us "breathing room", so that if there was a major flaw in our distribution pattern we would be able to correct it in a short period of time.
We were able to determine that, although we did ship to every state, we had more of a market in the north central states since our product line consists of heating products. We also had a smaller portion of business on the West Coast, the majority of which were shipments to the states of California and Washington. Even using LTL highway carriers, We would have been unable to provide service levels consistent with the rest of the country had we shipped from Chicago. We went to a small public warehouse in California to service our Western customers with a high degree of customer service, within the parameters of our quality program.

CARRIER DETERMINATION

All carriers are not created equal. Even the "Big Three", with roughly the same number of terminals, will each show a marked preference for some states if you examine their terminal locations. Make sure that the carrier is chosen because their coverage matches your customer requirements.
If you specify a national carrier when your shipments are confined to a geographic region and a regional carrier would suffice, you have reduced your carrier base to draw from, and potentially limited your negotiating clout.
Based on our analysis of our shipment pattern, we were able to determine that one national, or two large regional, carriers would be required. Various trade magazines were examined, especially Chilton's Distribution magazine's "Quest for Quality". The magazine polls the nation's shippers, on an annual basis, on which national and regional carriers they use, or had used in the past. They are then requested to "rate" the carriers, using various criteria. The result is a list of carriers that have set the standard for excellence in transportation service. Also listed, and ranked, are all other carriers of any size.
We next went to the "National Highway and Airway Carriers Directory" issued by the National Highway Carriers Directory, Inc. We like to use this particular directory since it has all the points listed in the United States by town and state, with all the carriers who service each point listed. It also indicates whether the carrier has a terminal in that town, and any limitations in its

licence. The forefront of the directory has carriers listed in alphabetical order, with operating authorities, equipment, and terminal listings for each. We are sure there are other excellent publications available that would be of equal value.
Last, but not least we went to the Dun & Bradstreet reports to ensure that each carrier was financially viable.
A list of carriers, suitable for our needs, was compiled based on all the above.

REVERSE MARKETING

Basically, reverse marketing is a definition of your company needs, and the realization that no one supplier can fulfil all your requirements. Instead of suppliers coming to you, you take the initiative and target potential vendors.
A number of the carriers on the tender list did not solicit business in Canada. They were caught unawares when we approached them with a request to bid. We first sold our company, then our freight tonnages, to the carriers to ensure their enthusiasm in the tender.
You should actively search for carriers suitable to your requirements. An increase in the number of suitable carriers to draw from will result in a proportionate increase in your negotiating "clout".

FREIGHT TENDERING

The tender process is a useful tool. You predetermine what your requirements are and rate them in order of importance. These requirements are then incorporated, as conditions, into the tender to the carriers. We prefer to tender rather than negotiate individually with carriers. Negotiation is very time consuming, and the information given must be repeated time and time again to each participating carrier. Tendering saves a great deal of time and insures that each carrier receives the same information on which to base their response. Carriers also perceive tendering as a fairer method in doing business; they are assured that the best overall package will secure the business, not the incumbent carrier who may be considered as having "pull" with your company.
When tendering, you put your "eggs all in one basket". There are a number of people who prefer to split their business to prevent single sourcing, afraid of the repercussions should something happen to the carrier. We single source; however, before a carrier is given any business we have already checked

his customer references, licence authority, reputation, service coverage, insurance, equipment and financial stability. We will use a transport company only if the carrier meets our stringent standards. We have never had to deal with our freight tied up on a bankrupt carrier's dock, which we attribute not to luck, but to our carrier screening process.

Why single source? Your administrative costs are lower for freight bill payment since you are cutting fewer cheques to fewer carriers. Tracing is usually simplified. We are using one carrier within the states at this time. We receive a shipment status report every morning through Electronic Data Interchange (EDI). We only use the one carrier, so it is the only report we have to obtain every morning. Reducing the carriers used guarantees lower rates. The larger the shipment volume, the greater your leverage in negotiations, the lower your rates. Our tender normally stipulates that only one carrier will secure the freight offered. The tender specifies a date in which all tenders must be received. If a bid is received after the deadline it is considered null and void. It will be placed in the bid reply file, however, so that the carrier will be included on the list for the next tender.

The data contained in a tender should be extensive, and include:

- the number of shipments for a one year period.
- average number of shipments a month by state.
- average weight of shipment by state.
- the number of shipments to each city by state.
- whether each shipment is prepaid or collect. If collect, is the routing done by the shipper or consignee?
- a complete list of all your product, including an indication of your "A" product, and their respective NMFC 100 freight classifications.
- how your freight will be tendered for shipment loose? on pallets? shrink wrapped?
- will the shipments be overdimensional, or require special handling equipment?
- are the shipments susceptible to damage - if so, is it due to inherent vice in the goods, or insufficient packaging?

One condition that will save a great deal of time in freight rate comparison is your specification of a carrier rate disk of a certain date, at a specified class. Each carrier would be instructed to offer a discount against the base rate and base

freight class. Our reasoning is simple. Since deregulation, each carrier has filed its own rates. It would be nearly impossible to try to compare each carriers' rates, lane by lane, class by class - so don't! You will be able to determine, at a glance, which carriers offer the best discounts, since all the discounts are predicated on the same base rate.

CARRIER CONTRACTS

Contracts are legal with American highway carriers on domestic shipments within the United States. We use them because they solve a lot of problems inherent in dealings with carriers and their standards in another country. For example, freight payment terms. In the U.S.A. the terms are seven days. As we are all aware, it can take up to seven days to receive the carrier invoice. It is impossible for the vast majority of Canadian shippers to make payment within the time specified, unless they have EDI capabilities. A number of shippers seem unaware that many carriers have provisions in their rules tariffs that allow the carrier to disallow any discounts agreed upon if the payment is late.

Another problem that has occurred is the Canadian packaging. The NMFC 100 specifies packaging to American codes for each product. It would be ludicrous to repack product into American cartons when we ship to the states, yet many carriers try to use this to their advantage in avoiding freight claim payment, citing that the Canadian product is not packaged to their specifications.

Both of the above can easily be rectified by the use of a contract.

Provisions can be written into the contract that will allow extended freight terms, anywhere from thirty to forty days, with the late payment penalty not nearly as onerous.

All our contracts acknowledge that the Canadian product packaging has been examined and has been found to be equivalent to the American standards, therefore no freight claim will be denied based on insufficient packaging.

American carrier tariffs seem to be in a constant state of flux. If you haven't seen the tariff referred to in the contract, have any reference to it stricken. If you have seen the tariff, for instance the Rules tariff, and disagree with some of the provisions, negotiate their removal. Most important of all, state clearly in the contract that no revisions will be allowed to any tariff past the date you examined them. The only exception would be their tariff containing their terminal locations. The

easiest way to circumvent this problem is to issue your own Rule tariff, with the carrier, which outline the agreed upon accessorial charges.
A word of caution - everything is negotiable until you sign the contract. Afterwards it is written in stone.

A PROFILE OF THE ONTARIO PRIVATE TRUCKING INDUSTRY

Greg Little, Ministry of Transportation, Ontario*

1 Background

1.1 Introduction

The Ontario trucking industry is often perceived to be a single entity with uniform characteristics. However, once it is examined in some degree of detail, it becomes clear that the trucking industry can be categorized in many different ways. One of the significant categories or sectors of the Ontario industry is private trucking. This paper will provide a profile of the Ontario private trucking industry.

1.2 Definition

Private trucking is generally defined in terms of ownership of the goods being carried. A private trucking company or carrier is generally operated by a company, such as a retailer or manufacturer, for the purposes of carrying its own goods. Statistics Canada defines private carriers as:

> Owner/operators of motor vehicles carrying their own freight. Their principal function is to provide logistical support service to the proprietary owner. (Trucking In Canada, 1988)

In contrast, a for-hire trucking company or carrier is one which carries other peoples goods for compensation. A for-hire carrier is subject to economic regulation by most governments in North America and must usually obtain an operating licence to carry on business legally. In Ontario, a for-hire carrier must obtain an operating licence under the Truck Transportation Act (TTA) provincially or the Motor Vehicle Transport Act (MVTA) federally.

A private carrier does not require an operating licence to operate in Ontario or any other Canadian jurisdiction. However, the other operating requirements for private trucking are, generally, the same as those for for-hire trucking e.g. hours of service, registration, and safety.

* The views expressed are those of the author and not necessarily those of the Ministry of Transportation.

1.3 Data Sources

There is no lack of data on the private trucking industry in Ontario. However, the various data sources often provide different, and sometimes conflicting, pictures of private trucking. In addition, some of the most important sources are limited in their timeliness. The following data sources are drawn upon for this paper:

- Statistics Canada annual surveys of private and for-hire carriers in Canada
- The Ministry of Transportation, Ontario (MTO) Vehicle Registration System (VRS), Commercial Vehicle Operator Registration (CVOR) System, and the Canadian Agreement on Vehicle Registration (CAVR) prorate files.
- Roadside Survey by MTO and other government agencies.

2 Survey Results

2.1 Scope of Private Trucking

The private and for-hire trucking industries are primarily engaged in the same activities i.e. transportation of goods on highways. However, the operating characteristics of the two industries are not necessarily the same. This paper will examine the composition and operating characteristics of the private trucking industry. Particular note will be made where these characteristics differ from for-hire trucking.

2.2 Size of the Ontario Private Trucking Industry

For-hire trucking has been the focus for much of the attention paid to the trucking industry by government, through economic regulation, and in the public perception. As a result, there is a danger that private trucking may not be given the attention it is due in considering issues affecting the industry. As noted in Today's Trucking:

> The world of trucking outside the for-hire sector may attract less attention, but it's significantly bigger and no less interesting. (page 26, November 1991)

This section will examine the above noted data sources to determine the size of the private sector in Ontario in relation to the total trucking industry.

2.3 Statistics Canada Surveys

As noted above, Statistics Canada conducts annual surveys of both for-hire and private carriers in Canada. These are census surveys which means they attempt to cover 100% of companies **included in the scope** of the surveys. The survey of for-hire trucking has been in effect since the mid 1970's. The private trucking survey is a more recent development, only being in place since 1981.

Given this basis for comparison by one of the foremost statistical agencies in the world, it should be possible to get an accurate comparison of the two trucking industry sectors. However, it is very important to note that the criteria used for inclusion in the surveys used by StatsCan differs for each sector. The for-hire trucking surveys include all establishments which earn annual revenues of $100,000 or more. In comparison, the private trucking survey covers establishments with 15 or more vehicles. It is obvious from this that it makes direct comparisons difficult.

Further, the number of firms covered in the private trucking survey for the 1989 survey year was limited to the larger carriers due to constraints within StatsCan. Therefore, we will use the data for 1988 on the Ontario private trucking industry for comparison of the private trucking industry to the for-hire trucking industry.

Table 1
StatsCan Trucking Data*

	Private Trucking	%	For-hire Trucking	%
Number of Carriers	845	37%	1,452	63%
Number of Employees	36,208	46%	43,134	54%
Number of Vehicles	52,768	42%	72,852	58%
Expenses (million)	$2,024.7	34%	$3,937.5	66%
Tonnes Transported (million)	30.0	27%	81.5	73%

N.B. Tonne-kms would be the best measure of comparison, but is not yet available.

* Trucking In Canada 1988

It can be seen that, as reported by StatsCan, private trucking has a significant portion of total trucking activity in Ontario. However, given the problems of comparability of the two StatsCan surveys, we will examine other data to see if this conclusion is valid.

It should be noted that, for 1989, the number of Ontario private trucking firms reported by StatsCan is 204 due to reduced coverage. This will make the use of this source for direct comparisons of for-hire and private trucking that much more difficult in future years. In addition, StatsCan has undertaken a major revision to integrate its annual trucking surveys for the 1990 survey year. This will require a further examination of the coverage for any future comparisons.

2.5.1 Roadside Surveys

Roadside surveys of commercial vehicle activity represent another major category of information on the trucking industry. Information for this type of survey is obtained by visual observations and by interviews of the vehicle drivers. As such, it provides a 'snap shot' of the trucking industry at a particular locations (survey sites) and times. The surveys can vary in focus from one or two locations to a province-wide survey of fifty sites or more. Although there are limitations on the applicability of this type of data (as with any type of survey data), on-highway surveys are particularly useful for obtaining many characteristics of the trucking fleet. The carrier type i.e. private or for-hire, is one of these characteristics.

2.5.2 MTO Comprehensive Roadside Surveys

MTO conducts a comprehensive roadside survey across the province every five years. The most recent survey was in 1988. In examining the carrier type by the registration of the vehicle, we find the following results from the 1988 survey:

Table 2
Jurisdiction of Registration
MTO 1988 Commercial Vehicle Survey

Jurisdiction of Vehicle Registration	% For-hire	% Private
Ontario	46.7%	53.3%
Quebec	47.6%	52.4%
Atlantic Provinces	60.9%	39.1%
Western Provinces	64.6%	35.4%
United States	57.2%	42.8%
All Jurisdictions	48.4%	51.6%

This provides a picture of the trucking industry as divided fairly evenly between private and for-hire. However, we also see that private carriers are most prominent for Ontario registered vehicles. There are two obvious factors which could be relevant to this. One is the distance involved. Private trucking tends to be involved in shorter trips than for-hire trucking. This will be examined later. It could also be concluded that the provincial border is a barrier to private trucking. An examination of border movements i.e. extraprovincial trips, supports this conclusion.

Table 3
1988 Commercial vehicle Survey
Extraprovincial Trips

Trip Type	% For-hire	% Private
International	61.1%	38.9%
Interprovincial	55.1%	44.9%
Intransit		
(U.S.A/U.S.A)	56.9%	43.1%
(Province/Province)	61.2%	38.8%
(Province/U.S.A.)	59.8%	40.2%
All Border Movements	58.1%	41.9%

A survey of transborder (i.e. Canada/U.S.) movements was conducted in February/March 1991 by StatsCan.

2.5.3 StatsCan Transborder Survey

The transborder survey was conducted over a six week period from February 4, 1991 to March 16, 1991 at border crossing points across Canada. The survey represented an estimated 255,000 transborder movements either into or out of Canada. The objective of the survey was to determine the market share held by Canadian trucking companies in the transborder market. However, information was also captured on the type of carrier i.e. private or for-hire.

Table 4
Base of Carrier
StatsCan Transborder Survey

Carrier Base	Carrier Type	Est.# Movements	Percent
Canada	Private	88,390	28.1%
	For-hire	226,191	71.9%
U.S.	Private	55,156	28.2%
	For-hire	140,194	71.8%
All	Private	143,546	28.2%
	For-hire	366,385	71.8%

2.6 Canadian Agreement on Vehicle Registration (CAVR)

Finally, we can examine a different type of data to look at the breakdown of the trucking industry operating interprovincially. The Canadian Agreement on Vehicle Registration (CAVR) is a mechanism to 'prorate' licence fees according to the distance travelled in each province by carrier fleets. Carriers report actual distance travelled to determine the proration of a fleet. Ontario 'plated' vehicles report the following breakdown of distance travelled by carrier type:

Table 5
CAVR Distance Travelled

Carrier Type	Fleets	CAVR Distance(km)	Percentage
Private	1,411	337,025,576	24.3%
For-hire	838	1,050,077,528	75.7%

3 Profile of Private Trucking

3.1 Characteristics of Private Trucking

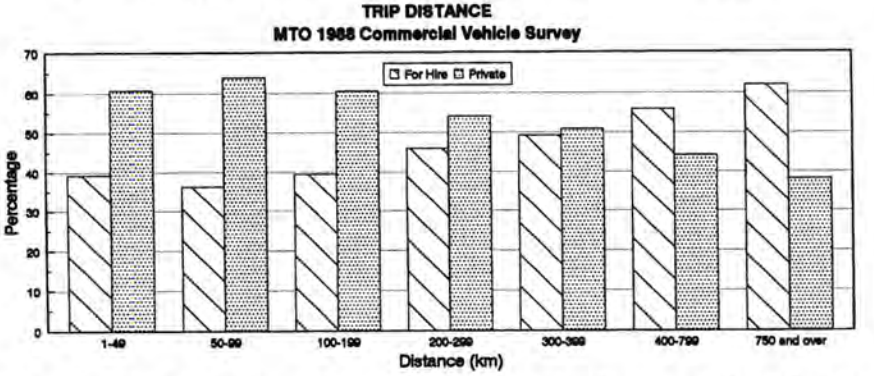
Now that some basic indicators of the size of private trucking have been examined, we will look at some of the characteristics of private trucking operations. The characteristics examined in this section include; length of trip, vehicle types, use of owner-operators, size of fleet, and capacity utilization.

3.2 Length of Trips

As noted above, one conclusion which can be drawn from the roadside survey data is that private trucking is more predominant in intra-Ontario operation. One possible conclusion drawn from this was that provincial and international borders were a barrier to private trucking. However, as noted, a possible corollary to this is that private trucking is more prevalent for trips of shorter distances. Data which addresses this directly is not available as many roadside surveys do not directly measure trip distance. However, the 1988 commercial vehicle survey by MTO does provide detailed information of trip length:

Table 6
Trip Distance
MTO 1988 Commercial Vehicle Survey

Trip distance (Km)	% For-hire	% Private
1 - 49	39.2	60.7
50 - 99	36.2	63.8
100 - 199	39.5	60.5
200 - 299	45.9	54.1
300 - 399	49.2	50.8
400 - 749	55.8	44.2
750 and over	61.9	38.1



From these data, we see a consistent picture of private trucking being predominant in local trucking. The 1988 roadside survey is undertaken on the provincial highway network. It is, in effect, a survey predominantly of intercity trucking activity. Therefore, most of the cartage or municipal trucking activity is not captured by the survey.

It is also of note that, in the 1988 Ontario roadside survey, the proportion of private trucks registered in Quebec was almost as high as for Ontario registered vehicles. This would appear to indicate that private trucking is more sensitive to the distance travelled as opposed to any restrictions imposed by borders.

The effect of trip distance on private trucking has also been examined in the United States. The Motor Carrier Industry In Transition by Ronald D. Roth noted:

> While private carriers transport some freight in all truck-oriented sizes*, they tend to dominate truck freight movements over very short lengths of haul - mainly less than 100 miles. For-hire carriers predominate in hauling the longer distance shipments.
>
> * higher value, non-bulk commodities

3.3 Use of Owner-Operators

An owner-operator is a owner of a commercial vehicle who leases himself and his vehicle to a private or for-hire carrier. The annual surveys of private and for-hire trucking companies by StatsCan are not wholly compatible in the collection of data on owner-operators. The survey of private carriers collects the number of owner-operators used by companies. The for-hire trucking survey does not collect data on the number of owner-operators used. However, both surveys collect information on expenses paid to owner-operators. This provides a basis of comparison on the extent of use of owner-operators in each industry segment.

Table 7
Use Of Owner-Operators(1)
StatsCan Annual Data

	1984	1985	1986	1987	1988
Private(2) O-O %	5.9%	5.4%	4.0%	5.3%	6.3%(1)
For-hire(3) O-O %	15.6%	17.5%	18.3%	18.7%	20.0%

(1) O-O payments as a % of total expenses
(2) Trucking in Canada 1988
(3) The Ontario Trucking Industry, Fred Nix

Two significant conclusions can be reached from this data. First, the extent of use of owner-operators is consistently much greater in the for-hire sector than the private sector. Second, the use in the private sector has not been increasing consistently over time as it has in the for-hire sector. However, there is an indication of increased use in more recent years i.e. 1987 and 1988.

Data on O-O usage is also available for on-road surveys. Data from three different on-road surveys has been examined to determine the usage of owner-operators; the MTO 1988 Commercial Vehicle Survey (Table 8), the CCMTA Interprovincial Survey (Table 9), and the StatsCan Transborder Survey (Table 10). The proportion of owner-operator usage by for-hire carriers is consistent in all cases at approximately 30%. However, the proportion for private carriers varies between approximately 10% and 20%.

Overall, the different data sources show somewhat different levels of owner-operator usage in private trucking and for-hire trucking. Therefore, it is not possible to draw hard conclusions about the level of O-O participation in each sector. What is consistent, however, is the significantly higher level of usage of O-O's in the for-hire trucking segment.

Table 8
Employment Type
MTO 1988 Commercial Vehicle Survey

	For-hire		Private	
Employment Status	Number	Percent	Number	Percent
Owner-operator	14,122	30.7%	5,216	10.7%
Employees	31,819	69.3%	43,685	89.3%
Total	45,941	100.0%	48,901	100.0%

Table 9
Employment Status
CCMTA Interprovincial Survey (Ontario Portion)

	For-hire		Private	
Employment Status	Number	Percent	Number	Percent
Owner-operator	728	29.9%	70	8.3%
Independent o-o	61	2.6%	29	3.4%
Company driver	1636	67.3%	738	87.8%
Other	6	0.2%	4	0.5%
Total	2433	100.0%	841	100.0%

Table 10
Employment Status
StatsCan Transborder Survey (Ontario Portion)

	For-hire		Private	
Employment Status	Number	Percent	Number	Percent
Owner-operator	42,285	32.3%	13,997	20.6%
Independent o-o	794	0.6%	1,463	2.2%
Company driver	87,935	67.1%	52,419	77.2%
Total	131,014	100.0%	67,879	100.0%

3.4 Capacity Utilization

Capacity utilization of a commercial vehicle is dependent on the extent to which the vehicle is loaded to it capacity and the extent of time on the road. An important factor in capacity utilization is success of a carrier in securing a backhaul i.e a return load. Private carriers have been more constrained in securing backhauls as they are primarily used to transport their own goods. This would often be only in one direction.

On-road surveys are the best source of data in examining utilization of a vehicle. The capacity utilization for the MTO 1988 Commercial Vehicle Survey is shown in table 11. This shows full utilization of for-hire carriers 50% of the time, whereas the incidence for private carriers is only 40%. Similarly for-hire carriers have a lower incidence of empty moves.

Table 11

Capacity Utilization
MTO 1988 Commercial Vehicle Survey

Level of	For-hire		Private	
Utilization	Amount	Percent	Amount	Percent
Empty	9,543	20.8%	13,039	26.7%
One Quarter Full	3,028	6.6%	4,840	9.9%
Half Full	4,023	8.8%	4,413	9.0%
Three Quarters Full	4,458	9.7%	4,497	9.2%
Full	23,244	50.6%	19,943	40.8%
Don't Know	1,600	3.5%	2,143	4.4%
Total	45,896	100.0%	48,876	100.0%

The higher utilization by for-hire carriers is also seen in the StatsCan Transborder Survey. Private carriage had a higher percentage of empty moves, and a lower percentage of full moves as in the 1988 survey.

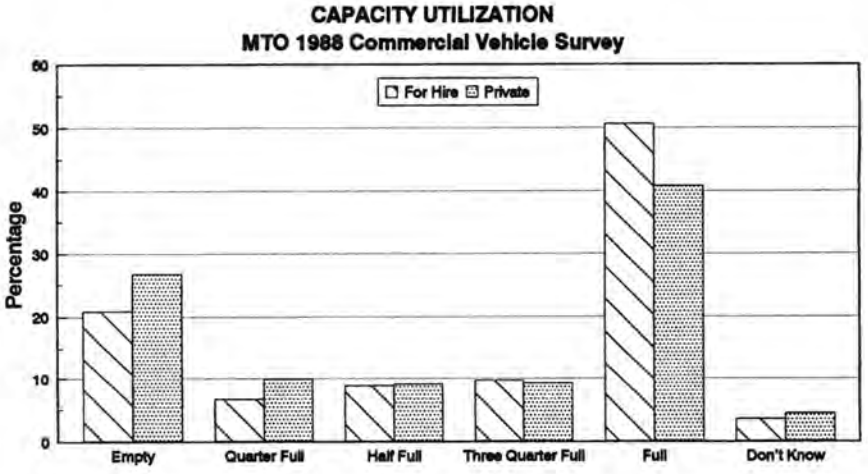


Table 12

StatsCan Transborder Survey
Capacity Utilization

Level of Utilization	For-hire Amount	For-hire Percent	Private Amount	Private Percent
Empty	40,828	31.1%	23,842	35.1%
Less than 25%	2,887	2.2%	2,442	3.6%
25% - 49%	3,813	2.9%	3,001	4.4%
50% - 74%	3,071	2.3%	1,669	2.5%
75% - 100%	80,515	61.4%	36,905	54.4%
Total	45,896	100.0%	48,876	100.0%

3.5 Size of Fleet

Information on the size of fleets for private and for-hire carriers is available from a number of different data sources including StatsCan surveys, CVOR files, and CAVR (prorate) files. It is not available from on-road surveys.

The annual StatsCan surveys of trucking companies for 1988 show the following average number of vehicles per firm:

private	17.0
for-hire	29.7

The smaller fleet size for private fleets is supported by data from the MTO Commercial Vehicle Operator Registration System (CVOR) for Ontario registrants. Registrants with 0 fleet size have been excluded:

Table 13

Fleet Size
CVOR Data (Ontario Registrants)

Declared Fleet Size	Unlicensed Registrant	%	Licensed Registrant	%
1	24,387	58.6%	5,570	48.3%
2 - 10	15,721	37.8%	4,970	43.1%
11 - 25	979	2.4%	598	5.2%
26 - 100	437	1.0%	289	2.5%
100 +	108	0.3%	93	0.8%
Total	41,632	100.0%	11,520	100.0%

Licensed registrants are for-hire carriers while unlicensed carriers are predominantly, but not exclusively, private carriers.

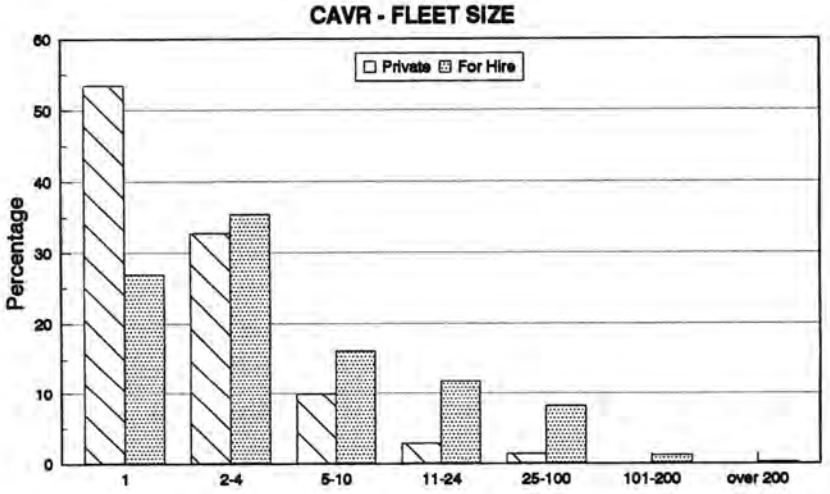
Unfortunately, statistics on the average fleet size are not available from CVOR records. However, from the breakdown available, it is clear that licence registrants have a higher proportion of large fleets than unlicensed registrants, while unlicensed registrants have a significantly higher number of fleets with 10 vehicles or less.

CAVR (prorate) licensing data provides a breakdown similar to CVOR files. This data is for commercial vehicles which are licensed for interprovincial travel.

Table 14

Fleet Size
CAVR Data

Fleet Size	Private	%	For-hire	%
1	754	53.4%	226	26.9%
2 - 4	461	32.7%	297	35.4%
5 - 10	139	9.9%	136	16.2%
11 - 24	39	2.8%	100	11.9%
25 - 100	18	1.3%	68	8.1%
101 - 200	0	0.0%	9	1.1%
over 200	0	0.0%	2	0.2%
Total	1,411	100%	838	100%



A similar pattern is evident as for the CVOR data i.e. for-hire carriers have a higher proportion of large fleets than private carriers. For CAVR data, the difference is exaggerated as we are dealing with interprovincial travel in which, as we have seen, for-hire carriers are more prevalent.

4 Summary/Conclusions

The importance of private trucking varies significantly depending on the data source and measure used. It ranges from a low of approximately one quarter of trucking activity in the case of the interprovincial activity measured by roadside surveys and CAVR records, to a high of well over half for a number of measures in other cases.

When examining the role played by private trucking, it is important to be aware of what activity is being measured. Data sources which include all trucking activity i.e. urban as well as intercity, give a picture of private trucking which predominates in the total industry. The significant data sources for this perspective are the StatsCan surveys and some roadside survey data. However, it is important to distinguish, if possible, private trucking which is involved in freight movement, from government and service trucking activity.

The data sources which focus on intercity movements and extraprovincial undertakings show the decreased significance of private trucking in this type of activity. These sources include the roadside surveys and the CAVR files of MTO.

Within this perspective, we can identify a number of key characteristics of private trucking:

- private trucking predominates in short haul, local trucking.
- in extraprovincial trucking, private carriage is in the minority, but is still a significant component
- private trucking makes less use of owner-operators than for-hire trucking
- private carriers fleets are smaller than for-hire carrier fleets
- capacity utilization by private carriers is less than by for-hire carriers
- private carrier fleets are smaller than for-hire carrier fleets

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MAINTAINING THE RURAL ROAD INFRASTRUCTURE OR THE BRANCH LINE PROBLEM REVISITED

by Jerry Fruin and Dan Halbach

Introduction

An adequate road system is essential for the economic and social well-being of the rural population of North America. The typical rural family relies on the road system for essential communication between town and city service centers. Children are bused to school. Farm produce is shipped, farm supplies are delivered, and repair parts, groceries, and household supplies are purchased many times throughout the week. Many vehicles, such as school buses and milk trucks, require year-round accessibility. Many rural families have one or more members who commute to factory or service jobs just as regularly as families who live in the cities. It is neither possible nor desirable for rural families to live in isolation.

Technological advancements have imposed the need that rural residents have better and safer roads. Faster speeds of passenger vehicles require smoother road surfaces for easy control and wider roads and intersections for safety. The heavier weights of vehicles require stronger roadbeds and bridges. Many rural roads do not meet reasonable standards for today's use. Other roads, adequate now, will deteriorate if funds are not available for required maintenance. On the other hand, the number and mileage of rural roads in some areas maybe excessive because of the technological advances in transportation, agriculture, and related industries (Fruin 5).

Background

The local rural road system--that is those roads maintained and controlled by counties or townships--consists of 2.2 million miles and represents 71% of the 3.2 million miles of rural roads in the United States. The system is generally laid out in rectangular grids, particularly in the Midwest where the regularity of the county roads dates back to the Ordinance of 1785 that established the one-mile survey grids to open the land for settlement.

Many of today's local rural roads and bridges were first built in the late 1800s and early 1900s when overland transportation was limited to horse and wagon or the recently built railroad lines. The discovery of large petroleum reserves in Texas and Oklahoma spurred the development of the automobile and truck industries during the 1920s and 1930s and created a need to get rural American "out of the mud." Roads were surfaced, and some bridges were replaced to accommodate trucks with gross weights of six to seven tons. About 70% of today's rural bridges in the U.S. were built before 1935, but even those constructed in the 1940s were designed only for 15-ton loads.

By 1950 about 50% of the local rural roads were improved with all-weather

gravel or paved surfaces. Thus the widths, grades, bases, surface designs, and capacities of many local rural roads and bridges are based on the traffic needs of the 1940s and 1950s.

The declining number of farms and the increasing size of farm trucks and implements are changing the traffic on the local rural road system. There are no weight limits on "implements of husbandry" (farm equipment). Today some farmers use a tractor and two wagons to haul 600 to 900 bushels of grain with a gross weight of 28 to 36 tons. Many bridges are over 55 feet long, so that the entire load is on the bridge at one time. Some single-axle wagons hold over 800 bushels of grain; after deducting about 6,000 pounds of hitch weight, the loaded weight ranges up to 50,000 pounds per axle.

As farm size has increased, so have the trucks serving agriculture. Tandem-axle trucks with gross weights of 27 tons are common on rural roads and bridges. In 1975, the U.S. Congress permitted states to set higher weight limits for trucks on the interstate highway system. Most states adopted the federal limits and raised the weight limits to the federal standard of 20,000 pounds per axle, 34,000 pounds per two-axle tandem, and 80,000-pound maximum overall weight.

The introduction of low-cost unit grain trains in the corn and wheat belts has encouraged the use of larger farm vehicles to haul grain longer distances. Some farmers are buying tandem-axle and semi-trailer trucks to move their grain out of the field quickly, to increase their marketing options, to reduce hauling costs, and to eliminate the safety hazards of farm tractor-wagon combinations. These heavy vehicles place additional stress on the local road and bridge system.

Frequently, a farmer will increase his farm size by buying or leasing land from neighboring farms, thereby reducing the total number of farms. This reduction in the number of farms means that some rural roads may no longer by needed for access to homes, schools, and markets. Some observers believe that the miles of rural roads might be reduced without denying access to the remaining farms and residences.

And finally, the declining rural population has resulted in a reduction in the number of rural schools. To help minimize the cost of transporting school children farther to fewer schools, school boards are purchasing 72-89-passenger school buses. These school buses weigh up to 15 tons when loaded and cannot cross bridges that are posted at less than their gross weights.

Precise data on the current condition of the local rural road system in the United States are not available since no ongoing coordinated data collection exists for local rural roads. However, there is ample evidence that the system is deteriorating rapidly. In a recent Illinois survey, farmers and agribusiness representatives rated about half of the Illinois local rural roads as needing more than regular maintenance; over 20% of these roads were rated as needing major repair.

The Office of Transportation of the U.S. Department of Agriculture has estimates that almost half of the rural road and bridge mileage has an earth, gravel, or loose kind of aggregate surface. Over one-third of this rural mileage is classified by township officials as barely adequate or even worse.

Common complaints about the local rural roads include:

1. Overweight vehicles breaking up road surfaces.
2. Lack of hard surfaces creating dust and rideability problems.
3. Road widths and other design characteristics inadequate for today's large farm equipment and heavy trucks.
4. Narrow lanes creating safety problems.

While the local road deficiencies are significant, the condition of local bridges is also of great concern. Deficient bridges on local rural roads create serious safety and traffic constraints. On 1 January 1986, 167,985 bridges or 55% of all off-federal-aid bridges that had been inventoried were deficient. In addition, 121,507 or 40% of the 304,948 on-federal-aid bridges were posted, or should have been posted, at less than legal weight limits. The estimated replacement and rehabilitation costs of these deficient off-system bridges is $20.4 billion. However, even this understates the magnitude of the problem. Bridges under 20 feet long were not included in the inventory, and thousands of such bridges need replacement or rehabilitation.

Because of the above reasons, the financing of the rural road system is becoming a major concern to rural officials. Local rural road and bridge construction and maintenance funds are typically obtained from highway user taxes and local property taxes. Highway user tax collections have been increased recently because of large increases in fuel and truck road use taxes. However, the increased fuel efficiency of new model cars tends to reduce income from fuel taxes. There is severe competition for funds from state, federal and municipal jurisdictions for their infrastructure and from competing transportation modes such as rapid transit.

Literature Review

The most extensive study of rural road management was done by Baumel (1). Baumel used a benefit cost analysis to analyze alternative strategies using three study areas of 100 square miles each in rural Iowa. Using Dijkstra's algorithm, Baumel created a network model consisting of nodes (intersection, farm gate, or similar dwelling) connected by arcs (the road in between the node). Data was collected pertaining to quantity, origins and destinations by vehicle type for household and farm travel. Data collection was performed by professional statisticians and interviewers. Baumel considered several alternative strategies and the results of their analyses showed that in each of the study areas, low volume roads could be removed with savings in maintenance costs to the county greater than the increased travel cost incurred by the traveling public. The study also concluded that impact on farm travel cost was greater than that of household travel cost.

Several papers stemming from this study were more specific about certain aspects of the study. In estimating farm vehicle travel cost, Baumel (2) revealed that most of the variance in travel cost is a function of size and type of the equipment as well as the type of the road surface. Zaniewski (10) found that road roughness of paved roads had little influence on travel cost, but that nonpaved roads indeed had adverse effects on travel cost.

Tucker and Thompson (9) examined the impact of rural road management on grain marketing costs in Michigan and addressed the question of the implications on the agriculture and rural communities from rural road improvement. They developed a linear programming transportation model to deal with the problem of distributing a homogenous product (in this case grain) from many spatially separated sources to a specific destination (in this case, an elevator). The model provided an optimal commodity flow at a minimum farm to market cost. After examining several scenarios, Tucker and Thompson showed that road deterioration places an added cost to grain producers and that producer costs decrease as road development increases. However, the decrease in grain transportation alone cannot justify an increase public investment of road maintenance. Specifically, road deterioration led to cost increase which was 39 times less than the corresponding investment to achieve this benefit. That is, public investment to repair a deteriorated road and decrease producer cost would cost 39 times greater than the benefit received by the producer. Furthermore, changes in the condition of the rural road system have little effect on optimal grain marketing traffic flow, the impact has a greater effect on producers than elevators, and the benefits to the grain industry are relatively small compared to the investment involved.

Hitzhusen and Nyamaah (7) developed a circuity cost model for measuring costs and benefits of rural bridge rehabilitation, closure or posting and estimating and comparing the costs and benefits using a case study in Wayne County, Ohio. They found a substantial increase in savings to motorist could be made by adopting the circuity cost model compared to that of the county procedure. They also found that there were substantial costs incurred by the traveling public when bridges were posted.

Chicoine and Walzer (3) did a major study which examined the physical and financial condition of rural road infrastructure in four midwestern states (Illinois, Minnesota, Ohio, Wisconsin). Information was collected through mail surveys to farmers, township representatives, and agribusiness. Information was studied to examine the need for updating of managerial practices, maintaining and upgrading roads and the financial resources available for maintaining and upgrading. There was an effort made to incorporate views of the farmers, road users and the government officials responsible for the roads. Several recommendations were made to aid local officials in better managing their road network and finances.

Chicoine and Walzer also edited a book (4) which offered numerous chapters from different authorities providing a broad background in the physical and financial resource condition of the rural infrastructure.

Johnson (8) developed models that could be used to estimate the benefits of road improvements, including building a new road, replacing and upgrading bridges, and widening or resurfacing a road. The analysis was conceptual rather than empirical, and no measured benefits were presented.

Research Objective and Methodology

The objective of this research is to evaluate a number of strategies for the use of limited funds to maintain and/or improve the rural transportation

infrastructure. The rural road infrastructure in one or more small areas will be studied intensively. Scenarios will be developed to consider the effects of different levels of road maintenance, development of optimal networks of paved roads, elimination of maintenance and/or the revision to private ownership of little used roads and bridge replacements or abandonments. Decision criteria will be cost based. Cost components considered included

1. Vehicle operating expense by road or surface type by type of vehicle.
2. Opportunity cost of travel by trip type/person type.
3. Road maintenance costs by road category.
4. Road upgrading costs--total or annualized.
5. Bridge upgrading costs--total or annualized.
6. Opportunity costs of land added or dropped from road system.

A number of possible criteria exist for determining the "best" management scenario. An example would be to minimize the total costs of 1 to 6 above. Another example would be to minimize total vehicle operating costs while not exceeding a given road and bridge maintenance budget. A detailed description of the methodology used to quantify the results of different strategies and the microcomputer software used is found in Halbach (6).

Characteristics of the Study Area

A rural area was selected by the researchers and the Minnesota Association of County Engineers for a detailed analysis of its travel requirements and rural road system. The case study area selected was in Polk County, Minnesota in the Red River Valley. The area is about 80 miles south of the Minnesota-Manitoba border and 140 miles south of Winnipeg, Manitoba. It contains about 580 sq. mi. and is definitely rural. The largest and only town in the study area is East Grand Forks, MN with a population of 8,500. The area has a nearly complete one square mile grid network of roads. These are primarily township or county roads. The study area has two major federal roads. There are seven miles of U.S. 2 in the southwest corner of the area that goes through East Grand Forks and 22 miles of U.S. 75 which bisects the area in a north-south direction. State highway number 220 runs north and south near the east side of the Red River.

The Red River is the western border of the area, so the western third of the area is the current flood plain of the Red River Valley. Farmers there raise sugar beets and potatoes and engage in very intensive agriculture. There are two to three farms or residences per square mile on average. Further east, the center third of the area has less intensive agriculture, with some sugar beets and potatoes but proportionately more wheat and small grains. There are one to two households per sq. mi. Finally, the eastern third of the study area is more suited for small grains then intensive agriculture and has less than one family dwelling unit per sq. mi. Significant amounts of land in the eastern third are not farmed or are in the Conservation Reserve Program.

Study Area Traffic

The study area traffic was divided into three categories for modeling purposes. These were:

a. Agricultural marketing (farm to market) traffic
b. Personal travel
c. Overhead traffic

Agricultural marketing trips by vehicle type for each square mile were estimated for each crop by township from data provided by the Agricultural Stabilization and Conservation Service. For modeling purposes, it was assumed that all truckloads of ag commodities from a square mile section would enter the road system at the southwest corner of the section.

Personal travel, that is, the number of automobile trips by residents of the area, was estimated from secondary data from an Iowa State University study by Baumel (1). Over 2000 households in 3 rural locations in Iowa were interviewed about trip frequency, purpose and destination. The average number of trips per household for all purposes was 2.13 round trips per day including business trips, commuting trips, grocery trips, childcare trips, etc. Study area residents were interviewed to determine traffic patterns. The estimated 2.13 trips per farm or rural dwelling were assigned to 3 or 4 destination locations depending on traffic patterns determined from the interviews.

The third type of traffic studied was overhead traffic. Overhead traffic is traffic going through but not having an origin or destination in the area. Overhead traffic trips were derived from the Minnesota Department of Transportation (MDOT) average daily traffic (ADT) data. MDOT periodically takes a traffic count on all county and state roads. Personal and agricultural traffic trips were subtracted from the ADT on each road. The remainder was assumed to be overhead traffic trips.

Surface Type and Jurisdiction

Table 1 shows the number of miles of road in each category of surface type and political jurisdiction in 1989, the baseline year. Surface type is across the top, and political jurisdiction on the side. Township and county roads, which are supported entirely by property taxes and other local revenues, accounted for 835 miles or 74% of the 1,135 total miles of road in the study area. County state aid highways (CSAH), which are supported in part by state fuel taxes and vehicle fees, accounted for 238 miles or 21% of the roads in the study area. State and federal roads, which receive no local funding, accounted for 62 miles or 5.5% of the area's road mileage.

Over 20% of the total area road mileage is dirt surfaced township roads. The remainder of the township and county roads are gravel surfaced. The CSAH roads are more than half gravel surfaced with the remainder hard surfaced. The state and federal roads are all hard surfaced, i.e., concrete or bituminous.

TABLE 1

STUDY AREA BASELINE ROAD MILES

	Concrete	Bituminous	Gravel	Dirt	Total
Township/County	0.0	0.6	603.9	230.1	834.6
% of total	0.0	0.1	53.2	20.3	73.6
CSAH	28.2	75.6	134.9	0.0	238.7
% of total	2.5	6.7	11.9	0.0	21.0
State	17.7	9.1	0.0	0.0	26.8
% of total	1.6	.8	0.0	0.0	2.4
U.S.	34.8	0.0	0.0	0.0	34.8
% of total	3.0	0.0	0.0	0.0	3.1
Total	80.6	85.3	738.8	230.1	1134.8
% of total	7.1	7.5	65.1	20.3	100.0

1989 Baseline Total Vehicle Operating Costs (VOC)

Computer simulations were done to compute vehicle operating costs (VOC) for the baseline road network by purpose and vehicle type for 1989. Vehicle operating costs include fuel, oil, maintenance and other types of variable costs associated with operating vehicles on different surfaces. Not included were the fixed costs of time depreciation, insurance or license fees. Driver wages or the opportunity costs of driver time were not included for personal travel or overhead traffic. Agricultural marketing travel had driver costs of $8.40/hr for farm labor or $12.60/hr for commercial drivers.

Table 2 shows the breakdown of the simulated vehicle operating costs for the area in 1989 for personal travel by surface type and jurisdiction. Total personal travel VOC (for 2.13 round trips per household per day) were $1.438 million. Although only 7.1% of the roads are concrete surfaced, 47.5% of the personal travel VOC occurred on concrete surfaced roads. Sixty-five percent of the roads are gravel, but only 32.8% of the VOC occurred on gravel. The CSAH system is 21% of the road network, but 36.5% of the personal travel VOC occurred there. Seventy-three percent of the roads are township roads, but only 21% of the VOC occurred there.

Table 3 shows the breakdown of the simulated 1989 baseline ag traffic VOC required to move the major crops from the farms to local elevators or processors. Notice much of the cost (66.4%) occurred on concrete and bituminous roads and only 1.6% was incurred on dirt surfaced roads. The CSAH system accounted for 51% of the ag marketing traffic VOC but includes only 21% of the roads. Township and county traffic roads accounted for only 22% of the ag marketing

TABLE 2

STUDY AREA BASELINE PERSONAL TRAVEL VOC
IN 000s

	Concrete	Bituminous	Gravel	Dirt	Total
Township/County	0	0	283.2	24.6	307.8
% of total	0	0	19.7	1.7	21.4
CSAH	112.9	222.5	188.8	0	524.3
% of total	7.9	15.5	13.1	0	36.5
State	293.6	36.0	0	0	329.6
% of total	20.4	2.5	0	0	22.9
U.S.	276.2	0	0	0	276.3
% of total	19.2	0	0	0	19.2
Total	682.9	258.6	472.0	24.6	1438.1
% of total	47.5	18.0	32.8	1.7	100.0

TABLE 3

STUDY AREA BASELINE AG TRAFFIC VOC
IN 000s

	Concrete	Bituminous	Gravel	Dirt	Total
Township/County	0	0	155.6	12.4	168.0
% of total	0	0	20.4	1.6	22.0
CSAH	58.3	242.2	88.1	0	388.7
% of total	7.6	31.8	11.6	0	51.0
State	124.2	5.0	0	0	129.2
% of total	16.3	.6	0	0	16.9
U.S.	76.6	0	0	0	76.6
% of total	10.1	0	0	0	10.1
Total	259.0	247.3	243.7	12.4	762.4
% of total	34.0	32.4	32.0	1.6	100.0

VOC although they account for 73% of the total mileage. The total simulated baseline ag marketing VOC was $762,400 or only about half of that for personal travel.

The breakdown of the simulated area overhead travel VOC by surface type and jurisdiction is shown in Table 4. The total baseline simulated overhead VOC exceeded $5.5 million. Note that this is a small area and the amount of overhead traffic in other areas will vary depending on location and traffic pattern. In this case, much of the overhead traffic was not on the state and federal system but on CSAH roads going east and west through the region.

Table 5 breaks down the total 1989 simulated VOC for all three purposes by surface type and jurisdiction. The total simulated VOC was $7.7 million. Of the total VOC, ag marketing traffic accounted for 10%, personal travel accounted for 19%, and overhead traffic accounted for 71%.

Over half of the total simulated VOC occurred on concrete highways, nearly 30% occurred on bituminous highways, 20% on gravel, and only 1/2 of 1% on dirt roads. The CSAH system which has 21% of the road mileage accounted for 35% of the total VOC. The CSAH system is very important for overhead traffic as well as local traffic. he township and county roads which account for 73% of the road milage had only 11% of the total simulated VOC.

Less Intensive Crop Production Scenario

The study area has intensive sugar beet and potato production. The average yield of sugar beets is 19.5 tons/ac and the average yield of potatoes is 9 tons/acre. In contrast a wheat yield of 1 to 2 tons/acre is normal. If wheat was grown on all crop acreage and had the average county yield, the ag marketing VOC would be only $178,000 rather than $762,400. The breakdown by surface and jurisdiction is shown in Table 6. If only wheat is grown, ag traffic accounts for only 3% of the total VOC rather than 10% when sugar beets and potatoes are grown.

Road Improvement Simulations

One of the research objectives was to determine to what extent selected road improvements would provide cost savings. Changes were made to the computer model to simulate paving of road segments (i.e., the indicated road surface type was changed in the computer model) and the VOC recalculated. One of the simulations estimated the change in VOC that was caused by the actual 1990 improvements to the network.

In 1990 Polk County paved 16.3 mi. of gravel roads on their CSAH system with bituminous. Several miles of these roads were on the east-west county road leading to Thief River Falls, a town of 9,000, which is 20 miles east of the study area. Table 7 shows the simulated vehicle operating costs after these 1990 road improvements. The new total VOC is $7,768,600 compared to the 1989 baseline of $7,712,000. That is an estimated reduction in vehicle operating costs of $53,400 resulting from paving those 16.3 miles. This is the result of a savings in local passenger VOC of $13,900, in ag marketing VOC of $8,200 and in overhead VOC of $31,300.

TABLE 4

STUDY AREA BASELINE OVERHEAD TRAFFIC VOC
IN 000s

	Concrete	Bituminous	Gravel	Dirt	Total
Township/County	0	0	369.4	0	369.4
% of total	0	0	6.7	0	6.7
CSAH	159.5	1198.1	446.7	0	1804.3
% of total	2.9	21.7	8.1	0	32.7
State	816.7	545.3	0	0	1362.0
% of total	14.8	9.9	0	0	24.7
U.S.	1976.0	0	0	0	1976.0
% of total	35.9	0	0	0	35.9
Total	2952.1	1743.5	816.0	0	5511.5
% of total	53.6	31.6	14.8	0	100.0

TABLE 5

STUDY AREA TOTAL BASELINE VEHICLE OPERATING COSTS
IN 000s

	Concrete	Bituminous	Gravel	Dirt	Total
Township/County	0	0	808.2	37.0	845.1
% of total	0	0	10.4	.5	10.9
CSAH	330.7	1663.0	723.6	0	2717.2
% of total	4.3	21.6	9.4	0	35.2
State	1234.4	586.3	0	0	1820.8
% of total	16.0	7.6	0	0	23.6
U.S.	2328.9	0	0	0	2328.9
% of total	30.2	0	0	0	30.2
Total	3894.0	2249.3	1531.8	37.0	7712.0
% of total	50.5	29.2	19.9	.5	100.0

TABLE 6
BASELINE AG TRAFFIC VOC--ALL CROPLAND IN WHEAT
(NO SUGAR BEETS OR POTATOES)
IN 000s

	Concrete	Bituminous	Gravel	Dirt	Total
Township/County	0.0	0.0	44.2	5.0	49.1
% of total	0.0	0.0	24.7	2.8	27.5
CSAH	16.3	39.9	18.7	0.0	74.9
% of total	9.2	22.4	10.5	0.0	42.0
State	23.8	2.6	0.0	0.0	26.3
% of total	13.3	1.4	0.0	0.0	14.8
Federal	28.1	0.0	0.0	0.0	28.1
% of total	15.7	0.0	0.0	0.0	15.7
Total	68.1	42.5	62.8	5.0	178.5
% of total	38.2	23.8	35.2	2.8	100.0

Other Savings due to Road Improvements

There are also savings in maintenance costs when bituminous paved roads replace gravel roads. This savings in Polk County averaged approximately $1050 per mile of bituminous surface per year for 1988-90 or an annual maintenance savings of $17,100 when 16.3 miles of gravel road are paved.

There are also savings in driver and passenger time as roads are improved and trips take less time. These may be savings in wages for hired drivers or savings in opportunity costs for unpaid or self-employed drivers. Such savings are difficult to quantify but if we assume that cost savings of the minimum wage of $4.20/hr. for a single person in each personal travel and overhead vehicle, the savings in driver wages and opportunity cost due to the 1990 improvements would be $11,250. These savings are included in the right column of Table 8. Note that with or without including a driver cost of $4.20/hr., about 45% of the benefits went to overhead traffic passing through the region. Also note that the reduction in maintenance costs accounted for over 20% of the total savings.

Bridge Replacements

Polk County has a program of replacing bridges on township roads that in need of substantial repair or functionally obsolete. Six bridges in the study area were replaced in 1991. The computer model of the 1989 road network was changed to simulate the abandonment rather than replacement of those six bridges. The simulated increase in total VOC was $7,680 (Table 9). An analysis of the simulation results indicated that two of the bridges accounted for most of the

TABLE 7
1990 IMPROVEMENTS -- TOTAL VOC
IN 000s

	Concrete	Bituminous	Gravel	Dirt	Total
Township/County	0	0	792.8	37.4	830.3
% of total	0	0	10.3	.5	10.8
CSAH	311.9	1806.6	570.5	0	2689.0
% of total	4.1	23.6	7.5	0	35.1
State	1226.5	584.1	0	0	1810.7
% of total	16.0	7.6	0	0	23.6
U.S.	2328.6	0	0	0	2328.6
% of total	30.4	0	0	0	30.4
Total	3867.1	2390.8	1363.3	37.4	7658.6
% of total	50.5	31.2	17.8	.5	
Total Baseline	3894.0	2249.3	1531.8	37.0	7712.0
% of total	50.5	29.2	19.9	.5	

TABLE 8
SAVINGS FROM 1990 IMPROVEMENTS--16.3 MILES PAVED

	NO DRIVER OPPORTUNITY COST	1 PERSON PER CAR AT $4.20 PER HOUR
Local cars	13,900	18,100
Ag products	8,250	8,250
Overhead	31,250	38,300
Reduced Maintenance (1050 per mile)	17,100	17,100
TOTAL	70,500	81,750

increase in VOC so that four of the bridges could have been abandoned with very little increase in total area VOC.

Road Abandonment

What happens to VOC if some of the lesser used roads are abandoned? The

model was changed to simulate the abandonment of all the roads that trip optimization models indicated would be used for less than an average of one round trip per day. Using that criteria simulations were run with 366 of the 1138 miles of area roads abandoned.

TABLE 9

INCREASE IN VOC IF 6 BRIDGES HAD BEEN ABANDONED RATHER THAN REPLACED IN 1991

Passenger Car Increase	5,170
Ag Traffic Increase	2,510
Overhead	0
Total Increase	7,680

TABLE 10
STUDY AREA ROAD NETWORK MILEAGE AFTER ABANDONMENT OF ROADS WITH LESS THAN ONE TRIP PER DAY

	Concrete	Bituminous	Gravel	Dirt	Total
Remaining Township/County	0	0	427.4	60.5	487.9
abandoned	-	(-.6)	(-174.0)	(-169.6)	(-346.7)
Remaining CSAH	28.2	72.6	118.4	0	219.2
abandoned	-	(-3.0)	(-16.5)	-	(-19.5)
Remaining State	17.7	9.1	0	0	26.8
abandoned	-	-	-	-	0
Remaining U.S.	34.8	0	0	0	34.8
abandoned	-	-	-	-	0
Remaining Total	80.6	81.7	545.8	60.5	768.8
abandoned	-	-	-	-	(-366.1)

Table 10 shows the breakdown by surface type and jurisdiction of the roads with less than one round trip a day. Note that most of the simulated abandonments were of township roads and that nearly 3/4 of the dirt surfaced roads were abandoned. No state or federal highways met the criteria for abandonment. Simulated abandonments accounted for about 33% of the total roads in the area and over 40% of the township roads.

Table 11 shows the personal travel VOC if these roads were abandoned compared to the baseline (Table 2). Personal travel VOC would only increase from $1,438,100 to $1,442,300 or about $4200. These would be no change in VOC for overhead traffic because no routes with overhead traffic would be abandoned. We were unable to develop a valid estimate for the increase in ag traffic VOC because the crops have to be moved out of the fields whether hauled over a road or a field lane. We expect there will be some increase in ag traffic VOC but probably no more proportionally than for local passenger traffic.

TABLE 11
STUDY AREA REDUCED NETWORK--PASSENGER VOC
IN 000s

	Concrete	Bituminous	Gravel	Dirt	Total
Township/County	0	0	258.0	24.3	309.3
%	0	0	19.8	1.7	21.5
CSAH	113.3	221.1	190.0	0	524.5
%	7.9	15.3	13.2	0	36.4
State	294.2	36.5	0	0	330.7
%	20.4	2.5	0	0	22.9
U.S.	277.9	0	0	0	277.9
%	19.3	0	0	0	19.3
Total	685.4	257.6	475.0	24.3	1442.3
%	47.5	17.9	32.9	1.7	

Conclusions

A. Cropping patterns have a large impact on the amount of ag marketing required. The Polk County sugar beet, potato, and row crop rotation required 2-3 times as much transportation as a small grain rotation.

B. Some rural roads (such as many of Polk County's CSAH roads), are important for regional overhead traffic. A case can be made for significant support from nonlocal funds for such roads.

C. Some rural road improvements such as hard surfacing of selected roads can be justified on the basis of the savings in vehicle operating and road

maintenance costs or on the basis of those cost savings plus intangible benefits such as improved safety and reduced travel times.

D. The abandonment of some rural bridges would have little impact on total area vehicle operating costs. The cost effectiveness of replacing rural bridges should be carefully considered on a case-by-case basis.

E. Some local roads (up to 40% of the township roads in the Polk County study area) could have reduced maintenance or be abandoned with very little increase in vehicle operating costs due to motorists having to drive further.

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INCREMENTAL ROAD COSTS DUE TO PRAIRIE BRANCHLINE ABANDONMENT: A LITERATURE REVIEW

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1.0 INTRODUCTION

Changes in road costs due to increased trucking resulting from prairie branchline abandonment is a controversial issue on which there is little consensus. At issue is the magnitude and even the direction of these changes.

On one hand, the Province of Saskatchewan has claimed that "The cost of upgrading and maintaining rural municipal roads and provincial roads as a result of increased grain trucking in Saskatchewan could average up to $15 per tonne hauled per year, including financing and depreciation costs" (Saskatchewan, 1991). To put this in perspective, the 1992/93 WGTA rail rate for grain is $32.12 per tonne for an average haul distance of 976-1000 miles.

On the other hand, bodies of the Federal Government have commented that increased use of larger commercial trucks after branchline abandonment "could very well reduce road damage caused by trucks" (GTA et al, 1991, pg. 12).

This paper reviews methods used to estimate incremental road costs and comments on their application to prairie branchline abandonment. The objective is to clarify some of the issues that have resulted in wide fluctuations of road impact cost estimates.

The paper begins with a definition of incremental road costs. This is followed by a description of how incremental road costs are determined for thick asphalt and surface treated pavements. The next section summarizes information found in the literature on incremental road costs for thin asphalt and gravel pavements.

(*) This paper is partially a result of my work at CP Rail, but the views expressed are my own and do not necessarily reflect those of CP Rail.

The method used by ADI (1989) to predict the need for upgrading Saskatchewan thin asphalt and gravel roads is described and evaluated. This is followed by comments and observations on various road impact issues.

The definitions of pavements and resurfacing, reconstruction and routine maintenance costs as used in this paper are contained in the Appendix.

2.0 INCREMENTAL ROAD COSTS DEFINED

One reason for the variation in road impact cost estimates is due to differences in which costs and revenues are included in the analyses. These differences exist because incremental road cost studies have been conducted from the perspective of society, provincial governments, and highway agencies. The costs considered from these various perspectives are not always the same. For example, some studies for highway agencies exclude increases in road user revenues.

This paper assumes the relevant cost is the incremental road-related costs to society due to additional trucking caused by branchline abandonment. Incremental road-related costs to society can be approximated by determining the change in total road costs - the sum of road agency and road user costs (Morlok, 1978). It is an approximation because it excludes some hard-to-quantify costs such as noise and air pollution. Table 1 below lists the components of total road costs and revenues most often considered in incremental road cost studies.

TABLE 1
TOTAL ROAD COSTS AND REVENUES

COSTS

HIGHWAY AGENCY COSTS
- Pavement Resurfacing and Reconstruction Costs
- Pavement Maintenance Costs
- Road Capacity Upgrading Costs

ROAD USER COSTS
- Travel Time Costs
- Vehicle Operation and Maintenance Costs
- Accident Costs

REVENUES

FUEL TAXES
REGISTRATION FEES
LICENSE FEES

3.0 DETERMINING INCREMENTAL ROAD COSTS - STRUCTURAL PAVEMENTS

This section reviews the methods commonly used to determine incremental road costs due to additional truck traffic. It applies to thick asphalt and surface treated pavements only. Where appropriate, comments on applying the methodology to the prairie branchline abandonment situation are made.

The incremental costs calculated apply to a single link in a highway network assuming no upgrading of pavement type. Traffic levels on the link before and after incremental loading of truck traffic are assumed to be known.

3.1 Incremental Resurfacing and Reconstruction Costs

Incremental resurfacing and reconstruction costs are usually the most significant incremental cost in road impact studies. In some studies it is the only measure of incremental road costs.

These costs result because additional truck traffic reduces pavement lifespan, resulting in earlier pavement resurfacing (and eventually reconstruction). Alternatively, pavement lifespan can be held constant through the use of thicker overlays during resurfacing. Either way, an incremental cost is incurred.

"Build Sooner" Costs

The most common approach to calculate these incremental costs is to calculate the "build-sooner" resurfacing cost, assuming no increase in pavement overlay thickness. "Build-sooner" costs refer to the increase in the present value of future costs resulting from building a project earlier rather than later.

"Build-sooner" pavement costs require an estimate of the decrease in pavement life with additional truck traffic. This requires a pavement deterioration model that can predict the decrease in pavement surface quality (e.g., Road Comfort Index or RCI) with increased truck traffic (usually expressed in terms of cumulative equivalent single axle loads or ESALs).

Pavement Deterioration Models

The pavement deterioration model is the most controversial part of calculating "build-sooner" pavement resurfacing costs. It is controversial because the models available differ widely in their prediction of pavement deterioration with increased truck traffic. The difference depends on if and how environmental pavement deterioration is modelled.

For thick asphalt pavements, the Ontario Flexible Pavement Deterioration Model (OFPDM) is often used in Canadian studies (e.g., Bisson et al, 1985; Coles, 1987). It may be more appropriate to use the Alberta model (Cheetham and Christison, 1981) for the low-volume roads in the prairies. See (Nix et al, 1992) for further discussion of these and other pavement deterioration models.

For surface treated pavements, there are no "off-the-shelf" pavement deterioration models available. Two studies reviewed developed their own models from available data. ADI (1986) developed a model based on Manitoba asphalt surface treated (AST) roads. However, ADI warned that the calibrated model was applicable to southern Manitoba only and should not be transferred. Scullion et al (1984) developed deterioration models for surface treated pavements in Texas.

3.2 Incremental Routine Maintenance Costs

Incremental routine maintenance costs are often excluded from road impact studies. They are excluded because they are perceived to be insignificant or data simply is not available to make an informed estimate. When they are included, they range from two to 35 percent of incremental resurfacing and reconstruction costs (Innes et al; Coles, 1987).

Some are not convinced that routine pavement maintenance costs are a direct function of truck traffic. Luhr et al. (1983) predicted routine maintenance costs as a function of the pavement surface roughness, not truck traffic. One implication of this is that routine maintenance costs will not change with truck traffic if the average RCI over time is maintained through more frequent overlays (i.e., only resurfacing costs will increase).

Others have assumed that trucks routine maintenance costs vary directly with truck traffic by dividing annual pavement routine maintenance costs by the annual number of truck axles. Still others have conducted sophisticated regression analyses (Gibby et al, 1989). Nevertheless, there seems to be no clear consensus on the magnitude of incremental routine maintenance costs or how to calculate them.

3.3 Incremental Capacity Costs

Incremental capacity costs vary widely in significance. For the low volume/capacity ratio, low traffic growth roads most often affected by branchline abandonment, it may be reasonable to ignore these costs (i.e, capacity expansion may never be needed).

Incremental capacity costs are relevant when base traffic levels are growing. With growth, expansion in traffic capacity expansion (e.g., additional lanes) will be required in the future. Adding additional truck traffic to this growing traffic base requires earlier capacity expansion resulting in a "build-sooner" cost.

Not all studies have included these costs. Bisson et al;(1985) and (Coles, 1987) were the only studies reviewed to include them. In those studies incremental capacity costs generally varied from four to 50 percent of pavement resurfacing costs, depending on the situation.

3.4 Incremental Road User Costs

Incremental road user costs are excluded if only the incremental cost to the highway agency is to be determined. They are also generally excluded in total road cost studies because where there is no pavement upgrading or traffic congestion they are considered insignificant.

One exception to this was found in (Tolliver et al, 1992) where incremental highway user costs were 12 percent of incremental resurfacing costs, with no upgrading of pavement type. Tolliver calculated road user costs based on the predicted RCI for each year into the future.

3.5 Incremental Road User Revenues

Incremental road user revenues are sometimes excluded from studies concerned with the cost to the road agency only (i.e., they are only concerned with road expenditures). Where they are included, they are calculated by determining increased fuel tax, truck registration, and license revenues.

With respect to prairie branchline abandonment, incremental road user revenues are small. This is because producers pay federal, but not provincial taxes for farm truck fuel. In addition, qualified Alberta producers receive a "farm fuel distribution allowance" subsidy.

For commercial trucking, the issue is more complex. The amount of fuel taxes that could be considered a road-related revenue is controversial. Some studies have included both federal excise and provincial fuel taxes. Others have excluded the federal excise tax and included only the provincial fuel tax. Still others have excluded the federal excise tax and taken only a portion of the provincial fuel tax (e.g., the portion

in excess of the provincial sales tax or the portion in excess of the provincial tax on railway diesel fuel).

4.0 INCREMENTAL ROAD COSTS - NON-STRUCTURAL PAVEMENTS

This section summarizes information found in the literature on incremental road costs for non-structural pavements.

4.1 Thin Asphalt Pavements

Incremental Resurfacing and Reconstruction Costs

No examples of thin asphalt "build-sooner" resurfacing and reconstruction costs were found in the literature. It is not clear that thin asphalt pavements even need reconstruction. They are resurfaced, on average, every five to six years and can last indefinitely with sufficient maintenance effort (Hassan and Heiman, 1986).

There were no thin asphalt pavement deterioration models found that could be used to determine a "build sooner" cost. Saskatchewan has developed thin asphalt pavement deterioration models, but it appears that it is not calibrated to include ESAL truck traffic as an independent variable (i.e., deterioration is a function of time only) (Bein et al, 1989). Even if an ESAL term is included in this model, some claim that the ESAL concept is not appropriate for thin asphalt pavements (ADI, 1989, pg. 13-5).

Incremental Routine Maintenance Costs

No information was found directly linking truck traffic to thin asphalt maintenance costs. The best information found relates average annual daily traffic (AADT) to annual pavement surface maintenance costs. Hassan and Heiman (1986) found that there is little relationship between AADT and annual pavement surface maintenance costs.

4.2 Thin Gravel Pavements

Incremental Blading and Regravelling Costs

Only minimal information was found on increases in gravelling costs with truck traffic. ADI (1986) tried to develop a regression relating AADT to regravelling costs but were unsuccesful. As an alternative, a model calibrated in Brazil was used to predict gravel loss with truck traffic. Of interest was that the model predicted that car traffic contributed more to gravel loss than truck traffic. ADI (1986) had more success developing a gravel road blading costs versus AADT model for Manitoba gravel roads.

Sparks (1986) collected regravelling and blading maintenance cost data for gravel roads in two Saskatchewan rural municipalities. The relationship between AADT and regravelling costs was weak, but there did seem to be some increase in costs with AADT. The relationship between gravel road blading costs and AADT was stronger. In both cases, there seemed to be a minimum level of maintenance cost, even at very low traffic levels.

5.0 THE SASKATCHEWAN STUDY

5.1 Description

A study for the Saskatchewan Government (ADI, 1989) developed a methodology for estimating gravel and thin asphalt road upgrading costs as a result of branchline abandonment and elevator rationalization. The study estimated a cost of $ 57 million for road upgrades if 990 km of branchlines were abandoned and surrounding elevators were rationalized.

Upgrade Criteria

The road upgrade criteria was based on the number of pavement failures per year. For thin asphalt pavements, it was two or more failures per year. If the upgrade criteria was met, thin asphalt pavement would be upgraded to a structural asphalt pavement at a cost of 180,000 $/km.

The upgrade criteria was determined based on the idea that two or more pavement failures per year would result in unacceptable road conditions for the majority of the year. Similar criteria were developed for thin gravel pavements.

Pavement Failure Criteria

The Pavement failure criteria was based on a threshold axle loading rate. For thin asphalt pavement on till subgrades, the threshold was 80 loaded truck axles/day in the peak week. The pavement failure criteria was primarily derived from a pavement failure test with subjective adjustments to account for field conditions.

5.2 Comments

Elevator Rationalization

The road impact costs determined by the study were not due to branchline abandonment alone. It also assumed that select elevators would be closed on nearby operating rail lines. This results in increased incremental haul distance and higher road costs than if just branchline abandonment is assumed.

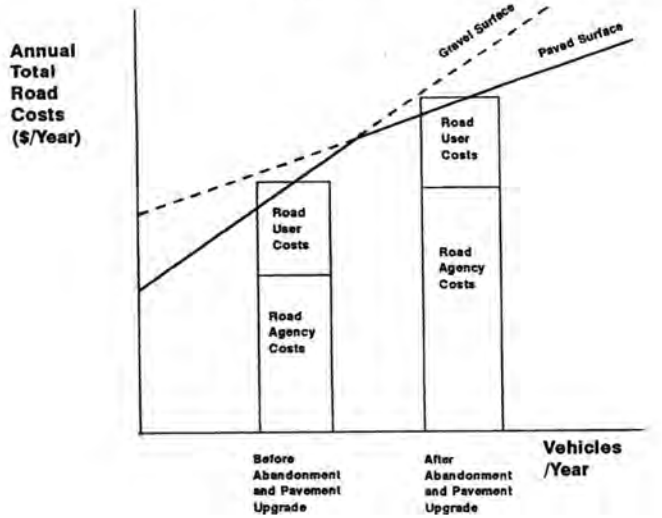
Upgrade Criteria

The criteria for upgrading a pavement is normally made in a quantitative economic analysis of road agency and road user costs for each pavement type at different traffic levels. Upgrading is then justified at the traffic level where the sum of road agency and road user costs are the same for each pavement type. Figure 1 illustrates how total road costs can be used to determine when to upgrade a pavement.

This method of analysis has been used by the Saskatchewan Government to upgrade from gravel to thin asphalt pavement at 100 AADT (Hassan and Heiman, 1986) and from thin asphalt to surface treated pavement at 250 AADT (Hassan and Said, 1982).

Because the Saskatchewan study did not quantify road user and road agency costs, it is impossible to evaluate whether their criteria is appropriate (i.e, why two and not one failure per year?).

Figure 1
Total Road Costs
by Pavement Type and Traffic Level

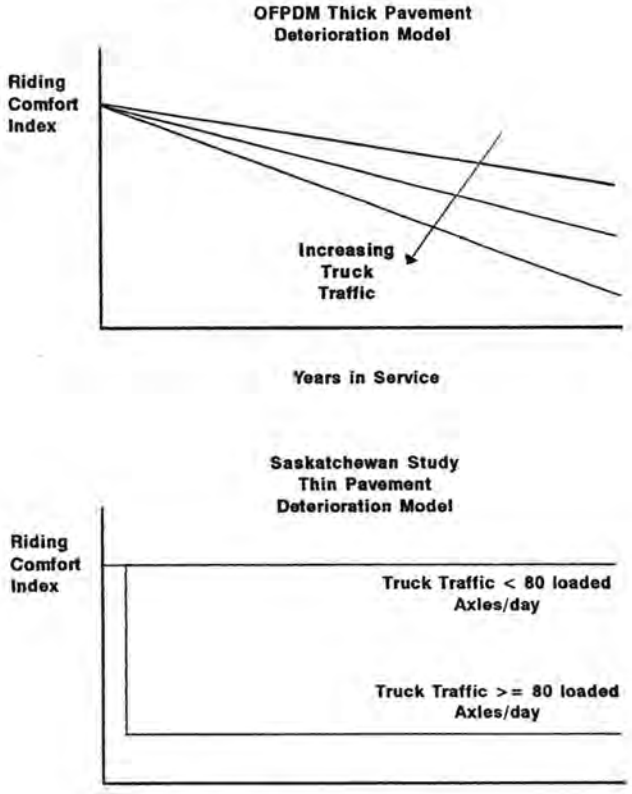


Pavement Failure Criteria

The pavement failure criteria is based solely on axle loading rate. As a result, thin asphalt pavement is predicted to have an indefinite life below the 80 loaded axles/day threshold and fail immediately when above.

This is a dramatic departure from previous pavement models that predict gradual pavement deterioration with cumulative axle loading. Figure 2 demonstrates the large difference in pavement behavior between the Saskatchewan Study and OFPDM pavement deterioration models.

Figure 2
OFPDM Thick Pavement
Deterioration Model and Saskatchewan
Study Thin Pavement Deterioration Model



6.0 GENERAL QUESTIONS AND COMMENTS

6.1 Larger Trucks Reduce Road Damage?

The claim by some that the use of larger trucks after branchline abandonment "could reduce road damage" needs some qualification. The claim is based on the ESAL concept which says that larger trucks reduce pavement damage per unit (i.e., ESAL/tonne-km). Offsetting this is the increase in number of units (i.e., tonne-kms) with branchline abandonment.

As mentioned before, it is not clear that the ESAL concept is applicable to thin asphalt and thin gravel pavements. For those roads where the ESAL concept is valid, the claim may be valid in certain situations.

In the case of the "off-track elevator" abandonment option, road impact costs will always increase, no matter what kind of truck is used. This is because the farm to elevator truck haul (and road cost) does not change after abandonment. However, the new commercial haul from the originating off-track elevator to alternate elevator will create an additional road cost, regardless of truck size.

6.2 Calculation of Incremental Tonne-Kms

Incremental tonne-kms are needed for a macro level analysis of prairie branchline road impact costs (i.e., $ = tonne-kms x $/tonne-km).

For the analysis of the "direct trucking" abandonment option, the "off-track elevator" assumption is sometimes used to approximate the incremental tonne-kms. This is done by multiplying the distance between the originating and closest alternate elevator by the tonnes delivered to the originating elevator. It is simpler than determining the tonnage and before and after abandonment direct haul distance for each farmer.

Though simpler, it can result in large errors. Ward (1986) found that the "off-track elevator" assumption overestimated the direct trucking tonne-kms by 52% in one case and 137% in another. He compared the incremental distance calculations using the "off-track" method and the Canadian Transport Commission's Producer Haul and Elevator Receipt (PHAER) system for the Inwood and Colony Subdivisions. The PHAER system accurately calculates "direct trucking" incremental distance. The PHAER and "off-track" incremental distances for two subdivisions analyzed were 18.6 and 28.2 miles (52% overstated) and 9.7 and 23 miles (137% overstated).

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APPENDIX
DEFINITION OF TERMS

Pavements

In this paper, pavement refers to any material placed on top of the soil (subgrade). The paper focuses on four pavement types - thick asphalt, surface-treated, thin asphalt and gravel. Thick asphalt and surface-treated pavements are considered structural pavements. Thin asphalt and gravel pavements are considered non-structural pavements. Non-structural pavements derive most of their strength from the subgrade.

Thick asphalt pavements consist of a granular sub-base, base and a thick layer (50-100 mm) of asphaltic concrete. They are used on high volume roads (greater than 1000 vehicles/day). Surface-treated pavements consist of a very thin (<15 mm) layer of aggregate in asphalt binder (seal coat) over a layer of granular base. They are used on mid-volume roads (500-1000 vehicles/day).

Thin asphalts consist of a thin layer (20-40 mm) of asphalt directly on subgrade. As far is as known, these pavements are unique to Saskatchewan. Their distinguishing characteristic is the lack of any granular material between the subgrade and asphalt. Gravel pavements consist of a layer of gravel directly on the subgrade. In Saskatchewan the layer is thin (25 mm). Elsewhere, gravel layers are thicker. Thin asphalt and gravel pavements are used on low-volume roads (less than 500 vehicles/day).

Resurfacing and Reconstruction

Resurfacing refers to the rehabilitation of a pavements surface smoothness through the application of an asphalt overlay, asphalt sealant or additional gravel (for gravel roads). Reconstruction refers to the removal and replacement of the pavement.

During their 40-50 year lifespan, thick asphalt pavements are generally resurfaced twice after initial construction (Nix et al, 1992). Resurfacing consists of an overlay of thin asphalt. Surface-treated and thin asphalt pavements are resurfaced by resealing every 4 to 9 years. Gravel pavements are resurfaced (regravelled) every 2 to 5 years.

Routine Maintenance

Routine pavement includes pavement maintenance activities that that are generally made on a regular basis during summer months, such as crack sealing on asphalt roads or blading of gravel roads. It excludes non-pavement maintenance activities such as snow clearing. It also excludes resurfacing costs, sometimes included in other definitions of routine maintenance costs.

LES CHEMINS DE FER D'INTÉRÊT LOCAL ONT-ILS UN AVENIR AU CANADA?

Les chemins de fer d'intérêt local (C.F.I.L.) constituent un phénomène nouveau tant au Canada qu'au Québec. En effet, la création du premier chemin de fer d'intérêt local au Canada, le Central Western, remonte à l'automne 1986. Rappelons qu'il existe aux États-Unis plus de 230 chemins de fer de ce type créés depuis 1980.

Avant d'essayer de prédire l'avenir de ceux-ci en l'an 2000, il serait utile de préciser l'état de la situation actuelle pour les C.F.I.L. au Canada et au Québec.

I. État de la situation au Canada et au Québec

L'Association des transports du Canada procède actuellement à une étude sur la définition d'un réseau ferroviaire national. Cette étude à laquelle participe l'ensemble des provinces devrait être remise au gouvernement fédéral l'automne prochain. Certains C.F.I.L. feraient partie intégrante du réseau national au même titre que le CN et le CP en raison de leur situation stratégique dans ce réseau. À ce titre, le gouvernement fédéral pourrait contribuer à leur financement.

En Alberta, le Central Western, en exploitation depuis plus de sept ans, demeure le pionnier au Canada. Le Central Western débute ses activités le 21 novembre 1986 par l'acquisition du tronçon ferroviaire entre Ferlow Junction et Dinosaur, autrefois propriété du CN. Aujourd'hui, les activités de ce premier C.F.I.L. au Canada se limitent en grande partie au transport du grain en raison de la présence de nombreux élévateurs de grain, exploités par différentes sociétés céréalières.

En Saskatchewan, nous suivons avec intérêt l'expérience du chemin de fer Southern Rail Cooperative.

En Ontario, le chemin de fer Goderich-Exeter est en exploitation depuis quelques mois. Rappelons que c'est Railtex de San Antonio (Texas) qui a acquis cette ligne du CN et a obtenu sa charte provinciale à l'automne 1990 suivie de l'autorisation de l'Ontario Municipal Board.

Il y a aussi le chemin de fer Port Stanley Terminal qui, en plus de sa vocation touristique, veut faire le transport de marchandises.

Rappelons qu'en décembre 1992, le CN a mis en vente, en Ontario, de nombreux tronçons ferroviaires au lieu de recourir à la procédure usuelle d'abandon. Voici une liste de ces tronçons offerts à des futurs exploitants potentiels de chemin de fer d'intérêt local :

- la subdivision Fergus, entre Cambridge et Guelph (2,7 kilomètres);
- l'embranchement industriel Waterloo, entre Kitchener et Elmira (19 kilomètres);
- la subdivision Marmora, entre Picton et Trenton (50 kilomètres);
- la subdivision Meaford, entre Barrie et Collingwood (47 kilomètres);
- la subdivision Midland, entre Uhthoff et Midland (39 kilomètres).

En milieu d'année, nous devrions connaître l'intérêt de certains exploitants de C.F.I.L. pour les tronçons que nous venons d'émunérer.

En Nouvelle-Écosse, le CN a vendu la ligne de 400 kilomètres entre Sydney et Truro à Railtex pour une somme de 20 millions $. En plus d'une autorisation de l'O.N.T., Railtex devra faire une demande d'incorporation pour l'exploitation de son chemin de fer au gouvernement de la Nouvelle-Écosse. La création de ce nouveau chemin de fer en Nouvelle-Écosse doit être suivie avec attention en raison de l'opposition manifeste du gouvernement de la Nouvelle-Écosse ainsi que de certains ministres fédéraux de la région :

> Le gouvernement de la Nouvelle-Écosse estime devoir agir ainsi afin que le CN maintienne cette ligne et que le gouvernement fédéral respecte son engagement envers l'expansion économique régionale. Il ne croit pas qu'un exploitant privé garantira l'exploitation à long terme du tronçon et estime que la meilleure solution serait que le CN continue d'exploiter cette voie[1].

Notons de plus que le CP a annoncé le 17 novembre 1992, en plus de la demande d'abandon de la ligne Sherbrooke/St-Jean au Nouveau-Brunswick via le Maine, la mise en vente d'un tronçon de 93 kilomètres reliant New Minas à Windsor Junction (Nouvelle-Écosse) comme chemin de fer régional.

En mai 1992, le ministère des Transports du Québec a dévoilé une stratégie de relance axée principalement sur l'établissement d'un réseau ferroviaire de base au Québec et visant l'identification des lignes ferroviaires jugées essentielles au développement économique des régions du Québec. Il a en outre tenu, en juin 1992, un colloque sur le financement des chemins de fer d'intérêt local regroupant ainsi de nombreux hommes d'affaires et banquiers.

Le CP poursuit des pourparlers exploratoires pour la vente des subdivisions Stanbridge et Saint-Guillaume au sud de Montréal. De plus, la vente par le CP d'un tronçon de la subdivision Saint-Gabriel à l'entreprise Bell Gaz Limitée souligne l'intérêt grandissant des Québécois pour l'option ferroviaire.

En août 1992, CN a lancé un appel d'offres pour la vente de deux subdivisions ferroviaires : la subdivision Murray Bay d'une longueur de 144 kilomètres situés entre Limoilou et Clermont et la subdivision Saint-Raymond, d'une longueur de 57 kilomètres, situés entre Limoilou et Jackson's. Cette année 1993, nous devrions connaître la ou les entreprises choisies pour exploiter ces tronçons. Précisons que ces négociations entre CN et la ou les entreprises choisies sont confidentielles.

Soulignons la mise en service d'un premier chemin de fer local à vocation touristique au Québec. Ce service ferroviaire qui a pour nom le Petit Train à vapeur Hull-Wakefield a été inauguré le 27 juin 1992.

Contrairement à la situation aux États-Unis, les débuts des C.F.I.L. au Canada sont plutôt difficiles. Entre autres difficultés, il faut souligner que les problèmes constitutionnels soulevés par la création des C.F.I.L. ont suscité des inquiétudes chez certains exploitants potentiels. En effet, l'incertitude rattachée au caractère provincial ou fédéral des conventions collectives a certainement retardé la création de C.F.I.L. Précisons que depuis la décision de la Cour suprême relative au chemin de fer Central Western rendue en décembre 1990, la situation s'est précisée.

II. Une vision de l'an 2000

Dans sept ans, le réseau ferroviaire québécois aura subi des mutations profondes. En effet, nous prévoyons trois grands éléments majeurs pour l'an 2000 : une éventuelle rationalisation commune des réseaux et services du CN et du CP, la création de six C.F.I.L. et la réalisation du plan intégré de trains de banlieue de la région de Montréal. Bien sûr, le transport intermodal sera un élément très important en l'an 2000, mais notre analyse se limitera à la dimension ferroviaire.

A. Vers une fusion CN-CP?

En l'an 2000, nous estimons qu'une rationalisation commune de CN et de CP serait envisageable. La compétition des chemins de fer américains et surtout celle du camionnage forceraient ces deux sociétés à s'associer pour affronter avec succès la concurrence. Le réseau de cette nouvelle entité ferroviaire se limiterait pour le Québec à un axe ouest-est (allant de la frontière de l'Ontario à celle du Nouveau-Brunswick), c'est-à-dire la ligne ferroviaire sur la rive sud du fleuve

Saint-Laurent. Ce réseau aura pour plaque tournante la région de Montréal et il serait alimenté par la majorité des lignes régionales actuelles.

C'est dans cet esprit qu'il faut voir la récente décision conjointe de CN et de CP de se doter d'une ligne ferroviaire commune reliant la région de Montréal, Ottawa et le nord de l'Ontario :

> Cette opération de rationalisation vise à supprimer les énormes coûts liés à la possession et à l'entretien de voies distinctes dans une région où un dédoublement des voies n'apporte aucun avantage concurrentiel. Sur la plus grande partie de ce territoire, quelques kilomètres seulement séparent les voies du CN et du CP. L'entente prévoit la création d'une ligne commune détenue à part égale par les deux chemins de fer; par le biais d'une société indépendante[2].

Cette récente décision de CN et de CP signifie à moyen terme la fusion partielle ou totale de leurs réseaux dans l'Est du pays. En effet, une équipe de travail commune, sous la direction de M. Jacques Côté, vice-président de CP, et de M. Merv Blackwell, vice-président de CN, étudierait déjà la possibilité de partager les voies et les équipements d'entretien, ou même la fusion pure et simple de services ferroviaires redondants dans les diverses régions du pays. Il va de soi que cette potentielle fusion aurait des impacts sur les C.F.I.L. en exploitation. En effet, le statut de quasi-monopole de cette nouvelle société fusionnée accroîtrait la dépendance des C.F.I.L. vis-à-vis cette dernière.

B. Création de six chemins de fer d'intérêt local

Dans le contexte du désengagement financier du gouvernement fédéral en matière de transport ferroviaire et de la volonté de l'éventuelle nouvelle société ferroviaire commune de conserver un réseau minimal au Québec, la création de C.F.I.L. constituerait une option intéressante en raison d'une réduction des coûts d'exploitation et d'un meilleur service à la clientèle :

> L'expérience a montré qu'un chemin de fer d'intérêt local peut prendre la place qu'un transporteur majeur doit abandonner et ce, pour deux raisons :
>
> . Premièrement, les chemins de fer d'intérêt local peuvent rapidement réduire leurs dépenses en raison de leurs frais généraux moindres, de classifications plus flexibles sur le plan de la main-d'oeuvre et de la possibilité d'un meilleur équilibre entre le niveau d'exploitation et l'entretien du réseau.
>
> . Deuxièmement, en raison de leur taille, les transporteurs régionaux peuvent mieux utiliser le matériel et

> accroître, par un service personnalisé, leur intégration au milieu et leur aptitude à attirer de petits et moyens expéditeurs hors de la portée d'un transporteur majeur[3].

En effet, les régions ressources auront besoin dans le nouveau contexte de l'accroissement du commerce dans l'axe nord-sud de la présence de chemins de fer d'intérêt local pour le transport des matières premières et des produits semi-ouvrés. C'est pourquoi nous croyons que sur une liste de 10 tronçons ferroviaires potentiels, il est probable que cinq ou six C.F.I.L. soient en exploitation au Québec au début du prochain siècle[4].

C. Projet de plan intégré de trains de banlieue intégré du Grand Montréal

En l'an 2000, la grande région de Montréal pourrait être dotée d'un système intégré des trains de banlieue englobant toutes les lignes ferroviaires de CN et de CP permettant une desserte de la population du Grand Montréal. Les pôles desservis seraient Rigaud/Deux-Montagnes/Sainte-Thérèse et Mascouche ainsi que Saint-Jérôme/Mirabel sur la rive nord du Saint-Laurent et Saint-Jean/Iberville, Châteauguay et Saint-Hilaire sur la rive sud. Il est possible que certains C.F.I.L., outre le fret, pourraient exploiter des services de transport pour les banlieusards.

Le projet consiste à revitaliser un réseau ferroviaire de 275 kilomètres avec l'implantation de 56 gares. Ce projet de revitalisation de trains de banlieue prévoit des investissements pouvant varier entre 90 et 100 millions $, sans compter le coût d'acquisition des terrains. L'avantage de ce projet serait d'enlever 20 000 automobiles dans le centre-ville de Montréal. Le financement des coûts d'exploitation serait assuré par les usagers et par les revenus du fonds d'indemnisation constitué de la somme de 30 $ déboursée par chaque citoyen possédant une automobile et demeurant dans une localité desservie par un service de transport en commun.

La réalisation de ce projet permettrait d'offrir un service intégré de trains de banlieue sur plusieurs circuits ferroviaires déjà existants mais qui ne sont pas utilisés actuellement pour le transport des passagers.

D. Régions éloignées

Il est concevable que les services passagers aux régions éloignées actuellement donnés par VIA soient assurés par des C.F.I.L. sous contrat avec Transports Canada. À titre d'exemple, certains exploitants ferroviaires locaux pourraient opérer en Abitibi, en plus du service de marchandises, un service de transport de voyageurs. Cette option permettrait la vente à un C.F.I.L. et son transfert à une juridiction provinciale d'une ligne sur laquelle il existe un service voyageur.

III. La problématique québécoise des chemins de fer d'intérêt local

Au Québec, l'émergence de trois nouveaux exploitants ferroviaires (chemin de fer Hull/Chelsea/Wakefield, chemin de fer de Lanaudière exploité par l'entreprise Bell Gaz, chemins de fer offerts en vente publique par CN - Québec/Saint-Raymond et Québec/Clermont) démontre l'intérêt grandissant des transporteurs québécois pour le concept de C.F.I.L. C'est pour répondre aux attentes de ceux-ci que le ministère des Transports du Québec a amorcé la révision complète de la partie corporative et commerciale de la *Loi sur les chemins de fer* du Québec (L.R.Q., chapitre C-14) dans le but d'adapter celle-ci au contexte de la formation de nouvelles sociétés ferroviaires. Un projet de loi est formellement prévu pour l'automne 1993.

Nous estimons qu'il y a trois éléments fondamentaux à considérer pour tout éventuel exploitant de chemin de fer d'intérêt local. Le premier, c'est l'existence actuelle et potentielle d'un certain nombre d'expéditeurs désireux de confier le transport de leurs produits à un transporteur ferroviaire local. En effet, soulignons que la réussite de tout projet de C.F.I.L. est tributaire de la capacité de l'exploitant de répondre aux besoins spécifiques de transport des expéditeurs de la région. Cependant, la réussite de tout projet de C.F.I.L. doit avant tout tenir compte de l'existence d'un marché pour lequel le rail est concurrentiel.

Le second élément important, c'est la réalisation d'un plan d'affaires qui soit à la fois complet et réaliste. En effet, le plan d'affaires doit comporter une structure financière adéquate, permettant à une compagnie acheteuse de récupérer ses immobilisations grâce aux recettes d'exploitation du réseau tout en tenant compte des risques associés au trafic offert (marché cyclique, client unique ou multiple, marchandises dangereuses) ou de la ligne elle-même (ponts majeurs, éboulis, inondations).

Le troisième élément fondamental, c'est le financement de tout projet de chemin de fer d'intérêt local. En effet, nous n'insisterons jamais assez sur cet aspect primordial de tout projet de transporteur ferroviaire local. Rappelons qu'à elle seule l'acquisition de certains tronçons ferroviaires peut se chiffrer en termes de millions de dollars.

Selon M. John Heads, directeur de l'Institut des transports de l'Université du Manitoba,

> une saine gestion et des capitaux suffisants sont les éléments essentiels de la viabilité du réseau ferroviaire. Ainsi, le petit exploitant doit être doté, premièrement d'une structure financière qui ne soit pas indûment grevée de dettes et, deuxièmement d'une équipe de gestionnaires compétents en opérations ferroviaires et dévouée à la collectivité qu'elle dessert[5].

Pour résoudre le problème fondamental du financement des projets de C.F.I.L., deux approches peuvent être retenues. La première est celle choisie par les États américains, soit un programme ponctuel d'aide financière. En effet, rappelons le rôle essentiel joué aux États-Unis par l'application de la *Local Rail Service Assistance Act* qui a permis le démarrage de nombreux chemins de fer d'intérêt local dans vingt États. Il existe chez notre voisin américain près de 230 chemins de fer locaux exploitant plus de 17 000 milles de voies. Cette loi fédérale prévoit une aide financière substantielle aux États voulant susciter la création de C.F.I.L. De plus, certains États fournissent aux chemins de fer locaux une aide financière destinée à l'acquisition ou au réaménagement des voies ferrées mais n'accordent pas de subventions pour couvrir des pertes d'exploitation.

La seconde approche est celle retenue par le ministère des Transports du Québec, soit celle de susciter le financement privé ou public (à titre d'exemple, la Société de développement industriel lorsqu'elle aura obtenu de nouveaux pouvoirs à cet égard) pour la création de transporteurs ferroviaires locaux. Soulignons que c'est dans cet esprit que le ministère a tenu, en juin 1992, un colloque sur les chemins de fer d'intérêt local axé principalement sur le financement de telles entreprises. Cependant, le ministère est ouvert seulement à une participation financière et technique pour la réalisation d'études de faisabilité de tout projet de C.F.I.L.

En dernier lieu, soulignons la recommandation sur ce sujet du mémoire du ministère des Transports à la Commission d'examen de la *Loi sur les transports nationaux* :

> La *Loi de 1987 sur les transports nationaux* devrait contenir une disposition et un mécanisme visant à permettre une assistance financière à la mise en place de chemins de fer d'intérêt local, principalement au niveau de l'achat et de la réhabilitation des voies ferrées. À défaut d'une disposition particulière, on devrait à tout le moins élargir la notion d'aide établie à l'article 175 de la loi, à la créatioin de C.F.I.L. et octroyer les crédits nécessaires à la remise en état des lignes ferroviaires cédées à des entreprises locales[6].

IV. Conclusion

Nous venons de constater que le problème principal des C.F.I.L. est celui de leur financement. Dans le texte *Examen complet de 1992 concernant la Loi de 1987 sur les transports nationaux : la dimension ferroviaire*, nous avions souligné trois obstacles à la création de C.F.I.L., soit la clause «à l'avantage général du Canada», la disposition sur l'aide financière prévue à l'article 175 de la LNT et l'obtention des droits de circulation. Nous espérons vivement que ces trois obstacles feront l'objet de recommandations spécifiques dans le rapport de la Commission d'examen de la *Loi nationale sur les transports* présidée par Me Gilles Rivard.

L'avenir des C.F.I.L. et leur succès dépendent des décisions futures des deux grandes sociétés ferroviaires actuelles ou de la société ferroviaire issue de leur fusion éventuelle.

Nous prévoyons, pour l'an 2000, l'exploitation d'une quinzaine de C.F.I.L. au Canada tandis qu'au Québec, nous estimons que cinq ou six transporteurs locaux exploiteront de tels chemins de fer.

Nous croyons fermement que les C.F.I.L. ont actuellement, et auront en l'an 2000, un avenir fort prometteur tant au Canada qu'au Québec.

Le défi de ces nouvelles entreprises est d'ordre financier. Le succès de ces entreprises est tributaire de leur capacité à générer un financement sur le marché privé. Un défi certes de taille, mais possible à relever.

NOTES

1. *Rapport du Comité sénatorial permanent des transports et des communications sur la décision du Canadien National de vendre la voie ferrée principale reliant Truro et Sydney en Nouvelle-Écosse*, juin 1992, p. 26.

2. Communiqué conjoint de CN et CP du 22 décembre 1992, p. 1.

3. Allocution de M. Jacques J. côté, directeur exécutif, Immobilisations, Réseau CP Rail, *Compte rendu du Colloque sur les chemins de fer d'intérêt local*, p. 43.

4. Voir la liste des chemins de fer d'intérêt local potentiels au Québec en annexe.

5. *Rapport du Comité sénatorial permanent des transports et des communications sur la décision du Canadien National de vendre la voie ferrée principale reliant Truro et Sydney en Nouvelle-Écosse*, juin 1992, p. 15.

6. *Mémoire sur la révision de la réforme de 1987 de la réglementation économique des transports présenté à la compétence de la Commission d'examen de la Loi sur les transports nationaux par le ministère des transports du Québec*, juin 1992, Québec, p. 27 et 28.

LISTE DES CHEMINS DE FER D'INTÉRÊT LOCAL POTENTIELS AU QUÉBEC

Région de l'Abitibi

1. Le tronçon Senneterre-Matagami

Région du Saguenay

2. le tronçon Montréal-Jonquière

Région de Montréal

3. le tronçon Montréal-Saint-Thérèse-Hull
4. le tronçon Montréal-Sorel

Région de l'Estrie

5. le tronçon Montréal-Sherbrooke-Cooaticook (frontière des États-Unis)
6. le tronçon Sainte-Rosalie-Farnham (frontière des États-Unis)

Région de Québec

7. le tronçon Québec-Clermont
8. le tronçon Québec-Trois-Rivières-Montréal

Région de la Gaspésie/Bas-Saint-Laurent

9. le tronçon Gaspé-Matapédia
10. le tronçon Matapédia-Rivière-du-Loup

ECONOMIC CYCLES, STRUCTURAL CHANGE AND THE TRANSPORTATION SECTOR - *Synopsis*

By Pierre Zalatan[*]

Since transportation activity is a derived demand i.e. a demand based on the level and changes in economic activity, it grows when general economic activity grows and slows down during slower economic growth. This is the long term affinity (trend) between the two. Therefore, understanding the socioeconomic changes affecting the economy is essential in assessing the transportation sector's performance and prospects.

During recent years, the economy and transportation have entered an era of important structural changes. Therefore the present muddling of the Canadian economy is not only the result of an economic business cycle (short term) but also the result of important structural changes (long term). Structural changes have two origins: changes related to the supply of goods and services and those related to the demand for such goods and services. Over the last few years, major changes which may have had an effect on transportation are as follows:

Structural changes in Demand:

- *Consumer behavioral changes.* A change in perception about common sense spending; consumers are now focusing more on their needs than on their wants.
- *Government behavioral changes.* Higher structural deficits have forced governments to increase revenues, mostly through taxes, and to reduce expenditures thus reducing their contribution to economic growth.
- *Redistribution of economic power.* Within the OECD area, economic power has shifted from the U.S. to Japan and to the unified Europe.
- *The Goods and Services Tax.* The GST is one of the most important structural changes introduced over the last three decades.

Structural changes in Supply:

- *Two major oil price shocks.* Ever since the first oil price shock, energy prices have been more widely, rigorously and frequently factored into the cost function of the firm.
- *Persistently higher real interest rates.* This has been the norm over the last ten years.
- *High unemployment.* Most economists agree that an unemployment rate cannot be held below 8 per cent by aggregate demand stimulation without generating higher inflation.
- *Excess capacity.* There is increased production capacity as a result of the Free Trade Agreement (FTA), Economic Regulatory Reform. On the one hand, the world-wide push for the reduction of tariff and non-tariff barriers has increased markets for producers.
- *Higher Canadian Dollar.* In the longer run, the Canadian economy will be in better shape and this will drive up the Canadian dollar. Therefore, businesses can no longer rely on a lower dollar to sell their goods and services abroad. They will have to restructure their operations and they must do it now.

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ECONOMIC CYCLES, STRUCTURAL CHANGE AND THE TRANSPORTATION SECTOR

By Pierre Zalatan[*]

Introduction

Services produced by the transportation sector affect various aspects of almost every economic transaction. This inherent characteristic has given that sector -and other similar sectors, for example, energy production- an indisputably strategic position in the economy. On the other hand, it has also made it vulnerable to variations in the economic short (business) and long term (structural) cycles. Therefore, understanding the socioeconomic changes affecting the economy is essential in assessing the transportation sector's performance and prospects.

Whereas transportation has sailed fairly smoothly through past cycles, the cumulative effect of the recent and not so recent changes in the Canadian as well as in the world economies are likely to cause some turbulence. The economy and transportation have entered an era of important structural changes. Normally, market forces should quickly "clear" these changes. This, however, may not be easy to do. The presumption is that these changes are calling for sizeable adjustments that our economic structure has difficulty accommodating. Moreover, for transportation, the rhythm of technological change and the massive investments that allowed the sector to improve productivity, lower prices and help it outperform total economic activity have slowed down.

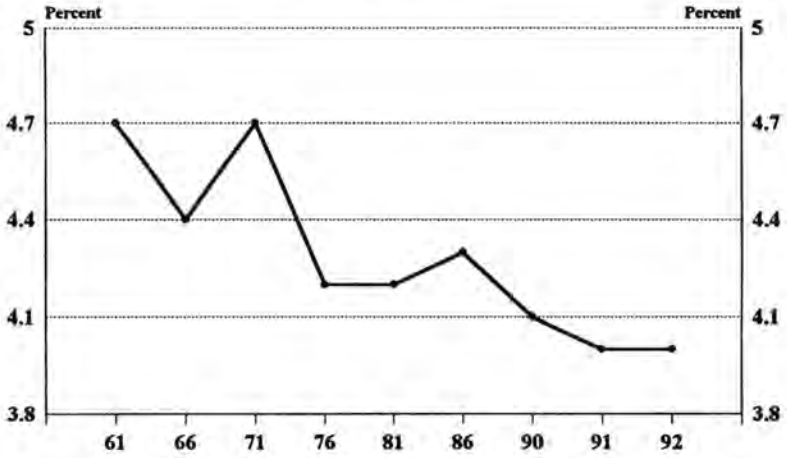
In real terms, in 1992, the contribution of the transportation sector (excluding the private automobile) to the economy accounted for 4.0 per cent of total economic activity. In other words, 4 per cent of the total Gross Domestic Product (GDP) originated, exclusively, in the transportation sector. This 4 per cent accounts for payments to all factors of production (labour, capital, entrepreneurship, used exclusively in that sector. (If all other productions, viz. petroleum products, tires, vehicles, etc., destined for the sector are accounted for, that share goes up to 16 per cent).

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In 1961, that share was 4.7 per cent and has, ever since, continued its downward trend (Figure 1). The drop in that share between 1961 and 1992, a sign of healthy sector, would be even higher when expressed in current dollars simply because transportation output prices have been increasing at a lower rate than the overall inflation in the economy. High productivity gains from a large transportation investment effort (the Trans-Canada Highway, Saint Lawrence Seaway, etc) associated with important technological changes (dieselization of the railways, the jet motor, etc) were essentially responsible for these low price increases.

Figure 1. TRANSPORTATION GROSS DOMESTIC PRODUCT
Selected Years - Share of Total GDP - in Percent
(Based on 1986 Dollars)



From 1975 to 1992, transportation prices increased at an average annual rate of 5.3 per cent compared to 5.6 per cent for the total economy. This discrepancy was even larger during the pre-energy crisis period 1962-73: less than 1 per cent for transportation against almost 4 per cent for the total economy (Figure 2). Since transportation costs are imbedded in the delivered price of almost all Canadian goods and services sold on the domestic and world markets, lower transportation prices have meant increased competitiveness for such goods and services.

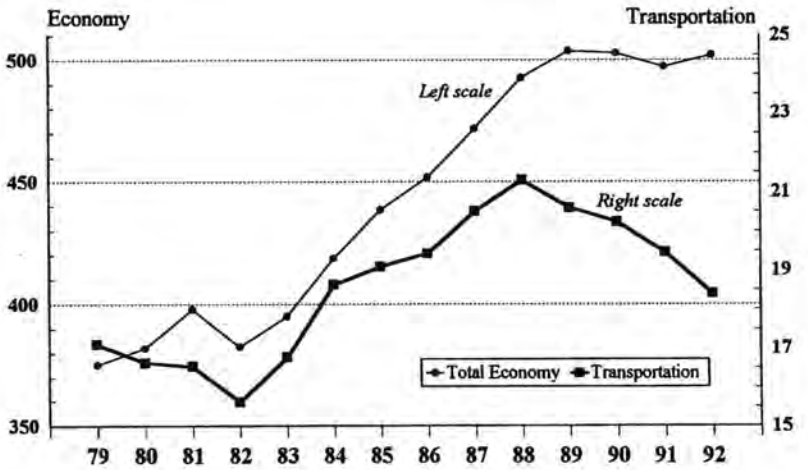
Moreover, transportation activity is a derived demand i.e. a demand based on the level and changes in economic activity in Canada and in Canada's trading partners. It grows when general economic activity grows and slows down during slower economic growth. Hence the association between transportation and the economy. In fact, a relationship exists between transportation activity and general economic conditions. This is the long term affinity (trend) between the two and as long as the demand for transportation remains essentially a derived demand, this relationship will persist.

Figure 2. TOTAL OUTPUT PRICES
Total Economy and Transportation
Average Annual Per Cent Change

Period	Economy	Transport
1961-74	*3.8%*	*0.9%*
1974-81	*9.9%*	*10.2%*
1981-92	*3.4%*	*2.8%*

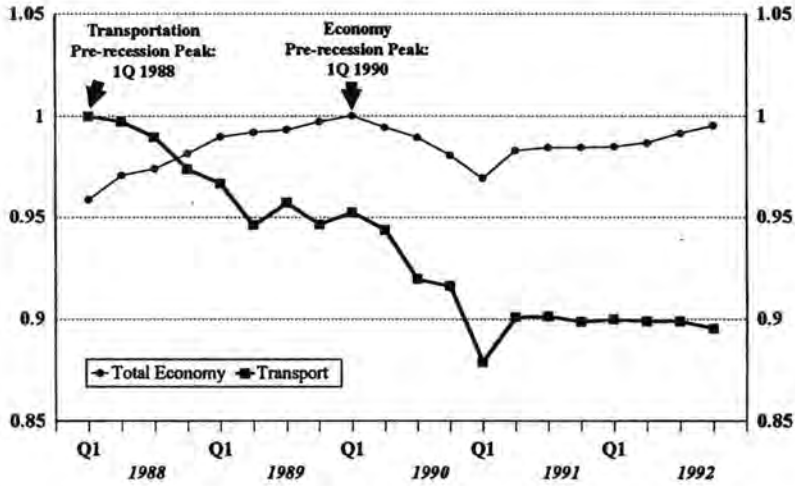
The case was clear until 1988 (Figure 3). To find out what happened since that time, it is best to analyze the output of the transportation sector in terms of the general business cycle. Over the last business cycle, the shorter term relationship (cyclical) between transportation and the economy was somewhat blurred. During the downturn phase of that cycle, the drop in transportation activity, when compared to

Figure 3. GROSS DOMESTIC PRODUCT
Total Economy and Transportation, 1979-1992
(Billions of 1986 dollars)



the economic downturn, was more severe and took place earlier. Whereas the downturn in the general business cycle started after the first quarter of 1990 (peak), the downturn in the transportation sector had started some two years earlier, after the first quarter of 1988 (Figure 4). Here is a possible explanation.

Figure 4. THE 1991 RECESSION IN PERSPECTIVE
Total Economy and Transportation
GDP at Factor Cost (Index: pre-recession peak=1.00)



Transportation services are used for both persons and goods. However, transportation of goods accounts for more than two thirds of all transportation activities whereas the transportation of persons is estimated at less than one third (Figure 5).

Figure 5. DISTRIBUTION OF TRANSPORTATION BY MODE
1991 - Based on Constant (1986) dollars GDP - in Per Cent

Total	Rail	Water	Truck	Air	Urban*	Other
100%	21%	8%	34%	15%	11%	11%

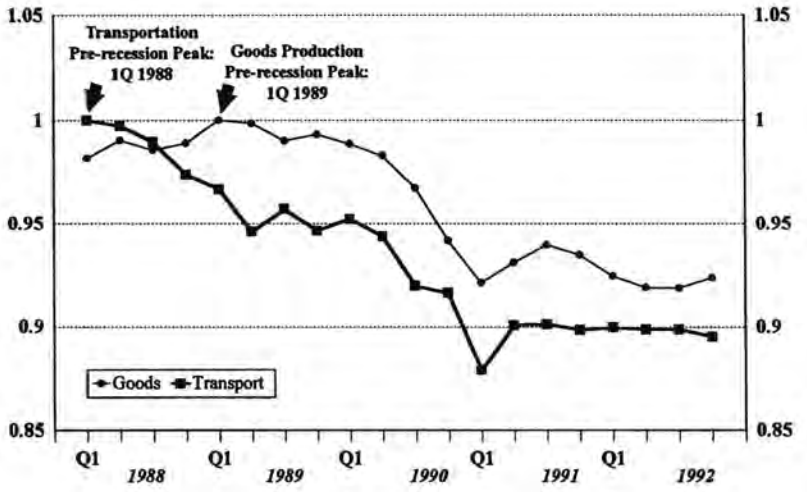
* Includes interurban and taxi

Therefore, total transportation activity tends to be more closely related to production in the goods-producing industries than it is to total economic activity. In addition, generally, economic downturns tend to affect goods production more than they effect services. (Since the service-producing sector now includes many service firms that were once part of the goods-production sector, the service-producing sector is now becoming less immune to economic downturns).

Transportation and Goods Production

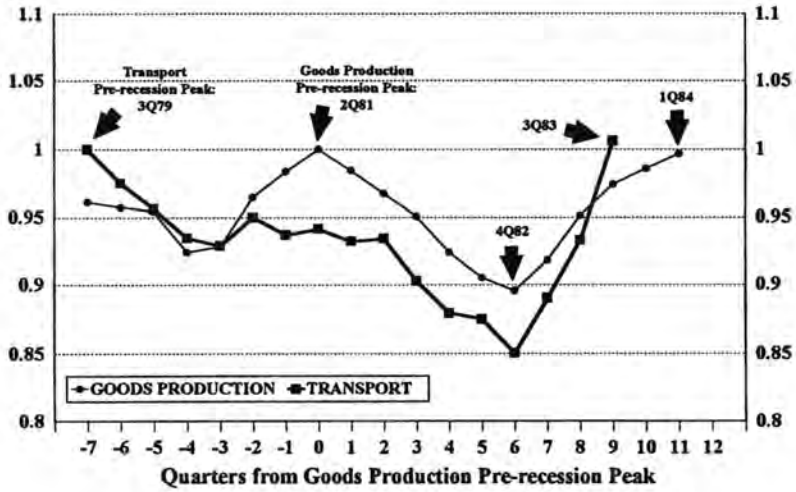
Since by definition, the inventory cycle exists in the goods-producing and not in the services-producing sector and because the demand for goods normally tends to be more cyclically sensitive than the demand for services, goods production has more often taken the brunt of recessions. And because of its strong link to the goods production cycle, transportation tends, during downturns, to behave more like a goods-producing industries than like a typical services-producing industry and consequently becomes a major victim during recessions. It was the case during the 1982 recession and is certainly the case during the 1991 recession (Figure 6). In fact, during the general business cycle downturn that started in the second quarter of 1990, goods production which began falling some 12 months earlier, dragged with it an already anemic transportation sector (weakness in transportation was evident as early as the beginning of 1988). With goods production accounting for only one third of total economic activity, compared to two thirds for services, it was not until production in services-producing industries started falling that total output in the economy dropped and the 1991 recession technically began.

Figure 6. GOODS PRODUCTION AND TRANSPORTATION
The 1991 Recession
GDP at Factor Cost (Pre-recession Peak = 1.00)



During upturns however, the behaviour of the transportation sector is different. Transportation activity climbs back to its pre-recession peak much earlier than activity in the goods-producing industries. Two reasons explain the usually quick recovery in transportation. First, because the drop in transportation activity during downturns is usually strong, one normally anticipates a stronger recovery in that sector. Second, during the earlier stages of the recovery, final demand for goods is more quickly satisfied through a depletion of existing inventories from producers to wholesalers and to retailers than through "new" production (which materializes only when producers are certain that the recovery is entrenched). Therefore, goods production is somewhat delayed but transportation activity is high, moving goods from producers to wholesalers and to retailers. The 1982 business cycle is a case in point (Figure 7).

Figure 7. EFFECTS OF THE 1982 RECESSION
Goods Production and Transportation
GDP (Index: Pre-recession Peak = 1.00) - 3Q79-1Q84



However, if the recovery following the 1991 recession appears hesitant for both the total economy (figure 4) and goods production (figure 6), it is even of less comfort to the transportation sector. For all, this is an unprecedented experience.

In the fourth quarter of 1992, the total economy, the goods-producing industries and the transportation sector had not yet reached their pre-recession levels, particularly the transportation sector. It is therefore arguable as to whether we are out of the recessionary phase of the current business cycle for good. We suspect that in the current business cycle, economic players are responding to longer term (structural) changes that are different from those normally present in the short term and that this behavioral change may have important repercussions on the transportation industry.

The Current Scenario

Usually, interpretation of economic cycles is laborious and complex. And the current cycle is no exception. The situation is further complicated by the fact that the present muddling of the Canadian economy is not only the result of an economic business cycle (short term) but also the result of important structural changes (long term). Consequently, effects that could be attributable to one could be mistakenly impute to the other. Moreover, when feasible, fiscal and monetary policies to correct cyclical deviations do not necessarily apply in the same fashion to help adjust to structural changes. In this context and over the last few years, the Canadian economy has been buffeted by a series of significant domestic as well as external structural shocks that have particularly left their mark on the transportation sector. The following is a description of the present situation where both cyclical and structural effects are present.

Cyclical changes are periodic and sometimes predictable. If economic activity drops, and given the short term immutability of certain parameters (labour force, capital stock, institutional set-up etc), it is possible to prescribe corrective action to bring the economy back on track (recovery), to predict how long that corrective action may take and which sectors may lead the recovery. However, this is the case only if structural changes are applied in small dosages and over a long period of time. The following example will help illustrate this behaviour. If a person's annual income increases by 2-3 per cent, it is unlikely that his or her expenditure pattern will change. One normally expects that person to distribute, almost equally, that extra income on all items contained in the same basket of goods and services he or she usually consumes. This could be compared to a cyclical change accompanied by small structural changes. If, however, that person's annual income increases by 50 per cent (a large lottery win, for instance) one does expect the spending pattern of that person to change. It is therefore incorrect to assume that that person will increase his or her expenditures equally across the board. This could be compared to a structural change. Present in the current economic situation are both cyclical and structural changes. Usually, most structural changes take place all the time but by little increments, with little effects on the business cycle but apparent in the longer term. However, the present situation is different. And it would be erroneous to try to describe it in terms of cyclical factors alone. The following is the current scenario which may seem to reflect an almost typical business cycle. However, structural changes are present and are beginning to be deeply entrenched.

After three years of below-inflation increases and anticipating the negative effect of the upcoming GST on real wages, wage settlements in the manufacturing sector started accelerating by mid-1988. Fearing a wage spiral that would eventually translate into higher inflation and undermine economic growth, the Bank of Canada opted for a more restrictive monetary policy. In a rare announcement, the Bank revealed an explicit inflation target for the next five years, a statement echoed by the Department of Finance.

The Bank of Canada rate moved from less than 10 per cent in mid-1988 to over 14 per cent in early 1990 pushing the interest rate differential between Canada and U.S. to more than 6 full percentage points. This raised the demand for the Canadian dollar which appreciated in value from about 81 cents U.S. in 1988 to over 88 cents by mid-1990. As a result, the competitiveness in world markets of Canadian exports was adversely affected. Moreover, for the first time ever, the government announced in its February 1991 Federal Budget, that together with the Bank of Canada, they had set common inflation targets.

External factors have also had serious effects on the Canadian economy and on transportation. The aftermath of the 1986 collapse of oil prices has left the economies of oil producing provinces in shambles (despite the sudden but short-lived flare in oil prices caused by the Persian Gulf War) and events in Europe are setting the stage for a new world order.

Structural Changes at Play

Structural changes have two origins: changes related to the supply of goods and services and those related to the demand for such goods and services. Over the last few years, major changes in each group which may have an effect on transportation are as follows:

Structural changes in Demand:

- *Consumer behavioral changes.* From environmental concerns on recycling to a change in perception about common sense spending, consumers are now focusing more on their needs than on their wants. The immediate consequence appears to be a cutback on consumer expenditures. A squeeze on personal disposable income, an important determinant of air travel, has been an additional factor behind the slow down in consumer expenditures;

- *Government behavioral changes.* Higher structural deficits have forced governments to increase revenues, mostly through taxes, and to reduce expenditures thus reducing their contribution to economic growth. In fact, cuts in current expenditures have been substantial. For instance, in fiscal year 1984-85, the operating deficit of the federal government (the budgetary deficit excluding debt charges) reached $16.1 billion, following increases since 1975. In 1991-92, the federal government is expecting an operating surplus of $10.1 billion. (Meanwhile, the cumulative deficit has reached $420 billion and the required debt servicing almost $33 billion).

Privatization of government firms and interests as well as economic deregulation are additional indications of governments retrenchment from direct economic activity. For the transportation sector, reduction of government expenditures has affected investment in much needed infrastructure especially the upgrading and repairs to Canada's highways and roads.

Governments have started to rethink the fundamental relationships between them and society and to reevaluate the economic costs of the large range of choices that have been offered to Canadians over the last forty years.

- *Redistribution of economic power.* Within the OECD area, economic power has perhaps shifted from the U.S. to Japan and to the unified Europe; but the power struggle continues. For Canada, the importance of the European market for Canadian exports has been eroding over the last few years. More trade with the U.S. and Japan has become the norm.

- *The Goods and Services Tax.* The GST is one of the most important structural changes introduced over the last three decades. In essence, the GST has changed the relative price of goods compared to services.

Before the GST came into effect, a certain equilibrium existed on the goods and services markets. In order to maximize their satisfaction from the consumption of goods and services, consumers spend their budget according to relative prices. The basket of goods and services they purchase is made up of a specific mix of goods and services the consumption of which maximizes their satisfaction. That mix of goods and services is dependent on the prices of goods relative to the prices of services. For instance, when the price of a good goes up, in order to continue to maximizes his/her satisfaction, the consumer buys less of the good whose price has gone up and more of all other goods and vice versa when the price of a good (or for that matter the price of a service) falls.

The removal of the Manufacturer's Sales Tax (MST) and its replacement by the Goods and Services Tax (GST) has effectively raised the price of services and reduced the price of goods to the consumer (investors) and caused a reallocation of consumers expenditures accordingly. The price of almost all services has increased by 7 per cent (or slightly less, depending on the weight goods have as inputs in the production of services and assuming that savings accruing from the replacement of the MST by the GST are passed on to consumers). Since for many industries providing services productivity gains are harder to achieve (retail trade for instance), it will be difficult for producers of such services not to absorb part of the GST if they want to maintain their sales level.

The effect of the GST on goods transportation appears to be negligible. However, the additional cost incurred by the imposition of the new tax on travel by air, rail and bus is sizeable. Particularly for air travel, the effect is compounded by the fact that other expenses associated with travel (meals, hotels, etc) have also been hit by the GST, therefore increasing total travel expenditures. It is expected that the effect of the harmonization of the provincial sales tax system with the GST, if and when it takes place, will hit hard the services industry and particularly transportation.

Structural changes in Supply:

- *Two major oil price shocks.* Ever since the first oil price shock, energy prices have been more widely, rigorously and frequently factored into the cost function of the firm.

- *Persistently higher real interest rates.* This has been the norm over the last ten years. The differential between the inflation rate and interest rates has remained constant. Lower inflation has usually been followed by a relatively lower drop in interest rates. Such a situation raises the cost of capital relative to other factor costs particularly when wage increases are low. It also redistributes income from wage earners to bond holders. On capital markets, this condition tends to reduce the availability of equity funds.

- *High unemployment.* The "Non-Accelerating-Inflation Rate of Unemployment", more commonly known as NAIRU (or natural rate) is estimated to have risen from the 4-5 per cent range in the 1950's and early 1960's to about 8 per cent today. Most economists agree that an unemployment rate cannot be held below this "natural" rate by aggregate demand stimulation without generating higher inflation. While many reasons explain this rise (age and gender of the labour force, unemployment insurance benefits, temporary structural imbalances between the demand for and supply of labour etc...), the effect of such high rate is to apply a downward pressure on wages and reduce the relative price of labour compared to other factors of production. However, as governments continue to reduce expenditures and increase the private share of the contribution for social programs and with the greying of the population, it is expected that this tendency will reverse before year 2000 is reached;

- *Excess capacity.* There is increased production capacity as a result of the Free Trade Agreement (FTA), Economic Regulatory Reform. On the one hand, the world-wide push for the reduction of tariff and non-tariff barriers has increased markets for producers, while on the other hand, globalization has increased competition and created excess capacity. New technologies, cheap world-wide labour, smoother and cheaper transportation systems have made it possible to produce almost anywhere, almost anything, cheaper, faster and easier. The diversification of firms in the late seventies and eighties has given way to consolidation during the late eighties and relocation in the early nineties. The transportation and manufacturing sectors in Canada and elsewhere are examples.

- *Higher Canadian Dollar.* For many industries, including transportation, the adjustments necessitated by these changes will be exacting; however, their presence suggests long term gains in efficiency and productivity. If the many reforms introduced by governments or otherwise are intended to make the Canadian economy more competitive domestically and abroad and make

Canadian goods and services more attractive for both Canadians and foreigners, the Canadian economy will be in better shape, will become more attractive to foreigners (for investment and immigration) and will generate a higher demand for Canadian goods and services. It is therefore expected that this will create a higher demand for the Canadian dollar and raise the exchange rate. Therefore, businesses can no longer rely on a lower dollar to sell their goods and services abroad. They will have to restructure their operations and they must be doing it now.

There is little doubt that these long term adjustments are being felt particularly during the present phase of the business cycle and that they will make the road to recovery and expansion longer and harder than is usually the case. No matter how exacting such changes are in the short term, longer term benefits should soon be apparent in the form of the rationalization of the Canadian economy and the transportation sector which, in the longer term, are expected to be in a relatively better shape. In the meantime, Canadians will have to cope with these significant, painful but much needed adjustments.

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Statistics Canada - *Gross Domestic Product by Industry (15-001)*
- *The Input-Output Structure of the Canadian Economy (15-201)*
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THE MODAL ORIENTATION OF CANADA'S ECONOMIC REGIONS:

REGIONAL TRANSPORTATION DEMANDS IN PERSPECTIVE

by Eugene M. Ludwick[1]

INTRODUCTION

For 150 years it has been argued that rail transportation is the key to the economic development of a town, a region, a province or even a nation. Rail transportation was correctly foreseen by many of those who built North America as a catalyst of prosperity. Business leaders and legislators everywhere did everything in their power not only to attract investment in railway infrastructure but to harness and control this revolutionary mode of transportation to best economic advantage. Indeed, many towns that failed to attract a railway 80 to 150 years ago effectively became casualties of the accelerated production-consumption industrial revolution and eventually dried up and blew away. With the development of automotive technology and highways as an alternative to railway transportation, the relative importance of railways to local, regional and even national economies began to decline, particularly following WW II. Economic development proponents reoriented their transportation lobbying efforts to obtain roads, paved highways, freeways, bridges, etc...

Despite this shift which has seen a dramatic decline in railway utilization in many parts of the country, cries continued to be heard in the run-up to the new national transportation legislation of 1987 and even in 1993 that railways are critical to the economic development of certain regions. Further, the loudest cries are heard from those whose regions make relatively little use of rail transport largely because their economies are built upon sectors whose transportation needs are best fulfilled by motor transport. For such persons, railway transportation (read railway employment and tax revenue) has become just another entitlement in the pluralist Canadian welfare state.

Signs are becoming increasingly clear that the current economic malaise is more than an extended trough in a typical business cycle. The need for companies to improve their global competitiveness has instigated drastic efficiency measures usually featuring major employment reductions which in turn have had multiplicative downward effects on government revenues.

Furthermore, unbridled public spending sprees in the 1970s and 80s have saddled governments and taxpayers with debts of such great magnitudes that money lenders are becoming reluctant to finance further political extravagance at any premium. In short, both entitler (in this case the federal government) and entitlee (provincial governments and those in whose interest they intercede) are almost "broke".

Assuming that both entitler and entitlees wish to continue playing the political game and that both recognize the inability of the entitler to deliver in full on all demands, they must find ways of dealing with the problem of maximizing entitlements subject to real budget constraints. In a macro sense, this means making trade-offs and choices between funding for health care, education, arts and myriad other social programs. Trade-offs will also have to be made within each entitlement area. Since transportation is viewed by many entitlees more as a social program or entitlement area than as a means for delivering economic outputs to world markets as efficiently and as cost-effectively as possible, trade-offs and choices must also be made in this sphere. Specifically, faced with the likelihood of not having all of their transportation expenditure demands fulfilled by the entitler, entitlees will have to rely less on rhetoric and more on factual information on how each mode fits into their respective economies.

A typical approach of research undertaken by groups lobbying for transportation entitlements is to demonstrate in some way 'the importance of transportation to the provincial economy'. Given the lamentable financial condition of Canada's transportation industry and the need for drastic productivity and efficiency improvements, the more appropriate question may be to ask 'what is the importance of a provincial or regional economy to the modes of transportation?'. Such a question of course is based on the notion that railways and trucking companies are not elements of government social programs but, rather, ordinary business enterprises with obligations to their shareholders and customers. Therefore, in setting out some basic information to assist public policy makers with the trade-offs and choices related to transportation entitlements, instead of dwelling on a mode's historic role or past undertakings, this paper focuses on the extent to which each of the regions "earns its keep" as a user of either of the two "wheeled" modes.

First, we will see that it is possible to quantify the individual and relative roles that rail and motor transport play in each sector of the "wheeled", transportable goods economy. This determination allows decision makers to identify the revealed rather than purported importance of each mode within a regional economy. Then, we will see that there are significant departures from the modal selections we would expect given the nature of the goods transported mostly because Canada consists of two very different economies. We begin with an examination of the contribution made by the various goods-producing economic sectors from which motor and rail carriers derive their revenues.

ECONOMIC SECTOR DATA

Without tracing their origins in detail, it is evident that the industrial categorizations used to measure activity in the general economy and in rail and truck transportation were designed for different purposes. Each of these categorization systems is tantalizingly (from an analytical point of view) similar to the other but differs enough to preclude straightforward comparisons without tedious manipulation. The Standard Industrial Classification (SIC) system used by governments to measure performance and output of the sectors which comprise an economy is based on the extent to which value is successively added: at the "primary" end of the economy are the basic resource extraction or exploitation industries; "secondary" industry adds value to these resources by processing them further, transforming them into finished/manufactured goods; and, the "tertiary or service" sector industries are those which support the goods-producing sectors by transporting, distributing, financing, retailing, governing and otherwise serving those who produce and consume goods.

For simplicity, this paper defines rail and motor (truck) transport as being the two choices available to shippers of goods in what we refer to as the "wheeled economy". Rail and truck transportation economic activity or goods categorizations used in Statistics Canada publications also reflect the notion of value added but for different reasons and in a way which is different than the economic GDP sector categorizations. These categorizations are rooted in historic economic regulation of transportation modes whereby carriers with the blessing of their regulators (e.g., the Interstate Commerce Commission and the Canadian Transport Commission) developed ways of reporting the nature and volume of business conducted in order to satisfy the regulatory function. The resulting categorizations were based on value-of-service pricing, also known as charging whatever the market could bear. These categorizations continue in use today and are evident in Statistics Canada publications like Trucking in Canada and Rail in Canada.

Both the above-mentioned publications provide descending rank listings of the principal commodities which earned revenues for each respective mode. Using Standard Industrial Classification definitions as to what constitutes an economic sector, we assigned the rail and truck commodity revenues to the various GDP sectors. Table 1 shows the sum of the various commodity revenues the revenues derived by rail and motor carriers from within each economic sector in 1989, effectively revealing the modal orientation of each sector. This modal orientation is expressed as a ratio in square brackets underneath sectoral gross transportation revenues in Table 1.

TABLE 1:
MOTOR CARRIER AND RAILWAY REVENUES
Sorted into
GROSS DOMESTIC PRODUCT INDUSTRY SECTOR DIVISIONS[2]
(millions of dollars, Canada total)

CODE: G D P SECTOR	MOTOR	RAIL	TOTAL
S01 AGRICULTURE	113.609 [12.6%]	789.737 [87.4%]	$903.346 [100.0%]
S03 LOGGING & FORESTRY	32.610 [45.0%]	39.936 [55.0%]	$72.546 [100.0%]
S04 MINES/QUARRIES/OIL WELLS	226.125 [12.5%]	1,582.504 [87.5%]	$1,808.629 [100.0%]
S05M08 FOOD INDUSTRIES	672.136 [67.7%]	321.018 [32.3%]	$993.154 [100.0%]
SO5M09 BEVERAGE IND.	82.877 [93.4%]	5.847 [6.6%]	$88.724 [100.0%]
S05M10 TOBACCO PRODUCTS	0.000 [0.0%]	6.857 [100.0%]	$6.857 [100.0%]
S05M11 RUBBER PRODUCTS	33.781 [63.2%]	19.695 [36.8%]	$53.476 [100.0%]
S05M12 PLASTIC PRODUCTS	46.116 [84.4%]	8.507 [15.6%]	$54.623 [100.0%]
S05M13 LEATHER PRODUCTS[3]	?.? [91.9%]	?.? [8.1%]	$?.? [100.0%]
S05M14 PRIM. TEXTILE & PROD.	152.013 [96.3%]	5.870 [3.7%]	$157.883 [100.0%]
S05M15 CLOTHING IND.	48.787 [91.9%]	4.301 [8.1%]	$53.088 [100.0%]
S05M16 WOOD IND.	157.619 [19.7%]	640.519 [80.3%]	$798.138 [100.0%]
S05M17 FURNITURE & FIXTURES	86.880 [86.2%]	13.873 [13.8%]	$100.753 [100.0%]

S05M18 PAPER & ALLIED PROD.	314.962 [26.7%]	865.109 [73.3%]	$1,180.071 [100.0%]
S05M19 PRINTING, PUBLISHING	36.438 [97.4%]	0.982 [2.6%]	$37.420 [100.0%]
S05M20 PRIMARY METAL IND.	245.788 [47.7%]	269.453 [52.3%]	$515.241 [100.0]
S05M21 FABRICATED METAL	151.861 [63.4%]	87.607 [36.6%]	$239.468 [100.0%]
S05M22 MACHINERY IND.	242.413 [93.4%]	17.113 [6.6%]	$259.526 [100.0%]
S05M23 TRANSPORT. EQUIP.	361.540. [34.8%]	676.998 [65.2%]	$1,038.538 [100.0%]
S05M24 ELECTRIC/ELECTRONIC	93.414 [73.5%]	33.663 [26.5%]	$127.077 [100.0%]
S05M25 NON-METAL. MINERALS	329.695 [76.0%]	104.086 [24.0%]	$433.781 [100.0%]
S05M26 REFINED PETROL./COAL	303.018 [55.4%]	243.535 [44.6%]	$546.543 [100.0%]
S05M27 CHEMICALS/CHEM.PROD.	321.068 [30.6%]	727.357 [69.4%]	$1,048.425 [100.0%]
S05M28 OTH. MANUFACTURING	26.353 [89.5%]	3.105 [10.5%]	$29.458 [100.0%]

Revenues from unclassified commodities account for approximately 10% of total revenues of each mode. Some portion of these commodity-non-specific revenues includes movements of goods which could have been included in the GDP economic sector categorizations of Table 1, leaving an unknown but very small portion of transportable goods uncategorizable. We thus submit that the percentages/ratios in Table 1 are suitable indicators of the "modal orientation" of each of the economic sectors.

The next step is to determine the presence of each of the GDP economic sectors within each provincial economy and to apply the modal orientation ratios against the dollar outputs of each sector in each province. This multiplication results in the assignment of each provincial sector's output to either the truck or the rail mode. Summing these modal assignments of outputs over all sectors

allows for the determination of the modal orientation of an entire economy. These calculations are summarized in Table 2.[4]

TABLE 2:
"WHEELED" TRANSPORTABLE GDP BY MODAL ORIENTATION

SUMMARY

	GDP ORIENTED TO MOTOR TRANSPORT		GDP ORIENTED TO RAIL TRANSPORT	
PROVINCE/REGION	$ BILLIONS	%	$ BILLIONS	%
NEWFOUNDLAND	1.209	100.0	0.000	0.0
PRINCE EDWARD ISLAND	0.270	100.0	0.000	0.0
NOVA SCOTIA	1.397	53.5	1.213	46.5
NEW BRUNSWICK	0.989	44.5	1.233	55.5
ATLANTIC SUBTOTAL	3.865	61.3	2.446	38.7
QUEBEC	17.199	53.5	14.977	46.5
ONTARIO	35.987	54.4	30.150	45.6
EASTERN CANADA	**57.051**	**54.5**	**47.573**	**45.5**
MANITOBA	1.793	42.8	2.397	57.2
SASKATCHEWAN	1.264	22.2	4.439	77.8
ALBERTA	5.085	24.4	15.756	75.6
B.C./TERRITORIES	5.965	38.0	9.718	62.0
WESTERN CANADA	**14.107**	**30.4**	**32.310**	**69.6**
CANADA TOTAL	71.158	47.1	79.883	52.9

The Eastern Canadian economy shows itself to be somewhat more oriented to motor (54.5%) rather than to rail (45.5%) whereas rail oriented sectors of the Western Canadian economy overshadow truck oriented sectors by more than 2 to 1. In particular, the economies of Saskatchewan, Alberta and British Columbia are highly oriented towards rail transport.

Table 3 examines provincial/regional truck and rail revenues from a relative - that is, per capita - perspective to see if the above observations could be made any more robust.

TABLE 3:
POPULATION AND PER CAPITA MODAL ORIENTATION
OF CANADIAN PROVINCES/REGIONS - 1991

PROVINCE/REGION	POPULATION	GDP IN $ PER CAPITA BY MODAL ORIENTATION MOTOR	RAIL
NEWFOUNDLAND	568,474	2,127	0
PRINCE EDWARD ISLAND	129,765	2,080	0
NOVA SCOTIA	899,942	1,552	1,348
NEW BRUNSWICK	723,900	1,366	1,703
ATLANTIC SUBTOTAL	2,322,081	1,664	1,053
QUEBEC	6,895,963	2,490	2,172
ONTARIO	10,084,885	3,568	2,990
EASTERN CANADA	**19,302,929**	**2,956**	**2,465**
MANITOBA	1,091,942	1,642	2,195
SASKATCHEWAN	988,928	1,278	4,489
ALBERTA	2,545,553	1,998	6,190
B. C. & TERRITORIES	3,367,507	1,771	2,886
WESTERN CANADA	**7,993,930**	**1,765**	**4,042**
CANADA	27,296,859	2,607	2,926

Essentially, Table 3 reinforces the conclusions of Table 2. We can observe that:

- the Canadian goods-producing "wheeled" economy as a whole is somewhat more rail-oriented (by 1.1 times) than it is truck oriented;

- the goods-producing "wheeled" economy of Atlantic Canada is 1.6 times more truck-oriented than it is rail-oriented and, Nova Scotia and New Brunswick where both modes are still available, are not (on a per capita basis) particularly vibrant markets for either motor or rail carriers;

- the economy of Canada's six easternmost provinces together are somewhat (by 1.2 times) more truck-oriented than rail-oriented; and,

- the economy of the 4 western provinces together is 2.3 times more rail-oriented than it is truck-oriented but, in particular, Alberta and Saskatchewan's respective rail orientations are not only substantially

greater than their truck orientations but are also much greater than the national average rail orientation.

Having considered the sectoral composition and the modal orientation of provincial economies from an absolute and relative perspective, we now consider each of the modes' potential for earning revenue in the various regions. This calculation requires a revisitation of Tucking in Canada and Rail in Canada. These publications indicate that the sum of revenues earned from transporting the outputs of each province in 1898 amounted to $5.4 billion for motor carriers and $6.2 billion for railways. These revenues are divided up in Table 4 among the provinces/regions in proportion to the truck versus rail orientation of each economy, using the expected modal splits or sectoral mode orientations given in Table 2. These figures indicate what portion of their total revenues motor and rail carriers would be expected to earn in each regional economy given the goods-producing sectoral make-up of each economy and the expected way (i.e., by truck or by rail) in which each of those sector's outputs is to be transported.

TABLE 4:
EXPECTED (POTENTIAL) MODAL REVENUE BY REGION

	TRUCK		RAIL	
PROVINCE/REGION	%	$ MILLIONS	%	$ MILLIONS
NEWFOUNDLAND	1.7	92.5	0.0	0.0
PRINCE EDWARD ISLAND	0.4	21.8	0.0	0.0
NOVA SCOTIA	1.9	103.4	1.5	93.2
NEW BRUNSWICK	1.4	76.2	1.5	93.2
ATLANTIC SUBTOTAL	5.4	293.9	3.0	186.5
QUEBEC	24.2	1,317.2	18.7	1,162.4
ONTARIO	50.6	2,754.1	37.7	2,343.5
EASTERN CANADA	**80.2**	**4,365.2**	**59.6**	**3,704.8**
MANITOBA	2.5	136.1	3.0	186.5
SASKATCHEWAN	1.8	98.0	5.6	348.1
ALBERTA	7.1	386.4	19.7	1,224.6
B.C./TERRITORIES	8.4	457.2	12.2	758.4
WESTERN CANADA	**19.8**	**1,077.7**	**40.4**	**2,511.3**
CANADA TOTAL	100.0	5,442.8	100.0	6,216.1

Table 4 reinforced by the previous tables allows us to draw several further conclusions. The most obvious is that the place for motor carriers to make their money is in Ontario and Quebec. The notion that a motor carrier company can gain access to over half of Canada's trucking market by obtaining authority to operate into/out of/within one province (Ontario) is borne out. Again, Alberta and British Columbia are shown as very strong railway oriented economies but Ontario appears to offer the greatest expected rail revenue among all provinces.

It stands to reason - that is, it is as expected - that most of the revenues earned by either mode should be generated from Ontario and Quebec where the majority of Canadians live and work. In terms of transportation policy and the allocation of transportation entitlements, Table 4 indicates that, generally, the correct choices are being made. However, the contrary conclusion is reached when expected versus actual regional modal earnings are compared below.

TABLE 5:
DIFFERENCE IN ACTUAL VERSUS EXPECTED (i.e., POTENTIAL) MODAL REVENUE BY REGION

	TRUCK		RAIL	
	DISTRIBUTION OF ACTUAL REVENUE	DIFFERENCE FROM EXPECTED REVENUE	DISTRIBUTION OF ACTUAL REVENUE	DIFFERENCE FROM EXPECTED REVENUE
PROVINCE/REGION	%	+% or -(%)	%	+% or -(%)
NEWFOUNDLAND	0.6	(64.7)	0.0	0.0
PRINCE EDWARD ISLAND	0.4	0.0	0.0	0.0
NOVA SCOTIA	2.6	36.8	1.2	(20.0)
NEW BRUNSWICK	3.3	135.7	1.4	(6.7)
ATLANTIC SUBTOTAL	6.9	27.8	2.5	(16.7)
QUEBEC	19.7	(18.6)	12.3	(34.3)
ONTARIO	41.9	(17.2)	25.0	(33.7)
EASTERN CANADA	**68.5**	**(14.6)**	**39.7**	**(33.4)**
MANITOBA	6.1	144.0	3.6	20.0
SASKATCHEWAN	3.1	72.2	14.4	157.1
ALBERTA	12.2	71.8	21.5	9.4
B.C./TERRITORIES	11.9	41.7	20.8	71.0
WESTERN CANADA	**31.5**	**59.1**	**60.3**	**49.3**
CANADA TOTAL	100.0	0.0	100.0	0.0

Comparing Tables 4 and 5:

- Atlantic Canada spends more on trucking and less on rail transport and less on rail transport than would be expected given the composition of the Atlantic region's economies.

- Quebec and Ontario together are Canada's largest trucking revenue generating economies but account for less trucking revenue than anticipated by Table 4. At the same time, both provinces together provide railways with about one-third less of their revenues than the than the structure of their economies would indicate.

- All four Western provinces provide both truckers and railways with more revenues than would be expected given the composition of their economies.

In simple terms, Eastern Canada is a trucking economy and Western Canada is a railway economy.

CONCLUSIONS

Every measure of modal presence or "importance" considered in this paper leads to the conclusion that Western Canada is substantially more railway-oriented than is the rest of the country. Indeed, the detailed individual GDP sector-mode orientation and revenue-potential calculations summarized in Tables 2, 3, 4 and 5 reveal, if this were not known already, that Canada consists of two distinctly different economies. In these circumstances, perhaps Canada's national transportation policy and its allocation of transportation entitlements should reflect these realities. In so doing, the waste of economic resources in continuing rail services where they are required strictly by politics and emotion rather than by market demand can be avoided in favour of allocating financial resources where they can truly help a provincial or regional economy become competitive. These results lead to the conclusion that regions of the country whose levels of economic output cannot support the full spectrum of transportation services must be prepared to make trade-offs in their demands on the federal purse.

It is evident that the economies of Ontario and Alberta offer railways their greatest revenue earning potential. Table 4 and 5 figures do not unequivocally make an obvious case for line retention or abandonment in any particular region of the country but they do call into question the current appropriateness of historical stationary investments in administrative and maintenance infrastructure. Assuming that the observed tendency of service industries [of which transportation is one] to be close to their customers is more than just a passing management fancy, there would appear to be little justification, beyond providing

social program entitlements, for certain railway non-transportation facilities to be located where they are:

- The economies of Atlantic Canada and Manitoba are both structured in such a way as to offer railways the potential to earn only 3% of their total revenues. Yet substantial, duplicative and therefore costly administrative centres and maintenance facilities are situated in both these regions.

- Alberta is the predominant western rail-oriented economy accounting for half of the potential railway earnings that can be derived from Western Canada and a fifth of potential and actual national rail revenues. British Columbia is the second strongest rail province in the west from both a potential and actual revenue generation perspective. Concentration of administrative and maintenance infrastructure by either railway in either of these two provinces would be consistent with the pursuit of efficiency, productivity and customer service quality.

- Without the benefit of an historic analysis that would show rates of rail revenue growth in Ontario and decline in Quebec, it is difficult to comment on the urgency of the situation. However, it is clear that within Eastern Canada, Ontario - read Metro Toronto - and not Quebec is where the railway action is. Although it may be precipitous to propose a wholesale evacuation of the Peel/de la Gauchetiere area, one must ask if the decline in rail transport utilization could be arrested if rail-supplying decision makers were situated near to rail-consuming decision makers in the same way that truck-supplying decision makers generally are situated near to truck-consuming decision makers.

The overriding conclusion in all of this is that the economic structure of Canada's constituent economies and modal utilizations is far from uniform. The differences in expected versus actual generation of modal revenues by each province/region indicate that there are serious underlying efficiency problems. Treating transportation infrastructure expenditures and service issues as though transportation was just another social welfare entitlement has resulted in inaccurate cost and price signals and has lead to inefficient mode choices and investment decisions.

More simply stated, at least from a transportation perspective, Eastern and Western Canada have two very different economies. Effective national transportation policy will recognize these differences and seek to develop for Western Canada policies which foster and facilitate efficient railway transport and for Eastern Canada, policies which foster and facilitate efficient competitive motor transport. Certainly there will be areas where the trade-offs and choices are not easy. However, let these not impede us from making the right decisions where factual information and real budget constraints offer obvious conclusions.

END NOTES

1. Eugene M. Ludwick, M.A., F.C.I.T is president of E. M. Ludwick & Associates Inc., a management consulting firm specializing in trade and transportation based in Alberta.

2. Sectors as defined in Provincial Gross Domestic Product by Industry, 1984-1991, Statistics Canada, Catalogue 15-203 (System of National Accounts). Motor carrier industry revenues (StatsCan 53-222) and railway industry revenues (Statscan 52-216) were reclassified to conform with the GDP sectoral divisions.

3. Same modal distribution as clothing industries assumed.

4. In these calculations, since Newfoundland and Prince Edward Island no longer have railways, their economies were considered to be 100% truck oriented. Further, the "Fishing and Trapping" primary sector is not included in this analysis firstly because no commodity entries for outputs of this economic sector are found in Statistics Canada's truck and rail revenue data and, secondly, the unprocessed outputs of these sectors tend to travel in relatively small volumes on modes other than truck or rail.

THE TWILIGHT OF TRANSPORT AND REGIONAL DEVELOPMENT

by John Heads*

Until the mid-1970s, there was a firm public policy conviction in the prairie provinces of Canada as to the vital relationship between transport and regional development. By the late 1980s, this interest had almost disappeared and a feeling of ennui had settled on the general subject of transport and regional development in the prairies and throughout Canada. To one who has worked in transport economics in Canada for twenty-five years, with much of this time in Manitoba, the virtual disappearance of transport and regional development as a major policy issue is remarkable. In a wider public policy context, it is a striking example of how a high profile and deeply embedded issue can virtually cease to exist in just a short period of time. This paper documents what has happened and looks for explanations.[1]

1. TRANSPORT AND REGIONAL DEVELOPMENT IN THE MID-1970S

Transportation concerns in western Canada preceded the completion of the Canadian Pacific Railway in 1885 and were embedded in the fabric of the western economic outlook until the mid-1970s. In the debate on the Crow's Nest Pass contract in 1897, Frank Oliver, Member of Parliament for Edmonton, stated in terms that would still have been very acceptable in western Canada in the 1970s:[2]

> ...it is because the railway rates have been distinctly against the west in particular and in general from the first that Manitoba and the Territories have shown so much less rapid progress than was expected when the Canadian Pacific Railway was first aided.

From approximately the mid-1950s, the railway monopoly of transport in landlocked areas became less of a problem as a result of competition from the motor carrier industry, a competitive pressure which has become increasingly more effective up to the present day. Nevertheless, public perceptions in western Canada were slow to change, slow to appreciate that the age of railway monopoly had passed. Transport problems and iniquitous freight rates continued to be regarded as a major obstacle to economic development.

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In 1973, a highly publicized Conference on Western Economic Opportunities was held in Calgary between the federal government and the western provinces to seek solutions to the economic problems of the west. Transportation had pride of place on this agenda and the four western premiers stated that:[3]

> The Western Economic Opportunities Conference has been called by the Federal Government "specifically to consider concrete programs for stimulating and broadening the economic and industrial base of Western Canada." One of the most dramatic and effective ways to do this is for the federal government to commit itself to new transportation policies to overcome the aforementioned inequities and hence significantly stimulate and broaden the economic and industrial base of Western Canada.

There was no doubt that the transport and regional development issue was high profile and there was no doubt that the federal government would listen to the complaints. Apart from the fact that the federal government had already received a shock message from the prairies in the results of the 1972 general election, this was also the heyday of regional development initiatives. Prior to the 1960s, the Government of Canada did not have an explicit regional development policy and it was assumed that a strong national economy would benefit all regions. Starting in the early 1960s, this policy changed and regional development initiatives were implemented specifically to promote growth in lagging regions. In 1968, the federal government set up a new Department of Regional Economic Expansion (DREE). Funds were allocated for infrastructure development in low-growth areas and generous cash grants were available to entrepreneurs establishing or enlarging activities in these areas. The Trudeau government had clearly placed an important stress on regional development policy from 1968 to approximately 1975.

Yet, how serious were the western complaints on rail freight rate inequities of that time? The specific complaints of the early 1970s fell into three broad categories.[4]

The first category related to raw materials versus finished products, where it was alleged that further processing was hindered in the west because finished goods were charged higher freight rates that raw materials. This complaint was articulated mainly in respect of rapeseed products and meat packing. It was cheaper to ship rapeseed as seed from western Canada for crushing in eastern Canada than to ship the oil and meal obtained from crushing in the west. Rapeseed moved at the Crow's Nest Pass rates from western Canada to Thunder Bay and then at water competitive rates by rail to Montreal. These transport costs were much less than the rates available for rapeseed meal and rapeseed oil and this mitigated against crushing rapeseed in western Canada. On meat packing, statutory grain rates to Thunder Bay and feed freight assistance onward to eastern points could make it economic to use western grain to feed hogs in

eastern Canada rather than transport pork from the west. However, both on rapeseed crushing and meat packing, the basic cause of any freight rate discrimination was the existence of extremely low freight rates for grain under the Crow's Nest Pass Rates and agricultural interests in western Canada were violently opposed to any increases in these freight rates.

The second category of complaint related to short-haul long-haul discrimination. Back in the early 1970s, this term was commonplace to any transport economist, but the passing of time has made the meaning somewhat arcane and an example is needed. In the case of structural steel manufactured in Hamilton, the freight rate was lower on the shorter haul from Hamilton to Calgary than on the longer haul from Hamilton to Vancouver. This disparity was originally justified on the grounds that water competition through the Panama canal competed with rail to the west coast. By the early 1970s, this justification was no longer relevant and the railways explained that any increase in rates from Hamilton to Vancouver would mean loss of traffic, as Hamilton structural steel would be unable to compete with off-shore imports. The existence of short-haul long-haul disparities was not disputed - especially in iron and steel products and canned foodstuffs, but also over a much wider range of products - but the railways argued that this discriminatory pricing was necessary as the only means to allow them to cover their fixed costs.

The third category of freight rate complaints related to rail rate groups. The argument was that, if the smaller centres surrounding each major city in the west were given the same freight rates as the city, industrial expansion would be encouraged in the smaller centres. The west did not enjoy rate groups of the size of those centred on Toronto and Montreal in respect of freight rates for movements between eastern and western Canada. A study at the time by the Canadian Transport Commission recognized that this problem existed, but questioned whether the establishment of rate groups would really cause any diffusion of industrial activity.

However, the western complaints of railway freight rate discrimination were generally expressed in terms of discrimination across the whole freight rate structure and not confined to the three specific categories examined above. Yet, at that time the railways were still obliged to carry grain traffic from the west at the Crow's Nest Rates, yielding revenues of roughly 0.5¢ per ton-mile. Statutory grain traffic accounted for 20% of domestic railway ton-miles in Canada and for only 5% of domestic rail freight revenues. With statutory grain originating in the prairie provinces, it was virtually impossible to establish overall freight rate discrimination. Even confining the analysis to "manufactured and miscellaneous products", accounting for 25% of all domestic rail traffic in Canada in 1970 and for 51% of domestic freight revenues, it was still not possible to establish any overall discrimination against products originating in the prairies.

To summarize the situation in the mid-1970s, transport was regarded as very important to regional development and regional development itself was a high profile issue in the political agenda. On freight rates in western Canada, the reality is that there was cause for complaint, but not quite on a panoramic scale. Statutory freight rates on grain discriminated against further processing in the west; freight rates were higher on manufactured products delivered to the prairies than on transcontinental rail movements; but allegations of overall discrimination across the entire rail rate structure could not be substantiated. Perhaps the major problem in the prairies was sheer distance where, even without any discrimination, transport charges were inevitably high on rail hauls ranging from 1,200 miles to over 2,000 miles from major centres in western Canada to Toronto/Montreal.

2. CHANGES OVER THE PERIOD 1975-91

What were the factors undermining the "transport and regional development" issue? The discussion commences with macro-economic changes and then proceeds to regional development policy and transport policy.

2.1 Macro-economic Changes

Together with many other economies in the western world, macro-economic conditions in Canada showed considerable change starting in the early to mid-1970s. In the twenty-five years following the end of the Second World War, living standards were improving steadily and society was confident that this improvement could continue. This confidence was badly shaken in the 1970s and has not been restored to the present day.[5]

- Inflation was not a problem prior to the 1970s. The Canadian Consumer Price Index increased by an average of 1.3% per annum in the decade 1951-61 and 2.9% per annum in the decade 1961-71. There was a shortfall in agricultural production in North America in 1972, followed immediately by the energy crisis. In the decade 1972-82, the Canadian Consumer Price Index rose by an average of 9.6% per annum. With the softening in oil prices, inflation began to fall in mid-1983 and averaged 4.5% per annum from 1983 to 1991. In 1992 the Canadian Consumer Price Index was only 1.5% higher than in 1991. Inflation has at least been temporarily beaten, but fear of a resurgence still exercises considerable influence on macro-economic policy.

- Unemployment was not a serious problem in the 1950s and 1960s, when it averaged 4.5%. The unemployment rate averaged 6.9% over the years 1971-81. It rose substantially in the recession of 1982 continuing above 11% for each of the years 1982-84. With the recovery from the recession,

the unemployment rate showed a modest fall, but it increased to 10.3% in 1991 and 11.3% in 1992.

- The standard of living is now only rising modestly in Canada. Average labour income per member of the labour force increased in real terms by 3.6% per annum over the period 1951-71. The real gain in average labour income was far more modest in the 1970s at 1.3% per annum. An even less impressive performance of 0.4% per annum was achieved in 1981-90, while in the 1991 recession average labour income per member of the labour force actually fell by 3%.

- The national debt has increased very substantially and a growth in debt servicing charges has severely limited the federal government's manoeuvring space in fiscal management and its ability to fund new initiatives. In 1991, interest on the public debt accounted for 26.0% of total current expenditures of the federal government as against 11.7% in 1971.

2.2 Regional Development Policy

The macro-economic problems of the Canadian economy since the early 1970s have caused a long-term period of financial stringency. This has had its repercussions on regional development policy. As early as 1978, William Davis, then Premier of Ontario, stated that "To trade off competitive industrial development so as to achieve a better regional distribution of incomes is a terribly expensive strategy which we can no longer afford".[6] Especially in the 1980s, Canadian economic policy has relied increasingly on competition and market forces to make the economy operate more efficiently. Such reliance is normally antithetical to regional development, which is perceived as encouraging production in areas which would not be favoured by market forces. Inevitably regional development considerations have tended to be given short shrift.

This has been evident in regional development policy, since shortly after the general election of 1974. The Department of Regional Economic Expansion (DREE) continued to function until 1982, but it became a much less important policy tool. There were few new initiatives; evaluations of infrastructure agreements were often inconclusive; and it was unclear as to how much success had been achieved from the incentive program for entrepreneurs establishing businesses in low growth areas. Infrastructure grants were diluted as they were spread over too wide a range of activities, while the industrial incentives program covered over 90% of Canada's land mass and over 50% of the population. By the time of the recession of the early 1980s, the federal government was more concerned about lack of employment opportunities in central Canada than in the traditional low growth areas of the country.

DREE was disbanded in 1982. Its regional incentives program was transferred to a new Department of Regional Industrial Expansion (DRIE). By the end of 1984, DRIE had signed Economic and Regional Development Agreements with all ten provinces and transportation was mentioned in five of these agreements. Nevertheless, this approach represented a continuation in lower key of the DREE program of the early 1980s and certainly no resuscitation of interest in regional development.

In August, 1987, the federal government established Western Economic Diversification Canada (WD) to assume the regional development mandate for Western Canada. Although WD has provided assistance for the manufacture of transport equipment, there has been little activity in transport services. Transport is not accorded any key role in the overall regional development program.

2.3 Transport Policy and Regional Development

As with policy in most sectors of industrial activity, transport policy in Canada during the 1975-91 period has been strongly influenced by increased reliance on competition and market forces. As a necessary concomitant, carriers have been relieved of most of their obligations to cross-subsidize unprofitable activities from profitable services. With more limited success, government has attempted to reduce the extent to which it subsidizes transport. It would be expected that these transport policy thrusts would militate against the use of transport as a tool for regional development.

The major transport policy development of the 1975-91 period was the National Transportation Act, 1987, and the accompanying legislation relating to the motor vehicle and marine modes. The other two major developments were probably the establishment of VIA Rail in 1978 and the Western Grain Transportation Act (WGTA) of 1983.

VIA Rail was established as a Crown corporation and commenced operation of rail passenger services in October 1978, taking over the complete passenger network of the Class I railways in April, 1979. Government has since attempted to stem the heavy subsidy flow to VIA Rail by rationalizing or reducing services. There have been strong complaints from many parts of Canada in respect of service discontinuances, especially in the west where the service loss in 1990 was more severe than in other parts of the country. However, railway passenger services are now a peripheral form of transport and it would be difficult to argue that passenger train policy has had any substantial effect on the regional development aspirations of the slow growth areas of Canada.

The Western Grain Transportation Act of 1983 gave federal subsidies on the rail movement of grain from the prairies to terminal elevators. Prior to this legislation, the Canadian railways were required to carry grain at statutory rates

established in 1925, which reflected the Crow's Nest Pass rates established in 1897. Although the federal government currently in 1992/93 bears 37.3% of the rail cost of moving grain, the farmer is no longer guaranteed frozen grain rates and his costs for moving grain have increased substantially since 1983.

The government subsidies on the movement of grain are paid directly to the railways and not to the grain producers. A debate on the method of payment, namely whether this should be to the railways or to the producers, started before the WGTA became law and has continued as a high profile issue to the present day. Under "pay the railways", farmers can still ship grain at subsidized freight rates. Advocates of "pay the producer" argue that this continues to inhibit development of "value-added" industries in the west, particularly the livestock industry and the further processing of agricultural products. This is, of course, reminiscent of the complaint of the mid-1970s that finished goods were charged higher freight rates than agricultural raw materials. "Pay the railways" means that the WGTA has not mitigated the effects of low grain freight rates on regional development.

The most important transportation legislation of recent years was the National Transportation Act, 1987, and its accompanying legislation, the Motor Vehicle Transport Act and the Shipping Conferences Exemption Act. The philosophical underpinning of this legislation has been well described in informational brochures issued by the National Transportation Agency. The following quotation is taken, as an example, from the first paragraph of the brochure on air transportation:[7]

> The new National Transportation Act reflects the principle of less regulation to encourage innovation and enterprise. This greater reliance on competition and market forces will improve service to both shippers and the public. The new Act also provides for a new, more open and efficient regulatory process.

This emphasis on increased competition would seem to have had very little effect on transport in the context of regional development. In air transport, deregulation accelerated development of hub and spoke operations, where a smaller centre may only have air connections to a larger hub and no ongoing service without change of plane there. However, hub and spoke operations can produce an improvement rather than a deterioration in service to small centres. A more critical issue facing smaller communities is that the loss of airline ability to cross-subsidize may mean a complete loss of service to the community. This has happened to the City of Brandon in Manitoba, although Brandon had also suffered from lack of air service in several time periods prior to airline deregulation. As far as can be established, Brandon is the only city in Canada which has suffered in this way.

Turning to the rail mode, there are two aspects of the deregulatory legislation which could impact on regional development. Before the 1987 legislation was

passed, fears were expressed that confidential contracts for rail transport would benefit large shippers in developed areas more than small shippers in the low growth areas of Canada. It is really not known whether this fear has materialized, as the very nature of confidential contracts means that the relevant data are not available for analysis; however, this has not been a matter of any widespread complaint in the years since 1987. Secondly, streamlined branchline abandonment procedures introduced under the 1987 legislation could militate against regional development, in that low growth areas could be at risk of losing railway transport. However, this has not been a problem in western Canada, partly because of the protection of prairie branchlines to the year 2000.

There have been no suggestions that increased freedom of entry in extraprovincial trucking or the continuance of the Shipping Conferences Exemption Act have had any impact on regional development. In summary, the overall effect of increased competition among transport carriers appears to have been neutral in respect of regional development in the prairies.

In these circumstances, it is intriguing to find explicit reference to transport as a key to regional economic development in the National Transportation Act, 1987. The policy statement in section 3 of the Act states the need to obtain transportation at lowest cost and that this is most likely to be achieved by competition. Seven explicit objectives are stated; (d) and part of (g) relate to regional development.

> (d) transportation is recognized as a key to regional economic development and commercial viability of transportation links is balanced with regional economic development objectives in order that the potential economic strengths of each region may be realized,
>
> (g) ... fares, rates and conditions that do not constitute ...
> (iv) an unreasonable discouragement to the development of primary or secondary industries or to export trade in and from any region of Canada or to the movement of commodities through Canadian ports.

Clause (g) (iv) is taken verbatim from the earlier National Transportation Act of 1967. The explicit statement about regional development in subsection (d) did not appear twenty years earlier. Looking simply at the words of the 1967 and the 1987 National Transportation Acts, one might think that transport as a tool for regional development was viewed as more important in 1987. This would be surprising, given the much greater stress placed on regional development in the late 1960s than today.

In fact, there is no evidence of any results from the inclusion of section 3 (d) in the 1987 National Transportation Act, as against the lower stress on regional

development in the 1967 legislation. The present refusal to sacrifice transport efficiency and competitiveness to regional development would seem to reflect the wishes of both carriers and shippers. The following quotation from an address by Martyn J. Armitage on behalf of the Canadian Industrial Transportation League is illuminating:[8]

> As long as the transportation system in Canada and, as long as transportation policy, is viewed as an instrument to equalize regions that are inherently unequal, there is little reason to believe that a happy balance can be struck between regional equality and economic efficiency. Fundamentally, the philosophy that is being put to the Canadian shipper and the Canadian public is that "Canada is a compassionate society".....Unfortunately, that philosophy, in a world that is becoming increasingly more competitive, is losing currency .....As every Canadian industry is competing in its particular marketplace for market share, the individual Canadian is becoming increasingly aware that his job, his lifestyle, his future is intricately linked to a product or service....In the face of such threats, regional economic expansion is becoming a concept which many Canadians feel that they can no longer afford.

To conclude, it is clear that, over the last fifteen years, governments have had increased difficulty in finding resources to fund new initiatives, there has been greater stress on competition in Canadian macro-economic policies, and regional development has consequently been regarded as somewhat of a luxury. This has been accompanied by a growing tendency to regard transport as an industry like any other industry and not as a development tool.

3. REACTIONS OF STAKEHOLDERS

Interviews were carried out with stakeholders in Alberta, Saskatchewan and Manitoba in January/March 1992 and the results are reported below.

3.1 Federal Government

Western Economic Diversification Canada (WD), which is headquartered in Edmonton, had initially expected to have a strong advocacy role in transport, where this was viewed as a constraint on regional development. In the early years of the department, transport matters were kept under review, but this has now become a low profile area. Transport is not regarded as a constraint on growth and WD clients are not coming to the department with transport problems.

Improvements in transport services have not been identified as a priority by WD in partnership agreements with the provinces, where infrastructure developments are jointly funded by both levels of government. This is also the attitude of the provinces. Manitoba had signed a five-year agreement, with expenditures to be mainly on municipal infrastructure, and the province did not include any transport initiative in its priorities. So far, transport issues have also been excluded from the priority lists of Alberta and Saskatchewan. This is a very different situation compared with the Agreements signed by WD's predecessor department in 1984, but both levels of government appear to agree that transport should no longer be a major expenditure object in regional development.

The two regional offices of Policy and Coordination, Transport Canada, voiced similar opinions. There were still specific regional problems - for example, Alberta concerns on west coast access and Edmonton's air services and Manitoba concerns on the Port of Churchill and air services at Brandon. However, both offices indicated that very little was heard nowadays about transport in relation to regional development in contrast to the situation fifteen years ago. The rhetoric on transport for regional development purposes was still to be heard, but now in fewer and fewer places, and this appeared to have little practical impact. The economy is in recession and regional development tends to be viewed as a luxury, while the National Transportation Act of 1987 had diffused many concerns. Back in 1973, the federal and provincial governments set up FPCOWT (Federal-Provincial Committee on Western Transportation) to deal with transport problems, when transport was still regarded as a tool for regional development, but this committee has been long defunct.

3.2 Provincial Governments

Interviews were held with transport policy groups in all three provincial governments.

Historically, the Province of Alberta was very active in protesting railway freight rate discrimination against Alberta and this was still a major policy issue even well past the mid-1970s. Yet complaints about freight rates are now relatively rare in Alberta and several reasons were suggested for this. Markets have changed, with a considerable expansion in truck transport to the U.S. and off-shore shipments from western ports. This has reduced the relative importance of freight rates between Alberta and eastern Canada. North-south truck movements have been facilitated by an extension of the more generous Canadian limits on weight and dimensions into Montana as far as Shelby, where connections can be made with the U.S. railroad, Burlington Northern (BN). Competitive line rates were established on methanol from Medicine Hat to Coutts for transfer to BN, although a competitive response from CP Rail has subsequently made it unnecessary for the shipper to seek a renewal of these arrangements. The 1987 National Transportation Act has increased the competitive bargaining strength of

Alberta industry through confidential contracts, the abolition of joint CN-CP rate determination, competitive line rates, and the threat of final offer arbitration. Nevertheless, the province recognizes that freight rates are still an important part of product cost for forest products, coal, sulphur and grain.

The province of Saskatchewan also has an ongoing concern in respect of the high transport component in the selling prices of its resource products, where transport costs for potash and coal can average 50% or more of the selling price. Nevertheless, the attention paid to transport and regional development and to railway freight rates is much less than even a decade ago. The explanations are similar to those offered in Alberta. Markets have changed, the 1987 National Transportation Act gives more redress and the economy is presently pre-occupied with matters other than transportation, particularly the effects of the recession. In addition, resource industries captive to rail have worked hard at achieving efficiencies in transportation with unit trains, leased cars and, in the case of potash, the establishment of storage facilities in the United States.

In Manitoba, there has been an increased orientation in transport toward north-south movements and westward rather than eastward movements, although the geographical location of the province means that the westward thrust has been less than in Saskatchewan and Alberta. The transport and regional development issue has become very subdued. The National Transportation Act, 1987, has given shippers more options, while the WGTA has greatly modified previous freight rate complaints on rapeseed products, described earlier in this paper. Shippers in Manitoba are more concerned with global competition and the recession than with transport problems. Nevertheless, specific problems were identified - the Port of Churchill and Brandon air services, as discussed earlier, and the need for more double stacked container services, although this need is now being met.

3.3 Carriers

Extensive interviews were not carried out with carriers. The Transport Institute is in frequent contact with railway and motor carriers in the course of its various research studies and did not expect to find strong views on the role of transport and regional development. This was confirmed by the small number of interviews specifically undertaken for the project.

The railways have, historically, had a fear of being asked to incur the costs of public policy expectations without compensation and this has included regional development. However, it would seem that this fear is much less strong now than formerly. The railways have become very unwilling to build infrastructure to assist in regional development because of the financial risk involved in unsuccessful projects. However, they are ready to operate track extensions for resource

development as long as they are not forced to take the investment risk. In general, they are being successful in having this attitude accepted.

In the past, railways have given incentive rates to new firms, usually in the resource field, to assist their initial development. Such rates were established on a case-by-case basis and were confined to the initial start-up period of the enterprise, but generally for a duration not less than two years. In a regime of confidential contracts, it is impossible to measure the present extent of this type of incentive rate, but the railways state that they are still in the incentive rate business. Although the study did not include any real analysis of this issue, inquiries with shippers did indicate that incentive rates still exist.

In principle, one would not expect to obtain evidence of any linkage between transport and regional development in the extraprovincial motor carrier industry, since there is now virtual freedom of entry into the industry. Obviously, there is no scope to use this industry as an agent of regional development in the sense of cross-subsidy of freight rates. Nevertheless, in the interests of academic thoroughness, interviews were arranged on this issue with two motor carriers. These interviews confirmed the expectations of the researchers, who were received by the motor carriers with courtesy, cups of coffee, and undisguised amusement!

3.4 Shippers

Shipper attitudes towards transport and regional development were examined in interviews in Alberta and Saskatchewan. The Transport Institute had conducted a lengthy survey of Manitoba shippers during 1988 and 1989 and there was no need to update this.[9]

The problem of a satisfactory transportation infrastructure generally occurs only in areas of new resource development, for example mines or forest product complexes. As already indicated, the railways are unwilling to fund the construction of new lines for resource development. The construction of public roads is, of course, a provincial responsibility and the Province of Alberta has also funded rail line construction to allow resource development.

Interviews with resource producers and large manufacturers in the prairie region showed a great appreciation of increased opportunities for competitive transport rates and service in both rail and motor carrier modes since the 1987 deregulation legislation. The importance of competitive access to raw materials and markets was repeatedly stressed. There was virtually no interest in the issue of transport and regional development, even in response to very specific questioning. Obviously, companies do not think in terms of transport and regional development and the major factor in their planning is to ensure continued access to transportation on a competitive basis and with adequate service levels. In

Winnipeg, which is the major manufacturing centre of the prairies, the provincial Department of Industry, Trade and Tourism stated that the transport system "is operating efficiently and does not appear to be a major impediment in the operation and/or enhancement of our manufacturing sector".[10]

Fifteen years ago, interviews of this type would not have yielded such a high degree of satisfaction and shippers would have complained about freight rates that were too high in comparison with eastern Canada. The change in attitudes is entirely consistent with the views expressed by various departments of federal and provincial governments, as explained earlier in this section. The prairie provinces are a long way from markets, but this is too obvious for lengthy comment by shippers; access to markets through a competitive transport system is crucial; and, beyond the provision of transport infrastructure, transport and regional development is not really a subject of interest to shippers.

4. CONCLUSION

Until the mid-1970s, transport was assigned a key role in regional development in the prairies. Since then, the process has been downhill for regional development and for transport as a tool of regional development. The federal departments and provincial governments in the prairie provinces are no longer faced with the freight rate complaints that were so common fifteen or twenty years ago; carriers and shippers are not interested in transport and regional development; and the whole issue is either dead or at best moribund.

The reasons for reduced stress on regional development in Canada are fairly clear. Global competition and higher levels of unemployment throughout Canada have reduced the attention given to the lagging regions, with this problem particularly acute in the current recession. Real incomes in Canada have been rising much less rapidly in the 1970s and the 1980s than in the earlier post-war decades and expenditures on regional development have been regarded as more of a luxury. As regional development has become less important, so have the tools for regional development including transport.

International competition, inflation, unemployment, increasing expenditures on education and social services, and budget deficits have pushed transport out of the limelight. Changing markets in western Canada, with greater stress on U.S. and west coast trade, have reduced the relative role of transport in east-west links within Canada. Truck transport has become more important and the economics of a deregulated motor carrier industry do not allow the cross-subsidy of one type of traffic by another. Most significantly, shippers have been given more competitive markets in which to buy transport services and this has greatly diminished freight rate complaints.

At times, it is difficult to comprehend the extent to which regional development and transport as a tool for such development have moved from centre stage in such a brief period of time. This development was not anticipated by any analyst in the early 1970s and any such forecast in the prairie region at that time would have been treated with scorn and derision. Yet, the change has happened. But then, in recent years, we have seen major policy issues wither away in many fields other than transport.

Will the reduced status of transport as a tool of regional development policy continue? The suggestion has been made that the vicissitudes of public policy are such that freight rate issues could be resurrected once the economy passes through the present recession. The present writer doubts that this will happen. Increased competition in transport markets has become a reality in recent years. Policy statements on transport and regional development may continue, but the intensity is already much reduced. Any real revival of the issue seems improbable.

ENDNOTES

1. This paper is based on John Heads, Transport and Regional Development: The Prairie Provinces, Economic Analysis Directorate, Transport Canada, May 1992. The financial support of Transport Canada is gratefully acknowledged. Transport Canada commissioned a separate study on Atlantic Canada with the University of New Brunswick, which was also completed last year. A summary of this study was given in B.G. Bisson et al, "Regional Economic Development and Transportation: Transportation as a Competitive Factor in Atlantic Canada", CTRF Proceedings, 1992, pp. 140-50.

2. Quoted in Manitoba, Report of the Royal Commission Inquiry into Northern Transportation, Winnipeg, Queen's Printer, 1969, p. 536.

3. Western Economic Opportunities Conference Transportation Paper, joint paper of the Premiers of Saskatchewan, British Columbia, Manitoba and Alberta, Calgary, 1973, p. 2.

4. For a full discussion of these freight rate issues, see John Heads, Transport Subsidies and Regional Development, unpublished Ph.D. thesis, University of Manitoba, Winnipeg, 1976, pp. 38-63.

5. The calculations below are from Statistics Canada publications, principally SC 11-010, SC 11-210 and SC 71-001. The treatment of these statistical sources is discussed in Heads (1992). The measurement of the standard of living in terms of average labour income per member of the labour force expressed in real terms is slightly unusual, but it is the

measure least subject to definition of changes over the last four decades and therefore appropriate for a comparison over a long period of time.

6. Donald J. Savoie, Regional Economic Development: Canada's Search for Solutions, University of Toronto Press, Toronto, 1986, p. 179. This book is an excellent source on regional development policy and is used extensively in this section of the paper.

7. The New National Transportation Act: A New Framework for Air Transportation, National Transportation Agency of Canada, Ottawa, 1987, p. 1.

8. Address delivered to Forum on Canadian Freight Transportation Policy, Canadian Institute of Guided Ground Transport, Queen's University, Kingston, November 19, 1991.

9. John Heads, Manitoba Transportation Action Plan to the Year 2000, University of Manitoba Transport Institute, Winnipeg, January 1990, Chapters 7-9.

10. ibid., p. 258.

TRAIN DYNAMICS SIMULATOR

Abstract:

Since 1970 CP Rail has leased Train Dynamics Analyzers (simulators) for the purpose of developing improved train handling techniques, investigating derailments and training Locomotive Engineers.

These simulators provide the realism that previously could only be found aboard a locomotive. They do this by incorporating an actual locomotive control stand with a graphic display monitor, laser disc video projection of the territory and digital sound.

The nine simulators in use across the CP Rail System have improved operating costs by improving fuel consumption and reducing lading and equipment damage. Furthermore Locomotive Engineers which use to take over a year to qualify are now qualified in under six months in some areas because of the simulator training they receive.

Locomotive Engineers on CP Rail are equipped to operate trains over some of the most difficult terrain in the country and we are proud to say that the Train dynamics Analyzer has helped us in maintaining one of the best safety record of any class one railroad in North America.

A. Manconi

Background:

In the Early 70's increased freight traffic on CP Rail demanded that more locomotive engineers be qualified in a very short period of time.

In order to meet this demand, CP Rail developed a locomotive engineer training program.

The program consisted of rules and mechanical classroom instruction followed by several months of on-the-job training. Depending on the size of the territory, it could have taken approximately one year for a locomotive engineer to be qualified.

At the same time CP Rail leased its first Train Dynamics Analyzer (TDA) from FM Industries of Fort Worth Texas. This analyzer or simulator, was used to determine the optimal location of mid train power for CP's remote control equipped trains and to assist in derailment investigations. This simulator was capable of graphically displaying in-train forces and air brake functions over any given portion of CP Rail's main track.

Knowing that a thorough working knowledge of the trains air brake system and its functions is of utmost importance for the safe and efficient operation of trains, CP Rail recognized the TDA as an excellent training tool for this purpose. In 1975, it leased its second TDA specifically for training locomotive engineers.

Over the past decade, freight trains have increased dramatically in length and weight, requiring locomotive engineers to be more knowledgeable and skilled in train handling. The future will certainly be even more demanding on locomotive engineers. New freight equipment, microprocessor controlled locomotive and automatic train control systems are only some of the technological advancements being developed.

Presently CP Rail has nine simulators on lease across Canada, for developing improved train handling techniques, investigating derailments and training locomotive engineers to meet the changes in the industry.

These latest generation simulators are no doubt the most valuable training tool ever introduced to locomotive engineer training.

System Description:

There are two different TDA models being utilized by CP at this time. They are the full scale TDA 4000, used for training locomotive engineers and the desktop 4100 used to develop improved train handling techniques and investigate derailments.

The TDA 4000 system as seen in figure 1 below, consists of the following hardware:



Figure 1. TDA 4000 simulator at CP Rail

-A full scale diesel-electric control stand, complete with all the gauges, indicating lights and controls commonly found in the cab of a locomotive.

-A Motorola mini-computer is the central processing unit of the system.

-An IBM PS2 pc is used as the data input terminal.

-A super VGA color graphics monitor is used to display the train movement over the track profile including sidings, curves, signals, crossings, bridges, tunnels, etc. In-train forces generated are also displayed on the screen along with brake cylinder pressure throughout the train and much more. See figure 2 below for a detail of the most common graphics which are displayed.

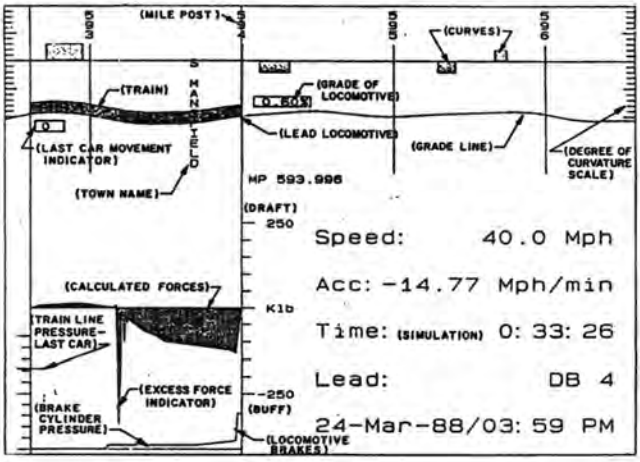


Figure 2. Dynamic simulation-Standard display format

-An EMSONIQ digital audio sampler generates recorded interactive locomotive and track sounds.

-Sony laser disc players run the actual video footage recorded on CP Rail's track.

-A Sony T.V. Monitor displays the interactive video of the track profile.

-A Hewlett Packard pen plotter, for plotting the graphics displayed on the VGA monitor.

A Texas Instrument Microlaser laser printer, for printing all simulation summaries and reports.

The TDA 4100 system as seen in figure 3 below, can perform all the same functions as the TDA 4000. However, a desktop console is utilized instead of a full scale locomotive control stand and the system is not equipped with an audio/video system. This makes the 4100 a practical alternative for the office environment.



Figure 3. TDA 4100 System

System Utilization:

A. Derailment Investigation

The TDA is used to investigate derailments when improper train handling is suspected or the cause is unknown. The following is the procedure undertaken in such an investigation:

-First the locomotive event recorder (black box) information is downloaded into a report showing all the events which took place on the locomotive prior to the train coming to rest following the derailment.

-All the details of the train involved in the mishap such as the number of cars, locomotives, number of loads and empties as well as their location are retrieved from CP Rail's main frame computer and downloaded directly to the TDA.

-The Specific territory were the derailment occurred is then called up from the TDA's track profile data base and displayed to the operator on the graphic monitor. The train is also displayed at the actual derailment location on the track profile.

-The operator then runs the simulation on the TDA based on the parameters obtained from the black box. (FM Industries is presently working on the capability to directly download the black box data to the TDA and have the simulation run automatically). If improper train handling is in fact evident, excessive in-train forces may be developed in the train during the simulation as in reality. The entire simulation run can then be printed in a report form as shown in figure 4 or a plot of the excessive in train forces can be created as in figure 5.

TIME 19Feb93	LOCATION MP.xxx	SPEED Mph	ACCEL Mph/min	DIST Ft	L_POS	L_TRC Amps	MAX_DRAFT Car	MAX_DRAFT Klbs	MAX_BUFF Car	MAX_BUFF Klbs
01:02.24	14.332	34.3	-1.02	3092	RUN 8	494	31	31	0	0
01:03.14	14.340	34.3	-1.28	3136	RUN 8	494	31	31	0	0
01:04.04	14.348	34.3	-1.53	3182	RUN 8	494	31	31	0	0
01:05.25	14.359	34.2	-1.72	3244	RUN 8	495	31	31	0	0
01:06.15	14.367	34.2	-1.95	3288	RUN 8	495	31	32	0	0
01:07.05	14.374	34.2	-2.19	3334	RUN 8	495	31	32	0	0
01:08.26	14.385	34.1	-2.44	3394	RUN 8	496	31	32	0	0

Figure 4. Typical simulation printout

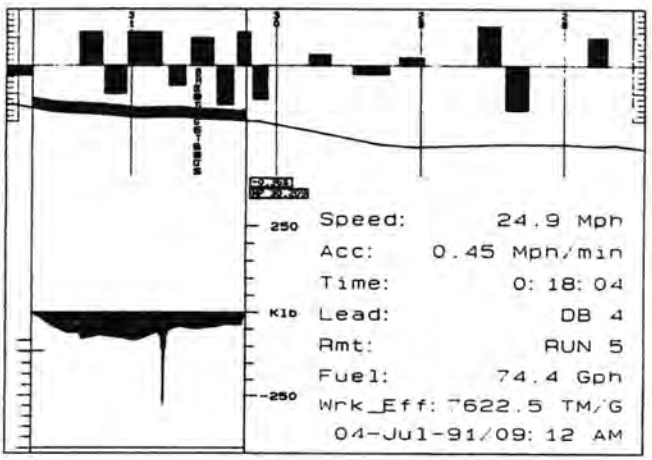


Figure 5. Plot of excessive in train forces

B. Development of improved train handling techniques

The TDA is used to evaluate and compare different train handling techniques and develop the safest and most fuel efficient train handling guidelines. An example of this work is shown in figure 6,7 and 8. These figures describe the same train being run over the same territory but utilizing three different train handling methods. One can easily see that the smooth in-train forces developed in figure 8 make it the train handling method of choice.

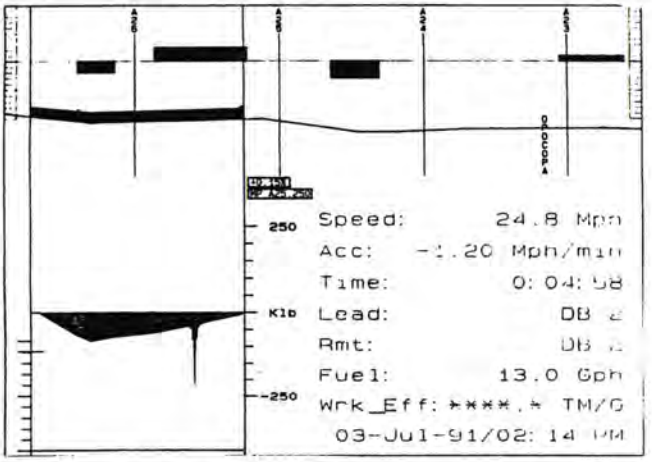


Figure 6. Plot of improper train handling

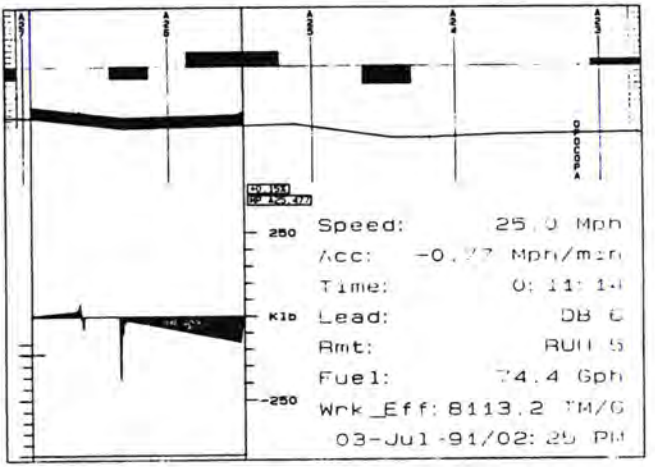


Figure 7. Plot of improper train handling

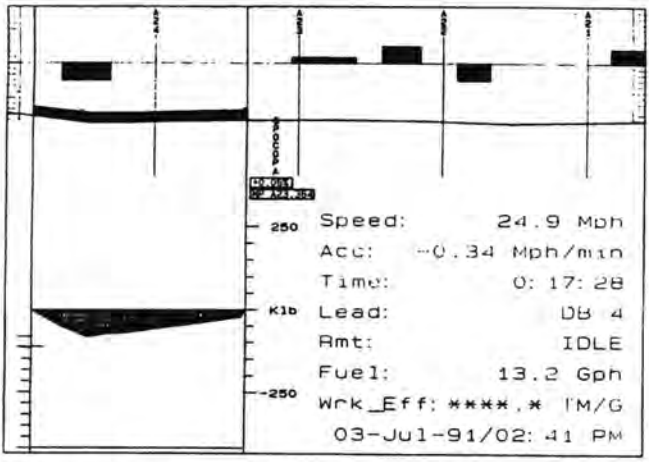


Figure 8. Plot of improper train handling

C. Establish speed limits and the location of block signals

The TDA can be used to determine effective stopping distances over certain sections of the railway. This data can be used to assist in the establishment of maximum speed limits and the location of block signals used to control the motion of trains.

D. Develop power requirements and train schedules

Simulations can be run using different numbers of locomotives and different train sizes. Data can be recorded on the amount of fuel consumed during a run and the running time for the trip. This data can be used to optimize train schedules and develop the most efficient power requirements to haul a specific train over a territory.

E. Locomotive engineer training and monitoring

Since the TDA can realistically simulate almost any situation encountered during an actual train run, it is the most effective tool for training locomotive engineers. New trainees can spend time practicing on the TDA and becoming familiar with the controls of a locomotive prior to actually operating in the field as part of their on-the-job training. Both trainees and qualified engineers can experiment with train handling methods they could not try in the field due to the potential for equipment damage, train separation or even derailments.

When teaching train air brake systems and their functions, the TDA air brake simulation program provide students with a graphical explanation of the functions of the different train brakes systems which can not be seen any other way. The misuses of the brake system can also be safely explained and demonstrated using the TDA.

A locomotive engineer grading program is also available to evaluate a trainee's ability to perform various operations. An operator has the ability with this software to design a test using any type of train on any piece of track. The operator can also select any rule or train handling criteria he wishes to evaluate the trainee on and apply a marking scheme as he sees fit. When a trainee has completed the test on the TDA he will then be automatically graded and his errors will be pointed out at the exact location and time during the simulation that they occurred.

This same grading program can be used to monitor and re-certify locomotive engineers as part of the mandatory locomotive engineer re-certification program enforced by the government regulatory body.

Benefits

In the 80's the TDAs at CP Rail assisted in the development of a fuel conservation program. Since this fuel conservation program has been in effect CP Rail has reduced its annual fuel costs by 50 million dollars, of which the locomotive engineer played a major role.

From the time CP Rail locomotive engineers were first given the opportunity to utilize the TDA back in 1975, train handling has improved, while operating costs have decreased due to a reduction in fuel consumption, lading and equipment damage.

The time it takes to train and qualify a locomotive engineer has also reduced from approximately one year to under six months in some areas, resulting in substantial savings.

Finally we are proud to say that although our locomotive engineers have to operate trains over some of the most difficult terrain in North America, the TDAs have helped CP Rail maintain one of the best safety records of any class one railway in North America.

AN INTERCITY PASSENGER PROFILE OF THE ALBERTA CORRIDOR

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INTRODUCTION

This paper sets out to identify the intercity passenger profile for the Edmonton - Calgary corridor (The "Alberta Corridor"), by travel pattern, mode, journey purpose and origin/destination patterns within the end point cities. High speed Rail's (HSR) ability, against other modes to attract an economically viable modal share of this traffic is assessed, together with an analysis of preliminary station locations in the two cities.

It is shown that 40% of total trips are business (but only 50% of these business trips are downtown - downtown) the remaining 60% of all trips are non business trips of which only 7% are downtown intercity trips. 50% of business and 93% of non business trips have at least one trip end in the suburbs.

The paper shows that suburban stations, additional to the downtown city location are required, to attract all segments of the passenger profile and ensure convenient access. The effect of air/rail transfer is also briefly assessed.

THE INTERCITY CORRIDOR

Alberta approaches the 21st century with its major Intercity corridor between Edmonton and Calgary in a virtual state of stagnation. No rail service, air service facing a very clouded and monopolistic future with a marginally profitable "short haul", intercity bus service at far from "budget economy" fares, itself with a virtual monopoly of ground public transport, with only limited "Red Arrow" bus competition and the "all embracing-all polluting" auto as dominant by sheer necessity for many trip purposes. Intercity travel indeed faces a bleak future in both Alberta and Canada wide by the turn of the century.

Recent research (Hall 1990) has shown that a High speed Rail (HSR) service between Edmonton and Calgary presents a practical viable alternative for implementation by the turn of the century. Passenger demand and modal split analysis establishing HSR's likely market share has been presented previously (Hall & Wirasinghe, 1991), also an economic analysis (Hall & Wirasinghe, 1992) established that a

commercially satisfactory rate of return (15% approximately) could be achieved by the turn of century based on present income patterns and "replication" population growth only (i.e a "no growth" solution). Any upturn in Alberta's economy would improve on this performance. Exhibit 1 gives a sketch outline of the corridor.

POTENTIAL PASSENGER PROFILE

It is however necessary to establish a passenger profile for the corridor to establish travel patterns, journey purposes and particularly origin/destination patterns within end point cities. HSR's major advantage, over air especially is its "downtown to downtown" access/egress ability, saving valuable airport access/egress time, often as long or longer than the flight itself, especially on "short haul" routes.

The downtown - downtown ability of HSR can however be a "two edged sword" in that some passenger origins or destinations (O/D) for certain suburban zones must "back track" from downtown, having passed through their zones by HSR in the initial/final stages of the journey. Typically this would be north Calgary and south Edmonton O/D trips. Unfortunately for HSR, these zones are quite airport accessible (Calgary International, Edmonton International), further, north Edmonton is quite accessible to Edmonton Municipal airport, giving competitive airlines a distinct advantage for certain journey patterns.

In addition many journey patterns will also be park n'ride access, plentifully available at airports (albeit expensive) but not necessarily readily available nor desirable at downtown locations.

An analysis is needed to establish passenger profiles by

i) Journey purpose
ii) Origin/Destination patterns
iii) Mode of access

This paper establishes criteria for the above parameters which are detailed in the next section

EXISITING PASSENGER PROFILE

Existing passenger profiles are set out below (1) by journey purpose, (2) by origin/destination pattern (3) by mode of access and are summarized in Tables 1 to 3.

1) JOURNEY PURPOSE - Trips are split into two major journey purposes, Business and Non business. Data was collected for all major carriers and Alberta Transportation screen lines (see references) and shows that approximately 40% of all corridor travel is business, 60% non business, over all modes, including mode captive (no car available) traffic. Table 1 gives a business/non business profile for the study period 1972-1982.

2) ORIGIN/DESTINATION PATTERN - A review of various studies made available by Alberta Economic Development (AED), Edmonton, Calgary and Red Deer screen line studies and the Stanley airport study (Stanley, 1984) made it possible to establish a pattern for the intercity origin/destination patterns by trip type and by trip pattern based on either a "downtown" or a "suburban" location origin and/or destination. These are reproduced in Table 2.

a) Downtown - Downtown Pattern - Only a proportion of trips are truly downtown/downtown (the major HSR selling point and the "typical" business trip). In fact only 50% of business and 7% of non business trips are of this pattern and based on the journey purpose split given in (1) above, these trips account for only some 24% of all trips.

b) Suburban to/from Downtown pattern - 33% of business trips and 50% of non business trips are of the "Suburban to/from Downtown" pattern, i.e. using a downtown station for one end of the journey (typically the business trip from office to the alternative city returning to residential home, or vice versa or a non business trip from home to the alternative city, eg trips from Edmonton to Calgary Zoo). This pattern acounted for about 43% of all trips.

Note that certain round trips will be a composite of both patterns particulary business trips (eg downtown to downtown office trip in one direction, a downtown to suburban home return trip). About half of all business trips are of this nature. Very few non business trips are of this nature, the vast majority originating at a residence. (The 7% downtown - downtown non business trips shown in table 2 represent both non business trips resident downtown and, more importantly, transit transfer traffic from a suburb not accessible through a suburban station).

c) Suburban from to/from suburban pattern - These trips represent 17% of business trips and 30% of non business trips for a total of about 33% of all trips.

The suburban destination business trips (patterns b & c) reflect the more dispersed nature of Edmonton's business community compared to the highly centralised location of much of Calgary's business. It appears that fully 11% of all traffic would be business trips with a Calgary origin (downtown and suburban) to Edmonton suburban destination, only about 3% of total traffic being a similar business trip from an Edmonton origin to a Calgary suburban destination.

It is assumed that the major land use patterns in Calgary and Edmonton will remain more or less stable, a reasonable assumption given the repetitive pattern of trip making, the fact that land use changes occur only slowly over time and the state of the present economy. However the models originally developed are set up to incorporate major land use changes (if known) by altering the above distributions and access parameters.

Table 3 summarises, on a total one way trip basis, passenger profiles by journey purpose and origin/destination pattern, by end point city.

3) ACCESS MODE - Access modes were investigated as far as data would allow. 98% of all airport access is by auto or taxi and was assumed to be the only access mode for air and for business trips.

Bus, particularly down market "mode captive" is more orientated to transit, although both kiss n'ride/taxi access are utilized.

Bus trips can be split into two segments i) car available (about 40% of bus traffic) ii) "mode captive", non car available (about 60% of bus traffic).

It appears that transit, as an access mode, can only account for about 15% of "car available" traffic. This is a "conservative" estimate. Mode captive traffic however is independent of access time, being highly fare dependent and transit access appears to account for about 80% of this segment. In total, as bus represent about 14% of the total market, about 7% of the total market will use transit for access (6.5% mode captive, 0.5% car available).

Waiting times were also assessed and added in. From the AED study auto clearly was 0 minutes access, rail and bus were found to be 25 minutes, this is somewhat excessive for HSR and could be drastically cut, however, to perform a "worst case" scenario, 25minutes was adapted in the model run. Air waiting time is 35 minutes.

It should be noted that transit plays only a small role. The study has assumed 7% transit access in total. In actual fact many business trips may well use transit, especially the downtown/suburban trip, if the business person uses park n'ride transit regularly as a commuter and parks their auto at a transit station at the beginning of the trip cycle. This pattern is simply not possible at present and only a rough estimate could be made of this impact. It has been ignored in this paper, needing further research, but could cut down significantly parking provision at the suburban station (and downtown, if provided).

The increase in access time caused by using transit would be probably be "rationalized" by the individual on the grounds of convenience (eg avoiding peak hour freeway traffic).

PRELIMINARY STATION LOCATION AND ACCESS TIMES

The city limits to city limits travel time by individual modes were first established, the access times were then established for the suburban station locations and for downtown station locations on the basis of "add on" times. Similar access times were established by mode for air, bus and auto. Figure 2 gives a typical example.

1) DOWNTOWN STATION LOCATION - Downtown station locations will require a detailed analysis of land use and availability. However based on preliminary studies by University of Calgary for Alberta Economic Development, provisional sites have been identified for Calgary to be at or near City Hall, adjacent to CP Rail and in Edmonton at about Jasper Avenue, near the former CP Rail station, accessed over the High level bridge. However it cannot be emphasized too strongly that these sites are tentative only, for the purposes of analysis and a much more exhaustive study would be needed before exact sites could be finalised.

2) SUBURBAN STATION LOCATIONS - Preliminary sites for the two suburban stations were chosen with reference to the surrounding highway network for auto and airport accessibility.

i) North Calgary - The north Calgary site was chosen at or about McKnight Boulevard, with convenient access by Deerfoot Trail (freeway) from north, south and south east Calgary, by McKnight and John Laurie Boulevards for north west Calgary and by Crowchild Trail/McKnight Boulevard from south east Calgary. East and west Calgary would gain access by Trans Canada Highway and Deerfoot Trail. A convenient link with Calgary International airport by shuttle bus could also be provided from this location, at least initially. See Figure 3.

ii) South Edmonton - The south Edmonton station was chosen provisionaly at or near Whitemud Freeway/Calgary Trail, although it could be further south towards the city limits, if sufficient space could not be identified. Whitemud freeway's "U" shape layout would give access to north, northwest and east Edmonton also St Albert and Sherwood Park and via Whitemud and Capilano Freeways to north or north east Edmonton. Access to south, south east and south west Edmonton would be by the surrounding highway network. See Figure 4.

It is important to note that the fare policy would allow alternative usage of either a downtown or suburban location, a ticket being available from either station in the originating city to both stations in the destination city. (Hall & Wirasinghe, 1992 has a more detailed explanation of proposed fare policy).

IMPORTANCE OF SUBURBAN STATION STOP

Table 3 shows that fully 33% of all trips will use the two end point suburban stations for both trips ends, with a further 43% of trips using a suburb station for one trip end. 76% of all traffic is dependent on a suburban stop for at least one trip end.

If only a downtown - downtown pattern was in operation, suburban access times would be severely increased resulting in a time consuming "contra-flow" journey for many person and/or passenger resistance to making the trip. Table 4 shows predicted modal splits to rail, with the suburban option, developed by Hall (1990). Rail's global modal share of 24% would be seriously affected without the

suburban option. A review of increased access times resulting from a "downtown only" scenario shows that business traffic would be most affected with half the traffic at potential risk.

The presence of Calgary International airport in north Calgary, Edmonton International in south Edmonton and Edmonton Municipal airport in downtown Edmonton would gravely affect this traffic to a "worst scenario" of about one half of all business. Running the modal split model shows that realistically about one third of business travel would no longer be attracted to HSR (about 14% of the total).

Non business travel is relatively more elastic, nonetheless auto is the dominant mode, resulting in most of this traffic being susceptible. Fare policy can overcome some of this disadvantage, however, but lack of adequate and cheap ("free") auto parking would put this traffic at risk (access by transit is estimated at about 15% of the segment). An analysis of the modal split model shows that approximately half of the non business travel will not be attracted (about 30% of the total).

This grim scenario would cut HSR ridership by about 45%. HSR's modal share would drop from just under 24% globally, to about 10-11%. The effect on the rate of return would be disastrous, especially on base revenues.

ECONOMIC IMPACT OF NO SUBURBAN STATIONS

A previous paper (Hall & Wirasinghe 1992) established an economic analysis of the corridor based on a "pessimistic" scenario of base traffic (fare paying passengers), "parcels express" traffic and a modest amount of regional traffic (to/from Red Deer). A 15% rate of return could be expected on a "no growth" scenario subject to certain conditions. (An "Optimistic" scenario was also developed, based on economic upturn in the economy but is not referred to here).

Table 5 shows projected revenues and rates of return at a "pessimistic" "lower bound" level (see Hall & Wirasinghe 1992) and assuming provision of suburban stations, a 3.6% "base" plus 11.24% "add on" rate of return can be expected for a total of 15% rate of return. With no suburban stops, the base drops to about 1.6%, regional traffic is also affected from a 3% contribution to about 1.4% only, however express and mode captive traffic would hold steady at 5% and 0.5% respectively.

Overall without suburban stations the rate of return declines to about 8.5%, far too low to be commercially attractive to finance houses and lower than the "benchmark" rate of return of 10% adopted by Alberta Transportation as justification for highway schemes.

STATION LOCATION AND FACILITIES

The two suburban locations referred to above and shown in figures 3 and 4 are tentative only. Actual locations would need a more detailed review. However any final location would need to be

accessible by surrounding highways, expressways and freeways, have space for present and future park n'ride and be reasonably accessible by transit. In the case of Calgary, the distance to the airport would be minimised.

Both Calgary and Edmonton suburban stations would initially have only transit bus access. Light Rail transit (LRT) access being confined to downtown locations (downtown sites are not exhaustively dealt with here, they themselves should be subject to ongoing study). Both suburban locations, however, have potential for future LRT access.

Passenger throughput of the two suburban locations would be significant since 76% of all traffic will use a suburban station for one trip end (33% using both suburban stations).

In total Edmonton suburban would handle about 58.5% of all traffic about 16.5% which are business trips. Edmonton suburban would have a higher usage than Calgary suburban, which would handle 50.5% of all traffic, (of which 10.5% are business trips). Edmonton downtown would handle 41.5% of all traffic, Calgary downtown 49.5% (for a total of 200%, since passengers use two stations, of course, in their one way trip cycle). Note Calgary downtown has a slightly higher volume than Edmonton (mainly business trips, 29.5% of total traffic, while 20% being non business) reflecting the "concentrated" business and commercial "hub" of downtown Calgary. Similar figures for Edmonton downtown station show that this station would handle 23.5% of total business traffic. Table 6 gives full details of passenger volumes on a "station usage" basis.

It is important to stress that, with each passing year, downtown intercity options get fewer due to land rezoning, redevelopment etc. It is vitally important to reserve a corridor alignment and to create a land bank at the present time if the project is to be implemented in the early years of the next century. Without this land banking and reservation, at best the corridor would not gain the necessary access to downtown (handling 41.5% & 49.5% of all traffic for Edmonton and Calgary respectively) while the provision of very remote suburban stations, beyond city limits, would negate both the downtown access convenience and attractiveness of a suburban stop, indeed such a scenario would have access times equal or more than flying. If the project is to be taken seriously for the next century, a decision on urban access corridors and suburban and downtown station locations should be taken within the very near future, before the opportunity is missed forever.

AIR/RAIL INTERCHANGE

The HSR corridor has potential to interface with three major regional airports i) Calgary International ii) Edmonton International iii) Edmonton Municipal.

Of the three, Calgary International is by far the most important, accounting for over 50% of Alberta's airline business. The HSR corridor will indirectly serve Calgary International through the suburban stop at North Calgary (McKnight Boulevard) with, initially at least, dedicated bus connection, through ticketing and baggage transfer.

Later a fixed "mini tram" direct link could be provided if volume warrants, eventually a highly "capital intensive" direct rerouting of HSR under the Airport may (or may not) be justified with a direct integration of rail/air transfer facilities.

However, in the initial stages at least these luxuries are unattainable and a bus (or later "mini tram" guided link) are all that can be hoped for. On this basis an additional 2.5 to 5% of traffic can be reasonable expected but is NOT assumed in the cost/benefit exercise shown in table 5.

The HSR corridor skirts the Edmonton International Airport and a very direct link could be installed. This additional traffic revenue has not been assessed, much depends on the future of this airport in regional, national and international terms. HSR could, however play a significant role in a future role of this Airport.

Edmonton Municipal does not really play a role in the HSR scenario, being totally (and inefficiently) competitive with the HSR corridor. The possibility exists, however, of extending HSR through the Jasper Avenue downtown location into this location, if the municipal airport site is redeveloped as a regional or city development centre.

CONCLUSIONS

HSR's major advantage over other modes is its downtown access ability, however this advantage needs to be supplemented by suburban stations to maximize HSR's modal advantage and obtain a satisfactory cost/benefit rate of return (15%). Fully 76% of all traffic will utilize a suburban station for at least one trip end of the journey. However downtown access is still a vital necessity in that about 67% of all traffic will also use a downtown station. With downtown stations only, the cost/benefit ratio drops to about 8-9%. With suburban stations only (no direct downtown access) the HSR mode would be as slow or slower than flying, on overall journey times.

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Table 1

BUSINESS, NON-BUSINESS AND TOTAL TRIPS

Year	Total Trips ('000)	Business Trips ('000)	% Business Trips	Non Business Trips ('000)	% Non-Business Trips
1972	1208	464	36.59%	804	63.41%
1973	1366	513	37.56%	853	62.44%
1974	1469	551	37.51%	918	62.49%
1975	1586	645	40.67%	941	59.33%
1976	1691	665	39.32%	1026	60.68%
1977	1808	694	38.38%	1114	61.62%
1978	1981	732	36.95%	1249	63.05%
1979	2166	853	39.38%	1313	60.62%
1980	2339	925	39.55%	1414	60.45%
1981	2458	1016	41.33%	1442	58.67%
1982	2293	928	40.47%	1365	59.53%

Table 2

INTERCITY ORIGIN/DESTINATION TRIP PATTERNS

Trip Type	Trip Pattern	% Trips
Business Trips	Downtown-Downtown	50%
	Downtown to/from Suburban Areas	33%
	Suburban Areas to/from Suburban Areas	17%
Non-Business Trips	Downtown-Downtown	7%
	Downtown to/from Suburban Areas	50%
	Suburban Areas to/from Suburban Areas	43%

TABLE 3

JOURNEY PATTERNS BY ORIGIN CITY AND TRIP PURPOSE

(ONE WAY TRIPS BY CITY OF ORIGIN)

JOURNEY PATTERN	ORIGIN	BUSINESS		NON BUSINESS		TOTAL	GRAND TOTAL
Downtown - Downtown	Calgary	9.5%	20%	1.5%	4%	11.0%	24%
Downtown - Downtown	Edmonton	10.5%		2.5%		13.0%	
Suburb - Downtown	Calgary	2.5%		7.0%		9.5%	
Suburb - Downtown	Edmonton	3.5%	13%	8.0%	30%	11.5%	43%
Downtown - Suburb	Calgary	6.0%		8.0%		14.0%	
Downtown - Suburb	Edmonton	1.0%		7.0%		8.0%	
Suburb - Suburb	Calgary	5.0%	7%	13.5%	26%	18.5%	33%
Suburb - Suburb	Edmonton	2.0%		12.5%		14.5%	
TOTAL, one way trips by origin		40%		60%			100%

Note

Downtown origin includes ALL trips originating in a downtown district plus some suburban trips originating from suburban zones accessing HSR at the downtown location (mainly non business, transit access trips).

TABLE 4

GLOBAL MODAL SPLITS

(MODAL CHOICE AND MODE CAPTIVE TRIPS)

Air		Rail		Auto		Bus	
B.	N.B	B.	N.B.	B.	N.B.	B.	N.B.
6.42%	5.55%	12.27%	11.61%	11.86%	38.43%	5.23%	8.63%
11.97%		23.88%		50.29%		13.86%	
Air Total		Rail Total		Auto Total		Bus Total	

Note

B. = Business Trips. N.B.= Non Business Trips.

Table 5

HSR "PRESENT WORTH" REVENUES & RATES OF RETURN

ALL DOLLAR FIGURES ARE IN 1990 DOLLARS

	Base ('000)	Add-on Traffic ('000)	Grand Total ('000)
Base Revenue	1,207,485	-	
Regional Traffic	-	36,224	
Express Traffic	-	60,374	
Mode Captive Traffic		6,038	
Total "Present Worth" Revenue	1,207,485	102,636	1,310,121.0
Total "Present Worth" Costs			1,165,235.5

"Present Worth" rate of return = $\frac{1,310,121,000}{1,165,235,522}$ = 14.86%
(24 year amortisation period)

Note
Above adapted from Table 5 of Hall & Wirasinghe, (1992)

TABLE 6

DAILY STATION UTILISATION by TRIP PURPOSE

(TOTAL ONE WAY TRIPS)

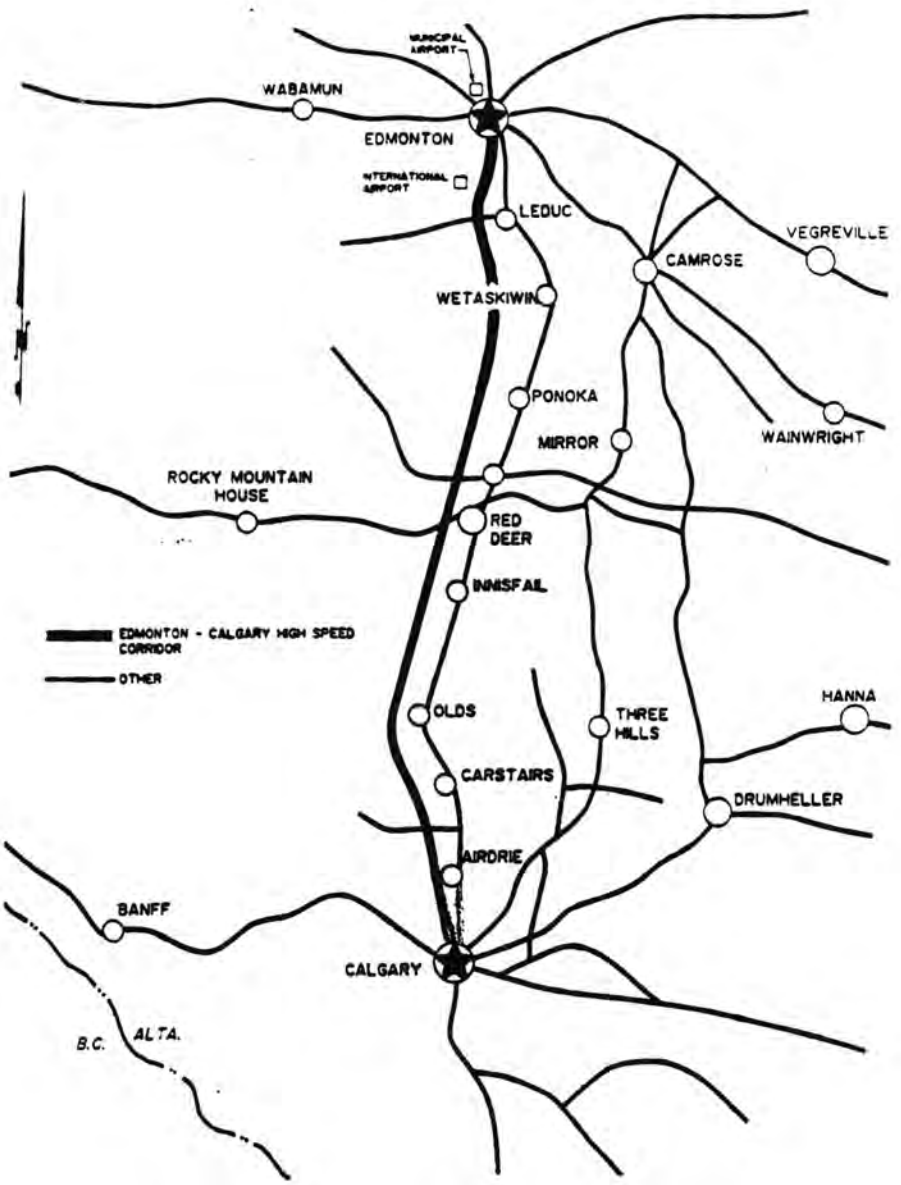
	BUSINESS	NON BUSINESS	TOTAL
CALGARY DOWNTOWN	29.5%	20%	49.5%
CALGARY SUBURBAN	10.5%	40%	50.5%
EDMONTON SUBURBAN	16.5%	42%	58.5%
EDMONTON DOWNTOWN	23.5%	18%	41.5%
	80.0%	120%	200.0%

Note

1) Total is 200% since a passenger uses TWO stations on a one way trip, one at each end of the journey.

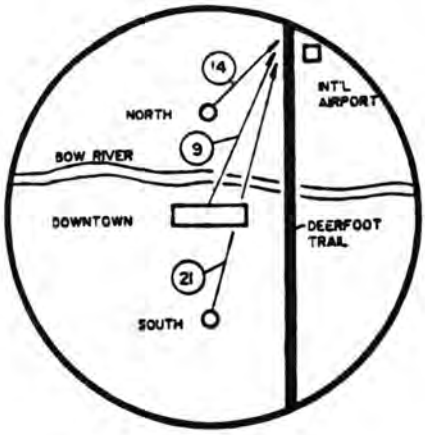
2) The above percentages should be applied to the daily TOTAL inter city volume, not the city of origin volume.

3) The total volume assumed is the week day (Monday to Friday) volume (weekend usages are different but less critical).



THE ALBERTA CORRIDOR

EXHIBIT 1



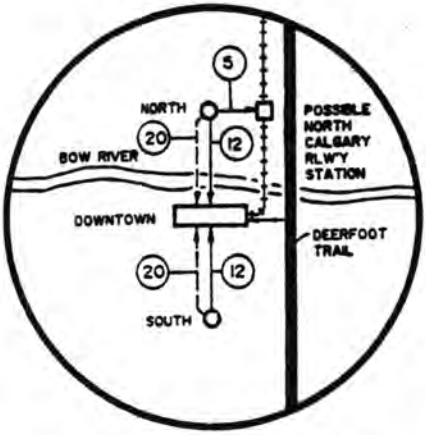
SUBURBAN ADD ON TO DOWNTOWN ACCESS TIMES

NORTH = 14-9 = 5 MIN. ADD ON
SOUTH = 21-9 = 12 MIN. ADD ON
AVERAGE ADD ON = 9 MIN.

(21) ACCESS TIME IN MINUTES
AUTO ACCESS

NOTE: Access to Calgary International Airport is assumed to be the same access to Calgary City Limits

ADD ON TIMES FOR AUTO AND AIR - CALGARY



(20) ACCESS TIME IN MINUTES
INTERCITY BUS
HIGH SPEED TRAIN
TRANSIT ACCESS
AUTO ACCESS (PARK 'N RIDE)

NOTE: The 5 minutes access to North Calgary Station allows for the reduced intown time to North Calgary vs. to Downtown from Edmonton.

ADD ON TIMES FOR RAIL AND BUS - CALGARY

EXHIBIT 2

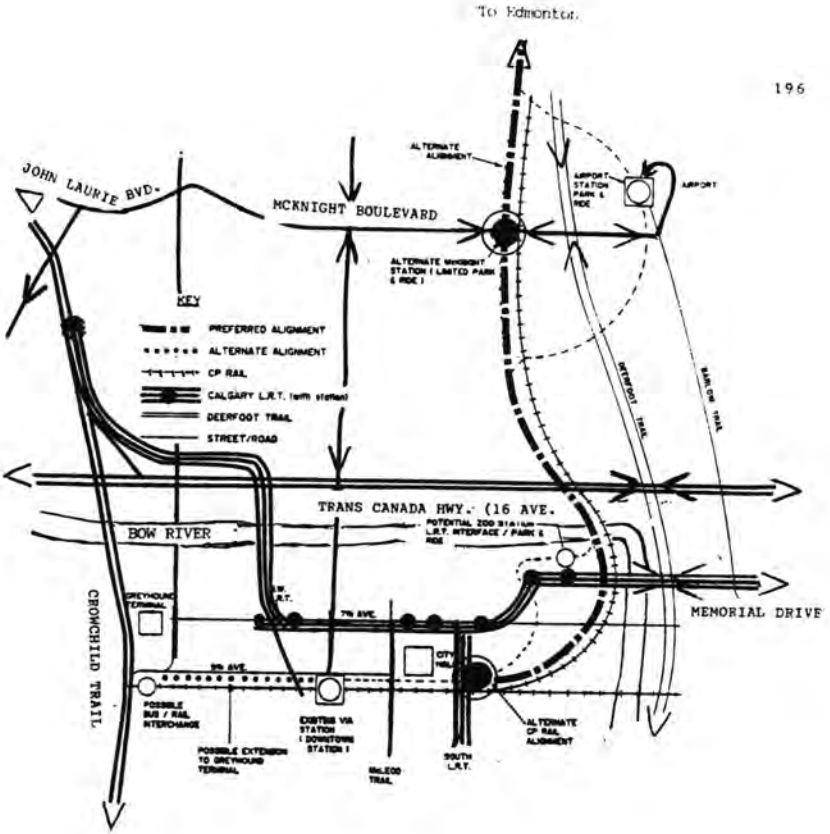


EXHIBIT 3

CALGARY DOWNTOWN ACCESS

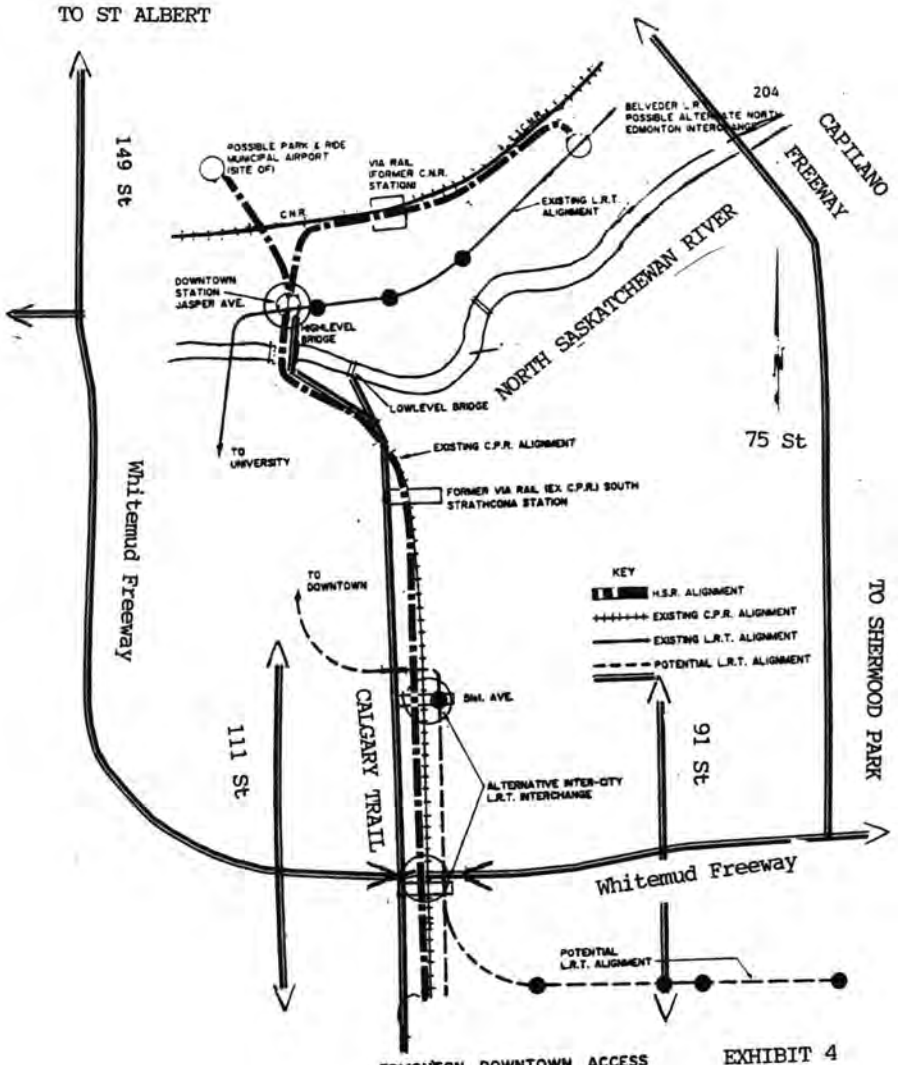

TO ST ALBERT
149 St
POSSIBLE PARK & RIDE MUNICIPAL AIRPORT (SITE OF)
VIA RAIL (FORMER C.N.R. STATION)
C.N.R.
EXISTING L.R.T. ALIGNMENT
BELVEDERE L.R.T. POSSIBLE ALTERNATE NORTH EDMONTON INTERCHANGE
204
CAPILANO FREEWAY
DOWNTOWN STATION JASPER AVE.
HIGH LEVEL BRIDGE
NORTH SASKATCHEWAN RIVER
LOW LEVEL BRIDGE
75 St
TO UNIVERSITY
EXISTING C.P.R. ALIGNMENT
FORMER VIA RAIL (EX. C.P.R.) SOUTH STRATHCONA STATION
Whitemud Freeway
TO DOWNTOWN
KEY
H.S.R. ALIGNMENT
EXISTING C.P.R. ALIGNMENT
EXISTING L.R.T. ALIGNMENT
POTENTIAL L.R.T. ALIGNMENT
TO SHERWOOD PARK
Bmt. AVE.
111 St
CALGARY TRAIL
91 St
ALTERNATIVE INTER-CITY L.R.T. INTERCHANGE
Whitemud Freeway
POTENTIAL L.R.T. ALIGNMENT
EDMONTON DOWNTOWN ACCESS
TO EDMONTON INTERNATIONAL AIRPORT
TO LEDUC

EXHIBIT 4

ACCESSIBLE TRANSPORTATION IN THE YEAR 2000?

Mary Anne Mounce
The MERLIN Group

INTRODUCTION

On a pleasant but hot August morning in the year 2000, Margaret James waited expectantly for the buzzer ring that would signify the arrival of her accessible taxi to take her to Pearson Airport. Now 35 years of age, Margaret had been confined to a wheelchair since she was 19, when a car accident had given her a severe spinal cord injury. The years immediately following her accident had been very difficult for Margaret; but finally she had taken some computer courses through the Neil Squire Foundation (a non-profit organization specializing in assisting severely disabled people to increase their employability through the acquisition of computer skills). She had then succeeded in finding a part-time job doing data entry and analysis with a research firm, The Merlin Group. While still requiring some limited daily nursing attention, Margaret was relatively independent, especially in comparison to her situation in the years immediately following the accident. Now she was in a position to take a brief holiday in Washington, financed by her own earnings. She would stay with a friend there whom she had met at an international conference in Vancouver, Independence '92. The two girls faced similar difficulties and had managed to stay in touch during the intervening 8 years. "It will be great to see Joan again" mused Margaret, and just then the buzzer sounded.

The taxi driver was friendly and his manner signified that he was very used to dealing with people in Margaret's situation. He took her small suitcase and headed towards the taxi to make sure that her wheelchair could easily enter the small lifting device on the passenger side of the vehicle. While holding the door open for her, he watched for vehicles on the street which might not have noticed his flashing light. When Margaret was settled and her wheelchair securely fastened down he carefully closed the door and got into the driver's seat. During the drive to the airport he ascertained with which airline she was flying and, upon arrival, made sure that she and her luggage were in the appropriate check-in line. When Margaret reached the check-in counter, she handed the

Air Canada representative her ticket and ID Card. The agent glanced at her file on his computer screen and commented:

> "I see you were contacted yesterday about your special requirements during this trip."
> "Yes," said Margaret "and nothing has changed since then."
> "Fine," said the agent "if you proceed to Gate 16, an Air Canada representative will meet you there and help you board the aircraft."

At Gate 16 the Air Canada representative smiled brightly at Margaret and assured her that she would be boarding the aircraft within a couple of minutes. The airline representative took the opportunity to confirm with Margaret that she would be met at the Washington airport by a friend.

> "Yes," said Margaret "and she is in a wheelchair as well."

After checking that the two had identified an appropriate meeting site in the airport, the Air Canada representative wheeled Margaret up the passenger loading ramp and assisted her to get into her seat in the aircraft. Her wheelchair was stored in a forward compartment of the plane. In no time Margaret was comfortably settled in her seat and then the other passengers started to embark.

Margaret's flight to Washington was uneventful. When she pressed the button to attract the attention of the stewardess, she was assisted to the washroom in her wheelchair and assisted back to her seat afterwards. The amount of assistance which she needed to do this had been previously discussed in the pre-flight telephone inquiry from the airline which had occurred the day before the flight. During the flight Margaret's needs were met with a minimum of questioning by airline staff. Her identification number on her computer reservation file, combined with the previous day's telephone interview assured airline personnel that she was entitled to some special services while travelling. The recent telephone interview ensured that nothing significant had altered in her situation which would have necessitated different services from those which were associated with her identification number.

In the Washington airport an Air Canada official saw Margaret through to the baggage pick-up area. He also took that opportunity to confirm her return flight to Ottawa two days hence. Margaret spotted her friend, Joan, waiting for her in her wheelchair near the exit door of the arrival level. The two friends greeted each other warmly and turned their chairs to go out the exit door. Joan commented that she hoped they would be

able to get an accessible taxi to take them to her apartment. She had attempted to arrange this earlier but had been told that the accessible taxis were in very short supply and she might have to wait. The first accessible taxi to arrive, after a half hour's wait, was only equipped to accept one wheelchair. The driver gruffly informed the two girls that it was very unlikely that they would be able to get a taxi that could take both of them at the same time. While the girls were debating what they should do, the driver slammed the door and proceeded forward to accept a regular fare. The two girls found a commissionaire and asked for his suggestions. He told them that an accessible mini-van should come by the arrivals door in approximately an hour's time. The two girls went back inside the airport and stationed their wheelchairs where they would be out of the way of busy travellers. Margaret tried hard not to think about how tired she was and how much she would like to use an airport washroom.

The accessible mini-van was half an hour late. The driver seemed pre-occupied with other matters and was not particularly pleasant or helpful in securing the two wheelchairs inside the van. He deposited the two girls on the sidewalk at the entrance to Joan's apartment, accepted her payment and left without ascertaining how they would get themselves and Margaret's suitcase up to Joan's apartment.

Fortunately, Joan's mother was now at the apartment and helped the girls. When they were finally settled in the small living room of the apartment, Margaret made a few tentative comments about the difficulties they had encountered in obtaining transportation from the airport to Joan's apartment. She had been surprised at how problematic this had all been, especially when she compared it to the treatment she was used to receiving at home. Margaret started off by saying:

> "Joan, when I first met you at the Independence '92 Conference in Vancouver, the *Americans with Disabilities Act* had quite recently been passed. You and many of your comrades were excited about the progress that this, and other regulatory initiatives, signified for persons with disabilities. In Canada, we did not have a high-profile legislative initiative to protect and enhance our opportunities. I recall regretting this fact. However, the treatment that you and I just received at the airport is definitely inferior to what I am used to back in Canada. Is this just an isolated incident, or is it indicative of the kind of services available for the transportation of persons with disabilities?"

Joan grimaced and shook her head sadly.

> "What you have seen today is not unusual. In the early days of the ADA, there was great enthusiasm for the opportunities that could be made available to persons like ourselves. However, the passing of the legislation coincided with the worst recession we have experienced in recent US history. The government officials became more strident in their demands that carriers meet the requirements stipulated in legislation and regulations. Carriers became upset that they were being forced to undertake expensive modifications and services at precisely the time that their very existence was in jeopardy. A situation characterized by frustration and animosity ensued. More recently, the economy has picked up and the surviving carriers are enjoying improved financial performance. However, the animosity which developed due to their perception of being forced to undertake expensive changes has eased only somewhat. What was very apparent is that carriers can be forced to modify equipment and provide specific services, but it is difficult, indeed, to force them to do so while presenting a positive and helpful attitude towards travellers with disabilities. It is very difficult to legislate attitude."
>
> "That's fascinating," commented Margaret "perhaps, after all, our less-dramatic approach at home is in fact preferable. While we lack a high-profile piece of legislation, government officials have managed to negotiate compromises with passenger transport providers. The situation is not perfect; but we have made steady gains."

COMMENTS

The above description makes several points. Initially, it should be noted that the Royal Commission on National Passenger Transportation proposed that persons with disabilities be provided with an identification system for purposes of travel. This system, the details of which were to be worked out in consultation with organizations representing persons with disabilities and passenger transport providers, was intended to provide a convenient method of establishing the entitlement and special needs of travellers with disabilities. During the public hearings in 1990, the Commission had heard extensively from organizations and individuals representing persons with disabilities. One consideration that had emerged from these representations was that persons with disabilities

resented the embarrassment and inconvenience of being questioned repeatedly by transportation personnel about their particular entitlements and special needs. In response to these concerns the Commission recommended the development of the above mentioned identification system. With emphasis on the utilization of existing computer based systems, and careful consultations with the affected parties, a workable system could certainly emerge. The above story is intended to provide an example of how the system might operate.

More fundamentally, however, the above story is intended to illustrate the differences in approaches to the needs of travellers with disabilities which have been taken in Canada and in the United States. The American approach has been characterized by detailed legislative and regulatory specification of equipment and services that must be provided by carriers for persons with disabilities. The Canadian approach rests upon a less detailed legislative framework. A few words in the *Canadian Charter of Rights and Freedom*, the *Canadian Human Rights Act*, and the *National Transportation Act, 1987*, form the legislative basis for the Canadian response to the needs of travellers with disabilities. The National Transportation Agency has had to accept a fairly slow rate of change in accessibility modifications. The Agency's approach has been characterized by a dogged determination to continue drafting regulations, negotiating with carriers and with organizations representing persons with disabilities, and lobbying senior officials inside the federal bureaucracy. At the political level, commitments to improvements in transportation accessibility have been frequently touted but less frequently acted upon, partially due to the precarious financial situation of many Canadian passenger carriers. All in all, the unspectacular, consultative approach taken by Canada may well result in better transportation accessibility for persons with disabilities than has the much more dramatic approach pursued south of the border.

CAN WE GET THERE FROM HERE?

The description of Margaret's relatively hassle-free trip within Canada may be overly optimistic; but it certainly presents a scenario that is worth aiming for. It is not the case at the present time that travellers with disabilities can access the various modes of passenger transportation within Canada in the manner described in the Introduction to this paper. The Human Rights Commission and the National Transportation Agency have received numerous complaints about a wide variety of problems which travellers with disabilities have encountered in their attempts to

gain access to the many cultural, educational, vocational, and commercial facilities which most Canadians take for granted.

The Royal Commission on National Passenger Transportation (RCNPT) held public hearings across Canada, between August and December of 1990. The Commission also accepted telephone briefs and written submissions from Canadians interested in commenting on passenger transportation issues. Of all the organizations and individuals heard from, those representing the needs of persons with disabilities were among the most numerous. Subsequently, the National Transportation Act Review Commission also sought submissions and representations from parties interested in the impacts of the *National Transportation Act, 1987*. Again, organizations and individuals representing the interests of persons with disabilities made the effort to present their views. At the time of writing, the report of the National Transportation Act Review Commission has not been made public;[1] however, it seems likely that it will come out in general agreement with the recommendations of the RCNPT. In both instances, the Commissioners were placed in a highly challenging position, from a policy perspective. On the one hand were the rights of Canadians with special needs which historically have not been generously treated. A clear opportunity was available to right a historical wrong, be on the side of angels, and respond to the briefs, submissions, and representations which both Commissions had received in significant numbers. On the other hand were the concerns of governments, who are desperate to reduce their burgeoning deficits, and Canadian carriers, many of whom were in precarious financial situations. This was a policy issue which had not been solved because it truly required senior-level decisions concerning trade-offs in the interests of important and socially-significant interest groups. The issue indeed merited the attention of a Royal Commission.

The final report of the RCNPT proposed 12 recommendations relating to transportation accessibility.[2] These recommendations represent a compromise between the positions discussed above and, while it is entirely reasonable to disagree with this particular compromise, most informed observers agree that it was essential to identify some sort of middle ground between the competing interests in this issue. The Commission's mandate, given to it by the government, directed it to propose general policy directions to take Canada into the 21st century in passenger transportation.

In line with this mandate, it proposed some general recommendations in this area. The following are two key policy recommendations.

- Travellers with physical or mental disabilities have opportunities similar to those enjoyed by all Canadians to use public passenger transportation.

- Governments establish a goal that all travellers in Canada have access to public transportation in a safe, reasonably comfortable and dignified fashion, irrespective of physical or mental ability.

It is useful to note what these recommendations do not say. For instance, they do not propose absolute "equal rights". Rather, they suggest that similar opportunities should be enjoyed by all Canadians. They also direct that a suitable goal for governments is that persons with disabilities have "reasonably comfortable and dignified" access to transportation services. This wording encourages a considerable degree of improvement in the existing situation; but does not present the unreasonable goal of perfect equality. No matter how much well-intentioned individuals may wish for equality, it must be accepted that many persons with disabilities will never be able to enjoy many aspects of daily life as fully as could be wished. No amount of legislation can change this reality. Furthermore, setting unrealizable goals and rights simply creates a multitude of court challenges and appeals to regulatory bodies which will, ultimately, benefit lawyers and dissipate the energies of persons with disabilities and their representatives. Their limited resources should be conserved for negotiations with governments and carriers to arrive at feasible and appropriate improvements which will promote transportation accessibility.

Lest the impression be left that the Royal Commission confined itself entirely to policy directions, it should also be pointed out that it proposed some specific actions for consideration. The following are a few specific recommendations.

- Carriers and providers of infrastructure begin now to ensure that their specifications for new equipment and infrastructure will provide people with disabilities with continuing improvements in accessibility to their services. They should also implement, where practicable, retrofitting programs for their equipment and infrastructure.

- Through consultation among groups representing people with disabilities, carrier associations and the National Transportation Agency, a mechanism such as a coded identification card system be devised that would indicate quickly to carrier personnel the kinds of services needed by each traveller with a disability, including whether or not the traveller requires an attendant for safety or other reasons.

- Provincial and territorial governments implement more-uniform and adequate minimum accessibility standards for buses for travellers with disabilities, or, if that does not occur, the federal government take back its delegated responsibility for nationally applied accessibility standards in order to ensure more uniformity.

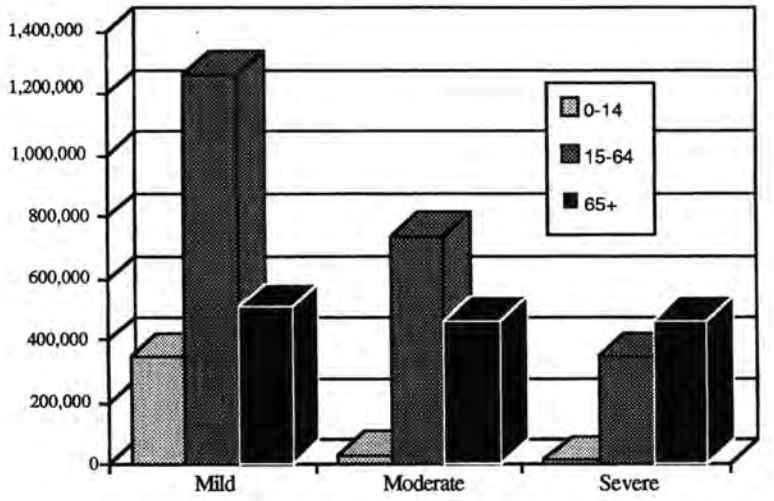
These recommendations are somewhat more specific than many offered by the Commission, which generally aimed at providing a framework for policy, rather than specific recommendations of a tactical nature. These actions were suggested because Commissioners were underwhelmed by the rate of progress on accessibility issues to date. However, it should be noticed that a great deal of emphasis is placed on reaching a negotiated agreement rather than government-imposed solutions. Like any compromise, the Commission's position is vulnerable to criticism from all sides. Only time will tell whether the gentle art of negotiation and compromise will prove to generate the changes which should occur in order for persons with disabilities to be able to participate more fully in Canadian life.

WHAT WILL NOT HAPPEN

The issue of transportation accessibility will not disappear in the near future. Demographic trends suggest quite the opposite. While transportation accessibility is far from a "seniors issue" the Canadian population is aging and the rate and severity of disability increase with age. In the longer term, the absolute number of Canadians who are over 65 and have a disability will substantially increase and this likelihood cannot be ignored. Figure 1 shows how the rate of severe disability increase with age and, also, that by far the largest number of Canadians with disabilities fall into the age group from 15 to 65.

Figure 1

DEGREE OF DISABILITY BY AGE GROUP



SOURCE:
The MERLIN Group with data from Statistics Canada's Health and Activity Limitation Survey, 1991

Another reason that the transportation accessibility issue will continue to demand attention by governments is that expectations have now been raised to a high level within the community of people who have a disability or who represent those who do. Events such as the Royal Commission, the NTA Review Commission, and the recent public inquiry by the National Transportation Agency into the accessibility of extra-motor coaches have asked for input from individuals involved in accessibility issues. These individuals and organizations have made enormous efforts to present their positions on these difficult policy issues. They will expect to see significant progress and are now well politicized so that they will make their disappointment clear if the future does not include substantial progress.

CONCLUSIONS

The number of Canadians with disabilities in age groups characterized by high travel demand is substantial and likely to increase as the "baby boom" ages. The much-publicized current financial difficulties of many Canadian carriers suggests that it is unrealistic to impose major expenditures upon them in order to render their current passenger services fully accessible. Between the just demands of individuals whose well-being and contribution to their society is being limited by inaccessible transportation services and the financial constraints of Canadian governments and carriers, a compromise must be negotiated which is fair to all parties. This is an enormous and important challenge.

It is much more than a semantic—not to mention grammatical—nicety that the term "the disabled" is, at the request of many thoughtful people, being replaced by "persons with disabilities." It is right that the emphasis should be placed upon the person (who happens to have a disability). The only term that is more unfortunate than "the disabled" is "the disabled community," which suggests two completely incorrect possibilities: first, that there is a monolithic group involved when, in fact, the range, needs and types of disabilities are very diverse; and, second, that this "community" is in any way dysfunctional when, in reality, it is strong and influential, as demonstrated by the impressive briefs and presentations that its various members are able to assemble for occasions such as the Review of the National Transportation Act and the Royal Commission on National Passenger Transportation.

A great deal of time and effort could be expended on refining and adding to existing legislation. However, it now appears that the legislative base is sufficient to allow for substantial progress. At the federal government level the two key actors in the transportation area are the National Transportation Agency and Transport Canada. Both have established advisory groups with diverse representation from many of the stakeholders. These advisory groups must have adequate resources with which to perform their very essential duties and should be consulted to determine their views on current resource levels. Because attitudes are so important in this area, solutions must be acceptable to the different parties affected. Consequently, consultation and negotiation should be given the best possible opportunity to improve transportation accessibility.

The Canadian section of the scenario presented in the Introduction is certainly within grasp. It would be immensely satisfying to be able to demonstrate that Canadian compromise can indeed produce the progress which is so fundamental to our social development.

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[1]The report of the National Transportation Act Review Commission is due to be Tabled in the House of Commons on March 9, 1993.

[2]see Chapter 9 of the Final Report of the Royal Commission on National Passenger Transportation, Directions, pp. 195 - 213.

The Extent to Which Congestion Acts as a Barrier to Goods Movement Within Ontario

Bill Raney

Ministry of Transportation, Ontario *

The Ministry of Transportation, Ontario (MTO) has conducted a number of economic corridor studies to evaluate the impact of improved transportation infrastructure on future economic and social development. As part of these studies, a number of interviews were conducted with individuals that used the highway system to transport their goods. Most users interviewed, even those located outside the Greater Toronto Area (GTA), felt that congestion in the GTA was one of the most significant problems of the existing system. In fact, many users located outside the GTA felt GTA congestion was more of a barrier to the movement of goods than were any infrastructure limitations found in their area.

The purpose of this paper is to quantify the extent to which congestion is a significant barrier for the movement of goods through the Greater Toronto Area, compared to the movement of goods on a corridor outside the GTA - the Queen Elizabeth Way (QEW) in the Niagara region. To measure congestion, this paper uses actual truck speeds as the criterion for determining the level of congestion; the lower the truck speed, the higher the level of congestion.

Methodology

For the purpose of this analysis the GTA extends from the Thickson Road and Highway 401 intersection in Oshawa, to the QEW and Trafalgar Road intersection in Oakville. The specific GTA express highway network of Highway 401, Highway 427, and QEW is illustrated in Figure 1. Another express route through the GTA is possible using Highway 403 rather than Highway 427. However,it is 5 kms longer and most drivers do not use this route. Thus, for this analysis, it was assumed that all drivers used Highway 427 through the GTA.

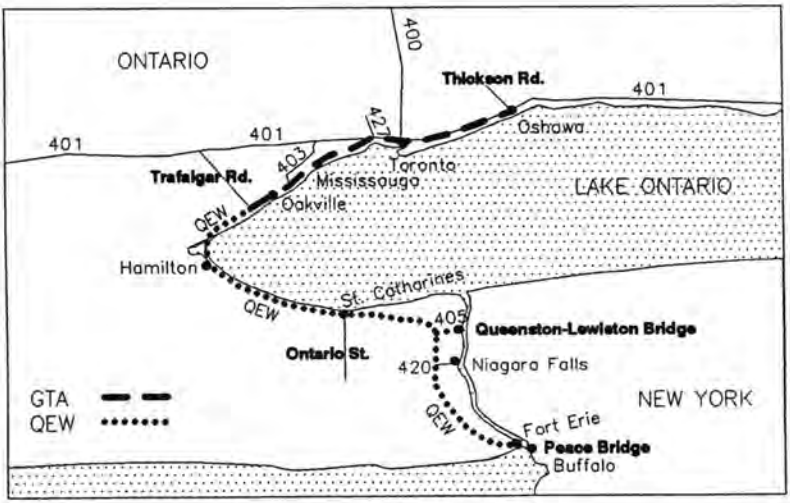
Originally it was intended that the GTA would be segregated into three separate sections. However, it became apparent once the analysis was started that this was not practical. The effort required to obtain accurate speed data for the shorter segments was prohibitive.

* The views expressed are those of the author and not necessarily those of the ministry.

The QEW portion of the analysis extends from the Trafalgar Road and QEW intersection in Oakville to one of three locations; the intersection of the QEW and Ontario Street in St. Catharines, or to the Queenston-Lewiston Bridge, or to the Peace Bridge. These possible truck routes are also shown in Figure 1.

Figure 1

Study Area



The distance for each of the truck routes evaluated is shown in Table 1 below.

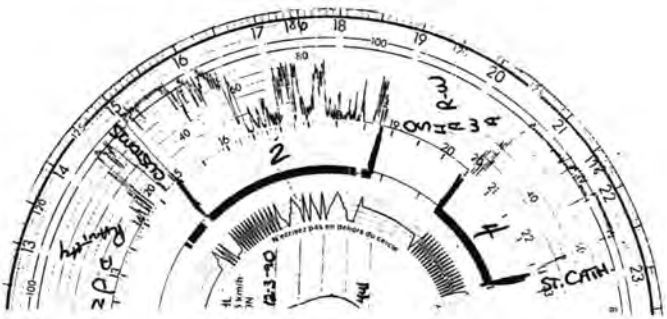
Table 1

Truck Route Distances

GTA Corridor	**Kms**
QEW & Trafalgar Rd. in Oakville to Hwy 401 & Thickson Rd., Oshawa	90
QEW Corridor	
QEW & Trafalgar Rd. in Oakville to QEW & Ontario St., St. Catharines	70
QEW & Trafalgar Rd. in Oakville to Queenston-Lewiston Bridge	90
QEW & Trafalgar Rd. in Oakville to Peace Bridge	120

To determine actual truck speeds, tachograph cards were obtained from a representative carrier operating in the study area. Tachographs are mechanical devices that record among other things, actual miles driven, driving time, non driving time, time of day and speed. The driver places a tachograph card similar to the one shown in Figure 2 in the tachograph at the beginning of the trip. At the end of the trip the tachograph card is removed, trip highlights are recorded and the card is given to office staff for analysis. Tachograph cards provide truck operators with valuable information for improving productivity and controlling costs, and have been used as evidence in accident investigations.

Figure 2



- This tachograph card shows the Oshawa bound trip leaving the Queenston-Lewiston Bridge at 14.95 hrs. The QEW segment of the trip (first 90 kms) is completed at 15.92 hrs for an average speed of 92.8 kms/hr. The tachograph distance for the GTA segment of the trip is 96 kms. The trip ends in Oshawa at 18.93 hrs for an average speed of 32.9 kms/hr.
- The return trip leaves Oshawa at 20.48 hrs and arrives in St. Catharines at 22.60 hrs with an average speed of 84.0 kms/hr on the GTA segment of the trip and an average speed of 90.7 km/hr on the QEW segment of the trip.

In this analysis, tachograph cards for 576 weekday trips through the whole study area were examined. There were 341 trips from the Niagara region to Oshawa, and there were 235 trips from Oshawa to the Niagara region. Each trip analyzed involved driving through both the GTA and QEW corridors. Distance travelled and actual driving time were obtained from the tachograph cards. Non driving time was excluded from the speed calculations. In order to segregate a trip into GTA and QEW segments, actual known distances between points were used to determine the distance for the first portion of a trip. For example, the actual distance for the GTA portion of a trip between Oshawa and Oakville is 90 kms. The GTA speed was calculated by using the time taken to complete the first 90 kms of the trip as determined from the tachograph card. The QEW speed was then calculated by using the time taken and distance travelled as recorded on the tachograph card to complete the remaining portion of the trip.

In some cases, due to an incorrect calibration of the tachograph, there were minor variations between actual known distances and recorded tachograph distances. Thus, although the average speeds are correct, there may be a small difference between what is included in the GTA or the QEW for different trips. A related problem results because tachographs record distance using very small, fine lines. This makes it difficult to determine tachograph distance with exact precision. However, these problems are probably not too serious given the length of the segments evaluated. It would be much more problematic if shorter distances had been analyzed. Another limitation of the study that should be noted is the time frame. The study might not accurately reflect the congestion facing today's truckers because the tachograph charts analyzed were for trips that occurred from July 1990 to March 1991.

Results

Overall Comparison Between QEW & GTA

As can be seen in Table 2, there is a 9.9 km/hr difference between average speeds on the QEW of 92.2 kms/hr compared to average speeds of 82.3 kms/hr through the GTA. Judging from averages, congestion does not appear to be a serious problem for either the QEW or the GTA. In fact, as shown by the maximums, some drivers are able to go through the GTA and along the QEW at average speeds above the speed limit.

Table 2

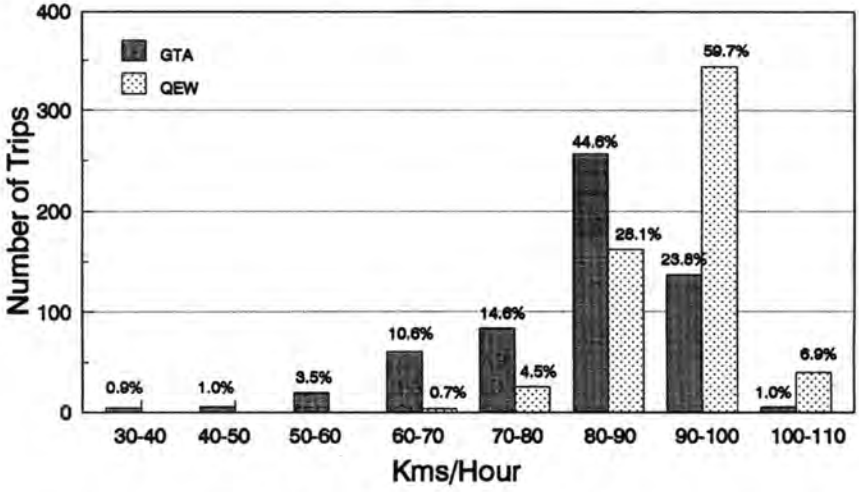
Average Speed Comparison between QEW and GTA (Kms./Hours)

	GTA	QEW
Average Speed	82.3	92.2
Standard Deviation	11.9	6.6
Minimum	32.9	64.8
Maximum	104.7	107.8

However, there is a wide variation in speeds, particularly in the GTA, ranging from a low of 32.9 kms/hr to a high of 104.7 kms/hr. On the QEW, average speeds are a bit tighter ranging from 64.8 kms/hr to 107.8 kms/hr. This tighter distribution is also reflected in the standard deviation calculation for the QEW. Not until a distribution of average speeds is plotted, as is done in Figure 3, does a potential problem appear.

Figure 3

Distribution of Speeds on GTA and QEW



Slower speeds are a problem for a number of drivers in the GTA, with more than 16% of the speeds falling below 70 kms/hr. Slower speeds on the QEW are not nearly as significant, with only 0.7% of the trips with an average speed of less than 70 kms/hrs.

Comparison Between Rush & Non-Rush Hours

Even more revealing information is gathered when the data is examined by the time of day. Appendix 1 shows the average speeds broken down for each hour of the day for the GTA and the QEW in both the Niagara bound and Oshawa bound directions.

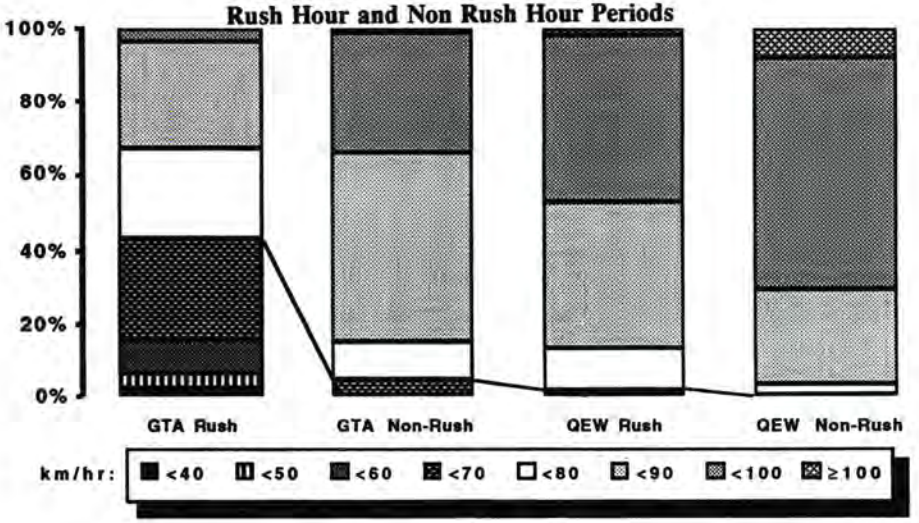
Patterns began to emerge from this data when the day is broken into rush hour periods and non rush hour periods. For the purpose of this analysis, trips beginning between 6 a.m. and 9 a.m. are considered to take place in the morning rush hour, while trips beginning between 3 p.m. and 6 p.m. are considered to take place in the afternoon rush hour. There is a potential weakness to this approach, because trips starting just before the designated rush hour period will be completed in the rush hour period but will not be considered as a rush hour trip. Trips starting near the end of the rush hour period that will be completed after the rush hour period will still be considered to be rush hour trips. Nonetheless, despite the apparent weakness of this approach some interesting results are obtained, as shown in Table 3.

Table 3
GTA & QEW Rush Hour Comparison
(Kms per hour)

	GTA		QEW	
	Non Rush Hour	Rush Hour	Non Rush Hour	Rush Hour
Average Speed	86.7	72.3	92.8	89.1
Standard Deviation	8.0	13.3	6.2	7.8

There is only a 3.7 km/hr difference between rush hour periods and non rush hour periods on the QEW. However, in the GTA there is a much wider gap of 14.4 kms/hr between rush hour and non rush hour speed. It would appear from Table 3 that congestion as a barrier to the movement of goods, primarily occurs in the GTA at rush hour periods. There does not appear to be a serious problem at any time on the QEW corridor outside the GTA, and there does not appear to be a serious problem even within the GTA at non rush hour times. This conclusion is illustrated further in Figure 4 which shows the distribution of speeds in the "Rush" and "Non Rush" hour periods. Over 40% of the trips in the GTA that occur during the rush hour are at average speeds below 70 kms/hr. This compares to less than 5% of the trips with an average speed below 70 kms/hr for the GTA non rush hour, for the QEW non rush hour, and for the QEW rush hour.

Figure 4
GTA & QEW Distribution of Speeds in Rush Hour and Non Rush Hour Periods



When the rush hours are analyzed by morning and afternoon periods as is done in Table 4, it can be seen that slower average speeds occur in both the QEW and GTA in the afternoon period. The average speed is 6.8 km/hour lower in the GTA, and 4.8 km/hr lower in the QEW in the afternoon rush hour period.

Table 4
Comparison Between Morning & Afternoon Rush Hours (kms per hour)

	Morning Rush Hour	Afternoon Rush Hour	Non Rush Hour
GTA			
- Average Speed	76.7	69.9	86.7
- Standard Deviation	11.9	13.4	8.0
QEW			
- Average Speed	92.1	87.3	92.8
- Standard Deviation	6.3	8.1	6.2

Comparison by Direction of Travel

There do not appear to be any significant differences between the Oshawa bound and Niagara bound directions of travel as illustrated in Table 5.

Table 5
Comparison by Direction of Travel (kms/hour)

	Oshawa Bound	Niagara Bound
GTA		
- Average	82.7	81.9
- Standard Deviation	12.2	11.4
QEW		
- Average	91.6	93.0
- Standard Deviation	6.0	7.4
Total		
- Average	86.4	86.6
- Standard Deviation	8.4	8.5

When direction of travel is analyzed by morning and afternoon rush hour periods, as is done in Table 6, some significant differences become apparent.

Table 6
Direction Comparison by Rush Hour Periods
(kms/hour)

	GTA (kms/hour)		QEW (kms/hour)	
	Oshawa Bound	Niagara Bound	Oshawa Bound	Niagara Bound
AM rush hour	80.1	**74.6**	90.8	93.9
PM rush hour	**70.7**	**67.4**	90.5	84.2
Remainder of the day	87.4	85.7	91.8	94.4

Although the afternoon rush hour in the Niagara bound direction on the QEW is a bit slow, there does not appear to be a significant problem on the QEW when analyzed by direction of travel or time of day. However, when the GTA average speeds are examined, it can be seen that Niagara bound trips are slow in both the morning and afternoon rush hours. In the Oshawa bound directions, it is only in the afternoon rush hour period that a significant problem seems to occur. This conclusion is illustrated further in Table 7 below.

Table 7
Percent of Trips with Average Speed
Under 70 kms/hour

	GTA (kms/hour)		QEW (kms/hour)	
	Oshawa Bound	Niagara Bound	Oshawa Bound	Niagara Bound
	(%)	(%)	(%)	(%)
AM rush hour	13.0	**35.1**	0.0	0.0
PM rush hour	**48.8**	**59.3**	0.0	6.5
Remainder of the day	4.7	4.1	0.3	0.5

Observations

If a driver was able to avoid the rush hour periods in the GTA, the following time savings could be achieved for the GTA portion of the trip:

- 11.3% or 14.4 minutes for the PM Oshawa bound rush hour
- 13.0% or 17.4 minutes for the PM Niagara bound rush hour
- 7.9% or 9.6 minutes for the AM Niagara bound rush hour

It would seem that truck operators could achieve substantial time savings if they could schedule their trips around rush hour periods. Although not always possible with "Just-in-Time" schedules, this in fact appears to have occurred to some extent with the carrier that was studied. It was necessary to over sample trips occurring in the rush hour period in order to get a sufficient number of observations for each hour of the day.

These results in conjunction with hourly costs could be used to determine the time costs of congestion. It is likely that other costs of congestion, such as extra fuel and maintenance costs, could be determined by using a methodology similar to the one described in this paper, but by using an on-board computer as the recording device instead of a tachograph. Moreover, a study using an onboard computer would enable the calculation of average speeds for segments within the GTA. It would then be possible to determine where the GTA bottlenecks occur. However, this is beyond the scope of this analysis.

Also beyond the scope of this analysis, but a study that could be undertaken from tachograph cards, is an analysis of average speeds by day of the week, by season or by driver. Impacts of weather or impacts of accidents on congestion could also be determined from an analysis of tachograph records.

Conclusions

Although there are some limitations of this tachograph analysis, some interesting and useful results have been obtained. The analysis confirms the highway users' observations, that congestion as a barrier to the movement of goods is a much more significant problem in the GTA than in the outlying areas. The analysis confirms the need to improve the express highway network for an efficient movement of goods through the GTA. However, even within the GTA, the express highway network appears to be able to adequately handle the traffic in the non rush hour periods. Only in the rush hour periods is a significant reduction in average truck speeds observed in the GTA.

Acknowledgements

The author would like to acknowledge the assistance of K.Siwak, F.Naccarato, and M.Babin in developing and analyzing the database.

APPENDIX 1
AVERAGE SPEED BY TIME OF DAY AND DIRECTION

	GTA OSHAWA BOUND		QEW OSHAWA BOUND		GTA NIAGARA BOUND		QEW NIAGARA BOUND	
	Avg. Spd. Km/Hr	# In Range	Avg. Spd. Km/Hr	# In Range	Avg. Spd. Km/Hr	# In Range	Avg.Spd. Km/Hr	# In Range
00:00-01:00	84.5	8	94.3	10	89.2	12	93.2	6
01:00-02:00	90.0	6	97.8	8	92.5	12	98.4	12
02:00-03:00	93.6	12	93.4	10	88.0	7	96.7	12
03:00-04:00	88.4	8	96.6	18	89.5	4	96.7	7
04:00-05:00	92.4	17	95.9	10	89.6	4	98.4	2
05:00-06:00	86.5	17	94.2	16	86.5	5	91.4	6
06:00-07:00	82.2	13	94.4	6	72.0	8	95.3	4
07:00-08:00	78.6	6	86.1	5	62.3	6	93.8	6
08:00-09:00	75.6	4	90.9	10	78.7	23	93.1	6
09:00-10:00	82.8	10	89.4	18	83.7	11	94.5	24
10:00-11:00	84.9	14	90.7	17	81.4	10	93.6	11
11:00-12:00	86.9	18	88.9	12	84.6	8	91.5	8
12:00-13:00	90.8	13	91.9	16	83.2	3	91.1	11
13:00-14:00	86.3	14	91.4	49	82.4	20	98.4	5
14:00-15:00	84.4	49	90.5	57	84.5	14	91.7	18
15:00-16:00	71.6	58	90.3	18	66.6	11	88.7	14
16:00-17:00	64.8	16	92.0	9	69.4	7	79.0	7
17:00-18:00	74.3	12	86.8	3	66.8	9	81.5	10
18:00-19:00	82.2	5	91.9	10	81.5	18	91.0	8
19:00-20:00	88.6	4	89.0	12	85.9	18	94.9	20
20:00-21:00	88.9	11	89.0	7	87.6	8	97.0	17
21:00-22:00	91.8	11	91.1	9	87.9	6	94.4	9
22:00-23:00	88.7	9	89.3	6	89.1	6	94.9	7
23:00-24:00	87.2	6	91.9	5	89.3	5	92.7	5

Beyond Highways: Developing Partnerships and British Columbia's Cycling Policy

by
Jordan M. Alexander
BC Ministry of Transportation & Highways[1]

Earlier this year, British Columbia's Ministry of Transportation & Highways (MoTH) released its Interim Cycling Policy:

> In keeping with the ministry mandate to provide an integrated, multi-modal transportation system in the province...cycle travel will be recognized as an efficient and healthy use of the provincial infrastructure (p.5).

This latest policy directive illustrates the continuing pivotal shift in transportation agencies worldwide to look beyond highways for answers to current transportation questions. Just as the automobile in the early 1900s was a driving force in the evolution of that era's transportation system, bicycles represent a major shift in transportation thinking from planning for the movement of cars to planning for the movement of people.

This paper traces the policy formation from inception to its present state. Through its evolution, the cycling policy for British Columbia passed through three major alterations due to consultations with cycling associations, ministry regional operations staff, and through the first provincial cycling conference. The discussion herein highlights the success of various agencies and government levels to address cyclist needs by building partnerships that can make cycling happen in BC.

A. IN THE BEGINNING

Connellan (1993) reports that there are over 70,000 bicycles in the Greater Victoria Area. On a continent where bike sales exceed automobile sales and various sources expect a doubling or tripling of bicycle commuters in the next five years, it is apparent that the bicycle is here to stay.

Cycling provides accessible and affordable transportation in these days of increased traffic congestion, high parking costs, and raised environmental awareness. It complements the existing transport network when proper linkages are provided. The increased public demand for safe facilities,

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[1] This paper represents the viewpoint of the author, and should not be construed as a poli or position of the Government of British Columbia.

combined with obvious health, economic and environmental benefits of cycling prompted the ministry to further investigate the cycling mode.

In British Columbia, as with many parts of North America, the increased profile of cycling is a strong trend reflected in many jurisdictions. Demands of cyclists have been felt at all levels of government. One of the chief challenges about bicycle transportation planning is the complexity of the issue, primarily due to the high degree of liaison and cooperation required with various levels of government and independent organizations.

Problems inherent to improving bicycle transportation include such issues as: education, funding, planning and design, and promotion elements, all of which require coordination between agencies. "Since bicycle transportation is a relatively new part of transportation planning [in North America], the experience in coordination and independent action is absent."[2] Agencies and government levels in British Columbia, however, have been able to develop a strategy to address cycling needs in the province without having the benefit of years of cycling experience.

A large part of the success of cycling is a result of the committed public support and cycling association input to the policy formation process, local and regional bicycle advisory committees and support at public events. The willingness of different levels of government to cooperate in cycling efforts explains the rest.[3]

The issue of cycling was first brought to MoTH via a municipal request. In 1989 at the Union of British Columbia Municipalities (UBCM), Resolution B57 was tabled which recognized the increasing popularity of cycling and the need for planning and design with cyclist safety being a primary consideration. The resolution read, in part, "that highways be constructed or upgraded recognizing bicycle usage and parallel safety requirements." Shortly thereafter, a formal policy review process began at MoTH.

B. LESSONS FROM AFAR

In searching for a starting point, MoTH's Transportation Policy Branch began to look at the experiences of other countries. The following section provides a brief outline of the role of cycling in other countries and provinces. The impact of the bicycle on transportation patterns vary. Applying the experience of others to British Columbia is limited due to differing structural and financial organization.

> In Europe, the number of bicycle owners has grown by 30% in 20 years. In the United States, more than one American in

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2 Mike Millar, Bicycle Transportation in Ontario, p.31

3 While numerous references are made throughout this paper to agencies and levels of government in British Columbia, the primary standpoint reflected is that from the Minist of Transportation & Highways.

> three rides a bike. That's 93 million cyclists, of whom 50 million are adults. Between 1983 and 1990, the number of adults who regularly use a bicycle has risen from 10% to 25%.[4]

Yet the number of countries that have formulated official cycling policies can be counted on the fingers of one hand. The Netherlands is one such place.

B. Verhooek, member of the project team for the Netherlands Ministry of Public Works Bicycle Master Plan outlines that:

> bicycle policy is not only the central government's concern. Regional and local governments especially have to recognize the necessity for bicycle policy, after all the construction of facilities is mainly their responsibility.[5]

Companies, recreation areas and shopkeepers, bicycle manufacturers and dealers, and pressure groups are all directly interested in good bicycle facilities.

Cycling advocates in BC recognize and agree with this multiplicity of interests, yet with federal direction absent, the various government responsibilities are unclear. Some would argue to apply the European experience to North America. This suggestion is often criticized because the success of European bicycle policy is largely a result of a welcoming European culture. Such policies are ineffective when imported to North America's auto-dependent society.

In Australia, the bicycle has been successfully integrated into policies of the various states, but cycling has not yet been given legitimacy by the Ministry of Transportation as a means of transportation equal to the automobile and mass transit.[6] Stepping from policy to action, Havana, Cuba, in one year, has transformed a city with over 2 million people where 30% of travel is now by bicycle. In Havana, 25 miles of bike-only lanes and pathways take over road space, new traffic regulations reduce speed limits and bike ferries traverse the bay and bridges have been built specially to accommodate cyclists.[7] Naturally the drive for Cuba to shift into fuel-free vehicles is not applicable for North America, however the case study does illustrate what can be done with fitting motivation.

Looking at North America, the U.S.A. has been very progressive in recognizing cycling as an alternate form of transportation. The states of Oregon, California, Minnesota and Washington provide excellent models for

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4 Robert Bovine, "The Bicycle: Constraint, Duty or Choice?" in Velo Mondiale Proceedings, p.16

5 Berco Verhoek. "Pilot projects in the Bicycle Master Plan of the Ministry of Transport, in Velo Mondiale Proceedings, p.270

6 Ibid, p.18

7 "Cuba's Bicycle Revolution," p.1

facility planning. Oregon, for example, has a comprehensive policy supported by a published Bicycle Master Plan and a Bicycle Advisory Group appointed by the State Governor. The state enjoys the benefits that come with over 20 years in the bicycle business. Here in British Columbia, cycling has not evolved for as long a duration. In Oregon, motorists and cyclists are well aware of each other and more apt to share the road.

Meanwhile in Minnesota, dramatic shifts in transportation policy have transformed the bicycle from being the subject of a powerful global vision to one of enthusiastic local action. Largely a result of funding provided through the federal Intermodal Surface Transportation Efficiency Act (ISTEA) 1991, Minnesota is transforming ISTEA's vision into reality with great success in its first year.[8]

In California as well, bicycle planning is coming into its own and becoming integrated with other transportation planning. Bicycle advocates have been making in-roads and receiving greater acceptability, much due to an increase in environmental awareness, air quality regulations calling for bicycles to be incorporated in transportation planning, and the new federal ISTEA legislation.[9]

Ferguson (1992) notes many paths to the successful development and implementation of statewide bicycle plans. Legalization of bicycle operations on streets and highways appears to be a consistent trend, but is not really critical to the adoption of a statewide bicycle plan. Funding, institutionalization, and citizen participation appear to be far more critical to the success of bicycle planning activities at the statewide level.

Funding:

Recent ISTEA (1991) legislation states:

> It is the policy of the United States to develop a National Intermodal Transportation System that is economically efficient, environmentally sound, provides the foundation for the Nation to compete in the global economy and will move people and goods in an energy efficient manner.

The Act allows states to obligate congestion management funds for construction of pedestrian walkways and bicycle facilities, and to carry out non-construction projects related to safe bicycle use. A high cycling profile has resulted in safe, marked bicycle routes in every major U.S. city and on many interstate highways (Bennett, 1982).

Just how much funding is available? ISTEA makes bicycle facilities eligible for National Highway System funds, authorized at approximately $3.6

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8 A Centre for Transportation Studies Symposium was held in February, 1993 in Minnesota wh focused on how ISTEA could be implemented to successfully accommodate cycling interests.

9 Ryan Snyder. "An overview of Bicycle Planning Efforts in California," in Velo Mondiale Proceedings, p.259

billion annually. Bicycle and pedestrian facilities are also eligible for Surface Transportation Program funds, authorized at approximately $4.0 billion annually. Of each state's Surface Transportation Program funds, 10% must be spent on one or more of ten separate transportation enhancements, one of which is bicycle facilities. Transportation enhancement funds are authorized at approximately $3.3 billion over six years.[10]

Many states were completely inactive in bicycle planning prior to the passage of ISTEA.[11] Two bursts of statewide bicycle planning activities are evident, the first in the early seventies, the second in the late seventies and early eighties. The passage of ISTEA has led more recently to an unprecedented increase in the number of states actively engaged in bicycle planning efforts.

Institutionalization:

P. Lagerwey (1988) states the importance of institutionalizing[12] bicycling in the decision making process. He argues that if only two people are working on bicycling issues, how can these people significantly improve bicycle safety and access?

It is interesting to note that in Oregon, the progression of accommodating cyclists clearly illustrates the benefit of institutionalization. A recent Department of Transportation reorganization sees bicycle management positions becoming redundant.[13] A functional reorganization of technical services, planning and design fields assumes integration of cycling services in current practices throughout the Department as a result of years of coordination and education. Accommodating cyclists is a regular way of doing business in Oregon.

It is clear that federal funding contributes to the success of cycling programs in the United States. The track record in the United States holds limited expectations for Canadian provinces. It is unlikely to replicate the U.S. experience without financial backing from Ottawa.

Closer to home, Alberta and Ontario provincial governments have both examined the role of cycling in their transportation systems. In Alberta, a map of cycling routes on the provincial highway system was produced by the Policy Development Branch (April 1989), and a "Safe Cycling" brochure was produced by the Traffic Safety Branch. Studies have been carried out by the Design Engineering Branch to accommodate cyclists on the primary

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[10] Eric Fergusson, Statewide Bicycle Planning in the United States, p.2

[11] Georgia Tech designed, implemented and analyzed results of 43 state transportation departments on the subject of bicycle planning and related activities in 1992.

[12] "Institutionalization" means that bicycle safety and access are automatically addressed all policies, projects, and programs, p.95.

[13] Telephone conversation with Michael Ronkin, Department of Transportation, Oregon: May 2 1992.

highway system and at intersections, however, Alberta does not have a provincial policy encompassing all these elements.

In Ontario, until the summer of 1992, the existing Ministry of Transportation (MTO) Cycling Policy (1981) did not recognize the bicycle as a legitimate form of utilitarian transportation for provincial travel patterns. The revised MTO cycling policy is similar to MoTH's interim policy in that both represent a significant shift in ministry thinking to: 1. consider the bicycle as a legitimate mode of transportation and legitimate user of provincial infrastructure; and 2. account for bicycles in the planning, building and upgrading of all provincial transport infrastructure.

The major difference between BC and Ontario is that Ontario has committed funding under the ministry road and transit programs to municipalities applying to build bike lanes, paths or other facilities. In British Columbia, the Revenue Sharing program considers funding cycling facilities only as part of a road improvement. For specific stand alone cycle projects, the program is still under review.

Considering the experiences of others, MoTH looked at ways to institutionalize cycling by incorporating it into the existing ministry structure. Citizen participation was also key in developing the policy.

C. WHAT, WHERE, WHEN & WHY? CYCLING AT THE MINISTRY OF TRANSPORTATION & "HIGHWAYS"

In order to successfully integrate cycling into the existing "system" a clear understanding of the ministry structure is necessary. MoTH is a large organization with nearly three thousand employees in specialized units. Planning and Major Projects, Highways Operations and Administrative Services are departments at headquarters, located in Victoria. Policy, programs, projects and procedures are planned and developed at this level. Technical leadership and standards are also provided by headquarters.

MoTH's six regional and 26 district offices carry out the policies and programs according to available resources. The bulk of operational matters are handled within each region with the closest public contact being the District Highways Manager. Any institutionalization of cycling into MoTH would have to incorporate this decentralized regional structure.

Making the Draft Policy:

It is a challenge to provide an all encompassing policy to accommodate every cycling interest. The needs of cyclists differ. Some cyclists need direct routes which facilitate quick travel and do not bring cyclists and pedestrians into conflict. Rails-to-Trails on the other hand appeal to recreation cyclists and stress the coexistence of many different types of users.

In trying to address key issues affecting all types of cyclists (i.e. safety, education, standards) the ministry began with an in-house interdisciplinary investigation. The Transportation Policy Branch, responsible for drafting new

and revising existing ministry policy, headed the investigation in order to coordinate efforts of different branches.

When activities are located in different departments, each department may establish its own "territory." When activities affecting cyclists are scattered among many departments, it may be more difficult to coordinate efforts, and duplication of efforts may also occur.[14] It was anticipated that having one branch responsible for coordinating efforts would produce a cohesive document reflecting solutions for activities within each ministry area.

The Draft Cycling Policy (February 1992) covered three main areas: a background look at current cycling practice in BC, a policy and planning section, and engineering standards and guidelines. The draft touched on some planning options such as route selection and bicycle advisory committees. The report summarized input from Major Projects, Highway Safety, Highway Maintenance, Highway Engineering, Transportation Policy and Highway Planning branches.

The initial review of cycling in British Columbia revealed that inconsistencies in policy as well as ad hoc implementation at the regional level proved inefficient to ministry practice and frustrating for users. The draft suggested that a comprehensive policy would address the concerns identified by the MoTH interdisciplinary team while moving ahead toward a proactive approach to transportation planning in the 1990s.

The draft policy provided a background rationale of why cycling was becoming an issue to be considered by the ministry and how cyclists could be accommodated by applying wider shoulder standards on the provincial infrastructure. The ministry philosophy behind the draft was quite progressive in that the intent of the brief document was clearly to recognize cyclists as legitimate users of the provincial transportation infrastructure. This philosophy remained consistent and appears in the current Interim Cycling Policy.

In favour of integration at MoTH, cycling would be a component in the duties of all employees. The Transportation Policy Branch was targeted to monitor integration, however all staff would address cycling within their area of expertise. Branches and regions would continue to undertake investigation of new and outstanding cycling issues, and cycling would be internalized in all project stages from planning and design through to construction and maintenance.

The draft clearly proposed that the accommodation of cyclists on the provincial infrastructure would best be met by constructing wider shoulders. Proposed highway standards would be incorporated on all new construction projects and would not address retrofitting issues. With these central directives under belt, it was time to ask a broader audience what they thought of MoTH's first proposal to accommodate cyclists. The intent was to

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14 E. Fergusson, Statewide Bicycle Planning in the United States, p.9

obtain input from knowledgeable user groups and other government levels who would be impacted by the proposed policy.

D. DRAFT CYCLING POLICY - ENTER BC STAKEHOLDERS

MoTH recognized at the formative stages that a general public consultation for the cycling policy would be necessary, however, a first run with "stakeholders" (i.e. those most directly influenced/affected by the policy) would be scheduled first.[15] This proved to be a prudent decision.

The contributions of Cycling BC[16] were critical both in the formulation of engineering standards with MoTH's Highway Engineering Branch, and in subsequent policy consultation. Cycling BC is a sport governing body whose responsibility is to develop and conduct programs for bicycle racing, recreation, safety and maintenance, bicycling as a means of transportation, and other related activities. The association works cooperatively with other community groups, agencies and organizations and relies heavily on volunteers.

Cycling BC and the Greater Victoria Cycling Coalition (GVCC[17])...added to the policy by pointing out omissions in the draft policy such as the 4E's of cycling: education, enforcement, engineering and encouragement. By contacting cyclists, the primary facility users, MoTH became more confident in the course selected to address cycling.

It is important to get views from municipal and regional governments because they will be responsible for providing facilities. Similar to Ontario's bicycling policy, municipalities in BC have a primary responsibility for planning, constructing and maintaining bicycle facilities as suggested in MoTH's Draft Cycling Policy.

Locally driven planning better accommodates the specific needs of an area. There is recognition that while the ministry policy applies to all of British Columbia, the diverse landscape of the province may reflect differing local needs. The commitment to cycling can differ between jurisdictions. A flexible approach is important as one municipality may prefer a single central path, while others may require a larger network. Route connectivity will reflect local needs.

Distribution of the Draft Cycling Policy to stakeholders took place in February 1992. The broad cross-section of stakeholders provided comments. Over 80% of those solicited responded with 60% providing in-depth detailed comments. While 85% of the respondents supported the general direction

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[15] A full list of stakeholders appears in Appendix A.

[16] Formerly the Bicycling Association of BC, Cycling BC is the provincial arm of the Canadi Cycling Association.

[17] The GVCC's purpose is to promote and improve conditions for cycling in the Greater Victc area by improving education and by facilitating communication between cyclists and governments.

the ministry was taking, several comments stated the policy did not go far enough to provide for cyclists.

Several comments could be easily integrated through revisions to the draft document. To make the policy more comprehensive for example, sections covering issues of education, enforcement, engineering and encouragement were added. Suggested revisions required additional research for some issues, such as the question of integrating versus segregating cyclists on the roadway. Additional public consultation via a provincial conference was suggested.

The planning committee for the conference comprised different ministries, government levels and agencies which satisfied another stakeholder issue that more interministry and interagency coordination was required to address cycling needs. At the same time planning for BC's first provincial cycling conference was underway, a parallel "education" component was being introduced to MoTH regions. An implementation perspective on the proposed policy was about to be realized.

Regional Road Shows:

In order to sensitize employees with respect to cycling issues, a brief presentation for MoTH employees was produced. The Policy Branch's "cycling road show" consisted of 80 slides introducing stakeholder comments on the draft policy and targeting headquarters policy development staff. The visuals covered all areas of project development from bikeway planning and design to construction and maintenance. This travelling road show introduced the needs and considerations of cyclists to employees throughout BC. In turn, regions and districts pointed out operational issues and possible implementation barriers which required further attention by headquarters.

While obvious climate differences exist in BC to significantly alter the cycling season, the road shows underlined how diverse the landscape really is. The applicability of engineering standards in the Kooteneys provided a key implementation concern. There are many kilometres of road with a rock face on one side and a 150 metre drop on the other. Adding a metre and a half shoulder to accommodate cyclists is quite difficult and costly. Attention to such issues is ongoing.

E. CYCLE BC '92 - FOCUS ON THE FUTURE BC'S FIRST PROVINCIAL CYCLING CONFERENCE

Input to the Draft Cycling Policy revealed cycling issues beyond MoTH's mandate for providing provincial infrastructure. Stakeholders revealed a larger cycling picture that required input and assistance from other ministries, government bodies and agencies.

Undertaking to accommodate cycling illustrates a challenge facing transportation professionals. The Transportation Association of Canada's May 1992 Bulletin discussed it: the urban mobility challenge. Simply put, we

are trying to find solutions to congestion with demand management[18], infrastructure upgrading and land use planning, however at the core of the problem is a fundamental institutional challenge; Many players trying to create a common vision for their urban area of the future. The bulletin states that common visions are the keys to future success and therefore "the fundamental challenge facing each Canadian urban area today is to create and agree on one common substantive vision of what its future urban area should be like and how it should function." (p.4)

This common vision was sought by conference organizers. The key objective of the "Focus on the Future" conference was to address the needs of cyclists by: providing up-to-date information from leading cycling authorities; establishing cooperation and communication among agencies that deal with cycling; and conducting workshop sessions to address issues of facilities, education and promotion of cycling in British Columbia.

MoTH entered into a joint sponsorship of the conference with the Capital Region and Greater Vancouver Regional Districts (CRD and GVRD respectively). Joint funding was the beginning of the cooperative effort. The CRD and GVRD were examining cycling through regional task forces as part of larger transportation studies to shape the future of each region. The task forces consist of different agencies (e.g. cycling associations, police, BCAA) and various levels of government. The regions provided strong support to MoTH's suggestion of a provincial conference. The conference provided an excellent forum in which solutions could be explored through the mixed audience of public, private and government representatives.

The steering committee consisted of MoTH, CRD and GVRD staff, the ministries of the Environment, Attorney General (Motor Vehicle Branch), Tourism and Culture, BC Transit, Cycling BC and the Greater Victoria Cycling Coalition. The varying perspectives brought together on the committee ensured the conference offered something for everyone and touched on a broad range of cycling issues.

Over 200 planners, engineers, environmentalists, politicians, and cycling advocates attended the conference. Participants worked together to flesh out an action plan to make cycling a more viable transportation option. William Hartley, MLA for Maple Ridge-Pitt Meadows said in the Legislature that:

> The first-ever provincial cycling conference was a great success. It is the way the provincial government wants to continue to work with the people of British Columbia.

Highlights of recommendations from the conference action planning session include creation of a provincial cycling coordinator; education strategies

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[18] Bicycle commuting is increasing and will continue to increase in the State of Washingto where the State legislature recently passed SSHB 1671, the Commuter Trip Reduction Act (CTRA), which requires a reduction of vehicle commuter trips. Components include for example the provision for safe bicycle parking and locker/shower facilities at destinat points, and employers of 100 or more people to develop plans to reduce the number of single-occupancy work trips (Parsons Brinkerhoff, p.7).

targeting adults, police officers, school teachers and bike couriers; improving existing road and path facilities; developing and promoting route destinations for touring cyclists; enhancing links with other transportation modes; and identifying ways to provide facilities for touring cyclists (e.g. storage, parking, showers, laundry).

As part of the conference follow-up, the original conference steering committee agreed to participate in a special task force to aid the coordination and implementation of the conference action plan. The post-conference team has identified agencies and tasks and will be working together to make them happen. The conference clearly concluded that resolving cycling issues in BC means different agencies all have roles to play. Accommodating cyclists will require continued partnerships.

Success at all government levels in BC contrast Millar's (1992) account of happenings in Metropolitan Toronto municipalities namely that "...cooperation between local municipalities and other agencies/departments is infrequent[19]". (p.40) That is not to say that every agency in BC has a well-defined role to play in the provincial cycling picture, but rather emphasizes the willingness of agencies to cooperate and improve cycling in the province.

F. NEXT STEPS - FUTURE DIRECTION

Actors are beginning to understand varying roles involved in accommodating cycling needs in BC. In certain circumstances one obvious solution exists; for others responsibility and solutions are less clearly defined. It is constructive that provincial agencies have the experience of successful partnerships to draw upon.

Partnerships will be called upon to address issues of a provincial cycling map, education campaigns and promotional activities. While MoTH is committed to participating in such partnerships, the focus of the ministry remains to be provider of provincial infrastructure.

A revised draft of the cycling policy titled the Interim Cycling Policy, was released to the public for comments in January 1993. The Honourable Art Charbonneau, Minister of Transportation and Highways accents MoTH's commitment to cycling:

> During the past year, the Ministry of Transportation and Highways has built a strong consultative process by which the public and stakeholders can make a meaningful contribution to that policy. This interim policy reflects that work and we now want to expand that circle by asking you to review this document...By so doing, we can ensure that government policy will represent the interests of the cyclists of British Columbia.

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[19] This is not intended to mitigate the success of individual municipal efforts such as the Toronto City Cycling Committee's great strides forward in promoting and educating cyclis

Over the next year, the ministry will coordinate its efforts with other ministries and cycling interest groups. This next phase of policy development will address issues uncovered by stakeholders and at the provincial Focus on the Future conference. The upcoming year will give all actors a chance to examine and implement the policy. Any inconsistencies or problems arising during this period will be addressed in a revised policy in 1994.

The lesson to glean from the cycling experience in British Columbia is that working together, with both public and private agencies, can be rewarding and ensures action. Partnerships lessen the burden placed on any one agency to find solutions to complex issues singlehandedly. Joint partnerships and committed representatives ensure action suggested through public consultations are followed up.

The Interim Cycling Policy in British Columbia will continue its metamorphosis. The importance of partnerships and the multiplicity of resources required to address challenges facing today's decision makers are evident when examining the policy development process. The experience provides an excellent guide to approaching non-traditional transportation modes. The only way to successfully implement a policy in these days of competing resources is by working together. Partnerships are the only solution to the transportation challenges of today and tomorrow.

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Appendix A

Draft Cycling Policy Distribution - Stakeholders contacted:

Other Ministries & Government Agencies:

- Ministry of Environment, Lands & Parks:
  Planning & Conservation Services;
  Visitor Services, Parks;
  Environmental Protection Branch
- Ministry of Tourism
- Ministry of Attorney General, Motor Vehicle Branch
- Ministry of Municipal Affairs, Recreation & Housing
- Ministry of Health
- BC Ferries
- BC Transit
- Alberta Ministry of Transportation & Utilities
- Ontario Ministry of Transportation

Cycling/Private/Special Interest Groups:

- Bicycling Association of B.C. (BABC) who also distributed the policy draft to bicycle coordinators in: Ottawa; Seattle, Olympia, Washington; Eugene, Oregon; Vancouver Cycling Coalition; Cross Canada Cycle Tour Society; Palo Alto, California; and San Diego.
- Greater Victoria Cycling Coalition (GVCC)
- Outdoor Recreation Council
- B.C. Carbon Change Workshop
- B.C. Safety Council
- The Islands Trust
- ICBC Traffic Safety Education Branch
- Professional Engineers of B.C. Municipal Division
- B.C. Trucking Association
- Youth Hostel Association
- Western Motor Coach/Operators Association
- B.C. Taxi Association
- B.C. Couriers Association
- R.C.M.P.

Municipalities and Regional Districts:

- Union of British Columbia Municipalities (UBCM);
- Greater Vancouver Regional District (GVRD) Transport 2021 Project;
- Capital Regional District (CRD) Transportation Strategy Project (all CRD municipalities included in responses);
- Individual municipalities and villages: e.g. Campbell River, Courtenay, Castlegar, Cranbrook, Dawson Creek, Kamloops, Kelowna, Merritt, Nelson, Penticton, Prince Rupert, Quesnel, Revelstoke, Terrace, Vernon, Williams Lake, Chilliwack, Kitimat, Vancouver, Logan Lake, Peachland, Port Hardy, Salmon Arm, Squamish, Whistler, Golden, Osoyoos, Smithers, Pemberton;
- Regional Districts of: Central Okanagan, Fraser-Fort George, Kootenay-Boundary and Thompson-Nicola.

The Role of Private Sector in Urban Transit
ABSTRACT

Sundar Damodaran[1], Ph.D. P.Eng.
Region of Peel

Growing concern in the 90's about the environment and emission level is putting a pressure on reducing the traffic congestion and diverting urban travellers from private automobiles to public transportation modes. TDM (Transportation Demand Management) measures in conjunction with public policy measures have been proposed to reduce the use of SOV (Single Occupancy Vehicle). In addition to a more aggressive marketing, there will be a need to streamlining operation and cutting costs in order to attract patronage.

Transit privatization has been recommended in Ontario before as means fo increasing the efficiency and reducing the cost. Experience in the States has clearly shown that cost benefits can be realized by privatization. In some instances the quality of service had even improved.

The present economic condition in Canada coupled with increasing difficulty faced by transit industry to be competitive is cited as a strong reason for considering a higher role for private sector in urban transportation.

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[1] Any suggestions or views expressed in this paper is entirely that of the author and neither reflect nor represent that of the Region of Peel.

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RESUME

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After completing his graduate studies, he worked with a Consulting firm, Cole, Sherman & Associates working on several studies dealing with transportation demand forecasting. He had then worked for Proctor & Redfern in Toronto, on Traffic Impact Studies and Area Transportation Studies.

Presently, he works in the Strategic Section of Transportation Planning at the Region of Peel dealing with Regional Transportation Modelling, Area Transportation Studies, transit related studies, and Environmental Assessment Studies.

Sundar Damodaran

The Role of Private Sector in Urban Transit

Sundar Damodaran[1], Ph.D. P.Eng.
Region of Peel

Introduction

The last decade has been marked by a growing concern and awareness on the environment and emission level. In the U.S., it had brought about legislations[1] to control emission level through increased efficiency in the urban transportation sector. While the general concern about the environment is shared equally in Canada, the urban transportation sector has not been targeted for any direct action through legislation. However, such pressures will be realized in Canada in the near future, especially in the large urban centres like the Greater Toronto Area (GTA).

The downturn in economy during the last couple of years has created a cash-crunch and resulted in a scarcity of funds available for transportation infrastructure building. This trend is likely to continue in the future necessitating the optimum use of the transportation system. The urban transit system has always been considered an efficient, environment-friendly, and a desirable mode of urban travel. However, transit industry has faced its problem and in the absence of any action, might lose its market share. This paper proposes that the private sector can play an important role in urban public transportation.

The Problem

The issues in urban transportation are multi-facetted. Insufficient capacity in the system or the inefficient use of it leads to traffic congestion with its adverse effects on the environment, economic costs, and the quality of life. The traditional approach of adding capacity is neither desirable nor feasible under the present state of economic condition that warrants prudent use of resources. This is more so in Ontario and Greater Toronto Area, where the pressure from the growth in population creates a higher need for the provision of transportation services.

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Transportation Demand Management (TDM) measures have been proposed to ameliorate this situation. Some of these measures, e.g.,HOV lanes, have been implemented in the States with varying degree of success. In the Metropolitan Toronto, there has been an increased interest in TDM measures like HOV lanes[2]. The single most significant factor that contributes to the problem of traffic congestion is the use of Single Occupancy Vehicles (SOV). TDM measures can facilitate more efficient use of the facilities, and when implemented along with policy initiatives that encourage carpooling and ridesharing, can bring about a change in travel behaviour. However, such impacts can only be expected in the long run. A long term objective of reducing the use of SOV's and thus the total Vehicle Miles Travelled (VMT) is already incorporated in the long term planning at the Regional Municipality of Metropolitan Toronto, (Metro Toronto, 1992).

Along the same line, increasing the share of transit in urban transportation should be given a high priority. Transit can have a direct impact on the condition of urban transportation; making transit more attractive to travellers will result in the same, and perhaps to a larger extent, benefits that are being pursued with the TDM and other measures. Unlike some of the TDM measures and policy initiatives, the transit option has the advantage that the industry has an established base to develop upon. The next section deals with the present state of the transit industry and the challenges facing it.

Challenges facing the Transit Industry

The performance of the transit industry in the last few years, especially in the Greater Toronto Area has been dismal. Toronto Transit Commission (TTC) that provides transit serves in the Metropolitan Toronto Area has been suffering from the loss of ridership in the last few years. The annual ridership has dropped to 424 million in 1991, which is lower than 432 million reported in 1985 (Ontario, 1985, 1991). Although not as extreme, other transit authorities in the GTA have recorded a similar trend, especially on a ridership per capita basis.

Two factors can be attributed to this trend; change in socio-demographic characteristics and the economic condition. In the GTA, the size of the age group that is most attractive to transit usage, i.e., 18-25 has reduced in the last five years. On the other hand, budgetary constraints brought on by the recession forced the transit authorities to service cuts in different areas.

The change in socio-demographic characteristics and its impact on transit ridership has been documented recently (CUTA, 1992). The Canadian Urban Transit Association (CUTA), recognizing the need to develop a strategy to promote transit usage, initiated a project in 1990 with an objective of understanding the transit market and to identify ways of increasing the transit modal share. One of the study conclusions was that factors like aging of the baby-boom generation, shifts in female labour participation, and increased auto ownership would have a significant impact on future transit modal share. It concluded that the greatest challenge to transit in the short term was the decline in ridership due to socio-demographic trend. In the absence of any strategy or

action, the study also indicated that the transit modal share in large metropolitan centres like Toronto and Montreal could drop by 5 to 13 per cent (CUTA, 1992).

It appears that the challenges to increase the transit modal share is likely to be severe under the present environment, and is expected to be more so in the future. Ironically, the need to achieve a higher transit modal share would also increase at the same time. If public transit has to play a role in alleviating the urban transportation problem, then it is imperative that transit is made more attractive to the users and the operation of transit is carried out more efficiently. The onerous task of achieving these two objectives is crucial.

Privatization of Transit Industry

Privatization of transit industry has been suggested before, in Ontario and elsewhere under the premise that a private operation is more cost efficient. This section provides a brief summary of some the earlier studies and experiences, especially in the States.

Ontario

There were 60 transit systems in Ontario in 1990, out of which 22 were operated by private operators through contracting. The same number in 1986 was 26, indicating a reverse trend. A study carried out for the Ministry of Ontario (IBI,1986) in 1986 reviewing the extent of private sector involvement in transit systems across the Province provided an overview of the factors influencing privatization. It found that the private sector involvement was more widespread in other areas than direct delivery public of services through the operation of routes. Notwithstanding, it did cite areas/examples where cost savings would result from privatization. The largest barrier to attaining a higher level of privatization was mentioned as the perception that the quality of service would suffer when provided by the private. The study emphasized the need to identify areas of opportunities and the cut-off point when it is cost effective to privatize, and concluded:

> ..This requires a careful investigation of the true cost savings/revenue potential and the impacts that there may be on the level and quality of service and on labour and public relations. (IBI, 1986).

As mentioned earlier, the pursuit of transit privatization in Ontario has been minimal in the last five years. A recent study in this aspect is the one completed by Kitchen (1992) for the Ontario Motor Coach Association. This study primarily focused on quantifying the potential savings that would have resulted if all the transit systems in Ontario were operated by private sector. It used the differential in the cost per RVH (Revenue Vehicle Hours) between the private and public operators reported in the annual operating statistics, to quantify the potential savings.

Another parallel is in the operation of school buses in Ontario. Traditionally, the school buses were operated through contract by private operators. In some areas, the move is towards public transit as a preferred alternative for school student trips. A study done for the School Bus Operators' Association of Ontario (Ernst & Young, 1992) found that the provision of a service by public transit would be 65% more expensive than the private operation.

Experience in U.S.

The Reagan Administration in the early 80's made a policy change that required local agencies to actively consider or encourage private firms involvement in the provision of transit services. This policy was accompanied by a decline in the budget allocation of the Urban Mass Transit Administration (UMTA), clearly deviating from the long policy of public transportation by public agencies. Since then, several agencies have tried to implement this policy, contributing to a growing wealth of information on this subject. In general, privatization has been favoured by many in spite an extensive debate on this subject (Black, 1991. Teal, 1987). There exists sufficient evidence in the literature of the cost savings resulting from privatization.

One example worth mentioning here is the Denver Experience. A senate bill in Colorado in 1988 required that at least 20 per cent of the transit services provided by the Denver Regional Transportation District (RTD) to be contracted out. A review of the performance and costs was done by a consultant one year after the enactment of the above legislation and the introduction of contracted services (Peskin, et. al. 1992). The study concluded, based on the first year's performance, that the privatization effort in Denver would result in cost savings of 15 to 25 per cent over the contract period. In addition, they also predicted a higher saving when the initial costs of privatization had stabilized. On the service side, the finding was that "many measures of safety and quality of service, the contractors performed as well or better than RTD" (Peskin, et. al. 1992).

In summary, the experience in the States has generally been a positive one. In the U.K., similar results have been achieved with the push for deregulation and the privatization of transit services. An interesting observation in the case of private operation in the U.K. was that the introduction of mini-buses and operation of a fleet with different types of buses had resulted in lower annual operating costs.[3]

Role for Private Sector

Given the experience on transit privatization elsewhere, a case for transit privatization has been made in Ontario. However, a detailed investigation is required before initiating any attempt at privatization since the factors influencing it may differ for each situation. Also, the extent of private firm involvement will have to be determined for each system. At one end of the scale is contracting out the entire operation, as presently done in some municipalities in Ontario. Such an approach may not be feasible in large regions or cities where other innovative ways of bringing the private firms into the operation of public transit should be

considered.

The public transit systems could retain certain key functions like route planning, fleet management and maintenance, and contract out the operation of certain routes to either individual or private firm operators. An analogy that can be drawn is in the widespread practice of owner-operated broker trucking. Under such a scheme, the transit systems would have to determine the routes or potential routes to be contracted out. The local planning agencies could play a role in this aspect. For example, a procedure for identifying potential markets for transit privatization in large urban centres had been proposed and applied in Detroit (Khasnabis, et. al. 1991). In the case of Denver, however, the private operators identified a concern that the public agency tended to impose their own expectations on them (Peskin, et. al. 1992).

Alternatively, private firms could be given a higher role in determining what market to serve and how to serve it. Essentially, the role of the private sector is not different from those in other transportation industries like airlines. Private firms would have a leverage in selecting a mix of bus types to attract different markets, or even to develop new markets. This can be seen as a stumbling block for the realization of the full potential. Also, with this approach, private operators could enter into agreement with big employers for the operation of certain routes. One example is in Fort Worth, Texas where Tandy Corporation runs free street cars between a large parking lot and Tandy Center, a downtown shopping mall (Black, 1991).

Case for Peel

It is not the purpose of this paper to propose a possible privatization for the Region of Peel. However, a brief summary of the existing transit services and operating statistics are provided here for information.

In the Region of Peel, transit services are provided by the two Local Area Municipalities, Brampton and Mississauga. In addition to that, inter-regional transit service is provided by GO Transit operated by the Province of Ontario and the Region of Peel operates TRANSHELP, a transit service for the disabled. In 1991, the extent of the service and some performance indicators are given in Table 1. A detailed evaluation of the opportunities for private input and the potential for increasing transit attractiveness in the Region is required and needs to be supported.

Table 1.
Transit Services in the Region of Peel in 1991

Detail	Brampton	Mississauga	Total
Population	230,000	460,000	690,000
Service Level			
Fleet Size	99	272	371
Rev. Vehicle.Km	4,629,000	15,891,000	20,520,000
RVK per capita	20.13	34.55	29.74
RVK per vehicle	46,758	58,423	55,310
Financial			
Total Expenses $	12,283,000	44,916,000	57,199,000
Revenue $	7,043,000	23,851,000	30,894,000
Contribution* $	5,240,000	21,065,000	26,305,000
Rev/Cost Ratio	0.57	0.53	0.54

* Contribution made by Municipal and Provincial Govts.

Source: CUTA 1992, Canadian Transit Fact Book: 1991 Operating Data

Conclusion

The private sector can and should play a higher role in providing public transportation services. There is adequate evidence, especially from experience in the States, of the benefits that are likely to result from such an endeavour. In addition to direct savings in the form of lower operating costs, the private sector has the potential to offer indirect benefits from the higher transit usage resulting from a better quality service.

Earleir proposals for such a pursuit, especailly in Ontario, had not been fruitful and it should be re-considered, given the present environment. At the same time, it essential to avoid the pitfall of privatization by carefully developing a unique role for private firms that is best suited for each situation. Further studies in this direction should be carried out, with consideration of factors that may be specific to the region or locality. Creation and adoption of a policy to encourage innovative techniques in urban transportation is perhaps the foremost requirement in Canada.

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ENDNOTES

1. Amendment to the 1990 Clean Air Act and the ISTEA (Intermodal Surface Transportation Efficient Act) at the federal level.

2. MTO is studying the possibility of HOV/RB lanes on Highway 403 in Mississauga.

Also, Metropolitan Toronto had completed a study recommending a system of HOV lanes of the arterial road network, Metropolitan Toronto (1992).

3. From Transmode Consultants (1989), as quoted by Kitchen (1992).

YIELD MANAGEMENT: A PHENOMENON OF THE 1980s AND 1990s?

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and

Kenneth Button*

Background

The past twenty years has seen significant changes not only in the technology of transport but also in the institutional environment in which it operates. In particular, the plethora of regulatory controls which had determined many of the decisions of both transport supply industries and transport users have been relaxed. The trend, while most thoroughly documented with regard to US transport markets, is almost universal in its incidence. The speed and nature of reforms have varied but liberalization and privatization have been experienced throughout the industrial western economies, are taking place in the post-communist states of Eastern Europe and, under the guidance of such bodies as the World Bank, are being encouraged in the less industrialized nations.[1] The mood for less intervention is almost universal.

The shift from greater to reduced intervention in transport markets has provided the stimulus for the transport supply industries not only to adopt alternative technologies but also to modify their management practices. It has happened at a time when electronic information systems have moved into real time and these provide management with powerful tools which offer the potential for closer control over their operations and the ability to rapidly adapt their strategies to evolving market trends.[2] Coupled with this, and to some extent endogenous to it, the transport industry has itself undergone something of a transformation in many sectors (such as aviation), with marked increases in the overall concentration ratio and vertical integration of activities.

The objective here is not to look at the entire spectrum of developments which have occurred but rather to consider one particular development which has been a feature of several transport industries in the 1970s and 1980s, namely the widespread adoption of fairly sophisticated yield management techniques.[3] The aim is to examine the conditions which have led to the use of such techniques and to assess the longer term durability of such a management strategy for transport industries into the next century. The literature in yield management is reviewed to gain some impression of how it has developed in the various transport industries. Its operation at present in a key transport sector, namely shipping provides a case study of current practice. Prior to this, however, it is useful to consider the nature of yield management and to assess the conditions which must pertain to make it viable.

Pre-conditions for Price Differentiation

Yield management, while often discussed in general terms in the literature, is seldom rigorously defined. Essentially it is the ability of management to maximize the revenue from a pre-defined activity (e.g. a scheduled flight or sailing) by a combination of price discrimination and product differentiation.[4] Yield management is not unique to the transport sector and its application has perhaps been most extensively practiced in the

hotel industry—for example, see Jones and Hamilton (1992) and Kimes (1989). Another way of looking at it is making the most effective use of a reservations inventory. The use of computer reservations systems (CRSs) by airlines to control booking levels and discount allocations is often cited as an example of yield management but, although highly refined in this industry, it is also used in other transport spheres. The use of a CRS enables an airline to adjust the fares offered on a given flight, the seats available at each fare and the preconditions for booking at any fare.[5] The preconditions (combined with some relatively minor quality differentials inherent in first class, business and coach class areas of an aircraft) introduce product differentiation into the management equation while the various fares charged for what are, in many ways, very similar service represent the price discrimination element. The combinations offered and the adjustments made by an airline as the time of any flight departure approaches are designed to maximize the yield from the pre-determined decision to offer that particular service. The challenge of management, therefore, lies in attempting to isolate the high and low price markets and this requires differentiating the product enough so that the low price version is unattractive to the high price market thereby minimizing the probability of revenue dilution.

The technique is somewhat different to that of the classic economic model of price discrimination where management increases revenue by charging different groups of customers (differentiated by their price elasticities) different prices for the *same product*. The cost of serving each customer is, in the classic model, identical. There is, however, normally some qualitative or other form of product differentiation involved in yield management which implies cost differentials in the provision of services to customers. First class air travel does cost an airline more than discount travel. Equally, however, the existence of economies of scope may mean that the supplier of a range of different services can keep unit costs lower than a number of suppliers each specializing. In overall resource utilization terms, therefore, yield management may provide for the development a more efficient market structure.

While yield management and price differentiation have become more sophisticated in recent years, the idea is certainly not a new one although its form and the motivation for its use have changed. It was appreciated, for example, by the early regulators of railroads that to recover costs optimally in an industry characterized by high fixed but low operating costs would require price discrimination. Simply employing marginal cost pricing, while ensuring optimal utilization for the system would not generate sufficient revenues to cover costs. This was the basis for the Ramsey Pricing approach favoured by public regulators and economists from the 1920s. The difference between this and yield management, however, was that the objective was to attain sufficient revenues to meet the costs of supply; it was not to maximize the yield (and potential profit) from a given service.

The management structure incorporating highly sophisticated CRS systems now used by the airlines represent the most complete form of yield management to-date. Yield management in transport is not, however, limited to this industry. It has been practiced with varying degrees of sophistication in virtually all transport markets where the supply of the service exhibits a number of important characteristics.[6]

- The service to be provided involves a fixed commitment; this normally means that we are concerned with scheduled services. The implication of this is that the cost curve confronting the supplier is downward sloping. Indeed, in many instances there is a high committed or sunk cost (the ship or aircraft) with very low marginal costs (associated with embarkation and debarkation). The service need not be homogeneous; there may be advantages if some degree of differentiation is possible, and

each variation may have associated with it a different marginal cost of provision.

- The supplier has information on the charges which the user 'will bear'. This in effect means that the transport supplier has reasonably good information on the demand elasticities of perspective customers. Good market research and forecasting models are thus a *sine qua non* for effective yield management.

- The supplier enjoys a relatively high degree of monopoly power. This in important for ensuring that the overall demand for the service being offered has a degree of elasticity associated with it. The monopoly power may be a simple function of technical market conditions (e.g. scale effects) or may come about through collusion of several potential competitors.

- It is possible (in the eyes of potential customers) to product differentiate. Without this ability it is not possible to 'price down the demand curve' and to extract the maximum revenue from each customer. If there was not a perception of product differentiation then different consumers would not be willing to pay different prices for the service(s) offered.

- There is asymmetrical information availability with customers having less information about the options available to them than the supplier has about the availability of capacity. This is a necessary condition to prevent the customer simply taking the lowest priced service on offer and thus dilute the revenue going to the transport supplier. It is usually fairly easily achieved in the service industries where output cannot be stored or easily transferred to other markets and where customers do not easily have ready access to one another for exchange of information.

- It is advantageous for the supplier to be able to respond rapidly to changing market conditions. In this context, the ability to employ modern information systems is of advantage; large US airlines, for example, may make up to 50,000 fare changes in a day. The nature of the technology required will, however, depend on the market served.

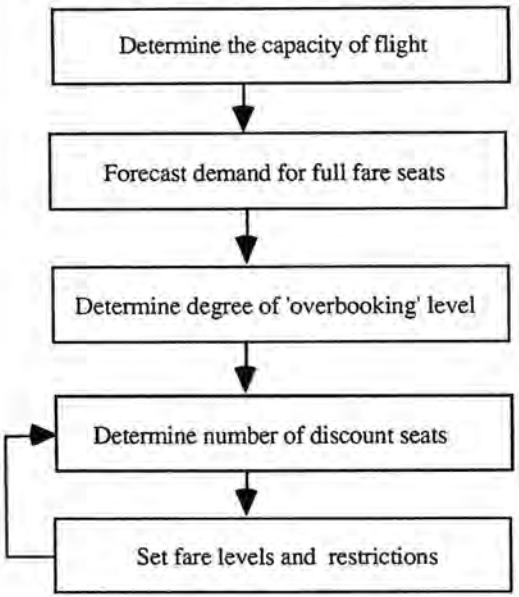
The nature of the decision-making framework confronting industries operating under these conditions is complex if successful yield management is be attempted. The interactions and options available are too numerous for fares levels, fare structures, constraints and capacity distribution to be determined simultaneously. This leads to a further common feature of yield management, namely sequential decision making. The form this takes varies between both sectors and firms within sectors but a broad indication of the decision sequence adopted by many airlines when considering a particular scheduled service is set out in Exhibit 1 (see also Tretheway (1991) and Smith *et al* (1992)). In this case the nature of the technology does permit a degree of interaction between some of the stages (e.g. discount levels and allocation of seat to different fare classes) as the time of the flight approaches.

Examples of Yield Management

The use of yield management in many sectors of transport is hardly surprising given the specific characteristics of supply which are encountered. Suppliers offering scheduled services in particular have a commitment to provide a service which is often used by a diversity of consumer groups. The service commitment leads to sunk costs while the various elasticities of demand of users provides scope for price differentiation. Limited capacity on any service, combined with some potential for providing variations in service attributes, enables a further level of differentiation. This traditional view has

found support in earlier studies. Some of the examples found scattered in the literature of price discrimination in transport include the following:

Exhibit 1: Stages in arriving at yield maximizing revenue in scheduled aviation



- *Shipping*. Shipping conferences have offered scheduled sailings since the 1870s and traditionally it has been argued that price differentiation is necessary to enable their continuance (UK Board of Trade, 1970). To maintain their services, therefore, shipping conferences have in the past established a system of yield management.[7] The argument ran, prior to the widespread adoption of containers, that competition at the upper end of the market from aviation and at the lower end of the market from tramp shipping (and in some cases surface transport) results in a broadly sigmoid pattern of conference shipping rates for any route. A detailed look at the Australia-Europe Conference by Zerby and Conlon (1978) produced a breakdown of rates which generally confirmed this. Exhibit 2 reproduces their average revenues for each type of cargo carried in 1973/4. The low value-bulk cargoes (i.e. ores and metals) are carried at (or sometimes slightly below if ballast is required) the average incremental costs of loading and unloading, while high value products are carried at considerably higher rates with a ceiling imposed by competition from air transport.

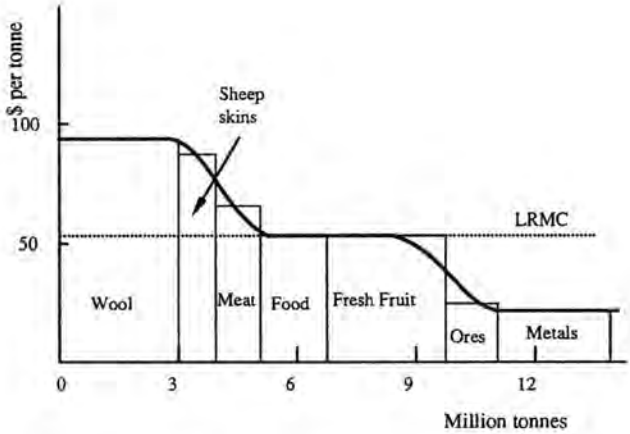
- *Railways*. Beginning with the 1962 Transport Act, the UK railways have enjoyed increased powers to price discriminate in their passenger fares. The result has been a number of experiments in price differentiation going beyond the first/second class distinction to embrace a variety of saver fares (i.e. discounted fares for off-peak travel with restrictions). Truelove (1992) provides an apt description of the current yield management employed by British Rail,

'The distinction between first and second class is further

> refined by the exclusion of discount fares from peak weekday and holiday trains, by the limited availability of old people's and students' discounts, and the reduction in supplement for travel in first class carriages at weekends, when leisure travel is heavy and business travel almost negligible'

Similar reforms in rail industry rate setting in the US, initiated under the 1980 *Staggers Act*, saw the Interstate Commerce Commission explicitly recognize the need for price discrimination, albeit with a ceiling to protect 'captive' shippers. There were significant knock-on effects of this on Canadian railroads with subsequent reforms in the *National Transportation Act, 1987* permitting greater freedom in rate setting and the legalization of confidential contracts. A subsequent study of the Canadian situation (KPMG Peat Marwick, 1988), confirmed that as a result some 55% of shippers had experienced no change in rate, 44% had experienced a reduction and 1% an increase. While some of these changes reflect rates coming closer to costs, they also reflect a greater use of demand-related price strategies.

Exhibit 2: Average revenues from cargoes carried by the Australia/Europe conference 1973/4



Source: Zerby and Conlon (1978)

- *Aviation*. The development of CRS systems in the US has led to what many consider the most sophisticated form of yield management to be practiced to date.[8] The availability of rapid computer systems provides airlines with real-time data on passenger demand for each flight, sometimes incorporating the functions of aircraft and crew assignments, even computing crew costs all of which permits management to calculate and adjust fares, levels of service and cabin crew complements to maximize revenues (Tretheway, 1991). Further, from a pragmatic point of view, yield management systems are unlikely to attract the attention of anti-trust legislators because they are primarily directed at enhancing an airlines internal efficiency. Yield management is credited with significant increases in revenue by many of the major carriers; American Airlines, for example, estimated the incremental revenue

attributable to its yield management system to $1.4 billion for the three years to 1992 and currently contributing $500 million annually (Smith *et al*, 1992). The system employed by American Airlines involves three functions, the optimization of overbooking, the allocation of discount fares and traffic management (and specifically meeting demands for connecting flights).

A Closer Look at Container Shipping

To examine the potential for yield management application in liner shipping, a study was undertaken to examine the existing tariff structure and pricing practices on the Northatlantic. On this route, conference carriers easily carry non-conference cargo, and therefore within the same vessel identical cargoes may bear different prices for the ocean leg. The conference structure limits pricing latitude while the non-conference cargo may be carried at whatever price the carrier is able to negotiate.

Methodology

The research data presented here was collected from the manifests of four sailings, two Eastbound and two Westbound. The manifests chosen had a mix of conference and non-conference cargo and took place within a three week period in 1990, prior to the implementation of the rationalization agreement of May 1991 and the attendant slot-charter arrangements between the conference operators in the Canadian trades. For each shipment, the data collected comprised of number of containers, length, type (dry van, reefer, etc.), port-port for the ocean leg, currency of ocean freight tariff, ocean freight tariff, the commodity classification, the weight, and the conference/non-conference status of the shipment. Collecting only the tariff for the ocean leg stems from the fact that most carriers merely pass the other costs along; although the shipper buys based on a door-to-door price, the carrier has only nominal control over this part of the container's journey. From this data, the TEU for each shipment was calculated, as was the tariff in US dollars per TEU using the exchange rate employed for accounting purposes (the *Financial Times* published interbank rate for the date of sailing).

The data was cleaned by deleting those shipments with a mix of 20s and 40s (and only a single tariff noted), and those which were repositionings or billed on another voyage and therefore no tariff was recorded. Consolidated shipments, those travelling on multiple bills of lading but in one container and with one tariff, were consolidated for weight data purposes and recorded as miscellaneous cargo.

The mean US dollars per TEU for the entire data set of four voyages was set as equal to 1 and all the tariffs indexed to that. The product categories were retained for all the analysis but do not appear in this paper in accordance with the terms and conditions for confidentiality set by the data source. It should be noted that the product categories do not always appear in the same order, as it is the means of the data for each category which are used to order the data and not the product label itself, following the format set by Zerby and Conlon (1978) in Exhibit 2. The full data set Eastbound contains 50 2-digit SIC product categories of non-conference cargo and 60 product categories of conference cargo, while Westbound there are more non-conference categories at 57 with 53 conference product categories.

The overall data

The parameters of the data set appear in Exhibit 3. The data are consistent with the multiplicity of tariffs found in a conference rate book, with multiple rates within each product category and the range very large even within categories, as found by Deakin and Seward (1973). The sample contains reefers, which require additional service and command a premium price, and other container types, which may arguably be more

expensive to the carrier to provide on demand and service en route. On the other hand, although empty containers being repositioned were deleted from the sample set, it is not possible to remove from the data containers which are being moved with very little cargo primarily for repositioning purposes and contain some revenue-contributing cargo which otherwise would not move; there is nothing on a bill of lading to indicate the extent of this practice and whether the particular container has been incrementally priced for this reason. Exhibit 4—Westbound Conference Tariffs—illustrates this wide range of rates clearly, showing what those with an interest in the industry already knew, the shipper pays what the market will bear. The same can be said of Eastbound Conference Tariffs (Exhibit 5).

Exhibit 3: The Sample

Voyage	Shipments	Containers	TEU	Mean* per TEU	Maximum* per TEU	Minimum* per TEU
1	497	679	961	1.572	7.364	.239
2	505	681	968	1.532	6.335	.239
3	494	771	1119	1.026	5.707	.044
4	357	636	861	1.145	12.751	1.090
EB Total	851	1407	1980	.463	12.751	.044
WB Total	1002	1360	1929	1.552	7.364	.239
Total	1853	2767	3909	1.000	12.751	.044

Note: * All means are reported as indexed to protect the confidentiality of the data.

Yield management principles suggest that pricing would also reflect the availability of cargo space and therefore prices would be expected to be different between east and westbound legs. The means Eastbound and Westbound track similarly but the differential between the two clearly favours North American conference shippers over European ones as the North Americans pay a lower price. The difference between the means Eastbound and Westbound was tested and found to be significantly different (at $p=.01$).

Likewise, if we examine conference with non-conference tariffs on the same leg (Westbound—Exhibits 4 and 6), the gap between conference and non-conference prices is wider at the higher end of the track and narrows to a common point. The differential between the two clearly favours non-conference shippers over conference ones for most product categories as the non-conference shipper pay a lower price in the same direction. This however is not true Eastbound (Exhibits 5 and 7), where the means track similarly, widening marginally at the bottom end of the price scale; the primary difference Eastbound between conference and non-conference rates appears to be the range of prices around the mean, with the range being smaller. What is interesting is that the non-conference tariff structure mirrors the conference one generally, although not specifically, as will be seen. Although non-conference shipments may be quoted a per box rate, the carriers here quote non-conference prices which reflect the crude yield management principles instituted by the conference system in the last century.

Discussion of selected commodities

Inclusion of all product categories limits the possibility for meaning comparisons because there are product categories with only a few boxes represented. Only those product groups containing more than 10 TEU and present in both east and westbound trades, and in both conference and non-conference cells are selected for this section of the paper.

Figure 4: Northatlantic Westbound Conference Tariffs

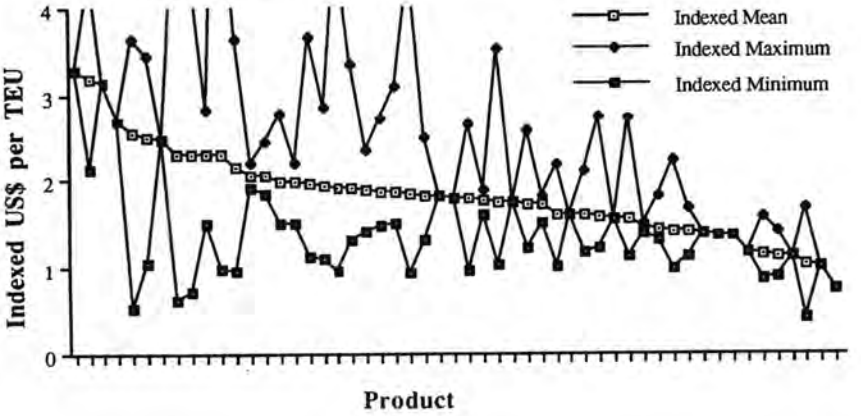


Figure 5: Northatlantic Eastbound Conference Tariffs

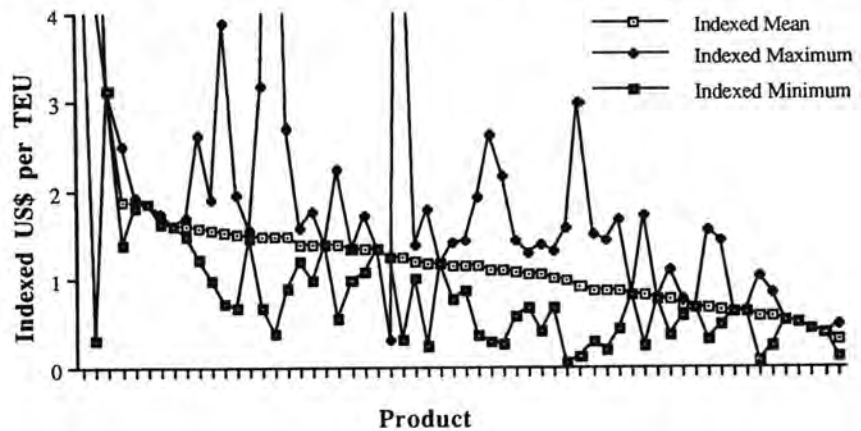


Exhibit 6: Northatlantic Westbound Non-Conference Tariffs

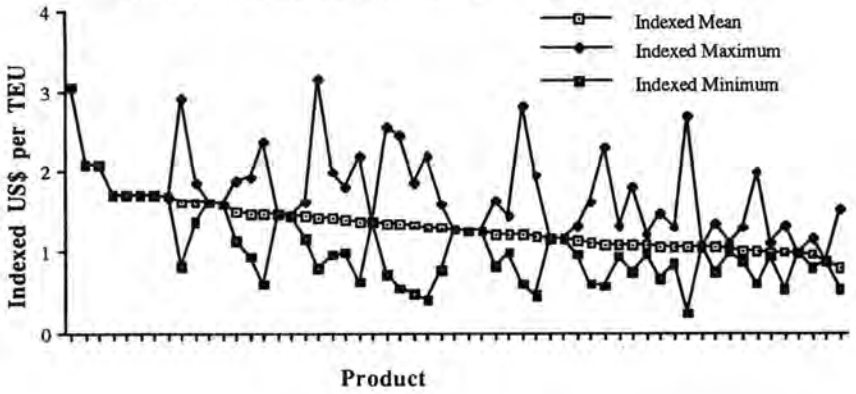
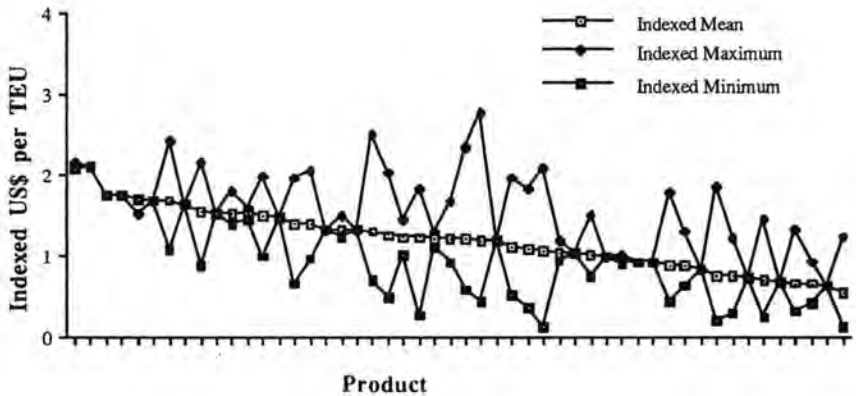
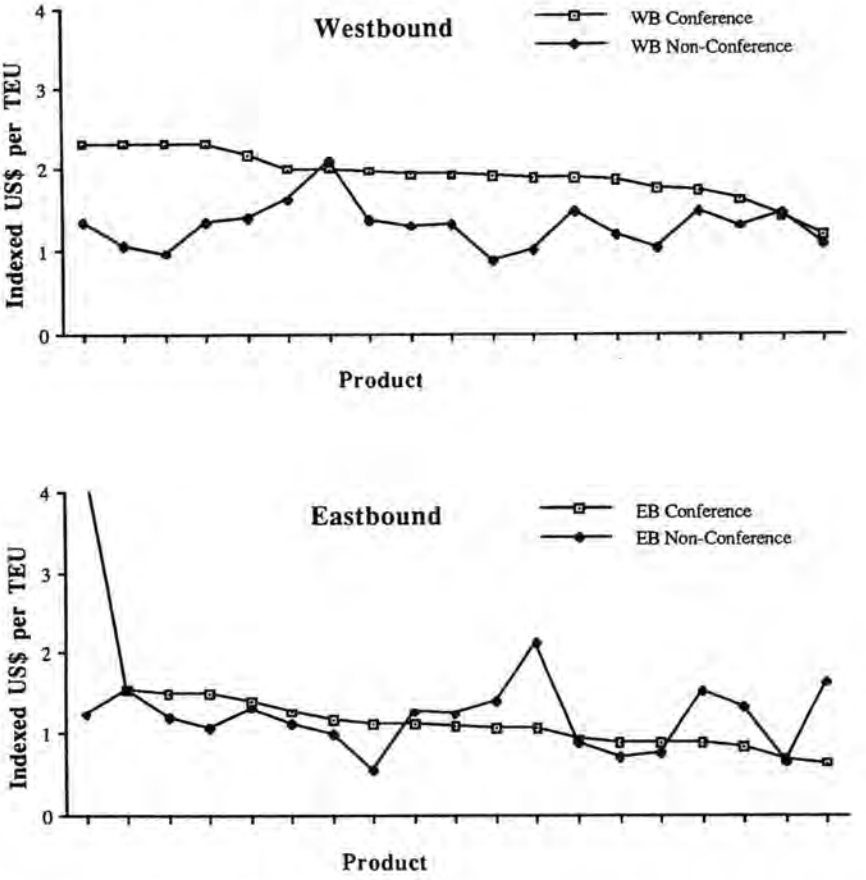


Exhibit 7: Northatlantic Eastbound Non-Conference Tariffs



A closer look at Exhibit 8 shows that Westbound non-conference tariffs on larger volume cargoes generally track below conference tariffs confirming the conclusions reached above in the comparison of Exhibits 4 and 6; only a few exceptions exist, largely at the bottom end of the scale. Eastbound, the conclusions above are misleading; the means, conference compared to non-conference, are similar in magnitude but not on a product-by-product basis. The revenue generation of conference cargoes is sometimes below that of non-conference cargoes in the same product class.

Exhibit 8: Comparison of Tariffs—East- and Westbound



Note: The product categories are not ordered similarly Eastbound as Westbound.

Commentary

The term yield management implies that active management of the yield takes place. The liner shipping industry, when conference tariffs were first established in the late 1800s, probably was more active in this regard. However, for many years now the Northatlantic conferences have adjusted rates on a dollar-per-box or percentage across-the-board basis; active rate manipulation reflecting user willingness to pay has been limited to annual rate meetings with some of the largest industry and shipper groups. The only area where active yield management might exist is in the non-conference area and there is little evidence to indicate a proactive approach is being undertaken.

The successful practice of yield management requires that the supplier have more

information on options available than the customer. This underscores a critical difference between passenger and cargo markets—buyers in the freight market are fewer and more sophisticated, and many have implemented supplier performance evaluation systems. The carrier loses power as buyers are able to use these systems to play off carriers on both performance and price. Although many carriers have information systems capable of being exploited for the active practice of yield management, their existence within a conference agreement prevents them from using such systems for conference cargos. Today's shippers are less willing to pay a premium price when service differentiation is muddied by slot charters on competitors' vessels. The result is more cargo carried non-conference and shipper resistance to conference price increases with each passing year.

Changes in the market environment

Yield management has grown to be a powerful management device in several transport industries during the past twenty years. There seems, however, to be indications that its use may have peaked, or at least that different forms of yield management may be necessary for its continuance in some sectors. Its practice in shipping has come under pressure in recent years because containerization and slot charter agreements have made the established product-based differentiation less tractable. In the context of recent developments in the USA, doubts are beginning to be raised about the longer term viability of yield management as the primary pricing strategy of industry. The adoption of a 'simple' four level fare structure by American Airlines in 1992 represented a significant move away from a situation where fare diversity and flexibility had been the norm (*Business-Travel-News*, 1991). The pressures on the ability for yield management to be as successful in the future as in the past stem from a combination of converging forces.

- Transport users are increasingly becoming more sophisticated and knowledgeable. This makes it increasingly difficult for supplying industries to differentiate on the scale that they have been doing in the recent past. Just as CRS and other computerized management tools provided transport suppliers with on-line information on consumer demands so personal computers and modems allow customers to acquire a fuller picture of the options available to them. Indeed, in some countries, in the case of hotels and package holidays, such information is increasingly becoming available on household televisions through teletext systems. Linked with this, there is also an increasing trend for transport users to combine to create countervailing forces to confront the monopoly power of the supplier. Such quasi-monopsony strength may come from the power of individual corporate users to demand preferential treatment or from large travel agents negotiating low cost bulk purchases of tickets or capacity, and this has come to the fore in the cost-conscious early 1990s. In the case of liner shipping, it is not clear whether the reduced tariffs paid by some non-conference users is due to their ability to negotiate better rates or reflects a floor on the discount offered on the conference rate; where non-conference users pay more, information gaps are probably a factor.

- As an extension of the first point, there are now more intermediaries in transport market who act as brokers and in effect cause gravitational pressures which effectively reduce the dispersion of rates and fares in any market. They in effect have knowledge of the market virtually akin to that of the transport supplier and can act to blunt the ability of the latter to exercise monopoly powers. The precondition of asymmetrical information is being weakened.

- The power of competition (either actual or, to a lesser degree, potential) in individual market segments is growing. One of the claimed advantages of large suppliers offering scheduled services is that they enjoy economies of scope—the cost of providing each individual service being lower than that possible with a plethora of smaller operators. In some sectors the pattern of costs and demand which has brought this about in the past may now have changed. In shipping, for example, containerization has changed the nature of the basic activity and made it difficult to justify differential rates except for extra services like reefer maintenance. The development of consortia, has introduced flexibility into liner operations which in turn offered more sailing options; conversely, however, consortia formation has left the shipper fewer bases for comparing services and less willingly to pay differentiated prices.

- There have been institutional changes which have blunted some of the power of suppliers to differentiate. Controls over the way CRS systems operate, for instance, introduced in both North America and Europe, have removed some elements of discrimination.

- In some transport sectors, the transactions costs for many customers have grown as the sophistication of yield management has increased. The efforts of American Airlines to simplify air fare structures was, to some extent, to meet customer complaints about the time and effort that it takes to find an appropriate fare/service combination to meet their travel requirement. While users are becoming more knowledgeable about the system, they are equally finding it more complicated to make choices and to be able to find a seat at the fare they thought would be available. This may also explain the new simplified fare structure effective February 1 for westbound conference traffic announced by the UK-based Canadian Atlantic Freight Secretariat in mid-December 1992 (Ryan, 1993). Eastbound rates were also to be simplified effective March 1, 1993. Consumer resistance to current yield management practices is, therefore, growing in some segments.

Conclusions

Yield management, as a practice, is certainly not new but its use in the transport sector has grown significantly in recent years. It has been seen as a way of generating profits from activities which involve high fixed costs, such as the commitment to provide a scheduled service. The current structure of yield management is, therefore, a logical outcome of the constraints confronting management, the nature of the markets it serves and the technology available to it.

The situation is not static, however, and the natural response of both customers and potential market entrants is, respectively, to seek ways of reducing yield enjoyed by suppliers in individual segments and to remove barriers to entry into such segments. This in turn reduces the basis for yield management by both increased revenue dilution and market penetration into the profitable sub-markets. Technology also plays its part. Yield management results from the technical features of the industry and as these change so does the scope for yield management. In the case of shipping, rate differentiation by product has become more difficult as containers are widely used, while in aviation it becomes easier as CRS systems are adopted and the seating configurations in aircraft become more flexible. In the case of shipping this does not mean that yield management will necessarily be replaced entirely (there is scope, for example, for differentiation by type of user along the lines of current airline practices rather than by product) but the range of possibilities is likely to be somewhat less.

Thus, while it is unlikely that yield management will cease, it seems from current trends that its practice may well have reached its peak and that in retrospect the 1980s and 1990s may be considered as its heyday.

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Endnotes

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1 See, for example, the studies reported in Button and Pitfield (1991).

2 A key development in the aviation sector, for example, was the seat management system developed by the Boeing Commercial Airline Company (see Tretheway, 1991).

3 This is not to say that yield management should treated lightly, R.L. Crandall of American Airlines, attests to its impact, 'I believe that yield management is the single most important technical development in transportation management since we entered the era of airline deregulation in 1979', (cited in Smith *et al*, 1992)

4 A useful account of the underlying theory of price differentiation in the context of scheduled transport services is contained in Turvey (1975).

5 These preconditions on discount tickets range from specified pre-booking periods, a minimum stay requirement, a 'no-change' without penalty clause, the lack of a guaranteed seat to the lack of a through booking.

6 For example see Nagle (1987) and Philips (1983).

7 Sjostrom (1992) provides a survey of the empirical literature in this field. He also highlights the problems of trying to isolate the specific effects of pure price discrimination, although it should be remembered that yield management, by also offering some variation in the product supplied, is concerned with price differentiation.

8 While the developments in passenger aviation have attracted most attention, there have also been major changes in yield management of air freight operations—for instance, see Proctor (1989). This is hardly surprising given the belly-hold capacity of many commercial airliners.

CANADIAN INTERNATIONAL MARINE CARGO FLOWS: A PROFILE OF TRANSSHIPMENTS THROUGH U.S. PORTS, 1989-1991

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David Dahm, Statistics Canada

Introduction and Purpose

Given the convergent evolution of the North American intermodal transportation system, it is difficult to imagine a future scenario in which Canadian imports and exports no longer move through U.S. ports. As competition between Canadian and U.S. ports escalates, more sophisticated intermodal transportation systems will inevitably appear in North America, with transshipped Canadian and U.S. cargo moving through each others' ports likely to continue to represent a substantial proportion of each nation's total international marine movements. In Canada, it is estimated that close to one-fifth of total inbound and outbound overseas non-bulk tonnage passed through U.S. ports on the way to or from Canadian markets in 1989 and 1990.

Major studies of Canadian transshipments through U.S. ports, such as Transport Canada's earlier publications (1988), relied heavily on information generated by the U.S. Bureau of the Census, and were generally not timely. Conversely, work of a more timely nature, such as the publicly available offerings of the Canada Ports Corporation, uses transshipment information collected by the U.S. Journal of Commerce for its Port Import/Export Reporting Service (PIERS) solely to highlight year to year changes in Canadian cargo flows through U.S. ports. In an effort to further familiarize Canadian transportation interests with existing Canadian transshipment statistics and to, hopefully, improve upon the scope and timeliness of past studies, the National Transportation Agency of Canada's Industry Monitoring and Analysis Directorate and Statistics Canada's Transportation Division have joined forces to report on the PIERS data base as a supplement to existing statistics on Canadian international cargo flows.

The objective of this paper is two-fold. First, an attempt will be made to assess the quality of Canadian transshipment information made available through PIERS by comparing it to other known sources such as that of the U.S. Bureau of the Census, Revenue Canada and Statistics Canada's International Marine Database in terms of its timeliness, content, quality and limitations. Second, the paper will provide a comprehensive profile of Canadian transshipments through U.S. ports in the period 1989-1991, focusing on U.S. ports through which Canadian overseas cargo is routed, Canadian origins and destinations for these commodities, and the corresponding foreign origins and destinations for these cargo movements.

Other Sources of Information on Canadian Transshipments

There are very few data sources available that can provide information on Canadian cargo transshipped through U.S. ports. Unfortunately, no information is currently available from any Canadian source. Revenue Canada had previously produced TEU (Twenty-foot equivalent units) figures for Canadian and U.S. containerized cargo transshipped through each others' ports but discontinued its collection and publication of such information in 1989 as a result of questions regarding its worth. Statistics Canada's international marine cargo statistics generated from its International Marine Database deals exclusively with cargo shipped through Canadian ports and can be used as a supplement to, but not a surrogate for, the JOC's PIERS data base. Although U.S. cargo transshipped through Canadian ports is captured in the Statistics Canada survey, it cannot be distinguished from Canadian cargo as inland origins and destinations are not identified for individual cargo records.

for individual cargo records.

While the U.S. Bureau of the Census data may be the best alternative to the PIERS information in terms of identifying the volume of Canadian transshipped cargo, it lacks timeliness. Although the data is available for purchase for the year 1991 (as of the writing of this paper) the most recent publicly available statistical reports produced on Canadian transshipments based on Bureau of the Census data is for the calendar year 1989. Moreover, the processing of this data involves several steps which can lead to a loss of information. Three tapes must be linked together in order to pool the required data and in this process some data is lost, goes missing or becomes unreliable. As well, certain fields of information in the resulting data base, such as that related to the foreign port, are also unreliable. This field records the first foreign port where cargo is unloaded rather than the ultimate destination. For example, in the case of South-East Asian cargoes where intra-Asian feeder services are prevalent, load-centres in Japan are considerably over represented in the Bureau's statistics. Finally, data obtained from the U.S. Bureau of the Census, although having values associated with its tonnages, does not include TEU figures as there is no container category on U.S. customs documents (the Bureau's information source) for "in-transit" cargo.

The PIERS Database

In contrast to other sources of information currently available, the JOC's PIERS data base offers detailed Canadian transshipment information on a more timely basis allowing for identification and analysis of current trends in the diversion of Canadian trade through U.S. ports. PIERS data is available both on a monthly basis through on-line access to the JOC's network or can be purchased on an annual basis, normally available within 45 days of the years end.

The PIERS data base provides a detailed description of each transshipment including, among others, the commodity exported/imported, the name of the exporter/importer, the Canadian province of origin/destination, the foreign country of origin/destination, the U.S. port of loading/unloading, the vessel name and shipping line involved in the carriage, the weight in pounds and the number of TEUs associated with a shipment. With this information each Canadian transshipment can be traced from point of origin to final destination and analyses can be carried out to determine the nature and scope of diversions from a Canadian perspective.

The PIERS database is presently utilized as a marketing tool and statistical source by several industry and government groups in Canada, including individual shippers, the Canada Ports Corporation and major Canadian ports, various shipping lines and conferences serving Canada as well as Transport Canada and the National Transportation Agency.

Limitations of the PIERS database

While the PIERS database has been found to be the most detailed and timely data source available for Canadian transshipment information it is not without its limitations. In editing and analyzing the PIERS some shortcomings were noted which affect the quality of the data and must be considered when utilizing the data and reporting the results.

First, the quantitative information (weight in pounds and TEUs) provided in PIERS, does not appear, on occasion, to be consistent from record to record. There are some cases where shipments of less-than-container-load cargo are recorded without tonnage figures, or neither tonnage nor TEU figures. PIERS has attempted to alleviate this problem by inserting additional records labelled as general containerized cargo with tonnage and/or TEU figures associated with one container comprised of several less-than-container-load shipments. There are, however, both

containerized and non-containerized records that appear to have missing tonnage and TEU figures. This problem of missing data implies that the numbers presented in this paper should not be interpreted as exact figures but rather as absolute minimum tonnages and TEUs of Canadian cargo transshipped through ports in the United States.

Second, the classification methodology used by PIERS to determine the volume of transshipped Canadian containerized cargo could also lead to an under-estimate. Some records, particularly those pertaining to normally containerized reefer (refrigerated) shipments, are not coded as containerized in the PIERS database as entire vessel holds may be refrigerated thus negating the need for conventional reefer containers for only the waterborne portion of the movement. Value judgements may be made to determine whether or not these cargoes should be classified as containerized transshipments.

Although the Canadian transshipment portion of the PIERS data base consists primarily of shipments moved in liner trade, an analysis of individual shipments indicates the presence of bulk and neo-bulk movements. While containerized cargo accounts for the majority of shipments in the database obtained from JOC, the small number of non-containerized shipments account for a significant proportion of total Canadian transshipped tonnages.

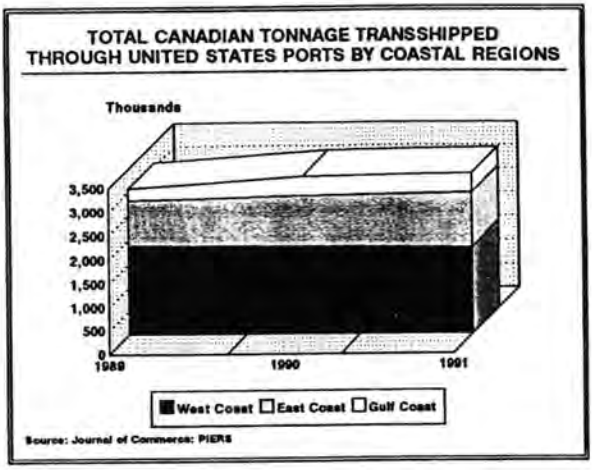
Other minor problems encountered in working with PIERS include information pertaining to Canadian origin and destination. In the case of a number of shipments, where the individual province of origin or destination was not specified on source documents, the JOC used a general Canadian "catch-all" code which made precise breakdowns of data on a provincial basis difficult. In the majority of instances where this occurred, the correct provincial code was imputed from the Canadian city of origin or destination. Where cities in more than one province had identical names other data associated with the particular shipment was normally sufficient to identify the province. Also, in cases where a freight forwarder or head office of a company handled the transportation of goods for a notified party, the name of the shipper and the province of origin/destination in the database may, in fact, not be the ultimate origin or final destination of the shipment. Presently, there is no way to rectify this problem and it should be noted that provincial totals, particularly for British Columbia, may be over-estimated. As well, there appears to be some anomalous shipments in the PIERS database which do not make much sense given known routing patterns in international liner trade today. However, these shipments were few in number and normally represented minimum tonnages and TEUs relative to totals.

Finally, the growing importance of the intermodal revolution in North America has intensified the search for statistics which can elucidate the use of various modes of transport in the through movement of overseas shipments. The PIERS database as it presently exists, does not provide any information on inland modes of transport used in conjunction with marine in the movement of Canadian export and import cargo transshipped through U.S. ports.

Canadian Transshipments Moved Through U.S. Ports

Canadian waterborne cargo transshipped through ports in the United States increased modestly but steadily between 1989 and 1991. A total of 3.4 million tonnes of Canadian cargo was transshipped through U.S. ports in 1991, eight percent more than in 1989.

In 1991, more than half (1.8 million tonnes) of the total tonnage transshipped moved through ports on the U.S. west coast while just over one-third (1.1 million tonnes) passed through U.S. east coast ports. While tonnages through U.S. gulf coast ports were significantly less, they still accounted for 12 percent of the total in 1991. Interestingly, Canadian tonnages through the U.S. west coast, the most important region in terms of Canadian transshipments, actually decreased by four percent between 1989 and 1991 , while U.S. east and gulf coast ports registered increases



of 20 and 60 percent respectively over the same time period.

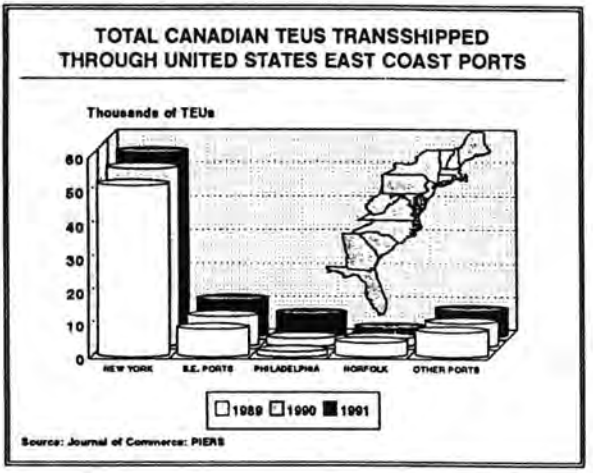
In 1991, over a quarter of a million TEUs were exported from and imported into Canada via the United States. Although transshipped tonnages increased between 1989 and 1991, total container traffic, measured in terms of TEUs, moved through the U.S. decreased by four percent over the same period. This trend was primarily due to the 11 percent decrease in Canadian boxes, from over 204 thousand in 1989, to 193 thousand in 1990, to 182 thousand TEUs in 1991, moving through west coast ports. The 13 percent increase, from 72 thousand in 1989 to 75 thousand in 1990 and 84 thousand TEUs, moved through the U.S. east coast over the same period was not enough to offset the west coast's loss and reverse the overall trend.

While the majority of Canadian cargo transshipped through the U.S. between 1989 and 1991 was containerized, a portion was found to be comprised of bulk and/or neo-bulk commodities. U.S. gulf coast ports handled the greatest share of Canada's transshipped bulk cargo. In 1991, it is estimated that 410 thousand tonnes of Canadian cargo were transshipped through the Gulf; in contrast, only 3,400 Canadian TEU's were routed the same way.

Profile of Canadian Cargo Transshipped Through U.S. East Coast Ports

The Port Authority of New York/New Jersey is by far the most dominant port on the U.S. east coast in terms of Canadian transshipments, consistently handling almost one-half of total tonnage and three-quarters of all Canadian TEUs exported and imported through U.S. east coast ports from 1989 through 1991. New York's dominance is especially evident inbound, accounting for 60 percent of tonnage and over 80 percent of TEU's imported into Canada through U.S. east coast ports in 1991 and throughout the three years examined. Philadelphia's role in the handling of Canadian imports has increased by three percent annually since 1989. By 1991 it accounted for nine percent of TEUs and 14 percent of total tonnes through U.S. east coast ports. While 24 other ports on the U.S. eastern seaboard shared in the handling of Canadian imports in 1991, together they accounted for only one in ten TEUs, but one in four tonnes, moving via the U.S. east coast.

On the export side, New York was only slightly less dominant handling 40 percent of Canadian transshipped tonnage and just over one-half of all TEUs in 1991, marginally less than in 1989. In 1991 Baltimore, despite more than tripling its tonnage handled since 1989, was a distant second to New York handling 22 percent of export tonnage moved via the U.S. east coast. Unlike New York however, Baltimore handled less than one percent of total Canadian TEUs exported through U.S. east coast ports. This percentage actually decreased from 1989 to 1991, suggesting a greater focus at the port on the handling of Canadian bulk and neo-bulk exports. PIERS data also revealed that ports on the U.S. south east coast including West Palm Beach, Miami, Port Everglades and San Juan, Puerto Rico were export gateways for a significant number



(approximately 25 percent in 1991) of TEUs moving off the U.S. east coast to destinations in the Caribbean and South and Central America.

While not among the leading ports handling Canadian cargo, a number of the smaller ports on the U.S. east coast were observed to be exclusively handling specific commodities such as apples imported into Canada via Wilmington, Delaware, or Canadian forest products exported through Portland, Maine.

Provinces of Origin/Destination

Although shippers in each Canadian province transported cargo through ports on the east coast of the U.S., not surprisingly, approximately one-half of the of total TEUs and tonnage originated in or were destined for Ontario between 1989 and 1991. Shipments to and from Quebec accounted for another 40 percent of the total over the same time period. Interestingly, while Ontario and British Columbia imported more cargo than they exported through U.S. east coast ports in 1991, other provinces' transshipped exports exceeded their transshipped imports.

With the exception of Prince Edward Island and Saskatchewan, tonnage transshipped through U.S. east coast ports increased between 1989 and 1991. Tonnage moving in and out of British Columbia via the U.S. east coast increased by 60 percent from 1989 to 1990 and then fell back to slightly higher levels in 1991 than in 1989. Although, cargo originating in or destined for Nova Scotia and Manitoba, together accounted for little more than two percent of the total Canadian tonnage moved through U.S. Atlantic ports in 1991, both provinces more than doubled their transshipped tonnage over the three years examined.

Nova Scotia and Manitoba, along with Newfoundland, also more than doubled the number of TEUs transhipped via U.S. east coast ports between 1989 and 1991. On the other hand, Prince Edward Island, Saskatchewan and British Columbia saw a decrease in the number of TEUs moving through the U.S. eastern seaboard over the same time period.

Foreign Country of Origin/Destination

Canadian shippers moved cargo through U.S. east coast ports to and from all major regions of the world in all three years examined. In 1991, the largest proportion, about 30 percent, of tonnage originated in or was destined for Asia (including the Middle East), followed by about one-quarter of the total to/from Europe, and 20 percent to/from South America. Canadian cargo imported from both Asia and South America through U.S. east coast ports was slightly higher than exports to the same regions; whereas, the reverse was true for Europe in that Canadian export tonnage was higher than import tonnage through U.S. Atlantic ports. Although tonnage exported to Central America and the Caribbean accounted for 20 percent of all Canadian exports moved through U.S. eastern ports, only four percent of import tonnage followed similar routing

patterns in 1991. Trade between Canada and Oceania routed through U.S. east coast ports increased more than three-fold between 1989 and 1991 with its proportion of the total increasing from two percent to seven percent over the three years.

Canadian TEUs transshipped via the U.S eastern seaboard to and from Asia fell from 38 percent of the total in 1989 to 30 percent in 1991. All other regions in the world saw an increase in the number of Canadian TEUs moved through U.S. east coast ports over the same time period. Canadian TEUs originated in or destined to Oceania increased more than 500 percent raising its overall proportion from one percent in 1989 to five percent of the total TEUs transshipped via U.S. east coast ports in 1991.

Table 1. Tonnage and TEUs of Canadian Imports Transshipped Through U.S. East Coast Ports by Foreign Region of Origin

Region of Origin	1991 Tonnes	TEUs	1990 Tonnes	TEUs	1989 Tonnes	TEUs
Central America/Caribbean	19,566	1,897	22,895	1,687	9,063	1,098
South America	116,664	8,034	109,230	7,063	94,655	6,204
Europe	137,986	15,839	118,227	13,235	141,124	15,599
Asia/Middle East	175,384	12,684	165,249	12,623	182,126	14,269
Oceania	45,189	1,747	38,540	382	12,833	230
Africa	30,165	1,267	15,236	372	43,350	630
Total	524,954	41,468	469,377	35,362	483,151	38,030

Tonnage and TEUs of Canadian Exports Transshipped Through U.S. East Coast Ports by Foreign Region of Destination

Region of Destination	1991 Tonnes	TEUs	1990 Tonnes	TEUs	1989 Tonnes	TEUs
Central America/Caribbean	121,115	11,598	118,107	10,329	108,122	10,080
South America	91,652	7,263	61,869	4,611	48,911	3,355
Europe	156,210	6,369	130,743	5,659	84,564	5,758
Asia/Middle East	170,855	12,743	219,652	16,568	171,735	13,920
Oceania	29,672	2,526	12,107	723	5,835	486
Africa	61,218	1,732	44,944	1,479	48,287	1,171
Total	630,722	42,231	587,422	39,369	467,454	34,770

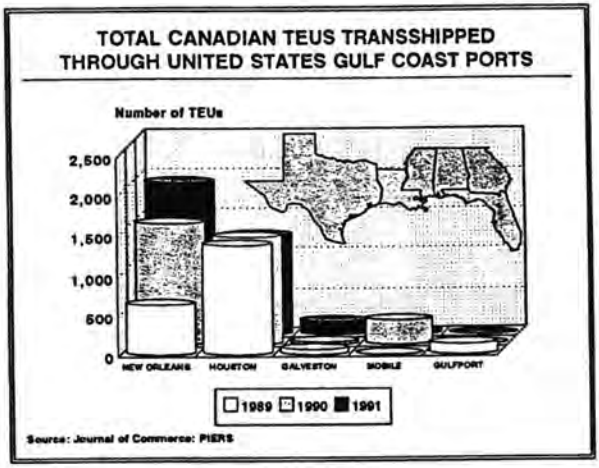
Origins and destinations of Canadian exports and imports transshipped via U.S. east coast ports differ substantially in terms of tonnages and number of TEUs with no one country accounting for more than 10 percent of the Canadian exports or imports through U.S. east coast ports. In terms of tonnage imported into Canada, Japan, Chile and Brazil were among the top five origin countries in all three years analyzed. Other countries among the top five included Korea and Spain in 1991, New Zealand and Indonesia in 1990 and Indonesia and Nigeria in 1989. While transshipped tonnage from Japan and Indonesia decreased over the three years, Chile, Brazil and Korea all increased their tonnage imported into Canada through U.S east coast ports. The major recipients of Canadian exports in each of the three years included Egypt and Japan, as well as Portugal, Brazil and Turkey in 1991; Turkey, Taiwan and Korea in 1990 and Taiwan, Hong Kong and Brazil in 1989. Canadian transshipped tonnage bound for all five leading countries via U.S. east coast ports in 1991 increased from 1989; tonnage exported to Hong Kong and Korea decreased over the same period.

Between 1989 and 1991, Brazil was consistently the top country of origin for TEUs imported into

Canada via U.S. east coast ports. Other origins of Canadian bound TEUs transshipped via U.S. Atlantic ports, with the exception of Taiwan, changed from year to year with Spain, Hong Kong and the United Kingdom among the top five in 1991, the United Kingdom, Korea and China in 1990 and Korea, the Netherlands and Japan in 1989. While transshipped TEUs increased from Brazil and the United Kingdom, they decreased for most Asian countries including Taiwan, Korea and Japan.

Japan was consistently the top destination country for Canadian TEUs exported through U.S. Atlantic ports over the three years. In 1991 the principal destinations for Canadian TEUs moved through U.S. eastern ports included Brazil, Trinidad, the United Kingdom and Australia. However, in both 1989 and 1990 the top countries transshipping goods via the U.S. eastern seaboard en route to Canada included the United Kingdom, Taiwan, Hong Kong and Korea. While TEUs exported to the United Kingdom and Brazil via U.S. east coast ports increased over the three years, they decreased to all other major destinations mentioned.

Profile of Canadian Cargo Transshipped through U.S. Gulf Coast Ports



In the three years examined, ports along the Gulf coast of the U.S. have been almost exclusively used as transshipment centres for Canadian bulk and neo-bulk exports. In 1991, outbound traffic accounted for more than 90 percent of the estimated total of 410,000 tonnes of Canadian cargo handled by U.S. gulf ports. New Orleans handled the greatest number of Canadian tonnes, accounting for over one-half of the total moving through the Gulf destined for overseas. Houston handled another 15 percent while the remaining one-third was distributed among 15 other Gulf ports. An analysis of shipments over the three year period indicates that much of this tonnage appears to be associated with very few shipments of rather large quantities of specific bulk commodities.

Canadian inbound traffic funnelled through the U.S. gulf region has been insignificant, comprising only eight percent of the total Canadian tonnage handled through the region's ports. Houston and New Orleans each handled close to one-half of this cargo, with the remaining two percent trickling through Mobile, Galveston and Gulfport.

Movement of Canadian containers through the gulf coast was minimal. Less than 3,500 TEUs, virtually all of which was handled by New Orleans and Houston, were transshipped through only five U.S. gulf ports. From the PIERS data it would appear that routings for Canadian containers favour ports on the U.S. south east coast rather than the Gulf coast.

Province of Origin/Destination

Shippers in all provinces, with the exception of Prince Edward Island and Newfoundland, also transshipped some cargo through U.S. gulf coast ports between 1989 and 1991. Ontario contributed the largest number of tonnes moved through U.S. gulf ports followed by Saskatchewan, which together, accounted for close to 80 percent of total transshipments through the U.S. gulf in 1991. Although both provinces exported far more than they imported (Saskatchewan imported less than 20 tonnes through the U.S. Gulf), Ontario transshipped a wide variety of goods while tonnage from Saskatchewan was comprised of very large shipments of only a few bulk commodities. Shipments into British Columbia accounted for the largest proportion (45 percent of total) of Canadian import tonnes through U.S. gulf ports in 1991.

Canadian TEUs moved through U.S. gulf coast ports, while minimal, were dominated by Ontario and Quebec which together accounted for about three-quarters of total Canadian transshipments through the region in each year from 1989 to 1991. British Columbian TEUs moved though U.S. gulf ports increased slightly from 400 TEUs in 1989 to 430 TEUs 1991; however, the proportion of total TEUs routed this way was 5 percent lower in 1991 than two years prior.

Foreign Country of Origin/Destination

Canadian shippers moved cargo through U.S. gulf coast ports to and from all major regions of the world in all three years examined. One-third of this cargo moved to and from South America and one-quarter moved to and from Europe in 1991. Cargo transported through U.S. gulf ports increased in all trade lanes with the exception of Oceania, where transshipped tonnage, which decreased by 75 percent between 1989 and 1991. On the other hand, tonnage moved through U.S. gulf ports to and from the Caribbean, Central America, South America and Africa more than doubled over the same time period. Tonnage to and from Europe and Asia was higher in 1991 than in 1989 but lower than in 1990.

Although South America accounted for one-third of Canadian tonnes through U.S. gulf ports, only five percent of total TEUs routed the same way were comprised of South American imports and exports. In 1991, almost one-half of TEUs routed through the Gulf originated or were destined for points in the Caribbean or Central America, three times as many as in 1989. Canadian containers moving to and from Europe accounted for another one-third of total TEUs through U.S. gulf ports in 1991. TEUs imported and exported to all other major regions decreased over the three years studied.

The leading origin and destination countries whose cargo was transhipped through U.S. gulf coast ports en route to/from Canada were far more concentrated, although more inconsistent from year to year, than countries whose transshipping products through U.S. eastern ports between 1989 and 1991. In 1991, more than one-third of Canadian tonnes exported through the Gulf were bound for Brazil, and another one-quarter was en route to Egypt. In 1990, 30 percent of total export tonnes were split between Taiwan and New Zealand, and in 1989, New Zealand, Guyana and Brazil received 55 percent of total Canadian tonnes exported through U.S. gulf coast ports. More than four of every ten transshipped tonnes imported into Canada through the Gulf originated in either Argentina or Nicaragua in 1991, Argentina or Finland in 1990, and Venezuela, Honduras or Brazil in 1989.

One half of Canadian TEUs exported through U.S. gulf ports were destined for Panama or Guatemala in 1991. While less concentrated in the other years studied, one third of outbound TEUs were destined to Spain, Trinidad or Costa Rica in 1990 and to the United Kingdom, Spain or Brazil in 1989. One-third of TEUs in 1991, and one-fifth in 1990, imported into Canada through the Gulf originated in Nicaragua. Germany and Costa Rica were also among the top

Table 2. Tonnage and TEUs of Canadian Imports Transshipped Through U.S. Gulf Coast Ports by Foreign Region of Origin

Region of Origin	1991 Tonnes	TEUs	1990 Tonnes	TEUs	1989 Tonnes	TEUs
Central America/Caribbean	6,419	711	4,435	348	6,718	211
South America	11,270	68	32,060	41	13,548	47
Europe	8,483	746	23,465	345	7,343	200
Asia/Middle East	5,419	49	14,942	31	8,124	42
Oceania	271	23	739	51	2,059	119
Africa	80	7	307	25	171	13
Total	31,942	1,604	75,948	841	37,963	632

Tonnage and TEUs of Canadian Exports Transshipped Through U.S. Gulf Coast Ports by Foreign Region of Destination

Region of Destination	1991 Tonnes	TEUs	1990 Tonnes	TEUs	1989 Tonnes	TEUs
Central America/Caribbean	36,054	863	29,585	893	9,046	342
South America	128,084	125	29,538	338	77,417	293
Europe	90,250	503	137,838	813	38,133	746
Asia/Middle East	39,151	190	80,986	267	16,093	177
Oceania	13,564	0	47,822	5	56,016	7
Africa	71,168	98	13,949	99	18,837	34
Total	378,271	1,779	339,718	2,415	215,542	1,599

origins of Canadian containerized cargo moved through U.S. gulf ports together comprising 15 percent in 1991, 21 percent in 1990 and 60 percent of total TEUs in 1989.

Profile of Canadian Transshipments via the American West Coast

Since the mid-1980s, three features have characterised intermodal transportation networks focused on North America's west coast ports. First, compared to other regional intermodal networks in North America, the west coast system has accrued tremendous benefit from burgeoning trans-Pacific container trade. Second, there has been a demonstrable northward shift in the aggregate movement of containerized marine cargo handled via west coast ports. Third, the efficiency of the American western minibridge has led to the capture of large quantities of transshipped Canadian cargo that might otherwise have been handled at the port of Vancouver.

Results

An examination of the size and direction of west coast transshipments for the period 1989-1991 reveals some features which may bode well for the future of the port of Vancouver (see Tables 3 and 7). In 1989, the PIERS estimate for west coast transshipments was 205 thousand TEUs (1.92 million tonnes), with Tacoma (122 thousand TEUs) and Seattle (54 thousand TEUs) capturing 86 percent of the transshipment activity. In 1990, diverted Canadian cargo clearing U.S. west coast ports declined to 193 thousand TEUs (1.87 million tonnes), with just over four-fifths of this traffic focused on the ports of Tacoma (113 thousand TEUs) and Seattle (45 thousand TEUs). Finally, in 1991, 182 thousand TEUs (1.81 million tonnes) of Canadian cargo was transshipped via U.S. west coast ports, with Tacoma (93 thousand TEUs) and Seattle (47 thousand TEUs) capturing less than three-quarters of this trade.

Table 3. Transshipments via U.S. Ports by Canadian Region

IMPORTS				EXPORTS		
Region	1991	1990	1989	1991	1990	1989
	TEUs			TEUs		
Atlantic	310	175	71	699	582	525
Québec	26,737	28,904	32,397	8,979	7,415	8,220
Ontario	63,555	62,310	61,673	19,533	19,335	17,490
West	23,121	27,158	30,651	39,176	46,673	53,662
Total	113,723	118,547	124,792	68,387	74,005	79,897
	Tonnes			Tonnes		
Atlantic	2,460	1,829	937	6,856	5,646	4,835
Québec	159,009	175,630	205,666	110,105	91,959	101,523
Ontario	408,325	426,281	423,954	223,525	228,033	206,271
West	294,770	353,743	323,340	611,771	596,369	651,764
Total	864,564	957,483	953,897	952,257	922,007	964,393
	Tonnes/TEU			Tonnes/TEU		
Atlantic	7.9	10.5	13.2	9.8	9.7	9.2
Québec	5.9	6.1	6.3	12.3	12.4	12.4
Ontario	6.4	6.8	6.9	11.4	11.8	11.8
West	12.7	13.0	10.5	15.6	12.8	12.1
Weighted Average	7.6	8.1	7.6	13.9	12.5	12.1

Table 4. Regional Transshipment Flows
(Export to Import Ratio: >1.0 exporter, <1.0 importer)

Region	1991	1990	1989	1991	1990	1989
	TEUs			Tonnes		
Atlantic	2.3	3.3	7.4	2.8	3.1	5.2
Québec	0.3	0.3	0.3	0.7	0.5	0.5
Ontario	0.3	0.3	0.3	0.5	0.5	0.5
West	1.7	1.7	1.8	2.1	1.7	2.0
Weighted Average	0.6	0.6	0.6	1.1	1.0	1.0

Table 5. Key U.S. Port for Transshipments by Province

1991						
Province	U.S. Port	TEUs via Port	% of Total	U.S. Port	TEUs via Port	% of Total
	IMPORTS			EXPORTS		
Ontario	Tacoma	39,402	63	Tacoma	8,038	42
Québec	Tacoma	14,012	52	Tacoma	3,538	40
British Columbia	Tacoma	12,369	58	Seattle	14,605	43
Alberta	Tacoma	645	51	Seattle	2,537	50
Manitoba	Tacoma	226	52	Seattle	71	48
New Brunswick	Long Beach	100	42	Seattle	485	78
Nova Scotia	Seattle	47	66	Oakland	32	49
Saskatchewan	Tacoma	27	53	Tacoma	34	49
1990						
	IMPORTS			EXPORTS		
Ontario	Tacoma	38,864	63	Tacoma	10,286	54
Québec	Tacoma	19,702	69	Tacoma	3,274	45
British Columbia	Tacoma	15,209	61	Tacoma	22,577	53
Alberta	Tacoma	867	64	Tacoma	1,894	59
Manitoba	Tacoma	233	46	Tacoma	47	70
New Brunswick	Seattle	70	70	Seattle	422	80
Nova Scotia	Tacoma	50	71	Oakland	26	57
Saskatchewan	Tacoma	34	54	Seattle	153	56
1989						
	IMPORTS			EXPORTS		
Ontario	Tacoma	38,358	62	Tacoma	10,479	61
Québec	Tacoma	22,340	69	Tacoma	3,232	40
British Columbia	Tacoma	17,594	63	Tacoma	25,420	53
Alberta	Tacoma	872	62	Tacoma	2,699	61
Manitoba	Tacoma	464	63	Seattle	150	65
Saskatchewan	Tacoma	63	58	Tacoma	88	80
Nova Scotia	Tacoma	24	56	Oakland	58	38
New Brunswick	Seattle	7	50	Seattle	192	53

Without discounting the dampening effects of the recession in Canada during part of the study period (particularly 1991), two consecutive years of falling container transshipments gives some cause for optimism. Intriguingly, while transshipments of Canadian cargo fell 11 percent during the period 1989-1991, international container traffic throughput at the port of Vancouver increased by 20 percent, from 289 thousand TEUs in 1989, to 317 thousand TEUs in 1990, and finally reaching 348 thousand TEUs in 1991 (Shipping in Canada). In the aggregate, this limited evidence suggests that efforts undertaken by the port of Vancouver to regain transshipped Canadian cargo may be generating some initial success. While such a deductive conclusion may prove correct, without further analysis, no definitive link can be established between rising container shipments at Vancouver, and declining levels of transshipped containers at Tacoma and Seattle.

Regional Patterns and Flows

Regionally, transshipment flows between Canada and the west coast of the United States reveal a marked export orientation in the hinterland economies of Atlantic and Western Canada, and a strong import orientation in the Ontario and Québec heartland (Table 4). For the nation as a whole, two tales may be told about the nature of Canadian transshipped cargo flows. If TEUs are the preferred measure, then the size and range of the central Canadian consumer market renders the nation a net importer of transshipped container goods. Alternatively, a tonnage based approach reveals the 'bulkiness' of Canada's transshipped container exports, and gives the impression of an overall export orientation. Ideally, a careful examination of the dollar value of transshipped container goods moving across the Pacific Ocean would provide the basis for drawing conclusions about Canada's import or export orientation.

Provincial Patterns and Flows

In assessing provincial transshipment flows, the dominance of the port of Tacoma as the clearing house for Canadian imports and exports is readily conveyed. As outlined in Table 5, the four largest provincial economies imported the majority of their transshipped goods via Tacoma in each of the data years examined. On the export side, only Seattle posed any challenge to the ability of Tacoma to attract Canadian transshipments. In the only year that this occurred -- 1991 -- the share of those two provincial transshipments captured by the port of Seattle from Tacoma was 50 percent or less (Table 5). More impressively, in the 33 instances where Tacoma captured the greatest share of transshipped provincial goods, 27 cases indicated market shares of greater than 50 percent of the provincial transshipment total. Finally, in those cases where other ports crept into the distribution hierarchy, the captured provincial transshipment business, as measured in TEUs, was generally very small.

Ultimate Origins and Destinations

Imports of containerized goods transshipped from the U.S. west coast reflect the space-economy of Canada, with the manufacturing and consumptive features of central Canada clearly evident in each of years examined (Table 6). Thus, the largest single origin markets for both Ontario (Japan: 14 thousand TEUs in 1991) and Québec (South Korea: eight thousand TEUs in 1991) remained unchanged over the study period. The only other province importing transshipped goods at a similar magnitude to the central Canadian provinces was British Columbia, where Japan and Taiwan vied for the province's business. Finally, all of the remaining provinces registering a dominant origin market for transshipped goods saw substantially smaller levels of inbound cargo. On the outbound side, the ultimate destinations of Canadian exports reveals the hinterland character of the Western and Atlantic provinces, with aggregate transshipment volumes substantially higher than on the inbound side (Table 6). Thus, the largest foreign market for

Table 6. Largest Import and Export Transshipment Route by Province, Ultimate Origin, and Ultimate Destination

IMPORTS			EXPORTS		
1991 Province	Ultimate Origin	TEUs	1991 Ultimate Destination		TEUs
Ontario	Japan	14,098	Hong Kong		5,155
Québec	South Korea	8,249	Japan		3,414
British Columbia	Taiwan	3,773	Japan		15,308
Alberta	Japan	172	China		1,449
Manitoba	Japan	144	Australia		34
Saskatchewan	Australia	32	Taiwan		25
New Brunswick	--	--	Japan		265
1990			1990		
Ontario	Japan	16,342	South Korea		4,317
Québec	South Korea	6,224	Japan		994
British Columbia	Japan	4,235	Japan		18,458
Alberta	Japan	292	Indonesia		714
Manitoba	China	78	Australia		28
New Brunswick	Japan	66	Japan		227
Nova Scotia	Australia	35	Japan		45
Saskatchewan	--	--	Japan		64
1989			1989		
Ontario	Japan	14,098	Japan		5,656
Québec	South Korea	8,249	Japan		2,548
British Columbia	Taiwan	3773	Japan		21,648
Alberta	Japan	172	South Korea		1,249
Manitoba	Japan	144	Taiwan		68
Saskatchewan	Australia	32	Australia		85
Nova Scotia	New Zealand	13	Japan		133
Yukon & NWT	--	--	Thailand		24
New Brunswick	--	--	Singapore		78

Table 7. Canadian Transshipments Handled at U.S. West Coast Ports

	IMPORTS			EXPORTS		
Port	1991	1990 TEUS	1989	1991	1990 TEUS	1989
Los Angeles	12,040	12,368	9,553	3,123	2,459	2,377
Long Beach	7,411	5,339	5,731	3,776	2,944	2,040
Oakland	2,351	1,168	1,564	7,634	7,234	4,654
Tacoma	66,753	74,986	79,746	26,730	38,230	42,126
Seattle	24,724	24,323	27,529	22,574	20,634	26,515
Other West Coast	444	346	629	4,549	2,505	2,186
Other	--	16	39	--	--	--
Total	113,723	118,546	124,791	68,386	74,006	79,898

Table 8. Total Canadian Transshipments by U.S. West Coast Ports and Imports as Proportion of Business

Port	1991 TEUs	1991 % Imports	1990 TEUs	1990 % Imports	1989 TEUs	1989 % Imports
Los Angeles	15,163	79.4	14,827	83.4	11,930	80.1
Long Beach	11,187	66.2	8,283	64.5	7,771	73.7
Oakland	9,985	23.5	8,402	13.9	6,218	25.2
Tacoma	93,483	71.4	113,216	66.2	121,872	65.4
Seattle	47,298	52.3	44,957	54.1	54,044	50.9
Other West Coast	4,993	8.9	2,851	12.1	2,815	22.3
Other	--	--	--	--	--	--
Total	182,109	62.4	192,536	61.6	204,650	61.0

Table 9. Top Ten Foreign Ports of Loading/Unloading for Canadian Cargo Transshipped via U.S. West Coast

IMPORTS: Ranked by Tonnes

Port of Loading	1991 Tonnes	TEUs	Tonnes/TEU
Kaohsiung	191,915	28,728	6.7
Hong Kong	159,309	27,853	5.7
Kobe	94,494	14,315	6.6
Yokohama	51,065	10,550	4.8
Busan	43,314	7,157	6.1
Tokyo	41,703	6,665	6.3
Nagoya	36,608	5,353	6.8
Melbourne	24,350	1,614	15.1
Singapore	17,148	2,431	7.1
Keelung	14,807	2,400	6.2
Group Totals	674,713	107,066	6.3

EXPORTS: Ranked by Tonnes

Port of Unloading	1991 Tonnes	TEUs	Tonnes/TEU
Kobe	140,907	12,694	11.1
Hong Kong	124,606	11,138	11.2
Tokyo	72,465	6,068	11.9
Yokohama	58,974	3,935	15.0
Singapore	41,570	3,818	10.9
Busan	39,814	2,700	14.7
Nagoya	31,991	2,923	10.9
Felixstowe	37,152	3,875	9.6
Inchon	33,246	2,295	14.5
Keelung	21,657	2,261	9.6
Group Totals	602,382	51,707	11.6

Port of Loading	1990 Tonnes	TEUs	Tonnes/TEU
Hong Kong	168,024	29,271	5.7
Kaohsiung	130,522	18,682	7.0
Kobe	127,035	19,661	6.5
Busan	74,277	14,202	5.2
Yokohama	46,354	9,952	4.7
Tokyo	43,208	6,435	6.7
Keelung	40,460	6,240	6.5
Melbourne	25,189	1,602	15.7
Shimizu	22,832	3,162	7.2
Singapore	13,657	1,969	6.9
Group Totals	691,558	111,176	6.2

Port of Unloading	1990 Tonnes	TEUs	Tonnes/TEU
Kobe	175,995	15,979	11.0
Kaohsiung	123,159	11,184	11.0
Hong Kong	118,933	10,851	11.0
Tokyo	77,716	7,014	11.1
Busan	76,302	3,088	24.7
Yokohama	65,096	6,160	10.6
Inchon	52,722	2,576	20.5
Singapore	38,568	3,800	10.1
Nagoya	32,771	2,861	11.5
Keelung	30,040	3,172	9.5
Group Totals	791,302	66,685	11.9

Port of Loading	1989 Tonnes	TEUs	Tonnes/TEU
Hong Kong	169,933	28,291	6.0
Kaohsiung	152,687	21,421	7.1
Kobe	139,043	21,612	6.4
Busan	80,307	15,446	5.2
Keelung	61,111	10,486	5.8
Yokohama	50,338	10,047	5.0
Tokyo	39,905	6,295	6.3
Nagoya	27,674	3,618	7.6
Melbourne	20,758	1,331	15.6
Singapore	13,591	1,840	7.4
Group Totals	755,347	120,387	6.3

Port of Unloading	1989 Tonnes	TEUs	Tonnes/TEU
Kobe	214,177	19,378	11.1
Kaohsiung	117,722	11,084	10.6
Hong Kong	115,113	11,002	10.5
Yokohama	100,404	8,282	12.1
Tokyo	58,717	5,439	10.8
Keelung	42,088	4,201	10.0
Felixstowe	40,094	4,199	9.5
Busan	37,447	3,418	11.0
Inchon	36,159	1,834	19.7
Singapore	27,711	2,838	9.8
Group Totals	789,632	71,675	11.0

British Columbia's transshipments from the U.S. west coast were roughly four to five times greater than the most important inbound market throughout the study period. For Canada as a whole, Japan's dominance of the export transshipment market is even more overwhelming than is the case with inbound containers. Moreover, in TEU terms, exports leaked from British Columbia and transhipped from the U.S. west coast were typically anywhere from three to four times greater than the next largest province ultimate destination combination.

American West Coast Ports

Transshipments of Canadian containerized trade from America's west coast shows a general distance-decay effect, with those American ports nearest the Canadian destination market enjoy greater proportional benefits than more distant ports. Of course, the complete absence of Portland is a notable deviation from this rule (Table 7).

Those ports which exhibit an overall import orientation and are a first port-of-call benefit the most from the Canadian transshipment trade, as suggested by the hierarchy outlined in Table 8. Thus, the relatively small overall trade of Oakland and the absence of Portland in Table 8 is related to the export orientation and last port-of-call status of these two centres. This point is substantiated by the observation that only Oakland attributes the majority of it's Canadian transshipments to outbound movements.

Foreign Ports of Loading and Unloading

Foreign loadcentres are those points which send or receive containerized Canadian trade transshipped via U.S. west coast ports. Table 9 provides a breakdown of the ten largest ports engaged in this particular trade during the period of study. Among the most salient features evident in Table 9 is the dramatic difference in average TEU weights between imported and exported Canadian transshipments. Generally, it has been assumed that the average outbound Canadian container is much heavier than it's inbound counterpart. In explaining this difference, it is important to recollect that Canadian exports are generally heavier, bulkier, and generate lower unit values than the finished, high-value containerized goods imported from Asia (note that the weight of exports from Melbourne bear a striking resemblance to Canadian outbound shipments, testimony to a similar national economic base).

Another striking feature found in Table 9 is the overall stability of the loadcentre membership engaged in the Canadian container transshipment trade. On the import side, of 30 available positions between 1989 and 1991, 28 were filled by ports which jockeyed for position with one another in each of the data years. Thus, only two positions were filled by ports which did not appear in the top ten for each of the years examined. Finally, a similar degree of stability characterizes the export side of the Canadian transshipment trade, with 24 of the 30 positions available occupied by ports occurring in each of the years examined.

Conclusions

Given the importance of the container trade to the national transportation system, there will be a constant need for the timely and accurate estimation of transshipped Canadian cargo handled at American ports. As no Canadian database presently measures the transshipment problem, PIERS will remain the only timely data source that provides empirical estimates of the size and direction of Canadian transshipment flows. Commencing in 1993, PIERS will offer users an expanded and improved database, including standardization of commodity codes, geocoding, and cargo tracking ability. For the transportation community, these improvements offer the

opportunity for a thorough assessment of the transshipment problem. With Canada's national container trade perpetually challenged by highly competitive American ports, the PIERS database should play an important role in the Canadian transportation system as it approaches the twenty first century.

Acknowledgements

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An Analysis of Marine-Rail Intermodal Commodity Flows in Canada, 1984-1990

Michel Cloutier, Statistics Canada

Introduction

This study examines two separate databases from Statistics Canada's Transportation division and identifies the intermodal links between marine and rail cargo, with a special emphasis on containerized goods. Section 1 of the study focuses on trends for marine-rail cargo over the period 1984 to 1990 (using the rail data only), while section 2 concentrates on 1990 data using both databases. Specific bulk and containerized commodity flows will be analyzed by origin and destination, for both the rail and marine portions of the movements.

1.0 Railway Freight Origin and Destination, 1984 - 1990

1.1 Marine-Rail vs Total Rail Freight

Over the period 1984 to 1990 total rail revenues and tonnage varied significantly from year to year. Overall, there has been a downward trend for this period, with a drop from 192 million tonnes of cargo transported in 1984 to 182 million tonnes in 1990 (see figure 1).

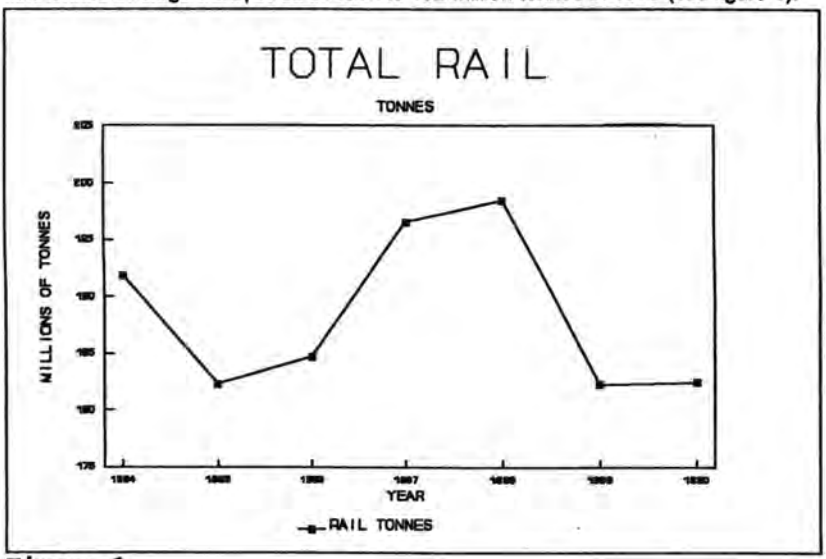


Figure 1

The only exceptions to this decline were the peaks of 1987 and 1988, years in which a great

deal of wheat was transported. As for revenues they have been just as volatile as tonnages with total revenues in 1990 at 7.1 billion dollars (see table 1).

Compared to total railway freight, marine exports and imports have performed much more consistently. Marine exports have been increasing steadily since 1984, except for 1989 when there was a decrease after the strong gains of 1987 and 1988 (see figure 2); marine exports went from 67.3 million tonnes in 1984 to 73.2 million tonnes in 1990. Marine import tonnages have remained relatively constant going from 3.5 million tonnes in 1984 to 3.9 million tonnes in 1990. Contrary to exports, there has however been a steady decrease since 1987 when the peak of 4.7 million tonnes was reached (see figure 3).

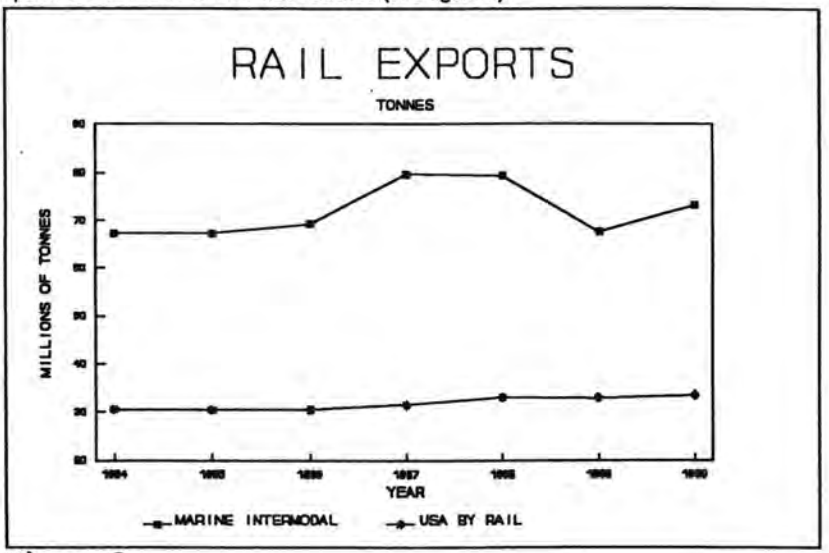


Figure 2

Marine exports represented approximately 40.1% of the total rail tonnage handled while marine rail imports represented another 2.2%, in 1990. These percentages are a substantial increase over the 1984 proportions, when exports represented only 35.1% and imports accounted for 1.8% of total rail freight (see table 1). This emphasizes the importance of marine/rail intermodal shipments as one of the key growth areas for rail commodity flows. Marine-rail exports of bulk commodities are obviously a much more important component of rail traffic than marine imports with export tonnages almost 19 times larger than import tonnages.

1.2 Marine-Rail Exports vs Exports to the U.S.

Marine-rail intermodal export tonnage has consistently been over double the exports to the U.S. by rail. As with marine-rail shipments, rail exports to the U.S. have been growing steadily over the seven years of this study and represented 18.3% (33.5 million tonnes) of total rail freight in 1990 up from 15.9% (30.5 million tonnes) in 1984 (see figure 2). Interestingly revenues for U.S. export shipments are consistently higher than for Canadian marine-rail exports reflecting the different types of cargo being handled (see table 1). Based on this data, it would seem that U.S. cargo represents much more lucrative market for the rail companies and may explain in part the rail companies interest in developing their north-south connections.

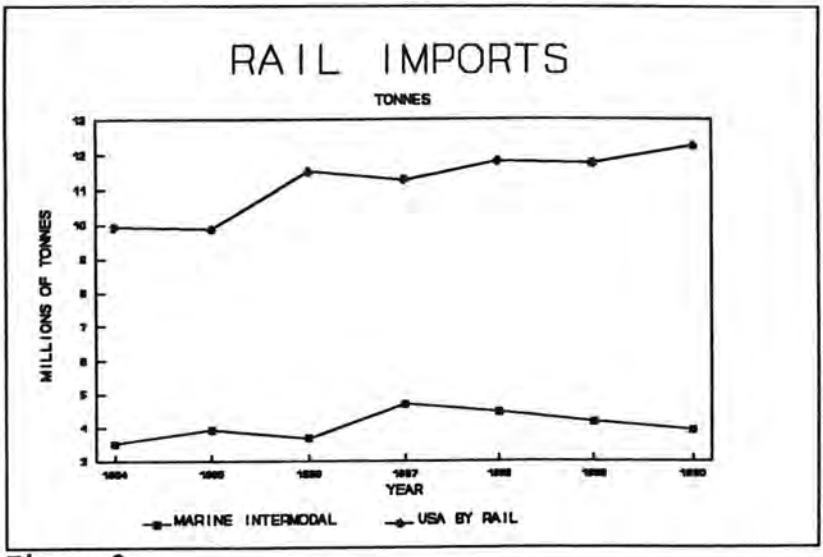


Figure 3

1.3 Marine-Rail Imports vs. Imports from the U.S.

Contrary to marine-rail imports, rail imports from the U.S. have been on a steady upward climb since 1984, going from 9.9 million tonnes (5.2% of total freight) to 12.2 million tonnes (6.7%) in 1990 (see figure 3 and table 1). Again, in opposition to the relationship for exports, rail imports from the U.S. are about 3 times larger in tonnage than marine-rail intermodal shipments, confirming the reliance of the Canadian economy on freight coming from our major trading partner. Revenues for rail imports from the U.S. were also 3 times larger than marine-rail revenues, giving a consistent relationship for tonnage and revenues.

1.4 Marine-rail with the U.S.

Marine-rail shipments to and from the U.S. represent transhipment cargoes which are handled in Canadian ports. A very strong upward trend is evident for both marine imports destined for the U.S. and for marine exports originating in the U.S. (see figure 4).

Marine-rail imports destined for the U.S went from 330 thousand tonnes (9.4% of total marine imports) in 1984, to 681 thousand tonnes (17.3%) in 1990. This is an increase of over 100% in seven years and by far the strongest growth area for marine-rail shipments, although it is also the smallest cargo type in absolute terms.

Marine-rail exports originating in the U.S. also grew, but at a slightly slower pace, going from 515 thousand tonnes (0.8% of total marine exports) in 1984, to 830 thousand tonnes (1.1%) in 1990. In absolute terms marine-rail exports originating in the U.S. were still about 31% higher than marine-rail imports destined for the U.S. in 1990 (in 1984 they were 56% higher).

1.5 Rail Containers

Overall rail container traffic remained relatively flat during the study period, with the strongest

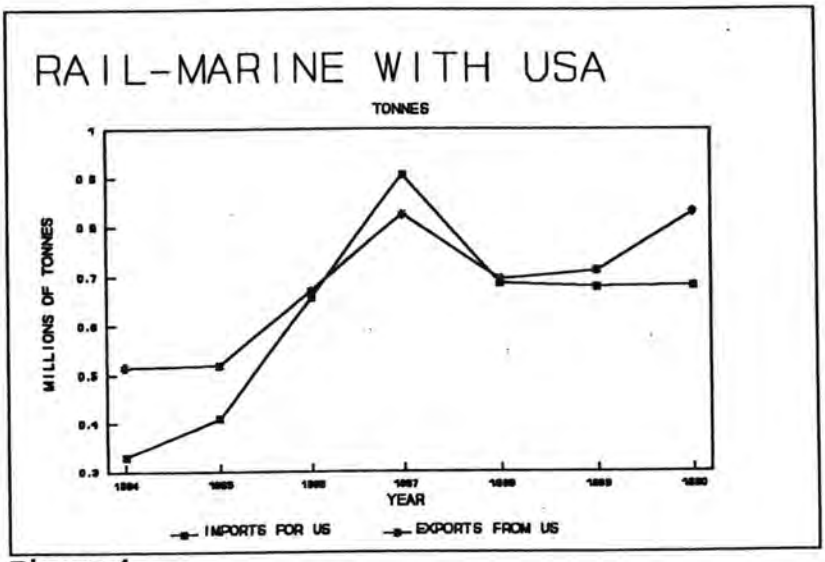


Figure 4

performance coming in 1988 when 2.9 million tonnes (1.5% of total freight) of containerized cargo was shipped. The main determinant of this rather lacklustre performance was the downward slide of marine-rail container imports which went from 1.6 million tonnes (64.6% of total container traffic) in 1984, to 1.3 million tonnes (48.4%) in 1990. This was somewhat offset by the strong performance of marine container exports which went from 0.9 million tonnes (34.8% of total container traffic) to 1.2 million tonnes (46.5%) (see figure 5).

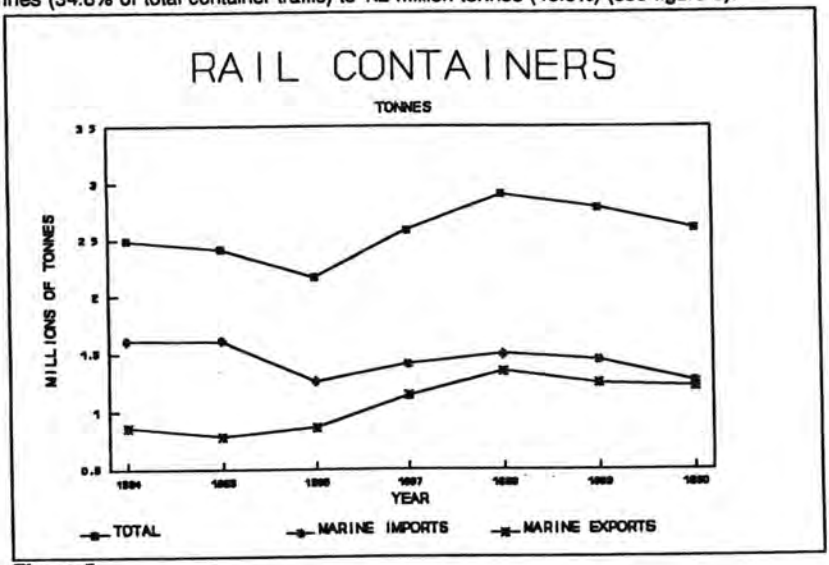


Figure 5

Marine-rail containerized goods account for almost 95% of all container tonnage as reported by the rail companies. This includes only those containerized cargoes which are classified as such because no details were available regarding the commodities within the containers. Containerized goods which were classified by commodity are not included in the above totals, thus true container growth may be understated due only to reporting procedures.

The gap between containerized marine imports and exports has narrowed significantly over the years to the point where the two have almost identical tonnages. Revenues for containerized goods have followed the same general pattern as for the tonnages, although there has been a more significant increase in dollar terms. In 1990, Marine-rail container import revenues were still about 37% higher than marine-rail container export revenues, even though the tonnages were about equal (see table 1).

2.0 Marine-Rail connection by commodity, 1990

This section presents an analysis of data from two separate Statistics Canada data bases. Tabulations were produced, for the 1990 data year, for rail and marine data so that comparisons could be made by commodity and for the total tonnage being reported. Based on the marine-rail indicator from the rail data base, linkages were made with the marine tonnages, by commodity. Unfortunately no marine-rail indicator is available on the marine data base so that an exact match was not always possible. Nevertheless, results are presented for selected commodities to show what percentage of marine cargo is really intermodal marine-rail cargo.

2.1 Marine-rail exports

A total of seven export commodities were selected for linkage with the marine data. These were the top marine-rail commodities (in terms of tonnage) as reported on the rail data base. Most of these are also very important commodities for the marine mode. The only significant export commodities, from the marine perspective, which were not included were iron ore, lumber and sawn timber, fuel oil and gypsum. For these commodities marine-rail intermodal shipments are not as prevalent as for the seven commodities in this study.

2.1.1 Marine-Rail Exports by commodity

In 1990, the most important marine-rail commodities in terms of tonnage, were coal, followed by wheat, sulphur, barley, potash, rapeseed and containers (see table 2). Coal and wheat were by far the most important of these, representing 40% and 26% of total marine-rail tonnage respectively.

These seven commodities accounted for over 88% of all marine-rail tonnage and almost 43% of total international marine tonnage. In addition, total marine-rail exports covered 33% of all marine loadings, in 1990. This clearly illustrates the level of interdependence for these two modes, especially for bulk commodities.

Coal
The best linkage between marine and rail tonnage is for coal, which is also the most important commodity shipped for both modes. Essentially all of the coal loaded on ships in B.C. is unloaded from rail cars. Coal loaded in other provinces, in international shipping, does not arrive at the marine ports by rail cars.

Wheat
For wheat, 96% of all marine shipments were covered by the reported marine-rail tonnage. B.C. again had the best linkage with 99% coverage of marine loadings by marine-rail wheat

movements. B.C. also accounts for about half of all wheat exports.

The match for Ontario is also very good at 95%, thereby covering most of the remaining wheat exports. In this case however both international and domestic wheat loadings must be added together to match the tonnage reported by the railways. This is explained by the fact that wheat is shipped by rail to Thunder Bay for loading by lakers which unload at St.-Lawrence ports, before the final leg of the trip by seagoing vessels leaving ports in the province of Quebec. The international tonnage loaded in Quebec was therefore reduced by the amount received from Ontario in domestic shipping, to avoid double counting.

Sulphur
As with coal, all marine-rail sulphur shipments are destined for British Columbia. In this case, 92% of marine loadings arrive at the port by rail with the remainder making other intermodal connections.

Rapeseed
B.C. dominates again for this commodity with over 87% of rapeseed tonnage and a 93% coverage rate of marine loadings. Almost all loadings in Ontario are in domestic shipping.

Barley
For this commodity more tonnage was reported in every province of destination than was loaded in either international or domestic shipping. Overall, marine-rail tonnage represented 109% of the tonnage loaded by vessels in 1990. This may be due to timing and/or commodity classification differences. The largest discrepancy in absolute terms was in British Columbia where about 900 thousand tonnes more were reported by the rail mode than by the marine mode. On the other hand almost none of the barley loaded in Quebec arrived on rail cars.

Potash
For potash the best match was again obtained in BC with 96% of marine loadings originating on rail cars. Both Ontario and New Brunswick showed substantial amounts of potash which were not originally shipped by rail (about 2 million tonnes in total).

Containers
Containerized cargo presented the most difficulties when attempting to match the two data bases. Since some containerized cargo is not reported as such by the rail companies and no commodity details were available for the rail container category it was impossible to identify the corresponding cargo on the marine database. Nevertheless it was decided to compare the tonnage for containerized general cargo from the marine side with the container tonnage from rail.

For all provinces reporting marine-rail containers the tonnage accounted for about 79% of marine containerized general cargo. It can also be seen that there is some similarity in the tonnages reported by province although they do not match very closely compared with the other commodities. Nova Scotia is obviously receiving much more than just general cargo containers by rail, where as B.C. and Quebec have a large number of container exports with intermodal links other than rail (the marine-rail tonnages reported for the latter two provinces would seem to confirm that a significant amount of containerized cargo is classified in other categories such as "mixed carload freight").

2.1.2 Marine-Rail Exports by province of destination

The most important province of destination for marine-rail exports was British Columbia, by a significant margin, with a total of almost 58 million tonnes unloaded there (although 42% also originated within B.C). About 4 out of every 5 tonnes of marine-rail cargo was shipped to B.C. for loading in international shipping. B.C. was followed by Ontario with over 9 million tonnes

and Quebec with about 3 million tonnes. These three provinces maintain the same relative shares for the seven commodities in this study (see figure 6).

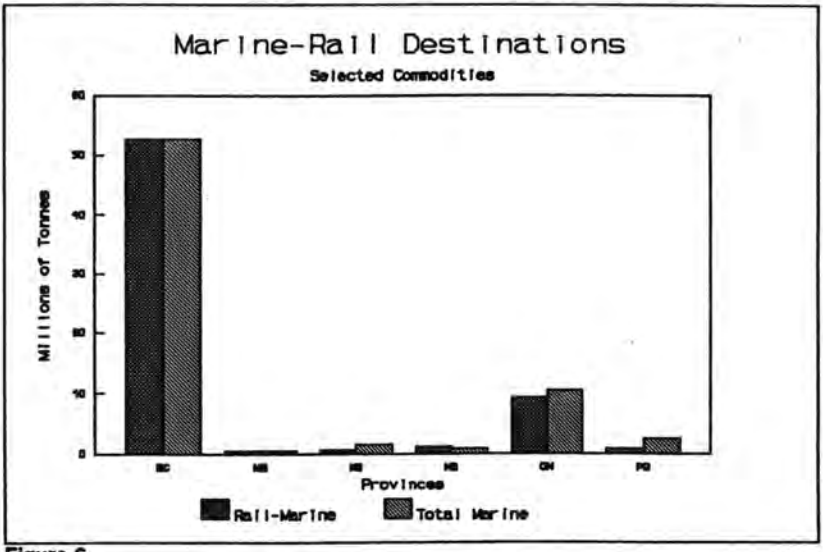


Figure 6

From the marine side, the total tonnage loaded by province for the seven commodities closely matches that of the marine-rail shipments (see table 2). For all provinces except Manitoba and Nova Scotia the marine tonnage is greater than the marine-rail tonnage. This indicates that in most cases marine shipments included all of the rail tonnage plus cargo from other sources or modes. In the case of Manitoba we are probably dealing with a timing difference since not all the marine-rail tonnage was loaded on ships in the same year (wheat in grain elevators at Churchill). In Nova Scotia's case differences are clearly due to difficulties in identifying the containerized marine cargo which is linked to the rail shipments.

Overall, 95% of all marine tonnage for these seven commodities was accounted for by the rail-marine cargo. Only two provinces showed a significant difference in tonnage reported. These were New Brunswick and Quebec at 41% and 31% respectively. This underlines the fact that the rail mode is not used extensively for some marine cargo shipped from these areas (Potash in New Brunswick as well as barley in Quebec).

2.1.3 Marine-Rail Origin and Destination

The decision to move a good by a given transportation mode is dependent upon the unit value and distance from market of a particular commodity. Reflecting this principle, the intensity of Canadian marine-rail cargo flows reveals a perfect west-east gradient. Thus, British Columbia generated 24 million tonnes of marine-rail cargo in 1990, followed by the three prairie provinces, with exports of grains and natural resources, Ontario, Quebec, and the Atlantic provinces (see figure 7).

The most important origin destination pair is from B.C. to B.C., for coal shipments, with 22.3 million tonnes being transported in 1990 (see table 3). This is followed by Alberta to B.C., also for coal (6.9 million tonnes), Saskatchewan wheat to B.C. (5.2 million tonnes), Saskatchewan

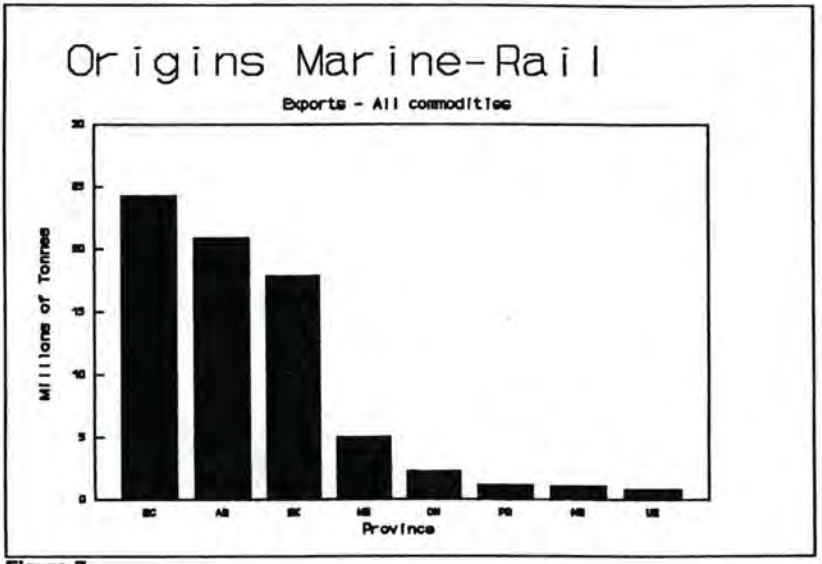


Figure 7

wheat to Ontario (4.5 million tonnes), Alberta sulphur to B.C. (4.5 million tonnes) and Saskatchewan potash to B.C. (3.7 million tonnes). It is easily seen from the above listing that the western provinces and in particular B.C. dominate as far as the most important rail routes for marine cargoes.

For six of the seven principal commodities the top 5 origin destination pairs account for between 95% and 100% of all rail-marine export tonnage moved. The only exception is wheat where about 88% is accounted for by the top 5 routes. For containers, almost 89% of the marine-rail tonnage is moving to Nova Scotia from Ontario and Quebec.

2.1.4 Marine Destinations by commodity and region

The commodities shipped intermodally by rail and marine are principally destined for Asia and Oceania, with the great majority leaving from B.C. Coal, wheat and potash are the principal commodities being shipped (see figure 8).

Most of the remaining cargo is shipped to Europe, the Middle East and Africa. Important cargoes are wheat, barley, coal and sulphur, shipped from both the west and the east. Europe is the major destination for containers followed by the U.S. Atlantic and Asia and Oceania (see table 4).

2.2 Marine-rail Imports

The top five commodities for marine-rail imports were selected for linkage with the marine data base. These commodities represent over 95% of all marine-rail import tonnage (see table 5). This cargo is equally distributed between the provinces of Quebec, Nova Scotia and British Columbia (in order of importance). This reflects the fact that almost all of the marine-rail import cargo is being handled at the major intermodal ports of Montreal, Halifax and Vancouver.

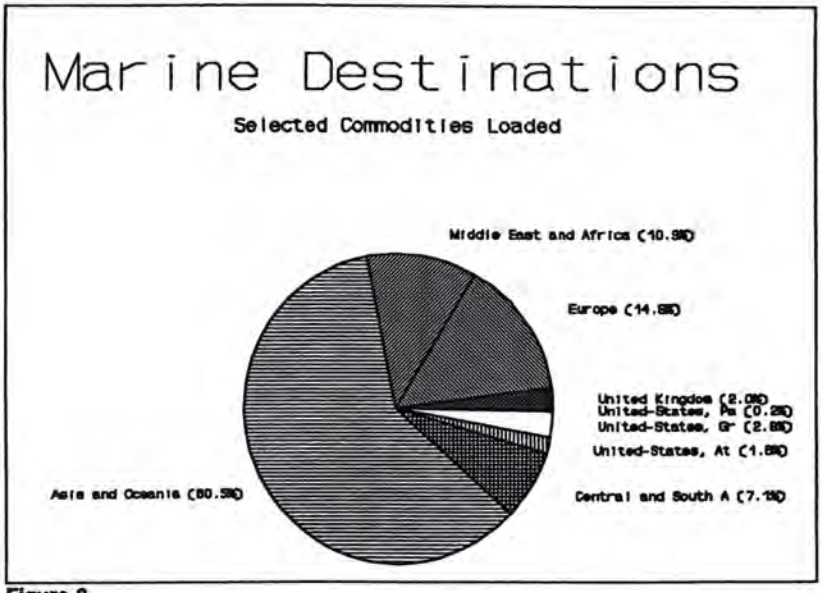


Figure 8

The major commodities imported in 1990, were predominantly containerized cargoes. The two most important categories by far, were mixed carload freight (57% of total marine-rail imports) and containers (32%). The other commodities were passenger autos and chassis, freight forwarder traffic and copper ores. Marine cargo equivalents do not exist for mixed carload freight and freight forwarder traffic, so no linkage was attempted (although these categories include containerized goods).

Marine-rail containers accounted for 62% of containerized general cargo from the marine data base. A better match would probably be attained if other containerized cargo classified in the two classes mentioned above were also included. Most of this cargo was destined for Ontario, Quebec and the U.S.

About half of all Passenger autos and chassis arriving by ships in B.C. and Nova Scotia were loaded on rail cars, with most of it again destined for Ontario and Quebec. The only crude material among the top five imported marine-rail cargoes was copper ores, with about 32 thousand tonnes received in Quebec and remaining in the province. Most of the marine-rail imports originate in Europe, followed closely by Asia and Oceania as the only other important source regions.

Conclusion

The data presented in this study confirms that there has been very strong growth in marine-rail shipments from 1984 to 1990. Transhipments to and from the U.S. have been one of the highlights of the past few years, in terms of increased marine-rail tonnage. With the emergence of more double stack rail corridors, the investment by rail companies in double stack equipment and the emphasis on north south alliances, it would seem very likely that the important intermodal link of marine and rail will continue to grow for a number of years.

Table 1
Railway Commodity Origin and Destination, Revenues and Tonnes, 1984 to 1990

Year		1984	1985	1986	1987	1988	1989	1990
Total rail								
Revenues	$'000,000	7,066.2	6,985.2	7,203.6	7,652.3	7,717.4	7,165.1	7,094.3
Tonnes	'000 000	191.9	182.3	184.7	196.5	198.5	182.2	182.4
Marine imports								
Revenues	$'000,000	174.9	225.5	225.1	280.2	274.3	263.4	263.8
Tonnes	'000 000	3.5	3.9	3.7	4.7	4.5	4.2	3.9
% of total rail tonnage		1.8%	2.2%	2.0%	2.4%	2.2%	2.3%	2.2%
Marine exports								
Revenues	$'000,000	1,612.3	1,519.7	1,754.1	2,116.9	2,041.2	1,710.7	1,923.0
Tonnes	'000 000	67.3	67.3	69.2	79.6	79.3	67.6	73.2
% of total rail tonnage		35.1%	36.9%	37.5%	40.5%	40.0%	37.1%	40.1%
Rail imports from the U.S.								
Revenues	$'000,000	627.9	620.2	681.7	640.5	714.6	669.0	649.8
Tonnes	'000 000	9.9	9.9	11.5	11.3	11.8	11.7	12.2
% of total rail tonnage		5.2%	5.4%	6.2%	5.7%	5.9%	6.4%	6.7%
Rail exports to the U.S.								
Revenues	$'000,000	1,981.9	1,983.3	1,892.4	1,968.1	2,150.1	2,100.0	2,069.5
Tonnes	'000 000	30.5	30.4	30.5	31.5	33.0	32.8	33.5
% of total rail tonnage		15.9%	16.7%	16.5%	16.0%	16.6%	18.0%	18.3%
Marine imports destined for the U.S.								
Revenues	$'000,000	11.2	14.8	22.7	30.6	28.0	29.0	29.9
Tonnes	'000 000	0.3	0.4	0.7	0.9	0.7	0.7	0.7
% of marine import		9.4%	10.4%	17.9%	19.3%	15.4%	16.3%	17.3%
Marine exports originating in the U.S.								
Revenues	$'000,000	21.5	24.2	28.9	33.5	32.8	33.3	40.2
Tonnes	'000 000	0.5	0.5	0.7	0.8	0.7	0.7	0.8
% of marine exports		0.8%	0.8%	1.0%	1.0%	0.9%	1.1%	1.1%
Total containers								
Revenues	$'000,000	108.2	107.8	108.4	127.6	145.8	149.3	148.4
Tonnes	'000 000	2.5	2.4	2.2	2.6	2.9	2.8	2.6
% of total rail tonnage		1.3%	1.3%	1.2%	1.3%	1.5%	1.5%	1.4%
Marine container imports								
revenues	$'000,000	67.4	68.1	66.3	78.2	84.4	85.6	80.0
tonnes	'000 000	1.6	1.6	1.3	1.4	1.5	1.4	1.3
% of total containers		64.6%	66.6%	58.3%	54.6%	51.3%	51.8%	48.4%
Marine container exports								
revenues	$'000,000	39.0	38.0	38.4	46.4	56.4	55.9	58.3
tonnes	'000 000	0.9	0.8	0.9	1.1	1.3	1.2	1.2
% of total containers		34.8%	32.7%	40.1%	43.9%	46.2%	44.5%	46.5%

Table 2
MARINE–RAIL EXPORTS AND CARGO LOADED AT CANADIAN PORTS, TONNAGE, FOR SELECTED COMMODITIES, 1990

COMMODITY	RAIL PROV. OF DESTIN.	RAIL–MARINE EXPORTS '000 t	MARINE DOMEST. LOADED '000 t	MARINE INTER. LOADED '000 t	TOTAL MARINE LOADED '000 t *	% COVER RAIL/ MARINE
BARLEY						
	BC	3 604.3		2 709.0	2 709.0	133%
	MB	38.9		33.0	33.0	118%
	ON	843.2	506.4		506.4	167%
	PQ	4.7		871.2	871.2	1%
	ALL	4 491.1		3 613.3	4 119.6	109%
WHEAT						
	BC	9 734.1		9 794.1	9 794.1	99%
	MB	418.8		381.7	381.7	110%
	NS	0.1	0.0	78.7	78.7	0%
	ON	7 937.6	7 758.2	632.7	8 390.9	95%
	PQ	693.7	**	948.7	948.7	73%
	ALL	18 784.2	**	11 835.9	19 594.1	96%
RAPESEED						
	BC	1 825.5		1 952.6	1 952.6	93%
	NS	0.1				
	ON	272.0	373.9	1.8	375.7	72%
	PQ	0.0		0.1	0.1	74%
	ALL	2 097.6		1 954.5	2 328.4	90%
COAL						
	BC	29 173.0		29 266.3	29 266.3	100%
SULPHUR						
	BC	4 504.0		4 897.2	4 897.2	92%
POTASH						
	BC	3 719.8		3 863.0	3 863.0	96%
	NB	613.0		1 506.3	1 506.3	41%
	ON	76.4		1 034.2	1 034.2	7%
	ALL	4 409.2		6 403.5	6 403.5	69%
CONTAINERS						
	BC	73.3		231.0	231.0	32%
	NS	1 087.5		718.0	718.0	151%
	ON	0.0		1.5	1.5	0%
	PQ	47.6		576.4	576.4	8%
	ALL	1 208.4	***	1 526.9	1 526.9	79%
SUB TOTALS						
	BC	52 634.0		52 713.2	52 713.2	100%
	MB	457.7		414.7	414.7	110%
	NB	613.0		1 506.3	1 506.3	41%
	NS	1 087.6	0.0	796.7	796.7	137%
	ON	9 129.1	8 638.5	1 670.2	10 308.7	89%
	PQ	746.1		2 396.4	2 396.4	31%
	ALL	64 667.5	8 638.5	59 497.4	68 135.9	95%
OTHERS		8 495.5	51 721.5	99 541.9	151 263.4	6%
TOTALS		73 163.0	60 360.0	159 039.3	219 399.3	33%

* ONLY INCLUDES PROVINCES WHERE RAIL–MARINE CARGO WAS HANDLED

** DOMESTIC TONNAGE OF 6.5 MILLION TONNES UNLOADED (FROM ONTARIO) HAS BEEN SUBTRACTED FROM INTERN. MARINE TO AVOID DOUBLE COUNTING

*** ONLY CONTAINERIZED GENERAL CARGO WAS USED FOR COMPARISON, FROM THE MARINE INTERNATIONAL DATA BASE

Table 3
Marine–Rail Exports – Rail Origin and Destination Tonnage, For Selected Commodities, 1990

Commodity	Origin	Destination	Tonnage '000 t	% of total
Barley	AB	BC	1 757.1	39.1%
	SK	BC	1 321.5	29.4%
	MB	BC	469.0	10.4%
	SK	ON	458.3	10.2%
	MB	ON	278.4	6.2%
Sub–total			4 284.4	95.4%
Others			206.8	4.6%
Total			4 491.1	100.0%
Wheat	SK	BC	5 202.6	27.7%
	AB	BC	3 419.7	18.2%
	MB	ON	2 698.8	14.4%
	SK	ON	4 521.5	24.1%
	MB	BC	608.0	3.2%
Sub–total			16 450.6	87.6%
Others			2 333.7	12.4%
Total			18 784.2	100.0%
Rapeseed	AB	BC	849.1	40.5%
	SK	BC	815.5	38.9%
	MB	BC	131.6	6.3%
	MB	ON	127.7	6.1%
	SK	ON	119.7	5.7%
Sub–total			2 043.6	97.4%
Others			54.0	2.6%
Total			2 097.6	100.0%
Coal	BC	BC	22 277.2	76.4%
	AB	BC	6 895.8	23.6%
Total			29 173.0	100.0%
Sulphur	AB	BC	4 504.0	100.0%
Potash	SK	BC	3 718.7	84.3%
	NB	NB	613.0	13.9%
	SK	ON	76.4	1.7%
	SK	BC	1.1	0.0%
	ON	BC	0.1	0.0%
Total			4 409.2	100.0%
Containers	PQ	NS	536.0	44.4%
	ON	NS	533.8	44.2%
	ON	PQ	32.4	2.7%
	AB	BC	28.1	2.3%
	ON	BC	24.5	2.0%
Sub–total			1 154.8	95.6%
Others			53.6	4.4%
Total			1 208.4	100.0%

Table 4
Selected Commodities Loaded, Tonnage by Region
International Shipping, 1990

Commodity Destination	Atlantic	St. Lawrence	Great Lakes	Pacific	Total Tonnage
			'000 t		
Barley					
United Kingdom	0.2				0.2
Europe	33.3	188.4		823.9	1 045.5
Middle East and Africa	0.0	683.2		1 056.5	1 739.7
Asia and Oceania	0.0			824.3	824.3
Central and South America	0.0	0.2		7.9	8.1
Total	33.6	871.7	0.0	2 712.6	3 617.8
Wheat					
United Kingdom	0.7	144.8	130.1		275.6
Europe	172.4	3 661.6	54.5	1 242.4	5 131.1
Middle East and Africa	240.1	1 894.1	52.6	1 309.0	3 495.8
Asia and Oceania	28.8	504.6	32.2	6 891.8	7 457.4
Central and South America	52.7	1 312.7	66.8	333.2	1 765.5
United–States, Atlantic	1.9				1.9
United–States, Great Lakes			296.5		296.5
United–States, Pacific				20.0	20.0
Total	496.7	7 517.8	632.7	9 796.5	18 443.7
Rapeseed					
United Kingdom	0.3				0.3
Europe	0.9	0.0	1.8	0.0	2.7
Middle East and Africa					0.0
Asia and Oceania				1 952.6	1 952.6
Central and South America		0.1			0.1
Total	1.2	0.1	1.8	1 952.6	1 955.7
Coal					
United Kingdom		0.0		828.9	828.9
Europe	575.8	0.2		1 634.4	2 210.4
Middle East and Africa		84.4		179.2	263.6
Asia and Oceania	26.9	0.0		25 279.5	25 306.4
Central and South America	241.9		19.8	1 316.3	1 578.0
United–States, Atlantic	30.0	33.1			63.1
United–States, Great Lakes		162.3	465.6		627.9
United–States, Pacific				28.5	28.5
Total	874.5	280.1	485.4	29 266.8	30 906.9

Table 4
Commodities Loaded, Tonnage by Region
International Shipping, 1990 – Concluded

Commodity Destination	Atlantic	St. Lawrence	Great Lakes	Pacific	Total Tonnage
		'000 t			
Sulphur					
United Kingdom				12.5	12.5
Europe				710.4	710.4
Middle East and Africa				1 827.0	1 827.0
Asia and Oceania				1 529.2	1 529.2
Central and South America				825.7	825.7
United–States, Pacific				8.2	8.2
Total	0.0	0.0	0.0	4 913.0	4 913.0
Potash					
United Kingdom	21.0	0.1	19.8	22.1	63.0
Europe	273.9	0.1	92.7		366.7
Middle East and Africa	41.0		12.0	35.9	88.9
Asia and Oceania	237.9			3 524.8	3 762.6
Central and South America	372.8		23.9	237.5	634.3
United–States, Atlantic	459.6		39.1		498.7
United–States, Great Lakes	103.4		846.8		950.2
United–States, Pacific				46.9	46.9
Total	1 509.7	0.2	1 034.2	3 867.3	6 411.3
Containers					
United Kingdom	89.7	112.0	0.0	3.7	205.4
Europe	180.0	425.3	7.1	12.3	624.8
Middle East and Africa	14.3	8.8	6.4	0.8	30.3
Asia and Oceania	130.8	22.3	3.0	173.3	329.3
Central and South America	6.3	10.7	1.9	14.3	33.2
United–States, Atlantic	258.9	258.7	0.2	0.0	517.8
United–States, Pacific	0.3	0.0	0.0	39.4	39.7
Total	680.3	837.8	18.7	243.8	1 780.5
Sub totals					
United Kingdom	111.9	256.9	149.9	867.2	1 385.9
Europe	1 236.3	4 275.7	156.1	4 423.5	10 091.6
Middle East and Africa	295.4	2 670.5	71.0	4 408.4	7 445.3
Asia and Oceania	424.4	526.9	35.2	40 175.4	41 161.9
Central and South America	673.8	1 323.7	112.4	2 735.0	4 844.8
United–States, Atlantic	750.4	291.8	39.3	0.0	1 081.5
United–States, Great Lakes	103.4	162.3	1 608.9	0.0	1 874.6
United–States, Pacific	0.3	0.0	0.0	143.0	143.3
Total	3 595.9	9 507.7	2 172.8	52 752.5	68 029.0
Others	18 860.7	38 375.0	7 917.4	25 857.3	91 010.3
Totals	22 456.6	47 882.7	10 090.2	78 609.8	159 039.3

Table 5
MARINE–RAIL IMPORTS AND CARGO UNLOADED AT CANADIAN PORTS, TONNAGE, FOR SELECTED COMMODITIES, 1990

COMMODITY	RAIL PROV. OF ORIGIN	RAIL–MARINE IMPORTS '000 t	MARINE INTER. LOADED '000 t *	% COVER. RAIL/ MARINE
COPPER ORES				
	PQ	31.9	46.9	68%
PASSENGER AUTOS AND CHASSIS				
	BC	178.0	360.5	49%
	NS	49.5	92.9	53%
	ALL	227.4	453.3	50%
MIXED CARLOAD FREIGHT				
	BC	763.1		
	MB	0.0		
	NB	29.4		
	NS	19.7		
	ON	0.2		
	PQ	1 409.3		
	ALL	2 221.8	**	N/A
FREIGHT FORWARDERS				
	BC	40.2	**	N/A
CONTAINERS				
	BC	117.6	516.4	23%
	NS	1 078.5	814.9	132%
	ON	0.0	2.6	0%
	PQ	62.9	685.3	9%
	ALL ***	1 259.0	2 019.1	62%
SUB TOTALS				
	BC	1 098.8	876.8	125%
	NS	1 147.7	907.8	126%
	ON	0.2	2.6	8%
	PQ	1 504.1	732.1	205%
	ALL	3 750.8	2 519.3	149%
OTHERS		178.2	70 776.7	0%
TOTALS		3 929.0	73 296.0	5%

* ONLY INCLUDES PROVINCES WHERE RAIL–MARINE CARGO WAS HANDLED

** NO EQUIVALENT CATEGORY FOR MARINE CARGO

*** ONLY CONTAINERIZED GENERAL CARGO WAS USED FOR COMPARISON, FROM THE MARINE INTERNATIONAL DATA BASE

TRANSPORTATION PROBLEM WITH CONTRACTOR SELECTION

Introduction

In this paper we address the transportation logistic problem of a company which has a number of warehouses and has to supply to a number of customers (retailer outlets). The problem facing the decision maker is to select contractors to transport the items from warehouses to retailer outlets at the minimum possible costs. Only one contractor must be given a contract to transport items from a particular warehouse. However, all the contractors can provide transportation facilities at all the warehouses if required by the company. We formulate a math model to address this problem and solve it using a math programming software. The following sections deal with the model formulation and the solution.

Model Formulation

For the "i^{th}" source or warehouse ($i = 1,..,l$):

a_i = available capacity.

For the "k^{th}" contractor ($k = 1,..,n$) :

$$Y_{ik} = \begin{cases} 1, & \text{if contractor "k" is selected to serve from location "i"} \\ 0, & \text{otherwise} \end{cases}$$

For the "j^{th}" destination ($j = 1,..,m$):

b_j = amount required.

For the i^{th} warehouse and the j^{th} destination, served by the k^{th} contractor:

C_{ijk} = unit transportation cost.

X_{ijk} = amount of material transported.

In this transportation problem, Y_{ik} and X_{ijk} are the decision variables. The resulting problem can be formulated as a mixed integer linear programming problem as follows:

Objective: Minimize cost

$$\text{Min.} \quad \sum_i \sum_j \sum_k C_{ijk} X_{ijk}$$

Subject to:

Constraints:

1) The total amount required by customer j should be met from the different warehouses allotted to different contractors.

$$\sum_i \sum_k X_{ijk} = b_j \qquad \text{for every j.}$$

2) Each warehouse (or source) should have only one contractor to transport items to different destinations.

$$\sum_k Y_{ik} = 1 \qquad \text{for every i.}$$

3) The total amount supplied from a source to all the demand points should not exceed the availability of items at the source point to which the specific contractor, k, is assigned.

$$\sum_j X_{ijk} \leq a_i Y_{ik} \qquad \text{for every i, k.}$$

4) Non negativity conditions:

$$X_{ijk} \geq 0, \qquad \text{for every i, j and k.}$$

The above formulation has m*n*l continuous variables, n*l binary integer variables, and n(l+1) + m constraints. The transportation costs are linear and the problem is a balanced transportation problem, i.e., the total supply from all the sources is equal to the total requirements from all the warehouses.

An Example

The following example is used to illustrate the mixed integer linear program model. A company has four warehouses and five retail outlets. The availability of an item at each warehouse and the requirement at each retail outlet are given in table 1.

Table 1: Requirements and availability data:

Warehouse "i"	Availability "a_i"	Retail outlet "j"	Requirement "b_j"
WH1	80	A	68
WH2	90	B	62
WH3	110	C	84
WH4	60	D	40
		E	86

Three transport companies have quoted the following rates per item as given in tables 2, 3 and 4:

Table 2 Rates quoted by Con 1 (contractor 1)

		To 'j'				
		A	B	C	D	E
From 'i'	1	3	6	1	1	2
	2	4	3	5	2	7
	3	2	7	3	4	1
	4	2	1	5	7	6

Table 3 Rates quoted by Con 2 (contractor 2)

		To 'j'				
		A	B	C	D	E
From 'i'	1	5	4	2	3	6
	2	5	4	6	4	5
	3	3	5	4	2	1
	4	1	7	5	4	6

Table 4 Rates quoted by Con 3 (contractor 3)

		To 'j'				
		A	B	C	D	E
From 'i'	1	4	5	3	2	1
	2	3	2	4	7	5
	3	1	6	2	3	4
	4	3	4	7	2	6

A matrix generator for developing the above model was written using the mathematical programming package LINGO. The model was solved on 386 IBM compatible computer using the branch-and bound routine available in LINGO. The actual matrix generator, generated model for the above data and the output of LINGO are provided in Appendix I. The solution is given in the following table.

Table 5 Solution to the 4 sources, 5 customer, 3 contractor problem:

	Units transported to retail outlets					
From Warehouse	A	B	C	D	E	Transported by Contractor
WH1			64	16		Con 1
WH2	8	62	20			Con 3
WH3				24	86	Con 2
WH4	60					Con 2

From the above table it is clear that warehouse 1 is assigned to contractor 1, warehouse 4 and 3 to contractor 2 and warehouse 2 to contractor 3. Retail outlet A is supplied by contractors 2 and 3; retail outlet B by contractor 3; retail outlet C by contractors 1 and 3; retail outlet D by contractors 1 and 2; and retail outlet E by contractor 2. The total cost of this solution is $502. The solution time was negligible.

Concluding Remarks

In the formulation of the problem, we assumed that unit transportation cost quotations are provided by 'n' contractors. In practice, different sets of contractors might provide transportation cost quotations. Such a situation can be handled easily in the formulation of the model. Usual approaches can also be applied for handling variations of the transportation problem such as unbalanced problems, prohibited routes, maximization of the objective function, etc,.

Appendix I

1. Matrix Generator

```
MODEL:
 1]! TRANSPORTATION PROBLEM WITH CONTRACTOR SELECTION;
 2]
 3]SETS:
 4]supply /wh1,wh2,wh3,wh4/;
 5]dest /a,b,c,d,e/: dem;
 6] cont /con1,con2,con3/;
 7]  link1 (supply, dest);
 8] link2 (link1,cont): cost, x;
 9] link3 (supply, cont):cap,y;
10]ENDSETS
11]
12]! OBJECTIVE FUNCTION;
13]! ========================;
14]min = @sum(link2:cost*x);
15]
16]! DEMAND CONSTRAINT;
17]!========================;
18]@for (dest(j): @sum (link3(i,k): x(i,j,k))=dem(j));
19]
20]! CAPACITY CONSTRAINT;
21]! ========================;
22]@for (link3(i,k):@sum(dest(j): x(i,j,k) ) - cap(i,k)*y(i,k)<0);
23]
24]! ONE SOURCE, ONE CONTRACTOR ASSIGNMENT;
25]!=============================================;
26]@for (supply(i): @sum(cont(k): y(i,k))=1);
27]
28]@for (link3(i,k): @gin(y); );
29]
30]DATA:
31]dem = 68 62 84 40 86;
32]
33]cap = 80  80  80
34]     90  90  90
35]    110 110 110
36]     60  60  60;
37]
38]cost = 3 5 4
39]      6 4 5
40]      1 2 3
```

```
 41]     1 3 2
 42]     2 6 1
 43]     4 5 3
 44]     3 4 2
 45]     5 6 4
 46]     2 4 7
 47]     7 5 5
 48]     2 3 1
 49]    -7 5 6
 50]     3 4 2
 51]     4 2 3
 52]     1 1 4
 53]     2 1 3
 54]     1 7 4
 55]     5 5 7
 56]     7 4 2
 57]     6 6 6;
 58]
 59]ENDDATA
END
```

2. Generated Model

```
MIN    3 X( WH1, A, CON1) + 5 X( WH1, A, CON2) + 4 X( WH1, A, CON3)
   + 6 X( WH1, B, CON1) + 4 X( WH1, B, CON2) + 5 X( WH1, B, CON3)
   + X( WH1, C, CON1) + 2 X( WH1, C, CON2) + 3 X( WH1, C, CON3)
   + X( WH1, D, CON1) + 3 X( WH1, D, CON2) + 2 X( WH1, D, CON3)
   + 2 X( WH1, E, CON1) + 6 X( WH1, E, CON2) + X( WH1, E, CON3)
   + 4 X( WH2, A, CON1) + 5 X( WH2, A, CON2) + 3 X( WH2, A, CON3)
   + 3 X( WH2, B, CON1) + 4 X( WH2, B, CON2) + 2 X( WH2, B, CON3)
   + 5 X( WH2, C, CON1) + 6 X( WH2, C, CON2) + 4 X( WH2, C, CON3)
   + 2 X( WH2, D, CON1) + 4 X( WH2, D, CON2) + 7 X( WH2, D, CON3)
   + 7 X( WH2, E, CON1) + 5 X( WH2, E, CON2) + 5 X( WH2, E, CON3)
   + 2 X( WH3, A, CON1) + 3 X( WH3, A, CON2) + X( WH3, A, CON3)
   + 7 X( WH3, B, CON1) + 5 X( WH3, B, CON2) + 6 X( WH3, B, CON3)
   + 3 X( WH3, C, CON1) + 4 X( WH3, C, CON2) + 2 X( WH3, C, CON3)
   + 4 X( WH3, D, CON1) + 2 X( WH3, D, CON2) + 3 X( WH3, D, CON3)
   + X( WH3, E, CON1) + X( WH3, E, CON2) + 4 X( WH3, E, CON3)
   + 2 X( WH4, A, CON1) + X( WH4, A, CON2) + 3 X( WH4, A, CON3)
   + X( WH4, B, CON1) + 7 X( WH4, B, CON2) + 4 X( WH4, B, CON3)
   + 5 X( WH4, C, CON1) + 5 X( WH4, C, CON2) + 7 X( WH4, C, CON3)
   + 7 X( WH4, D, CON1) + 4 X( WH4, D, CON2) + 2 X( WH4, D, CON3)
   + 6 X( WH4, E, CON1) + 6 X( WH4, E, CON2) + 6 X( WH4, E, CON3)
```

SUBJECT TO

2] X(WH1, A, CON1) + X(WH1, A, CON2) + X(WH1, A, CON3)
+ X(WH2, A, CON1) + X(WH2, A, CON2) + X(WH2, A, CON3)
+ X(WH3, A, CON1) + X(WH3, A, CON2) + X(WH3, A, CON3)
+ X(WH4, A, CON1) + X(WH4, A, CON2) + X(WH4, A, CON3) = 68

3] X(WH1, B, CON1) + X(WH1, B, CON2) + X(WH1, B, CON3)
+ X(WH2, B, CON1) + X(WH2, B, CON2) + X(WH2, B, CON3)
+ X(WH3, B, CON1) + X(WH3, B, CON2) + X(WH3, B, CON3)
+ X(WH4, B, CON1) + X(WH4, B, CON2) + X(WH4, B, CON3) = 62

4] X(WH1, C, CON1) + X(WH1, C, CON2) + X(WH1, C, CON3)
+ X(WH2, C, CON1) + X(WH2, C, CON2) + X(WH2, C, CON3)
+ X(WH3, C, CON1) + X(WH3, C, CON2) + X(WH3, C, CON3)
+ X(WH4, C, CON1) + X(WH4, C, CON2) + X(WH4, C, CON3) = 84

5] X(WH1, D, CON1) + X(WH1, D, CON2) + X(WH1, D, CON3)
+ X(WH2, D, CON1) + X(WH2, D, CON2) + X(WH2, D, CON3)
+ X(WH3, D, CON1) + X(WH3, D, CON2) + X(WH3, D, CON3)
+ X(WH4, D, CON1) + X(WH4, D, CON2) + X(WH4, D, CON3) = 40

6] X(WH1, E, CON1) + X(WH1, E, CON2) + X(WH1, E, CON3)
+ X(WH2, E, CON1) + X(WH2, E, CON2) + X(WH2, E, CON3)
+ X(WH3, E, CON1) + X(WH3, E, CON2) + X(WH3, E, CON3)
+ X(WH4, E, CON1) + X(WH4, E, CON2) + X(WH4, E, CON3) = 86

7]- 80 Y(WH1, CON1) + X(WH1, A, CON1) + X(WH1, B, CON1)
+ X(WH1, C, CON1) + X(WH1, D, CON1) + X(WH1, E, CON1) <= 0

8]- 80 Y(WH1, CON2) + X(WH1, A, CON2) + X(WH1, B, CON2)
+ X(WH1, C, CON2) + X(WH1, D, CON2) + X(WH1, E, CON2) <= 0

9]- 80 Y(WH1, CON3) + X(WH1, A, CON3) + X(WH1, B, CON3)
+ X(WH1, C, CON3) + X(WH1, D, CON3) + X(WH1, E, CON3) <= 0

10]- 90 Y(WH2, CON1) + X(WH2, A, CON1) + X(WH2, B, CON1)
+ X(WH2, C, CON1) + X(WH2, D, CON1) + X(WH2, E, CON1) <= 0

11]- 90 Y(WH2, CON2) + X(WH2, A, CON2) + X(WH2, B, CON2)
+ X(WH2, C, CON2) + X(WH2, D, CON2) + X(WH2, E, CON2) <= 0

12]- 90 Y(WH2, CON3) + X(WH2, A, CON3) + X(WH2, B, CON3)
+ X(WH2, C, CON3) + X(WH2, D, CON3) + X(WH2, E, CON3) <= 0

13]- 110 Y(WH3, CON1) + X(WH3, A, CON1) + X(WH3, B, CON1)
+ X(WH3, C, CON1) + X(WH3, D, CON1) + X(WH3, E, CON1) <= 0

14]- 110 Y(WH3, CON2) + X(WH3, A, CON2) + X(WH3, B, CON2)
+ X(WH3, C, CON2) + X(WH3, D, CON2) + X(WH3, E, CON2) <= 0

15]- 110 Y(WH3, CON3) + X(WH3, A, CON3) + X(WH3, B, CON3)
+ X(WH3, C, CON3) + X(WH3, D, CON3) + X(WH3, E, CON3) <= 0

16]- 60 Y(WH4, CON1) + X(WH4, A, CON1) + X(WH4, B, CON1)
+ X(WH4, C, CON1) + X(WH4, D, CON1) + X(WH4, E, CON1) <= 0

17]- 60 Y(WH4, CON2) + X(WH4, A, CON2) + X(WH4, B, CON2)
+ X(WH4, C, CON2) + X(WH4, D, CON2) + X(WH4, E, CON2) <= 0

18]- 60 Y(WH4, CON3) + X(WH4, A, CON3) + X(WH4, B, CON3)
+ X(WH4, C, CON3) + X(WH4, D, CON3) + X(WH4, E, CON3) <= 0

```
19] Y( WH1, CON3) + Y( WH1, CON2) + Y( WH1, CON1) =  1
20] Y( WH2, CON3) + Y( WH2, CON2) + Y( WH2, CON1) =  1
21] Y( WH3, CON3) + Y( WH3, CON2) + Y( WH3, CON1) =  1
22] Y( WH4, CON3) + Y( WH4, CON2) + Y( WH4, CON1) =  1
END
GIN Y( WH4, CON3)
GIN Y( WH4, CON2)
GIN Y( WH4, CON1)
GIN Y( WH3, CON3)
GIN Y( WH3, CON2)
GIN Y( WH3, CON1)
GIN Y( WH2, CON3)
GIN Y( WH2, CON2)
GIN Y( WH2, CON1)
GIN Y( WH1, CON3)
GIN Y( WH1, CON2)
GIN Y( WH1, CON1)
```

3. Solution

VARIABLE	VALUE	REDUCED COST
X(WH1, C, CON1)	64.00000	.0000000
X(WH1, D, CON1)	16.00000	.0000000
X(WH2, A, CON3)	8.000000	.0000000
X(WH2, B, CON3)	62.00000	.0000000
X(WH2, C, CON3)	20.00000	.0000000
X(WH3, D, CON2)	24.00000	.0000000
X(WH3, E, CON2)	86.00000	.0000000
X(WH4, A, CON2)	60.00000	.0000000
Y(WH1, CON1)	1.000000	-240.0000
Y(WH2, CON3)	1.000000	.0000000
Y(WH3, CON2)	1.000000	-220.0000
Y(WH4, CON2)	1.000000	-120.0000

ROW	SLACK OR SURPLUS	DUAL PRICE
1	502.0000	1.000000

The Cost of Inefficient Allocation of Inputs in the Canadian Airline Industry

Kobina Kobia

What Contributes To an Airline's Costs ?

An airline provides a number of services to the public, including scheduled passenger services, scheduled mail and cargo services, and passenger and freight charter services. To provide these services, the airline uses aircraft, pilots, fuel, and other inputs. In addition, the airline operates in an environment with technological and regulatory constraints which may have an impact on the way it delivers these services to the public. Hence, an airline makes a number of fundamental decisions with respect to the kinds of services to provide and to whom, the number and type of aircraft, labour, fuel and other inputs to use, and over what type of network to deliver these services. These decisions affect the total cost incurred by the airline in providing its services. The question is, how ?

Modelling Airline Costs

Numerous attempts have been made in the past to identify the relationships between an airline's services, inputs, regulatory or technological environmental, and its costs, using various ad hoc graphs and other constructs[1]. However, it is currently recognized that the assumptions underlying most of these studies are inappropriate to model costs within an industry producing several outputs (for example, airline services). It is now usual to derive a model, called a cost function, that is sufficiently flexible to identify the relationships among all the factors believed to influence an airline's costs[2].

What is a Cost Function ?

Suppose an airline produces a whole range of services (outputs) in quantities labelled $y_1, y_2, \ldots, y_m$. Also suppose that in producing these services the airline uses a range of inputs in quantities labelled $x_1, x_2, \ldots, x_n$, and the inputs have prices $w_1, w_2, \ldots, w_n$. Then, the total cost incurred by the airline per year in purchasing all its inputs may be written as:

$$C = w_1x_1 + w_2x_2 + \ldots + w_nx_n \qquad (1)$$

To transform inputs into services, the airline needs the technical know-how. The level of technology within the industry at the time dictates the minimum quantities of various inputs needed to provide a certain service level (for example, so many aircraft, so much crew, so much fuel, etc., to provide so many passenger-kilometres of service between City A and City B). This technical know-how, called a *production function*, is expressed as f in the relationship:

$$y_1, y_2, \ldots, y_m \leq f(x_1, x_2, \ldots, x_n) \qquad \text{or } y \leq f(x) \qquad (2)$$

If we assume that the airline operates with the objective of minimizing its total cost, then the objective function may be stated as:

$$\text{Minimize } w_1x_1 + w_2x_2 + \ldots + w_nx_n \quad \text{subject to } y \leq f(x) \tag{3}$$

The solution to this cost-minimization problem (satisfying various regularity conditions) is known as the *cost function*, generally represented as

$$c = C(y,w) \tag{4}$$

In Eqn 4, c is the airline's total cost, y represents measures of the set of services provided by the airline, w is the set of input prices within the industry at the time, and C is the unknown relationship between c, y, and w. As noted earlier, factors other than inputs contribute to an airline's costs. These include the way its service network is set up, and regulatory constraints. If we assume that a set of network and regulatory constraints $z = z_1, z_2, \ldots, z_j$ impact on the airline's costs, then the cost function (Eqn 4) can be modified to:

$$c = C(y,z,w) \tag{5}$$

Costs To be Included in a Cost Function for Canadian Airlines

In terms of impacts on costs, flights between different origin-destination points, use of different aircraft types on a route (for example, some with jet service and others not), and even Class I and Economy levels on the same flight, all constitute different services and should theoretically be included separately in the cost function to identify their individual impacts. However, this is impossible in practice and some services have to be grouped together. Aggregator functions are generally used to combine all airline services into one or more outputs. Since information is lost in the aggregation process, the more outputs represented in the cost function (i.e., the less aggregation of outputs) the more useful the resulting model, all things being equal. For Canadian airlines, data is available to combine airline services into scheduled passenger, scheduled freight, and passenger and freight charter services.

As with services, airlines use a large number of inputs, each of which has different implications for airline costs. These include: several categories of capital equipment (aircraft, buildings, computer systems, maintenance equipment, etc); several categories of labour (pilots, flight attendants, administrative personnel, mechanics, etc.); and different types of fuel and oils. Again, aggregator functions are used to derive prices for groups of inputs. For example, a unit price for labour may be constructed as a price index from information on different employee categories and the salaries paid to each employee category.

The type of network operated by an airline has a considerable effect on its costs. In particular, cost per unit of output may differ among firms depending on the "size" of the network served. A popular measure of network size is the number of unduplicated points served by the airline. The inclusion in the cost function of a variable measuring the size of an airline's network makes it possible to distinguish between the effects of changing service levels within the existing network (returns to density), and the effects of changing service levels within an expanded network (returns to scale).

Everything else being equal, an airline's costs decreases with increasing average stage length over the network, since it implies fewer takeoffs and landings to produce the same level of output. This means, for example, that an airline carrying a relatively small number of passengers over long distances has costs different from those of another airline which carries large numbers of passengers over relatively short distances, even if the two airlines produce the same number of passenger-kilometres. Hence, average stage length has a direct effect on airline costs and must be included in the cost function.

Another network characteristic that can have a substantial impact on airline costs is the percentage of available capacity that is actually utilized in the production of services (average load factor). An airline's costs should, everything else being equal, decrease with increasing average load factor, since it implies fewer flights to produce the required same service level. On the other hand, at any given load factor, an airline's cost should increase with increasing available capacity, since it implies larger aircraft or more flights to produce the same level of services. Therefore, available capacity and load factor have opposite effects on airline costs. These effects are not necessarily equal. Two airlines may have the same average load factor over their networks and yet have vastly different costs because of different capital utilization. Therefore, average load factor and available capacity should both be included in the cost function.

Regulatory restrictions may also have a considerable influence on airline costs. For example, prior to 1988 Canadian airlines were restricted to operating in specific regions of the country and overseas, which had an impact on the type of network developed by each airline. As well, airlines were required to provide services to some small communities regardless of the economic feasibility of the prescribed levels of service. Thus, a variable measuring the "connectedness" of an airline's route network may be included in the cost function to assess the impact of network structure on airline costs. In addition, a variable may be included in the cost function to measure the route kilometres of an airline's total network that generates little traffic but must be served nonetheless.

The above discussion presents the variables that have been used, in one form or another, in all cost functions derived to study the Canadian airline industry. Data availability, computational limitations, and multicollinearity among variables does not permit the inclusion of all the above variables in a single cost function.

Differences among most cost functions to date may be due in part to the level of aggregation of outputs and input prices, the way each aggregate was derived, and what network variables are included. Other factors that impact on an airline's costs and how these are incorporated (or not) in studies of Canadian airline costs are discussed in the following sections.

The Effects of Technical Progress Over Time

Due to the relatively small number of Canadian airlines, the most feasible way of estimating the relationships between an airline's costs and its outputs, input prices, network, and regulatory constraints is to examine the costs of Levels I and II Canadian airlines over time. To do this, the cost function is generally expressed in the form:

$$\ln C_{nt} = \ln \hat{C}_{nt}(y,z,w) + \epsilon_{nt} \qquad (6)$$

This expression states that the cost of airline n in year t is a function of its output quantities, network and regulatory constraints, and input prices, plus a random component. For estimation purposes, $\ln \hat{C}_{nt}(y,z,w)$ can be any mathematical relation that has the properties of a cost function, but the most convenient is a *translog* function[3].

The use of airline costs over time introduces a major complication in sorting out an airline's costs, because of changes in technology during the period. For example, regular jet service was introduced in Canada in the early 1960s, and by 1975 both Air Canada and CP Air had all-jet fleets while the regional airlines had various percentages of jet aircraft in their fleet mix. During the same period, other innovations such as computerized reservations and ticketing system, and mechanized baggage and passenger handling systems, rapidly became the norm in the industry. Thus, a Canadian airline in 1964 is technologically very different from the same airline in 1985.

While it is recognized that changes in technology have had substantial impacts on airline operations over time, the measurement of these impacts presents a number of difficulties. Two different approaches have been used in the past. The most popular approach has been to include a simple time trend variable in the cost function for Canadian airlines. This approach, however, assumes that technical progress takes place in a gradual and continuous fashion over time, which may not be very realistic. Another approach has been to introduce dummy variables at specific points in time at which various technical innovations were introduced. However, for this approach to be valid, the effect of the technical change on cost must be confined to the year of its introduction, which is also not very realistic.

The impact of technical change over time on airline costs is further complicated by the relationship between technical change and input prices. The issue is whether changes in input prices induce changes in technology and airline operations, or whether technical progress in the airline industry is independent of changes in the

prices of inputs. If technological change and price change tend to move in parallel, then there will be no indication of the effects. But if there are drastic changes in one of the tracks, such as there was when the jets were introduced, or more drastically when the cost of fuel as a fraction of the total cost of inputs increased, then one would be able to detect changes due to such a disturbance. But the effects would tend to damp out when long-term time series are used.

Roy (1980) discussed at length the difficulties inherent in an empirical assessment of the effect of technical progress on the production of air transportation services by Canadian airlines. He, therefore, estimated models which assume technical change to occur independently of input prices (time is entered as a simple trend variable in the cost function), as well as models which assume that technical change over time affects both input prices and output levels (time is a full regressor in the cost function). Gillen and Oum (1984) assumed that technical change over time influences airlines primarily through input prices. Hence, the input prices used in their cost function are not observed input prices, but observed input prices adjusted for time effects. The two studies presented conflicting results on the effects of technical change on the industry.

The Effects of Airline Inefficiency

In deriving the cost function it was noted that the technological know-how in any time period dictates the maximum quantities of outputs that can be produced from any given set of inputs. Or, said another way, the production function describes the minimum feasible set of inputs needed to produce a given level of outputs. An airline that uses more than the minimum technically feasible quantity of inputs in producing its services is said to be *technically inefficient*. For example, if one Dash 8 turboprop with equivalent fuel, flight crew, ground support, etc., comprise the minimum quantities of inputs needed to produce say 300000 passenger-kilometres per year on a route, then an airline using a Boeing 747 jet aircraft and corresponding fuel, flight crew, etc. to produce the same passenger-kilometres would likely be technically inefficient. Such an airline, then, should have higher costs than the relationship described by the cost function in Eqn 6.

It was also noted earlier that a wide range of inputs are used by each airline in producing its services: different types of aircraft, several categories of employees, etc. Within limits, it is possible to provide the same level of services using different combinations of inputs. For example, an airline may decide to replace its booking staff with a completely automated reservations and ticketing system. In effect, the airline has traded labour for capital. Since airline inputs are not perfectly substitutable for one another, and each input may have a different price, it follows that one combination of inputs would impose the least cost on the airline, given current input prices. An airline that uses a different combination of inputs than the minimum-cost combination (given input prices at the time) should have higher costs than dictated by Eqn 6, and is said to be *allocatively inefficient*.

Therefore, including measures of technical and allocative inefficiency[4] of the airlines in the cost function provides a solution for the effects of changing technology over time since, by definition, they indicate how well the airlines adapted their operations to utilize technical progress within the industry and changes in input prices. *It must be pointed out that inefficiency, as defined in this paper, only refers to higher costs than the minimum dictated by the cost function, and is in no way a reflection on the competence of airline management. Technical and allocative inefficiency may be caused by, among others, regulatory and market distortions preventing airlines from achieving a cost-minimizing objective.*

More important, including measures of inefficiency in the cost function eliminates a fundamental flaw in all previous studies of the cost structure of Canadian airlines. For example, Roy (1980), Gillen and Oum (1984), Roy and Cofsky (1985), and Gillen, Oum, and Tretheway (1986), all derive cost functions for Canadian airlines using variations in the specification described by Eqn 6. In effect, these studies all assume that Levels I and II Canadian airlines were each using the minimum technically feasible quantities of inputs and the least cost combination of inputs in producing their services over the relevant time period. This assumption may not necessarily be valid, and should at least be tested in the cost function.

An Airline Cost Function That Accounts for Inefficiency

From these considerations, a cost function for Canadian airlines that includes the extra cost of technical and allocative inefficiency may be expressed (based on Bauer, 1985) as:

$$\ln C_{nt} = \ln \hat{C}_{nt}(y,z,w) + T_n + A_{nt} + \epsilon_{nt} \qquad (7)$$

C_{nt} is the observed cost of airline n in year t;

$\hat{C}_{nt}$ is a function relating the minimum cost to airline n of producing its range of services y over a network described by a set of characteristic z, given the range of input prices w in year t;

T_n is the (log of) the additional cost incurred by airline n as a result of technical inefficiency;

A_{nt} is the (log of) the additional cost incurred by airline n in year t as a result of allocative inefficiency; and

ϵ_{nt} is random cost incurred by airline n in year t.

Variables and Data

Annual data for Level I and Level II Canadian airlines between 1964 and 1985 were compiled for this study. For each airline in each year, output quantities, input prices, and network characteristics were estimated. The airline output variables used in the cost function included scheduled revenue passenger-km, scheduled freight tonne-km, and total (passenger and freight) charter tonne-km. Input prices were estimated in terms of average salary per employee, average fuel cost per BTU, and service price of capital. Two network variables were included in the cost function: number of unduplicated points served by each airline, and average stage length. Most data for constructing these variables were obtained from Statistics Canada publications. The number of points served by each airline was provided by Tae Hoon Oum (1964-1981 data) and by the Aviation Statistics Centre of Statistics Canada (1982-1985).

Estimation of the Cost Function

For estimation purposes, a translog function was used to represent $\hat{C}_{nt}$. As well distributional assumptions were made about T_n, A_{nt} and ϵ_{nt}, to permit derivation of a joint density function for the cost system[5]. The log-likelihood function was then derived and maximized using the computer program GQOPT.

Results From The Estimated Cost Function

Study results indicate that Canadian airlines have persistently overemployed capital and underemployed fuel and labour, relative to the most efficient (i.e., least cost) combination of inputs over time.

T_n, the additional cost incurred from using more than the minimum technically feasible quantities of inputs, was practically zero, while A_{nt} the additional cost incurred from not using the minimum cost combination of inputs, was not negligible. That is, Canadian airlines have been technically efficient over time, but have incurred more than the minimum possible costs due to employment of sub-optimal input combinations.

In contrast, Bauer (1985) found relatively high values of technical inefficiency dominating allocative inefficiency and random noise on the cost equation for U.S. airlines. These results lend credence to the view that service-oriented scheduling competition in the United States prior to deregulation had produced there higher levels of excess capacity and technical inefficiency than in the Canadian airline industry.

The Cost of Allocative Inefficiency

From the cost equation (Eqn 7), it is not difficult to demonstrate that the portion of observed total cost of an airline resulting from inefficiency is given by:

$$\textit{Cost of Inefficiency} = \textit{Observed Total Cost} \times \left[1 - e^{-(T_n + A_m)}\right] \qquad (8)$$

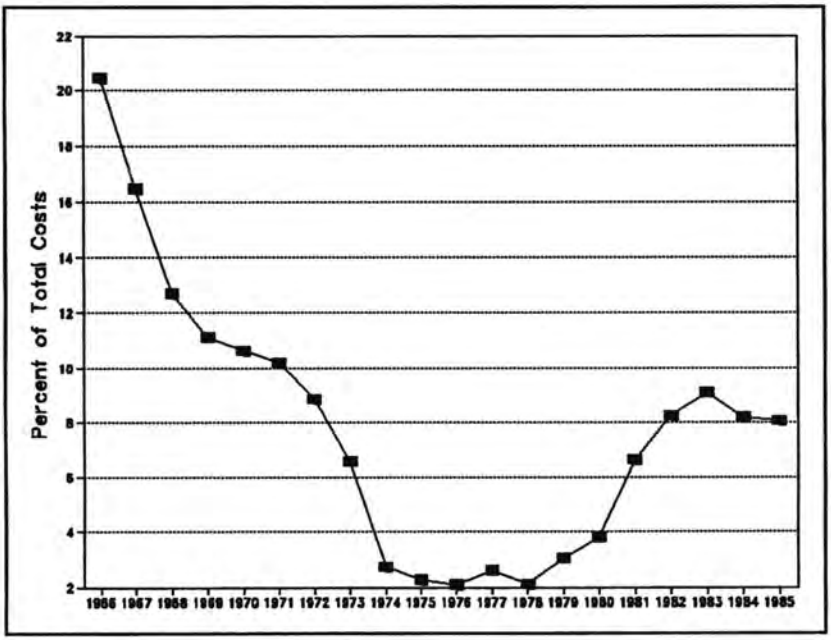
Conservative estimates[6] of the total annual cost of inefficiency within the Canadian airline industry (Levels I and II airlines between) 1966 and 1985 are presented in Exhibit 1 and the percentage of inefficiency in annual total industry cost is illustrated in Exhibit 2. As a proportion of total cost, inefficiency declined from about 20% in 1966 to a little over 2% between 1974 and 1978, the period immediately following the first energy crisis of 1973. However, inefficiency as a proportion of total costs has since increased to over 8% by 1982, and remained at that level for the rest of the study period.

Total industry cost in 1990 was about $5.9 billion. If the cost of inefficiency still constitutes over 8% of total cost as it did in the first half of the 1980s, then it represents approximately $472 million of extra cost that could be reduced through more efficient allocation of inputs, especially of capital equipment. This cost is not insubstantial. Further study is recommended to identify the sources of deviations from efficient input shares within the industry, and any corrective actions needed to minimize the costs of allocative inefficiency.

Exhibit 1
Annual Cost of Inefficiency in The Canadian Airline Industry

Year	Total Operating Expenses ($ m)	Cost of Inefficiency ($ m)	Percent Inefficiency in Total Cost
1966	378.06	77.26	20.44
1967	452.46	74.47	16.46
1968	497.80	63.20	12.70
1969	569.31	63.27	11.11
1970	701.38	74.64	10.64
1971	722.51	73.77	10.21
1972	806.59	71.34	8.84
1973	969.12	63.72	6.58
1974	1269.56	34.66	2.73
1975	1535.28	34.48	2.25
1976	1642.72	34.17	2.08
1977	1787.66	46.44	2.60
1978	2016.49	42.70	2.12
1979	2419.08	73.17	3.02
1980	2945.41	111.33	3.78
1981	3487.50	231.58	6.64
1982	3648.13	300.65	8.24
1983	3575.75	325.47	9.10
1984	3823.93	312.38	8.17
1985	4259.34	342.91	8.05

Exhibit 2
Percent Inefficiency In Annual Total Cost



ENDNOTES

1. For example, Douglas and Miller (1974). Roy (1985) provides a fine summary of relevant findings from these studies.

2. A partial list of such studies would include Roy (1980), Roy and Cofsky (1985), Gillen, Oum, and Tretheway (1986), and Kobia (1988).

3. This paper is intended to present the results of applications of some highly technical concepts available to a broader audience. Therefore, discussions of the properties of cost functions, suitable functional forms, and even the form of the translog function itself, are omitted. Readers interested in the more technical aspects of the study are referred to Kobia (1988).

4. The discussions of technical and allocative inefficiency given here are based on measures suggested by Farrell (1957).

5. Interested readers are referred to Kobia (1988) for full discussions of the density functions assumed for T_n, A_{nt}, and ϵ_{nt}, as well as the relationship between ϵ_{nt} and the disturbance terms on the input share equations. The joint density function and log-likelihood function for the cost system described above are also provided.

6. Bauer (1985) argued that the density distribution of the allocative inefficiency term, A_{nt}, assumed in this study are biased toward finding small estimates of allocative inefficiency. However, data limitations did not permit more accurate density assumptions to be adopted. Hence, estimates of the cost of allocative inefficiency within the airline industry presented in this paper may be very conservative.

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THE BEHAVIOUR OF QUEBEC TRUCKING FIRMS SINCE THE 1988 REGULATORY REFORM

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1. INTRODUCTION

Beginning in 1988, as a result of the regulatory reform enacted by the new transportation law, market forces really began to determine the conduct of the Québec trucking industry. Motor carriers operating in Québec had to modify their behaviour because economic and technical procedures and practises, developed over the years in a regulated environment, were no longer relevant or efficient. Any reluctance or delays in adjusting to a new competitive situation would invariably put a heavy burden on the financial future of any given firm. In order to avoid this sure and direct road to bankruptcy, some radical changes had to be made. Since 1988, trucking firms have real incentives to develop a new learning curve in order to survive in a market place where the general conduct of the industry is solely dictated by the behaviour of the most efficient firms among them.

The purpose of this paper is to assess, through the analysis of two specific corridors, namely the Montréal-Saguenay-Lac Saint-Jean one and the other, covering Montréal-Greater Trois-Rivières, how trucking firms implement new management and technical practises coming from their daily experience and translate them into more efficient behaviour. It takes the following form: Section 2 gives an overview of the past and present institutional arrangements in order to understand the pressing search for efficiency by trucking firms. Section 3 briefly describes the consequences of the removal of barriers to entry on the market structure of these two typical corridors. Section 4 presents and analyzes the adapted behaviour which results from this increase in competition. Because many basic changes have occurred in the industry, only the major ones are considered. Finally, section 5 offers some comments on the adjustment process and its time path.

2. CONSIDERATIONS ON INSTITUTIONAL ARRANGEMENTS

An explanation regarding the manner in which institutional arrangements have changed following the new trucking act implies a clear understanding of what transportation is about. Any transportation activity is, by definition, a real input to a manufacturing firm because the production plant is generally not located at the same place as that of the ultimate use of its product, as a consumption good or an intermediary input. Therefore, all institutional arrangements are available and the choices, made by a given producer, are based on its sole efficiency [1]. For instance, if the transaction costs of a contract are high because the incurred costs involving

monitoring, compliance and enforcement are important, a manufacturing firm will own its private fleet as the best cost-minimizing device available. A particular service or division is then formed in the firm: trucks are bought, drivers are hired and a transportation strategy is set up to satisfy the transportation requirements. In short, an internal command-and-control approach is put in place. This institutional arrangement, or vertical integration as it is called, allows the manufacturing firm to be totally in charge and to internally control every step of the production function, starting from the choice of the various inputs needed to produce it to the delivery to its final users. The opposite of this hierarchical approach is to contract out because the manufacturing firm cannot beat the market, namely to internally produce the transportation activity at inferior full costs. It is cheaper for a manufacturer to let an external organization, a trucking firm, produce the required service and pay fees for services done. In this context, the market does it all because competitive forces generate a level of rates and tariffs which reflects the behaviour of the most efficient trucking firms. This division of labour occurs because the price mechanism spreads information on rates and tariffs which reflects the real opportunity costs of both parties of the transaction.

Under the previous regime, regulation reduced the various possible institutional arrangements available for both parties, the shippers as well as the trucking firms. Regulation, implemented and enforced by a regulatory body, was an imperfect substitute for private contracts. That induced political institutional arrangement was indeed a form of implicit contract, although incomplete, linking shippers and trucking firms. A regulatory agency was a political third-party entity whose objectives consisted of managing trade-offs among various interest groups who invested time, energy and money in rent-seeking activities. Distributional considerations were generally as privileged as allocative motives by that exogenous organization to the industry [2]. As both parties felt constrained to behave inside that particular framework, built over the years by the numerous and different decisions of the regulatory board, many opportunities to reduce transportation costs or to promote and to expand transportation activities were not exploited. Transactions which would have increased the wealth of the nation were neglected, because they were strictly unlawful or were unprofitable under such a regime. In short, the latter limited and restricted the variety of institutional arrangements prevailing in a market because the costs of transacting strongly restricted the gains of exchange available between shippers and trucking firms.

The new competitive regime is characterized by the absence of an intermediary institution, the regulatory agency. There is no more exogeneous choice of markets through public hearings. Now, trucking firms select their own customers and make decisions regarding the spatial distribution of their services on the basis of their comparative advantages. Because financial stability is no longer guaranteed, trucking firms also face a higher level of uncertainty. In short, new behaviours introduced by price competition appear on the market. Therefore, it becomes imperative to develop a new learning curve, especially if the market place is also opened to outsiders who have operated in more competitive segments for some years.

More diversified institutional arrangements are found between the two extreme forms, vertical integration and the for-hire trucking firm. Various mixed organizations based on different combinations of the hierarchical approach and the price mechanism are now in operation in the industry, reflecting the various needs of shippers and the capabilities of motor carriers. The gains from trade have increased under the competitive regime and both parties are enjoying opportunities which were previously non-existent.

3. TWO CORRIDORS: THEIR MAIN CHARACTERISTICS

Two particular corridors are selected for this study because they really reflect two somewhat typical situations which actually prevail in the Québec trucking industry. The main characteristics of the Montréal-Saguenay-Lac-St-Jean market segment are the following: the average length of haul between the origin and destination is 478 km. Secondly, inbound shipments from Montréal to this peripheral region are mainly LTL (less-than-truckload) consolidated freight and composed of supplies for producing firms and consumers whereas outbound shipments to Montréal are mainly formed by TL (truckload) fabricated materials, inedible freight, coming from natural ressources of the region and eventually redirected to external markets. The other segment considered, Montréal-Greater Trois-Rivières, is slightly different in that the average length of haul between two given points is much shorter, namely 167 km. Moreover, inbound as well as outbound shipments are more diversified than in the former corridor. Finally, the distribution of traffic between LTL and TL shipments on both directions is also quite different.

Table I presents, for both corridors, the general information on revenues, shipments, tonnes-kilometres, all measures of output, and also the number of trucking firms in operation in 1988. The upper part of Table I shows these main facts on the Montréal-Saguenay-Lac-St-Jean corridor even though the lower one shows them for the one between Montréal and Greater Trois-Rivières. The high number of firms on those two markets confirms events observed during the American experience of deregulation. In a competitive regime, motor carriers prefer to invest or to expand in dense corridors rather than less dense ones like the Montréal-Greater Trois-Rivières and also on activities which do not require large initial investments as truckload activities rather than LTL activities like the Montréal-Saguenay-Lac-St-Jean market. Although a comparison with previous years are presently impossible, it remains that these respective numbers are higher than before.

(Table I)

TABLE I

Measures of Activities on Corridors

Origin-Destination / Types of freight	Montréal/Saguenay-Lac St-Jean				Saguenay-Lac St-Jean/Montréal			
	Revenues ($ million)	Shipments (thousand)	Tonne-kilometres (million)	Firms	Revenues ($ million)	Shipments (thousand)	Tonne-kilometres (million)	Firms
Less-than-truckload	8.4	84.2	25.0	35	0.7	6.1	1.2	10
Truckload	3.9	5.3	58.1	20	4.0	5.2	68.2	17
	Montréal /Greater Trois-Rivières				Greater Trois-Rivières / Montréal			
Less-than-truckload	7.4	117.9	11.4	48	1.5	20.6	3.0	21
Truckload	5.5	14.2	87.2	41	3.8	12.0	39.9	21

Source: Computations done by the author on the 1988 Trucking Origin-Destination data bank, Statistics Canada, 1990.

Tables II and III respectively present the level of competition for each of the five disaggregated markets, given by the Statistics Canada product section code. Three measures of output are computed and the measurement of concentration adopted is the Herfindhal index (H) which is defined as the summation of the squared share of firm i (S_i), namely $H = \sum_i s^2_i$. The minimum value of H occurs when all competitive firms are of equal size and the maximum value is one in a monopoly situation [3]. A careful reading of these Herfindahl indices reveals that the level of competition is very intensive when the volume of carried commodities is important. In other words, Herfindhal indices are low (high) when the output, whatever be the measure used, is large (small). However it may also be possible to deduce the number of potential competitors in a given disaggregated market. As a matter of fact, these different market segments are not as isolated from one to another as it seems because many trucking firms already operating on a given specific market would quickly become more than fringe suppliers on another potential markets, if market conditions changed, even marginally. In fact, some trucking firms do not actually carry specific shipments because their operating costs are relatively higher than those presently in service or their revenues are relatively low because they prefer to concentrate their activities on what they do best. However, any change in productivity, caused either by a reduction in new equipment costs or in a better use of their labour force, would give firms new opportunities to complete against existing firms.

TABLE II

Herfindahl Indices for five Markets on the Corridor Montréal - Saguenay Lac St-Jean

Product Section	Types of freight	Montréal / Saguenay-Lac St-Jean				Saguenay-Lac St-Jean / Montréal			
		Revenues ($ million)	Shipments (thousand)	Tonnes-kilometres (million)	Firms	Revenues ($ million)	Shipments (thousand)	Tonnes-kilometres (million)	Firms
Food, Feed, Beverages and Tobacco	LTL	0.258	0.298	0.293	9	1	1	1	1
	TL	0.331	0.339	0.354	4	0.623	0.735	0.800	4
Crude Materials, Inedible	LTL	0.851	0.540	0.949	2	1	1	1	1
	TL	0.587	0.471	0.475	3	0.831	0.630	0.722	2
Fabricated Materials, Inedible	LTL	0.340	0.419	0.355	14	0.412	0.554	0.427	3
	TL	0.238	0.223	0.199	16	0.468	0.389	0.454	11
End-Products Inedible	LTL	0.246	0.372	0.213	21	0.273	0.492	0.200	8
	TL	0.522	0.459	0.443	5	0.313	0.444	0.426	6
General Freight	LTL	0.326	0.227	0.657	7	–	–	–	–
	TL	–	–	–	–	–	–	–	–

Source: Computations done by the author on the 1988 Trucking Origin-Destination data bank, Statistics Canada, 1990.
A dash (-) shows the absence of measures.

TABLE III

Herfindahl indices for five Markets on the Corridor Montreal - Greater Trois-Rivières

Product Section	Type of transport	Montréal / Greater Trois-Rivières				Greater Trois-Rivières / Montréal			
		Revenues ($ million)	Shipments (thousand)	Tonnes-kilometres (million)	Firms	Revenues ($ million)	Shipments (thousand)	Tonnes-kilometres (million)	Firms
Food, Feed, Beverages and Tobacco	LTL	0.170	0.167	0.214	14	0.451	0.478	0.474	4
	TL	0.215	0.229	0.257	9	0.423	0.334	0.496	4
Crude Materials, Inedible	LTL	0.359	0.320	0.395	5	0.368	0.462	0.264	4
	TL	0.336	0.410	0.375	6	0.403	0.456	0.494	4
Fabricated Materials, Inedible	LTL	0.129	0.156	0.114	25	0.184	0.193	0.208	11
	TL	0.127	0.138	0.155	29	0.223	0.230	0.209	14
End-Products, Inedible	LTL	0.112	0.111	0.204	35	0.158	0.187	0.269	14
	TL	0.249	0.240	0.268	7	0.350	0.352	0.333	12
General Freight	LTL	0.288	0.281	0.282	7	0.296	0.339	0.396	5
	TL	0.739	0.810	0.853	2	1	1	1	1

Source: Computations done by the author on the 1988 Trucking Origin-Destination data bank, Statistics Canada, 1990.

4. ON NEW BEHAVIOUR AND LEARNING PROCESSES

New behaviour coming from an adjustment process caused by an increase in competition is deduced from the results of interviews and questionnaires dealing with trucking firms operating on these two particular corridors. The principal elements analyzed are the concept of network, being the most important among them the management of the rolling stocks and the production workers, and the new institutional arrangements allowed by a competitive market. When these elements, as well as some minor ones, are then translated into new behaviour on the market, trucking firms are able to reduce their operation costs and consequently offer services at lower rates and tariffs.

4.1 The Firm Network

Until 1988, for aggressive firms seeking new markets, the acquisition of a common carrier already holding a coveted permit authority provided a means of minimizing costs or lost earnings caused by public hearing procedures and the waiting period for obtaining a permit authority, if indeed one was finally granted by the regulatory agency. In a regulated environment of entry control, mergers, acquisitions and takeovers constituted the main instruments of expansion. Because the number of competing firms was also limited, the need for a good understanding of its network activities was not among the top priorities. However, in a competitive regime, a trucking firm, whatever its basic activities, has to comprehend all its spatially separated links of interest. For a general freight carrier, producing both TL and LTL shipments, its links are determined by its terminals, whereas for a truckload carrier, its links are established by the various origins and the destinations of its shipments. Consequently, the real difference between them is that the network of the former is spatially fixed although the latter may change it, up to the shippers' needs.

Two aspects of a trucking network are particularly significant because their eventual consequences on the costs of firms are different: its configuration and its utilisation[4]. The network configuration represents the physical structure of the network and reflects the spatial distribution of its terminals over the territory chosen by a firm. In contrast, network utilisation shows the actuel allocation of freight traffic over the existing network and thus measures how efficiently the firm routes its traffic over the overall network. More precisely, network configuration represents the possible links actually available to the carrier and thus, is independent of its actual distribution of traffic. A firm which uses the most possible connected links of its network ensures that its network is fully connected. Secondly, a firm with dense terminal operations will consider these as important to its success. On the other hand, network utilisation describes traffic density over the network and the ability to perform direct service, thus avoiding indirect routings. It reflects the concentration of traffic over the network. So the more efficient a firm becomes, the more its freight traffic is highly connected and the more its traffic flows are concentrated on relatively few links. In short, these two particular characteristics of

a trucking network imply that the latter must always converge toward an equilibrium and one of the prerequisites must be balanced flows in both directions.

In a competitive regime, the use of an efficient network, whatever the extent, allows a firm to maximize all economies of configuration and utilisation associated with its own network. Therefore, the more a firm uses a network of connected links and the more its freight traffic is concentrated on a relatively few links, the easier it becomes to lower its production costs. As a matter of fact, a highly connected network enables a firm to utilize its equipment more efficiently, all things being equal. Moreover, highly concentrated traffic flows imply more efficient traffic utilisation, namely direct service. As a trucking firm cannot always perform direct service, its costs may not be affected, even declined, if indirect routings permit greater consolidation and more efficient terminal utilisation. Finally, lower costs may occur if the cost savings associated with the reduced pick-up and delivery costs outweigh those associated with dense terminal operations.

As deduced from these theoretical considerations, the economies of network configuration, of which the economies of network densities constitute the most important part, are very weak for trucking firms relative to railways, for instance. Available economies of network densities are exclusively related to terminals and only trucking firms owning an important network can really enjoy them. Two polar examples show their relative importance and how the latter is determined by the kind of activities chosen by trucking firms. Large American firms such as Consolidated Freightways, Yellow and Roadway take advantage of them when using "the hub and spoke" approach. Their objective of long-haul, LTL operations is to minimize the carrier's shipping cost through the efficient utilisation of their network of local and centralized break-bulk terminals by appropriate routing strategies. Thus direct service and speed are not, in general, of principal concern. On the other hand, general freight LTL carriers attempt to utilise direct service on short-haul movements for competitive reasons, typically using the standard of next-day delivery. In that context, the search for economies of network densities are minimal because of the nature of the service itself.

The second source of economies comes from the network utilisation, and the latter are associated with an efficient use of equipment and an efficient routing through highly concentrated traffic flows. The American firm, J.B. Hunt Transport, represents the best example how a truckload firm can realize them, namely by serving only shippers with high volumes on very dense corridors [5].

All Québec based trucking firms interviewed and/or having completed the questionnaire have developed a network over the years and many of them have extended their activities on the Montréal - Saguenay-Lac-St-Jean corridor to complete it. A direct consequence of operating in such a framework is the dire necessity of knowing the marginal cost of carrying a shipment, whatever the type of freight, on all the links of its network. For instance, when a trade-off appears for two possible shipments, a trucking firm is therefore able to pick up the most profitable one [6].

Consequently, the traditional way of computing rates and tariffs, which consisted of charging a penalty for possible lack of backhaul shipments, is no longer realistic or efficient. As a matter of fact, the most efficient firm on any link dictates the level of rates and tariffs [7]. In other words, an efficient firm is able to balance its links and thus avoids costly empty backhauls. It will always get lower costs and outbid its rival competitors when their respective network overlaps or is similar. Thus, one of the strategies put forth by Québec trucking firms is to systematically seek out backhaul shipments, even if they incur losses in the process and then to eventually generate profits by carrying them on long distances, generally in the United States. It should be noted that the triangulation technique used by Canadian carriers on the transborder market for the last 20 years is a simple application of that concept.

4.2 The Fleet and Labour Management

The use of the network as the basic framework of trucking activities also implies better management of various inputs going into the production function. More and more firms buy trucks and trailers up to their shippers' needs. For example, B-trains are now enjoying great popularity, although it was difficult for trucking representatives to convince shippers of their relevance. Moreover, preventive repairs and inspections are now increasing because trucking firms do not want to bear the financial burden of having mechanical problems when carrying shipments on a just-in-time basis. Indeed, many contracts include penalities when time schedules are disrupted. However, they mostly fear the long-run consequence of their sporadic non-compliance on their reputation and their goodwill.

There exists an overcapacity in the industry, which means that firms not only reduce the number of trailers in their fleet, but they also put in place new rules on their turnovers when parked in a shipper's yard. Finally, most of general freight LTL carriers get a new loading plan to increase shipment size on a traditional five axle tractor-trailer. The average shipment size is now higher than under a regulated regime by 20 to 30 percent.

Many changes have also altered the picture of the labour force in the industry. First of all, the existing overcapacity and the decrease in the demand for transportation services, caused by the recession, not only reduce the number of firms in the industry [8], but they also induce the survivors to rationalize their transportation processes to become more efficient. Secondly, a high number of firms obtain a reduction or a freeze in wages, earned by their unionized drivers. Unionized trucking firms now try to hire more owner-operators when their collective agreement does not forbid it [9]. Changes in work rules also introduce more flexibility, but constraints remain, such as the by-laws on working hours. For instance, working hours for the personnel on the docks are now synchronized with those doing the pick-up and delivery service. The end result of this is that trucking firms operate with fewer workers, whatever the service. As they achieve a higher level of productivity, their production costs are now lower, as well as their rates and tariffs.

4.3 Institutional arrangements in a competitive market

Many new institutional arrangements are allowed by market forces and trucking firms as well as shippers are plainly taking advantage of that opportunity [10]. Trucking firms which expand their activities to new coveted market segments, without incurring large fixed costs, have more opportunities than before, other than interline and interchange arrangements. A possible strategy for an expanding firm is to associate with a firm already in the coveted market segment and to use the same waybill; this is the connecting carrier approach. A second one is to contract out with a particular firm in the coveted market to perform the necessary activities of transportation in its name. But the firm no longer has control when given off the shipments. These two possibilities differ from what already exists in the Province of Quebec. Indeed, two voluntary associations of small and medium size regional carriers actually share terminals and pick-up and delivery services in the Greater Montréal Area. However, each of the regional trucking firms is a shareholder of the Montreal firm. Finally, whatever the contract, the main point is that it involves an agency relationship between a principal and an agent. It necessarily implies the existence of incentives that motivate the agent to make decisions that are consistent with the interests of the principal [11].

A second form of expansion for a trucking firm is to invest in warehouse and distribution activities for third parties, usually referred to as logistics. Their relevant know-how and recent technological developments, mainly in microcomputers, give them comparative advantages over shippers who would like to perform these activities internally. However, few trucking firms dare to go outside their own domain.

New arrangements are also being developed between shippers and carriers, the former being better informed of the services which trucking firms can perform in a competitive regime. What a shipper really wants is a contractual relationship, a form of vertical integration, which gives him some authority regarding a trucking firm's decisions, without impairing its profits. In this context, the principal (shipper) and the agent (trucking firm) must incur positive monitoring and bonding costs (non-pecuniary as well as pecuniary) in order to minimize the divergence between the agent's decision and the principal's decisions. The Chrysler company recently did it by hiring one single trucking firm to carry its inbound as well as outbound shipments rather than hire 375 firms as it did previously. Some scenarios based on this kind of contractual relationship are in progress in the Province of Québec. Large shippers are ready to guarantee exclusive shipments on any corridor, on an annual or multi-year contract. In return, the bidding trucking firms will perform all the logistic decisions (time schedule, JIT shipments, quality control, inventories, etc.). To further increase their mutual confidence, these shippers will help them by also convincing their suppliers to use their services in order to better balance their activities. As the principal will reduce his monitoring expenditures, and therefore will spend these savings in more efficient ways, he is ready to share them with the agent who sees his management load increasing. However, the principal asks the

bidding firms to inspect their financial statements on a regular basis and also their planned investments. The agent will also expend ressources (bonding expenditures) to guarantee that some of his actions would not harm the principal or that the latter will be compensated if he does undertake such actions.

Trucking firms know that this form of alliance can also be beneficial. However, the politization of their industry through regulation has considerably diminished their mutual respect and confidence. For so many years, both transacting parties have lost the virtues of an efficient market to the extent that both users and suppliers of trucking services gain by trading.

4.4 General considerations

The overall consequence of this adjustment process undertaken by Québec trucking firms is to lower rates and tariffs to their competitive level. Some do not do it because they exit and the others realize it with a lot of pain. Being forced to increase productivity because of their survival, they react efficiently. Although Québec trucking firms knew since the mid 80s that they would have to adjust, either because they operated on the transborder market, or because of the publication of the policy-oriented discussion paper, Freedom to Move, they did not really change until the very last moment, when the trucking law was enacted [12]. However, it is actually impossible to compute the decrease in rates and tariffs since the beginning of the year 1988. As a matter of a fact, Statistics Canada changed the 1989 For-Hire Trucking Origin and Destination Survey. However American research shows that the cumulative effect of the Motor Carrier Act of 1980 on productivity is substantial, well over 16 percent after four years [13].

5. CONCLUDING REMARKS

The trucking regulation, an instrument of the political process, has impeded the natural evolution of partners because they did not directly negotiate all the terms of trade, having to deal most of the time through a third party for some of their basic conditions. They now have to develop a mutual confidence to discover that they may gain from exchange, up to respective advantages. However, some prerequisites are needed to initiate that type of action and to converge to a steady-state equilibrium. For instance, trucking firms must have completed their adjustment process and have enjoyed the results of their new learning curve. In other words, they have to continously improve their productivity by being able to modify their newly-learned behaviour. As trucking firms fill more backhaul shipments, utilize more efficient routes and develop other cost-cutting techniques, their costs decrease steadily over time, relative to costs in a regulated environment. When this new behaviour will be completely endogeneous and assimilated, they will naturally follow the trend, the learning-by-doing effect, which means that productivity gains will probably continue for several more years. This trend will be disrupted, either by new technological changes or changes in the environment.

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7. This sentence also leads to the complaint raised by trucking firms when negotiating with intermediaries such as forwarders and load brokers to get backhaul shipments. The bench-mark used by the latter is the marginal cost of the most efficient firms operating on a particular link. If a firm bids for such a backhaul and its marginal costs are superior, it incurs monetary losses. But the alternative is far more expensive, namely to start or expand its marketing department.

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STRATEGIC INVESTMENT IN HIGHWAY TRACTORS

by

Darcy B. Toms

Peat Marwick Stevenson & Kellogg

A. Introduction

There are two basic schools of thought on the useful life of highway tractors. Some companies dispose of their tractors relatively early, before warranties expire and mechanical problems begin to appear. Other carriers keep tractors seven years or more, often shifting them to low mileage roles in the latter stages of their life. Replacement decisions are frequently based on intuition rather than formal economic analyses.

It appears that many carriers have reduced their tractor purchases in response to the economic recession. As shown in Exhibit 1, new heavy truck sales in Canada have fallen more than 50% since their peak in 1988 [1]. This implies that the average age of highway tractors has increased.

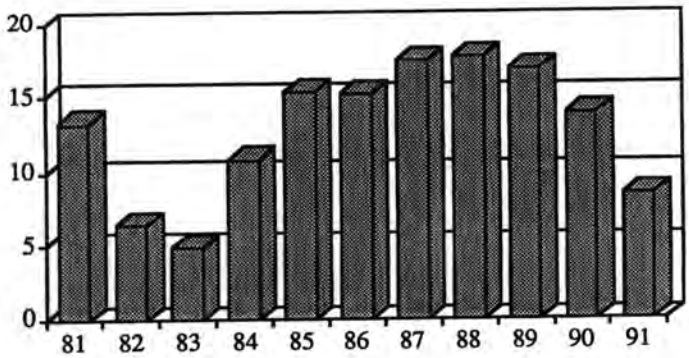
In the short term, deferring tractor investment may be a rational business decision. However, aging tractors have cost and other implications for several aspects of trucking operations. This paper deals with tradeoffs inherent in tractor replacement decisions, and develops a methodology to evaluate alternative replacement policies.

B. Methodology

Tractor replacement issues were evaluated using a discounted cash flow methodology. Under this approach, the optimal replacement policy minimizes equivalent annual tractor costs. Four cost elements are considered by the model:

- Capital cost (initial cash outlay).
- Repair and maintenance costs.
- Salvage values.
- Tax effects.

Exhibit 1
New heavy truck sales in Canada, 1981-91 (thousands of units)



Other cost elements have been excluded based on the following rationale:

- Driver wages and benefits are not directly affected by tractor age.
- Rates of fuel consumption are relatively stable for well maintained vehicles beyond the break-in phase (e.g., after the first 75,000 kilometres).
- Tire wear per kilometre should not be affected by tractor age if equipment is well maintained.
- Provincial registration fee schedules do not consider model year.

In theory, insurance costs are affected by tractor age since newer vehicles have a higher replacement value. However, it is very difficult to isolate the impact of vehicle age on overall premium levels. Insurance costs depend on a number of factors, including type of coverage, fleet size, company safety record, and geographic location. Furthermore, vehicle age should not change the liability portion of insurance premiums except in provinces with a no fault insurance system.

Assumptions and data sources for the four elements considered by the model are briefly outlined below.

1. Capital cost

Capital costs have a major effect on the results of discounted cash flow analyses because they are incurred at the beginning of the vehicle life cycle. Therefore, it is important to specify tractors carefully to avoid options that increase costs without adding real value.

Capital costs used in the model are based on data published in *The Truck Blue Book* [2]. Prices are converted to Canadian currency at the rate of $1CDN = $0.80 U.S. Carriers are assumed to pay 70% of the suggested factory price, based on a sample of 8 tractors purchased by a Canadian fleet between 1989 and 1990. An additional 8% is added to account for provincial sales tax. The federal goods and services tax is ignored because it can be recovered as an input tax credit.

The base scenario vehicle is a 1993 Ford LTA9000 Aeromax Series conventional tractor. The estimated fleet price for this vehicle after currency conversion and taxes is $79,700.

2. Repairs and maintenance

The cost of basic preventative maintenance (e.g., oil changes and lubrication) should not vary significantly between new and older vehicles. However, old tractors are more prone to breakdowns, and they may require preventative engine work or component replacement. Furthermore, the cost of repairs increases as vehicle and component warranties expire.

Repair and maintenance costs for individual vehicles tend to vary widely from month to month. For analytical purposes, it is more useful to think in terms of average costs per kilometre calculated over a period of one year. This has the effect of smoothing out otherwise "lumpy" expenditures, and it provides a reasonable basis for predicting overall fleet performance.

Exhibit 2 shows average repair and maintenance costs per kilometre incurred by a Canadian fleet of highway tractors. Tractor utilization for this carrier is approximately 125,000 kilometres per year. Cost curves vary from company to company, depending on utilization, driver behavior, maintenance practices, and other factors. For example, the cost curve would likely be quite different for tractors driven 300,000 kilometres annually.

In this case, the relationship between tractor age and maintenance cost is close to a linear function. The slope of the regression line suggests that costs per kilometre increase 2.4 cents per year. Very similar results were obtained for another Canadian fleet with comparable utilization levels. In contrast, a U.S. source shows large variations in parts consumption from year to year [3].

3. Salvage values

Equipment salvage values result in a cash outflow (recovery) at the end of the vehicle life cycle. They also have tax implications, which are discussed below. Salvage estimates for the model are based on forecasted wholesale price data published in the *Truck Blue Book of Residual Values* [4].

Exhibit 3 shows estimated salvage values (percent of initial cost) for the base vehicle with utilization of 160,000 kilometres per year. Salvage values are not available for lower utilization levels. Tractor values fall rapidly over the first few years, and then begin to level off by the end of year five. Actual values vary depending on vehicle condition, maintenance history, region, and other factors.

Exhibit 2
Repair and maintenance costs per kilometre vs tractor age (1993 cents)

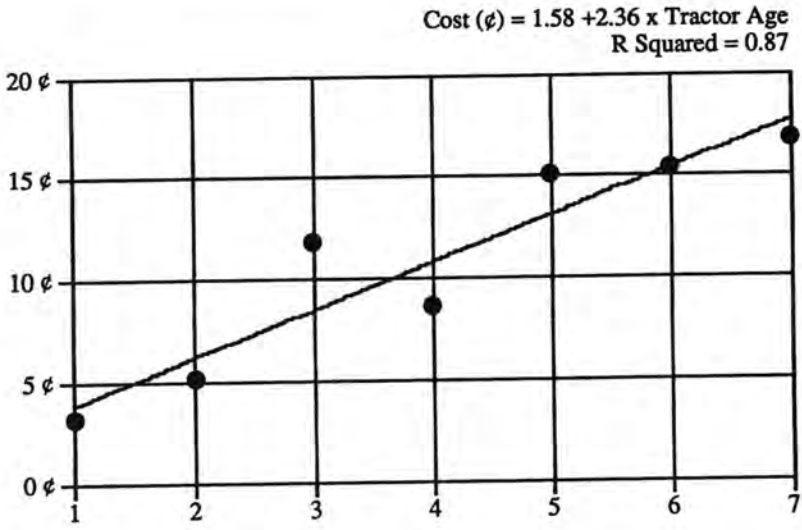
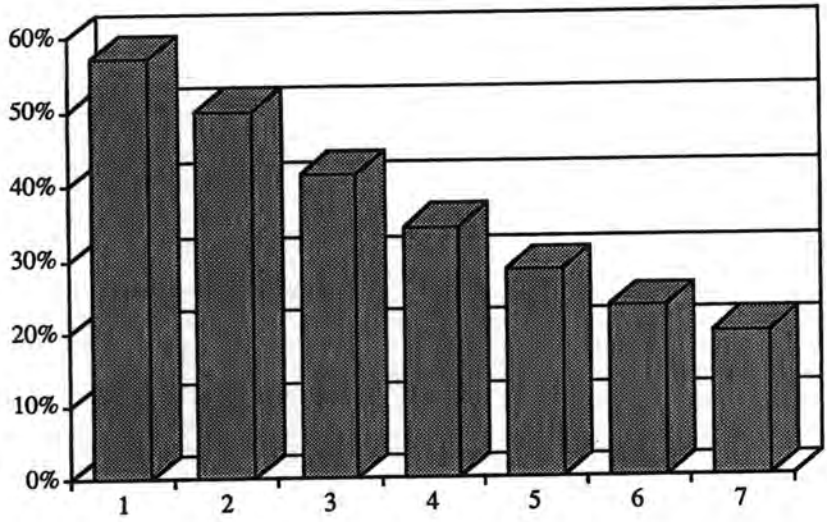


Exhibit 3
Projected salvage values vs tractor age (percent of initial cost)



4. Tax Issues

Vehicle replacement policy has tax implications in two areas. First, new tractors may generate an investment tax credit. Second, they provide a depreciation tax shield for future earnings.

The Canadian government has proposed amendments to the Income Tax Act that include a 10% non-refundable investment tax credit for tractors purchased between December 2, 1992 and December 31, 1994 [5]. This change provides an immediate benefit for carriers in a taxable position, since it reduces income taxes payable. However, companies are not eligible if their capital as defined for tax purposes exceeds $10 million.

In Canada, depreciation tax shields are generated through the capital cost allowance (CCA) system. CCA is calculated on a declining balance basis at the rate of 40% per year [6]. However, under the "half year rule" a carrier can only claim 50% of CCA during the first year that an asset is put in use [7]. Assuming that the company is in a taxable position, tax savings from CCA are equal to the amount claimed times the applicable corporate tax rate.

Capital cost allowances are calculated using asset pools rather than individual tractors. If a tractor is sold for less than its tax value the difference stays in the asset pool and continues to generate a depreciation tax shield. If a tractor is sold for more than its tax value the difference reduces the tax value of remaining vehicles in the pool. Normally, tractor sales do not have immediate tax consequences for companies that continue to replace their fleets.

The present value of the depreciation tax shield from a new tractor can be determined using the following formula [7]:

$$\text{PV of Tax Savings} = \frac{\Delta UCC \times d \times t}{k + d} \times \frac{1 + k/2}{1 + k} - \frac{S \times d \times t}{(k+d)(1+k)^n}$$

Where:

	ΔUCC	=	Purchase price net of tax credits
	d	=	CCA rate (40%)
	t	=	Corporate tax rate
	k	=	Cost of capital
	S	=	Salvage value of vehicle at end of life cycle
	n	=	Year vehicle was sold

This formula assumes that the company is in a taxable position throughout the vehicle's life cycle. Therefore, it is not valid for carriers with significant loss carry forwards or expected operating losses.

C. Calculation of equivalent annual costs

Exhibit 4 demonstrates the process used to calculate equivalent annual tractor costs. In this example, the vehicle is operated for five years before being replaced. The diagram shows the timing of cash inflows and outflows with the exception of the depreciation tax shield. Present values are determined in the table, and converted to an equivalent five year annuity.

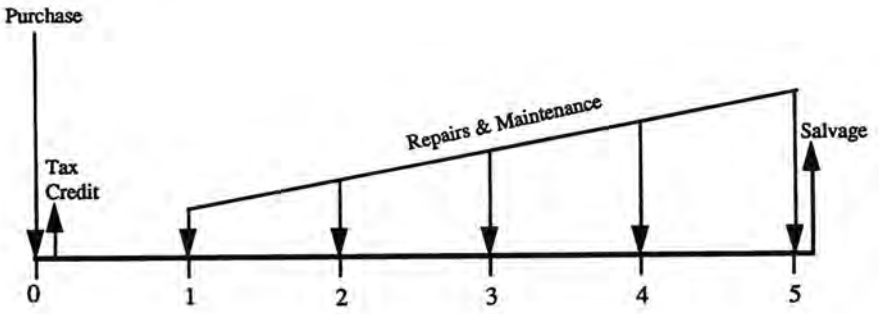
Since tax savings are calculated in nominal dollars the discount rate and life cycle cash flows are expressed in nominal terms. Base scenario assumptions are as follows:

- Tractor cost including tax is $79,700 (see above).
- Cost of capital is 15%.
- Annual inflation is 3%.
- Vehicle utilization is 125,000 kilometres per year.
- Repair and maintenance costs per kilometre are based on empirical data presented in Exhibit 2, rather than the regression equation. Costs are adjusted each year to account for inflation.
- Salvage value is determined from the initial tractor price and the Exhibit 3 residual value profile.
- The combined federal and provincial corporate tax rate is assumed to be 44.3%, the rate in effect for Ontario and Alberta [8]. For comparison purposes, the combined rate in Quebec is 35.7%, while rates for other provinces range from 43.8% to 45.8%. Tax rates are lower for Canadian controlled small business corporations (income less than $200 thousand). For example, the combined small business rate in Quebec is 16.55%.

Tire costs have been excluded from the model, so the initial cash outlay must be adjusted to reflect tractor cost net of tires. For this purpose, tires are assumed to account for $3,500 of the new tractor price.

In the Exhibit 4 example, the present value of tractor life cycle costs is $75,841. This amount is equivalent to an annuity of $22,624 per year over the five year vehicle life.

Exhibit 4
Cash flow diagram and sample calculation



Present value of life cycle costs

Item	Dollar Amount (cash flow)	Year	Present Value
Tractor price net of tires	\$79,700 - \$3,500 = \$76,200	0	\$76,200
Investment tax credit	\$79,700 x 10% = \$7,970	0	(\$7,970)
Repairs & maintenance	125,000 x \$.0312 x 1.03^1 = \$4,011	1	\$3,488
Repairs & maintenance	125,000 x \$.0511 x 1.03^2 = \$6,777	2	\$5,125
Repairs & maintenance	125,000 x \$.1176 x 1.03^3 = \$16,069	3	\$10,566
Repairs & maintenance	125,000 x \$.0856 x 1.03^4 = \$12,046	4	\$6,887
Repairs & maintenance	125,000 x \$.1503 x 1.03^5 = \$21,773	5	\$10,825
Salvage value	\$79,700 x 29% = \$22,770	5	(\$11,321)
Depreciation tax shield	From present value formula	–	(\$17,974)
TOTAL			\$75,841

Note: figures may not add due to rounding.

EQUIVALENT ANNUAL COST = \$75,841 x Annuity Factor $_{(5\ yrs,\ 15\%)}$ = \$22,624

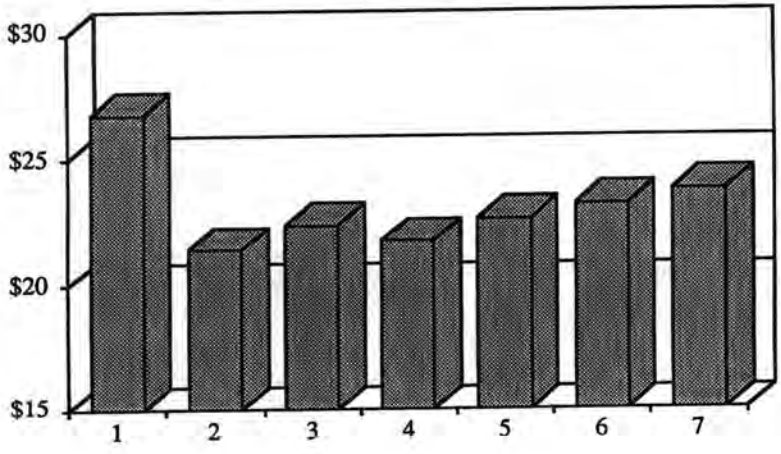
D. Results

Exhibit 5 shows base scenario equivalent annual tractor costs for tractor lives of one to seven years. The following conclusions can be drawn from this Exhibit:

- The equivalent annual cost function is relatively flat for tractor lives of two to five years.
- Costs are minimized if the tractor is replaced after two years.
- Costs are very close to the optimum level if the vehicle is replaced after four years. However, replacement after three years increases equivalent annual costs because of the maintenance cost spike in year three.

Extending tractor life from four years to seven years would increase equivalent annual costs by $2,050. To put this in perspective, annual revenue per tractor for general freight truckload carriers is approximately $200 thousand. This implies that, other things being equal, the extension to seven years would raise a company's operating ratio by about 1%.

Exhibit 5
Equivalent annual costs for base scenario (thousands of dollars)



E. Sensitivity analyses

Sensitivity analyses were used to evaluate how alternative cost and operating assumptions affect the overall results. Variances from the base scenario were considered for several input factors, with each factor tested independently.

Results are summarized in Exhibit 5. For each scenario, the Exhibit shows the optimal vehicle life and resulting equivalent annual tractor costs. Several scenarios shift the optimal vehicle life from two years to fours years. However, no scenario justifies keeping tractors more than four years.

It is acknowledged that some fleets achieve much higher utilization than the maximum assumed for this analysis. Higher levels were not tested because the empirical maintenance cost curve would not be valid for high utilization fleets.

Exhibit 5
Results of sensitivity analyses

Factor	Adjustment	Optimal Life	Equiv. Annual Costs
Base scenario	n/a	2 years	$21,414
Tractor price	+ 25%	4 years	$25,213
Tractor price	+ 10%	4 years	$23,136
Tractor price	- 10%	2 years	$19,587
Cost of capital	10%	2 years	$18,408
Cost of capital	20%	4 years	$24,212
Utilization	+ 25%	2 years	$27,739
Utilization	- 25%	4 years	$19,469
Maintenance costs	+ 25%	2 years	$27,739
Maintenance costs	- 25%	4 years	$19,469
Salvage value	+25%	2 years	$19,530
Salvage value	- 25%	4 years	$22,308
Investment tax credit	0%	4 years	$23,702
Corporate tax rate	16.55%	4 years	$25,387

F. Other considerations

A quantitative economic analysis can not capture all aspects of the fleet replacement decision. Several qualitative issues should also be considered:

- New tractors project a positive marketing image to existing and potential customers. They can also contribute to better customer service through fewer breakdowns on the road.
- Equipment down-time increases with vehicle age. By modernizing its fleet, a carrier may be able to operate with fewer tractors.
- Aging tractors create heavy demands on maintenance resources. Symptoms include excessive overtime charges, unplanned outsourcing, and requests for more technicians and service bays.
- Drivers like new tractors because they are a source of status among peers, and they are generally more comfortable to operate. A modern fleet can help a carrier attract and retain qualified drivers [9].
- New tractors are less likely to experience failures that can cause accidents.

All of the above factors clearly favor early replacement of highway tractors. However, there is one important counter argument. New tractors substitute fixed ownership costs for variable maintenance expenses. While this increases profits in good times, it raises the risk of bankruptcy if business levels fall suddenly. It can also be argued that early tractor replacement increases administrative costs for the purchasing function.

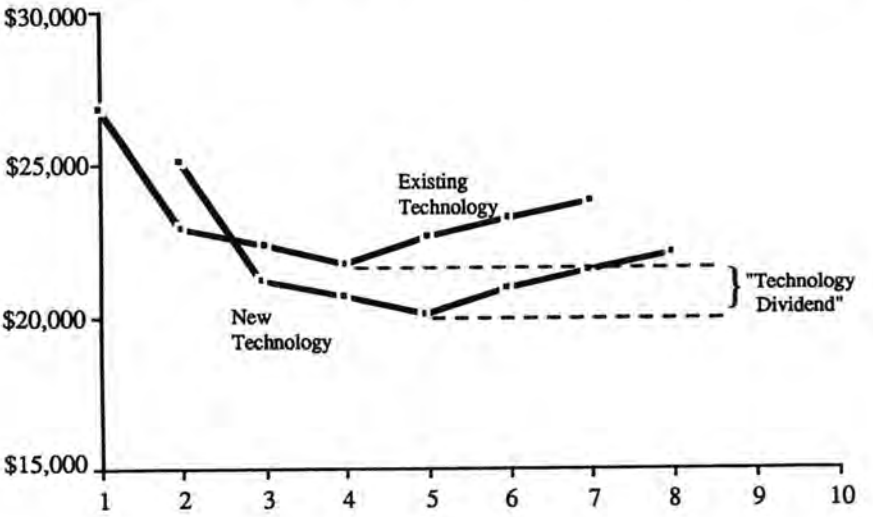
Many carriers defer new tractor purchases because they lack the required capital funds. Carriers that can not afford to replace tractors are caught in a vicious circle – keeping old equipment only makes things worse. For some companies, leasing tractors or buying late model used vehicles may be a viable solution.

G. Obsolescence

To this point, the analysis has focused on identifying replacement policies that minimize equivalent annual costs for a given vehicle. However, technological innovation can make it worthwhile to replace a tractor before it has reached the minimum point on its cost curve. Recent examples include the introduction of electronic engine controls and improvements to tractor aerodynamics. Together, these innovations have reduced fuel consumption dramatically [10].

Exhibit 6 depicts the concept of technological obsolescence using the equivalent annual cost framework. In this hypothetical example, annual costs for existing technology are minimized after four years. However, an improved vehicle is available at the end of year two. Purchasing the new tractor and keeping it four years reduces equivalent annual costs below the minimum possible with existing equipment.

Exhibit 6
Identifying obsolescence with the equivalent annual cost methodology



When faced with the possibility of obsolescence the financial model should be adapted to consider all incremental cash flow effects. For example, if new technology reduces fuel costs by $2,000 per year that amount should be included as a cash outflow (recovery) when determining equivalent annual costs for the replacement vehicle.

H. Conclusions

Several conclusions can be drawn from the research presented in this paper:

- The equivalent annual cost curve is relatively flat for tractor lives of two to five years.
- Most qualitative considerations favour early tractor replacement.
- New tractors substitute fixed ownership costs for variable maintenance expenses. Therefore, they increase the risk of financial distress or bankruptcy if business levels fall suddenly.
- Under the base scenario, costs are minimized if tractors are replaced after two years, and they are very close to optimum with replacement after four years. None of the alternative scenarios justified keeping vehicles more than four years, a practice followed by many Canadian fleets.

- Technological innovation can make it financially worthwhile to replace a tractor before it has reached the minimum point on its equivalent annual cost curve.

Applied financial analyses can help a trucking company identify and exploit cost reduction opportunities. However, most carriers need to improve their information systems to gain full advantage from such techniques. Maintenance cost curves and other factors vary significantly from carrier to carrier. Therefore, results for one company may not be transferable to another.

To a large degree optimal tractor life is a moving target. Carriers must consider many factors, including changing equipment prices, tax laws, warranties, vehicle technology, and tractor resale values. Therefore, replacement policies should not be cast in stone.

Acknowledgements

I would like to thank the trucking companies and suppliers that provided information for the analysis and shared their insights on tractor replacement issues. Assistance from Claude Pedneault of Peat Marwick Stevenson & Kellogg is also acknowledged.

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MAINTENANCE, DEPRECIATION AND NORMATIVE COSTING OF FLEETS FOR INTERMODAL COST COMPARISON - THE MYANMAR EXPERIENCE

by

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1.0 INTRODUCTION

This paper deals with the technical problems of how best to cost fleets when carrying out intermodal cost and efficiency comparisons. It is based on work recently done for the World Bank and the United Nations in Myanmar (formerly called Burma) during the past two years. The project in Burma is called the Myanmar Comprehensive Transport Study (MCTS) and involved a full analysis of the various modes of transport in Myanmar including the road system, the railway, the air system, the inland water transport system, ports and coastal shipping.

The project required that the legislative and regulatory structure through which the transport system operated be reviewed; that ways of changing the current legislation, regulations and organisation be explored and appropriate improvements which recognised the current move towards a liberalised, free market economy be recommended; that the current condition and state of each mode be described; that specific organisational, operational and structural changes within each of the modes to improve its productivity and effectiveness be suggested; and that recommendations on how best to structure the overall transport system to ensure that it functioned as close to a state of "economic" efficiency as possible be made.

To analyse the cost per unit of traffic moved for any mode, and to ensure that the comparative costs for any commodity between modes was in reality comparable, it was essential to establish a level playing field for dealing with key input costs to the modes. In practical terms that means deciding on how to treat depreciation, interest on capital and normalised fleet costs to ensure that like is being compared with like. Before entering into the particular discussion of the fleets and how they can be costed for an intermodal comparison, it is important that the basic background to the study be described to provide focus to the subsequent discussion of fleets.

2.0 BACKGROUND

Myanmar has been a very controlled "socialist" style economy for much of the past 40

years. Over that period, organisations such as the Myanmar Railway and the Inland Water Transport Corporation have gone through an interesting metamorphosis. During the early days of the establishment of those organisations during the 1920's, they were given not just a mandate to be profitable, but a charge that they must be profitable and pay their own way, otherwise, the Government (read British Governor) was empowered to step in, assume control of the company and ensure that it remained profitable. (This is a somewhat neat twist to the current Western perception of the role of Government intervention .)

In the years which followed the Second World War, the development of Myanmar society was very much dominated by an autocratic socialist model. The organs of development were seen to be the large producer companies and the transport organisations. Consequently, a structure of State Economic Enterprises (SEEs) was set up with virtual total Government control over those organs. The SEE's included the Myanma Oil and Gas Enterprise, Myanma Timber Corporation, Myanma Foodstuff Industries, Myanma Fisheries and all the transport organisations, including road transport. In essence, the SEEs acted like extended Government departments. Control of pricing was absolute and revenue passed to the Government either directly or through "profits".

The allocation of transport was controlled through the Central Movement Coordination Committee (CMCC). Shippers requiring service applied to the CMCC. The CMCC met to decide the most efficient way to move the shipment, and to optimise the allocation of transport capacity. Based on that meeting, a shipper was told to ship via a specific mode and the mode was directed to provide service to the shipper. The rates were set by the CMCC and "Government" cargo, either military or generated by the SEE's was given priority.

For some modes, the allocation of traffic by the CMCC was total. The railway being a Government owned organisation, was totally under the control of the CMCC. Consequently, all traffic on the railway moved to or from the other SEEs or the Government Deparments. Other modes, such as the road and inland water system, offered both public owned carriers, as well as private operators. The public owned carriers handled as much of the Government traffic as possible, with the private operators providing surge capacity. Generally the SEEs have not been able to offer sufficient capacity to carry all traffic and it has been necessary to rely heavily on private trucks for road transport and private vessels and barges on the river system.

Lest there be a discontinuity between the cost of moving via the SEE or the private operator, the CMCC wielded a stick in the form of fuel allocation. Fuel is in short supply in Myanmar and the Government controls its allocation. As with most scarce commodities in a controlled economy, the free market price for fuel is higher than the controlled price by a factor of 15.

The private owners who were willing to carry Government cargo or passengers at the controlled fare, were given sufficient fuel for the outbound and inbound trip. The economics argued for a strategy that accepted Government cargo for the trip out at controlled prices in order to obtain sufficient subsidised fuel for the trip out and back. The vehicle operator then charged much higher prices for the return trip by carrying private sector cargo or passengers not able to get on a Government bus or the railway.

The alternate strategy was to buy free market fuel and carry private cargo at a higher rate for both the head and the back haul. This strategy was potentially more lucrative if the backhaul was guaranteed. However, if the backhaul was somewhat questionable, then this strategy could lead to a loss on the trip. The private shipping rates, adjusted freely to

ensure that these two strategies remained in equilibrium.

In 1988 pro democracy riots culminated in the military once more assuming control and forming the State Law and Order Restoration Council (SLORC). The SLORC supported democratic elections in 1989, but subsequently ignored the outcome with the result that the country is still controlled directly by the SLORC and their cabinet appointees. In turn, local Commandants chair a LORC at district level which decides on local policy and priorities.

While the control at the political level has been very repressive, the philosophy followed at the economic level since 1989 has been market focused. The control over transport allocation has been largely removed from the CMCC. Fuel is only partly controlled and some Government petrol stations now sell fuel at a price close to the free market rate. Increased autonomy has been given to the SEEs to determine the direction of the future service offered - including privatisation of some components of the SEE itself. SEEs are allowed to buy products from the open market rather than from other SEEs. For instance, the railway can buy sleepers from private companies, not just from the Myanma Timber Enterprise.

The exchange rate, although still formally only 10% of the "black market" rate, has been effectively devalued by allowing local citizens to maintain US dollar accounts and to move money from account to account without control. In early 1993, a Foreign Currency Unit was introduced into which visitors must change their money. This unit is legal tender anywhere in Myanmar and its impact on commerce and the economy in general is still unclear. The model of development now parallels the model in China with tight political control but an expanding free market economy. The loosened economy has led to an increase in purchases of vehicles - both cars and trucks, and a much expanded role for the private sector in the economy and in transport.

3.0 THE FLEET

The fleet is made up of a variety of public and private components. Significant elements of the fleet are owned by the Government through the SEEs but in the road and water sectors in particular, the Government owned fleet is also supplemented significantly by privately owned vessels and vehicles. Because of tight state control over foreign exchange, the SEEs are much more likely to purchase new equipment than the private sector. This has set up a cascade sequence whereby "old" state owned equipment is sold to the private sector who refurbish it and then compete with the SEEs for traffic.

State owned transport enterprises are involved in all transport subsectors:

- Road Transport (RT) operates inter-urban freight and passenger services and urban bus and taxi services with a fleet of 2,600 trucks, 380 taxis and 1,200 buses;
- Myanma Railways (MR) runs a total of 116 inter-city passenger trains, 136 suburban passenger trains and 24 freight trains each day;
- Inland Water Transport (IWT), with a fleet of 237 vessels, provides passenger-cum-cargo and freight-only service over the main river and delta routes;
- Myanma Airways (MA) has five Fokker F27s and three Fokker F28s, and flies internal routes out of Yangon with international service to Bangkok, Hongkong, Singapore and Jakarta;
- Myanma Five Star Line (MFSL) operates ocean-going and coastal shipping services, the latter with six passenger-cum-cargo vessels having a capacity of 4500 tons of cargo and 1,350 passengers.

3.1 Road Transport

Nearly 76,000 passenger cars were registered at the end of 1991, of which 65% were located in the capital, Yangon (formerly Rangoon). On a world scale the level of passenger car ownership is very low, at less than 2 cars per 1000 persons. Most of the new additions to the fleet are reconditioned secondhand vehicles from Japan.

At the end of 1991, 18,000 buses and 10,000 light trucks were registered. Most light trucks are used for passenger service. This fleet is more evenly distributed over the country with only 25% of the light trucks and 50% of the buses registered in Yangon.

The cargo fleet has reduced in size between 1981 and 1991 from 31,000 to 22,000. This is partly because of compulsory deregistration of old vehicles and partly because of extreme shortage of spare parts for the older equipment. The average age of the truck fleet is 18 years.

An example of typical trucks loading at the port for shipments up country is shown below.



The most common type of truck used for interurban service is a 6 1/2 ton, 2 axle, 6 wheel straight truck, often with suspension and frame strengthened to carry 15 to 18 tons. Static

load tests have exceeded 20 ton axle load limits on portable scales. The loads carried are often extreme and cause extensive damage to the road surface. However, traffic volume is very light, normally less than 500 vehicles per day. A typical loaded truck is shown below.



Many of the trucks in the fleet are 1940's and 1950's vintage, having in some cases been provided to Myanmar as war reparations by the Japanese. Because of shortage of foreign exchange, relatively few new vehicles have been purchased over the years, but maintenance has been continuous and it is very difficult now to determine the actual age of a particular vehicle. Some have had their suspension and frame strengthened, some have had new engines or parts of the drive train installed, and all have had the upper body and cab changed or renewed.

3.2 Rail Transport

The railway network is comprised of a main north south spine with a series of branch lines extending out from the main spine. The network covers 3,330 kms. The fleet includes 242 main line diesel locomotives, 33 diesel shunting locomotives, 77 steam locomotives, 7,764 goods wagons and 1,109 passenger coaches. The system handles about 2 million tons of goods traffic annually and about 57 million passengers. Of the passengers, about 23 million are carried on the suburban lines in Yangon and Mandalay.

As with the road fleet, the average age of the railway fleet is very high. Locomotives on average are 22 years, wagons 33 years and coaches 25 years. The high average age coupled with the inevitable shortage of spare parts and stolen equipment results in low availability (65%) and utilisation (36%) of the fleet.

MR began to dieselise in 1959 and many of the first diesels purchased are still operating. The steam fleet is largely out of service and those that remain, are only used for local shunting at some yards. While much of the service is targeted at passengers, about 60% of the interurban passenger trains are mixed, that is, they carry both passengers and some freight.

A typical passenger/mixed train is shown in the following photograph.



3.3 River Transport

The river system in Myanmar has always been the backbone of the country, both for agricultural production and for transport. The river system fans out in the southern end of the country into a broad fertile delta with many tributaries and runs directly up through the centre of the country toward the lower Himalaya Mountain ranges.

Transport on the river system combines privately owned vessels with those owned by Inland Water Transport. The private vessels number about 800 and those of the IWT include 285 powered vessels and 210 dumb barges. The fleet is made up of cargo vessels, passenger-cum-cargo vessels and liquid bulk tankers. The IWT fleet on average is very old at 36 years representing 90% of its useful life with consequent high cost and long periods of maintenance. The steel hulled privately owned vessels in many cases were salvaged from the river having been scuttled by the retreating British during the Second World War and are far beyond their normal useful life. Most of the private fleet is timber construction.

An example of the type of vessels that make up the fleet is shown in the following photograph.



4.0 MODE COSTING

Given the above backdrop, the task was to provide a base of cost comparison that allowed options for improving the modes to be compared internally on a consistent basis while also allowing for an unbiased comparison between modes. Each of the modes was analysed using a mode specific costing model - HDM III for roads, OSCAR/QRAIL for railways and Ayeyarwady Model for the river system[1]. One of the features of all the

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1 The **HDM III** model was developed by the World Bank for economic analysis of roa maintenance options over the past 20 years. It is extensively used around the world f cost analysis. It contains a vehicle operating cost submodel which can be used to det the impact of policy changes on road user costs and maintenance strategies.

The **OSCAR/QRAIL** model was developed by Dr. Ed Petersen at Queen's Univers working for the Hickling Corporation under contract to the World Bank. The model World Bank form is called OSCAR which stands for Operationally Simplified Costs Railways. It is a Lotus based model building on the over 15 years of work done by Petersen for the World Bank in producing the earlier World Bank RAIL model.

models is the need to account for not just the direct costs of operation but also the depreciation of the equipment and capital charges.

A number of schools of thought exist on how best to consider the capital carrying cost of a system and its longer term replacement cost. Most papers that deal with economic cost benefit analysis, simply input capital as it is expended and deduct residual value of the asset at the end of the evaluation period. The *Guidelines for Economic Analysis of Projects* [2] of the Asian Development bank argue that:

> "The financial Accounts of a project include provision for depreciation on the basis of prevailing accounting practices. For purposes of economic analysis, the important factor is the stream of real investment required for realizing and maintaining project benefits at the assumed levels. ... Moreover, at the end of the project's life, the assets created may have some residual value, even though they may be fully depreciated in the financial accounts. Hence, economic analysis requires that depreciation provisions be excluded and that expenditures for repairs, maintenance and replacement and the salvage value of an asset at the end of the project life be taken into account".

In the Myanmar case this was not possible, because of the complexity of the models needed in order to handle the wide range of investment option types considered - from road widening, to increased road maintenance on roads, dredging and river training works for the river, new track and signals on the railway and second, the need to assess the viability of fleet replacement itself. The railway model, for instance, is based on an equilibrium cost structure that is calibrated to the actual operations for a target year and the corresponding income and expenditure statement. Costs are annualised and evaluation of benefits are assumed at an annualised rate. To apply such a model to evaluate project benefits over a project life cycle, some surrogate for the investment stream in capital replacement must be used, and the surrogate in this case was the assessed depreciation and cost of capital.

Most economic analysis assumes that the fleet is normally replaced; that is, the size of the fleet is assumed to be evenly distributed over its effective life, and the proportion of the fleet replaced each year equals the number of units of the fleet that become too old during that year, or in numerical terms, the fleet size divided by the expected life of each unit.

In Myanmar, visual observation argued that this strategy in practical terms was not optimal. What seemed to be conventional wisdom in the west, was not conventional wisdom in Myanmar. Moreover, when we began to look at the costing process, it became difficult to see how we could recommend changes to the fleet that would result in lower costs. Consultants tend to get uneasy when all they can offer their clients are options that will make the system more expensive. This concern led to a deeper review of the role of depreciation and interest in a controlled economy and the most effective way to deal with depreciation and interest in a multimodal analysis.

4.1 Financial Depreciation / Physical Depreciation / Maintenance

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The **Ayeyawady Model** was developed by HASKONING Royal Dutch Engineers United Nations during an earlier project to look at the Inland Water Transport syste Myanmar.

2 Asian Development Bank, Economics Office, 1987, pg. 9.

Normal accounting practice uses depreciation as a way of setting aside sufficient funds to allow for replacement of equipment when it is worn out and needs to be replaced. An interesting example these days are computers which are obsolete technologically in less than two years, much quicker than they become obsolete physically. Companies complain that they are not able to depreciate the equipment fast enough to enable them to purchase new equipment that has functionally replaced the original. This is essentially an accounting issue, not a work issue.

In a situation where the technology does not change, say for instance the steel rail for a typical railway, the question of depreciation is really one of physical wear. How fast will the physical entity, in this case the rail, wear away to a point where it will be necessary to replace it. The same case can be made for a locomotive or a ship. If it is not being used for 75% of the time because of poor availability and utilisation, is it wearing out?

Normally equipment is assumed to have an effective working life. For instance, buses and trucks may be assumed to last 12 to 15 years, railway locomotive for 20 to 25 years and ships and ferrys for 40 to 50 years. In a normal analysis, these effective working life expectations would be used as the controlling factors on depreciation. In some costing models, this approach is modified to measure wear rate. For instance, if a locomotive is normally able to last for 20 to 25 years at an availability of 90% and a utilisation of 65%, we would expect that the loco was working actively for between 100,000 and 120,000 hours in a working life. Depreciation can then be measured as the percentage of the expected working life of the locomotive which is consumed annually, based on the replacement cost of the locomotive at that time. The same logic also applies to the other types of vehicles and vessels.

The problem that confronted us in Myanmar, was the case where the fleet in some instances was already on average, older than the expected life. The road fleet is already older than the normal life expectancy and in most cases there is no compelling reason from a technological point of view, to retire trucks that are still producing an economic return. The question can then be posed as to why to charge depreciation for that kind of fleet at all? If no depreciation is charged for an old fleet, then the cost of that fleet becomes just the maintenance cost to keep it on the road or on the rails or in the water.

In an economy where labour is a very low component of any cost equation, then maintaining an old worn fleet becomes the least expensive option. In an economy where foreign exchange is severely rationed, then replacement of the unit at the end of some arbitrarily defined economic life is just not possible. The depreciation in this situation becomes simply maintenance cost. As the parts are worn, they are repaired. A broken down electric starter motor or a generator will be rewound rather than replaced because currency is just not available to replace it. Any recommendations to improve the fleet, unless very considerable gains in productivity can be achieved, will have the immediate result of increasing the transport cost. Therefore ever extending the age of the fleet becomes a viable option and results in least cost. Clearly, in the extreme this is a nonsense option.

4.2 Normative Age of Equipment / Availability and Utilisation

A further consideration is the longer term implication of the differences in fleet age. Annual fleet depreciation, requires that sufficient funds be set aside be to return the fleet to the age condition that existed at the beginning of the year. If one fleet is for instance 60% of its effective life, and if another is 75% and the third is 90%, then the depreciation and interest charged against each of the fleets in proportion will be different. This is

because the fleets will have a decline in availability and possibly utilisation as they become older and the reduced effective working time requires that a larger than average fleet be maintained just to do the required work. While the availability and utilisation are highest for a very new fleet, the capital cost of maintaining a totally new fleet makes that option sub optimal. Therefore, in the above example, the mode that has the lowest unit cost of transport for a particular commodity may be least expensive only because, by chance, the age profile of its fleet generates the lowest interest and depreciation cost.

The normal way of handling this problem is by assuming a normative age distribution for the fleet. Assuming a normative fleet means that each fleet is assumed to have added new vehicles at a normal replacement cycle with purchases each year of (fleet size / life). In the longer term, this results in an average fleet age of half the expected life.

While it is conceptually correct to presume a longer term normative fleet, such assumption also assumes that the fleet will have efficiency characteristics of a fleet of that age as well. Therefore modified fleet availability and utilisation to correspond to the level that would be achieved if the fleets had in fact been at the half life - average age is needed. This is called the long term economic case.

In the case of Myanmar, it was assumed that the fleets in the longer term would become normative and that investment options for infrastructure change or operational change should be based on that normative case. While the base economic cost per unit of traffic is higher in economic terms following this approach, the rigor of the comparison is more defendable and more closely relates to the true longer term condition.

This leaves begging, the question of what to do about the staging of investments in the fleet itself. One approach argues that since fleets must be replaced to exist in the longer term, replacement is therefore not an investment and should not be evaluated in an investment sense. This answer does not provide much comfort for a general manager who wants to know how best to spend the next bit of foreign exchange that becomes available.

In order to allow comparison of various expenditures for equipment on the various modes, the only valid base condition is the current one, that is the short term economic case. In the Myanmar study, the objective was to find the most economic way to achieve incremental improvements in the fleet carrying capacity, keeping in mind the availability and utilisation arguments noted above. The options came down to improved maintenance practices on the existing fleet, rehabilitation and rebuilding of the existing fleet and purchase of new equipment. Each of these options also spread over time.

5.0 SUMMARY

The practical aspects of comparing a wide variety of improvements to a range of modes in a competitive setting requires careful treatment of the elements included in the analysis. In the case of Myanmar, because foreign exchange is in such scarcity, the economic cost of transport per passenger or ton, is dominated by the depreciation and the cost of capital on equipment. By example, up to 75% of the economic cost of railway transport is comprised of interest and depreciation on capital.

One of the very real dangers of this situation is the arbitrary role of the analyst. Philosophical changes in how items like depreciation and interest are handled, can dominate the analysis and in cost terms can overwhelm the impact of changes to the physical system. When 50% of the cost of a mode is comprised on the interest cost or capital, choice of an interest rate can have more impact than investment in new roads or

track or wharves. The analyst must be very conscious of this and take care to limit the impact of the arbitrary decision as much as possible

The following comments result from the analysis in Myanmar and perhaps apply equally to other situations where fleets are very old and where foreign exchange is very limited.

- contrary to conventional practice, even in economic analysis, depreciation may need to be included. However, where possible, depreciation should be linked to work done, not the accounting approach based on financial cost and book value;

- the appropriate economic life of fleets changes with the culture. In some cases, the appropriate economic life should be increased due to lack of pressure for technological renewal. If technology is not a driving force, in many cases, the economic life may be 1.5 or more greater than the equivalent life in a western setting;

- where the normal economic life has been exceeded by a fleet, depreciation has essentially become long term maintenance and is carried as an annual cost. No further depreciation should be charged;

- long run economic costs should be based on normative fleet composition. This composition includes both the fleet elements themselves as well as the normal productivity measures of that fleet, namely, availability and utilisation. While this may bias the absolute value of comparisons within individual modes, it should provide a more consistent basis for evaluations across modes;

- comparison of investments in fleet replacement are necessarily part of the process of expenditure analysis in developing economies. In those cases, an incremental approach to expenditure, based on minimising the net present cost of the expenditure per unit of workable capacity appears to be most feasible.

The 1988 Agreement on Truck Weight and Dimension Regulations

Fred P. Nix

In 1988 the provinces signed an agreement on weight and dimension regulations making truck standards more uniform across Canada. The implementation has not been perfect as some provinces have still not amended their regulations and there is still some lack of uniformity. Nevertheless, the agreement was important. An impact study forecast an annual reduction in trucking costs of about $160 million, a slight increase in annual bridge costs ($16 million) because of the heavier trucks and a slight decrease in annual pavement costs ($3 million) on account of the more "pavement-friendly" axle configurations allowed. The study also forecast that the railways would lose between $232 and $409 million in annual revenues (both in lost traffic and in lower rates) because the more efficient trucks would lower trucking costs.[1]

These are significant impacts and at some point a retrospective study should be done to find out if they occurred. Indeed, it is understood that this may happen sometime this year. In the interim, this paper examines the methodological issues, the available data, and, on the basis of a few examples of what can be obtained from the data, makes tentative observations about the probable impact of the 1988 agreement.

The 1988 Agreement

The agreement was endorsed in February 1988 and most provinces were allowing trucks--*TAC trucks*--to operate under the new regulations by 1989. Many details were covered: vehicle lengths, heights and widths; axle loads and spacing; vehicle weights; definitions of key components ("tandem," "tridem" axles); allowable internal distances (draw bar length, hitch offsets); and so on. But only three main aspects of the regulations are important in determining the carrying capacity of a truck: vehicle length, axle loads, and gross vehicle weight ("GVW").

LENGTH The agreement retained the old limit of 48 feet (14.65 m) for semitrailers. However, because technical studies backing up the agreement had suggested there was nothing wrong with longer lengths, the Western provinces adopted a new 53-foot (16.2 metre) standard. Indirectly, then, the agreement increased trailer lengths in Western Canada. Ontario and other Eastern provinces probably will also adopt 53-foot length in the future. Ontario already allows 2,400 of these long trailers under permit and has just finished a study of the benefits of allowing them to be used more generally. The advantage of a 53-foot semitrailer is, roughly, a 10% increase in cubic capacity over the 48-foot trailer.

The agreement also increased the lengths of double-trailer combinations: A-trains (two semitrailers and a single drawbar dolly); B-trains (two semitrailers where the second couples directly onto the first); and C-trains (two semitrailers and a double drawbar dolly). The new B- and C-trains have roughly 11% more capacity than the most common double-trailer configuration prior to the 1988 agreement (an A-train with two 28-foot trailers).

As the Eastern provinces have not yet adopted the 53-foot semitrailer, there has been no increase in trailer sizes in the East (other than Ontario's 2,400 permits). Also, because the old regulations allowed rather odd configurations--for example, tractors with 18-foot freight "dromes"--there were and still are "old" trucks exceeding the cubic capacity of TAC trucks. In a strict sense, then, the new regulations did not increase cubic capacities in Eastern Canada as they did (indirectly) in the West. In a practical sense, however, the agreement opened the way for the use of larger capacity doubles. For those who could use them--and they are not suitable for all applications--B-trains and C-trains with a length of about 19 metres in usable floor space can now operate in all provinces. (In Eastern provinces they can only operate with short wheelbase tractors because of a restriction on overall vehicle length.)

AXLE LOADS The second thing the 1988 agreement did was increase allowable axle loads in the Prairies and the Northwest Territories. Most other jurisdictions already had heavy axle load limits and, in many provinces, these provincial axle-load limits remain in place at levels higher than those specified in the 1988 agreement. On the Prairies, tandem axles loads were increased from 16 to 17 tonnes and a new 3-axle group--the "tridem"--was introduced at 24 tonnes.

GVW The third thing the agreement did was standardize GVWs (although a few inconsistencies remain). On the Prairies, the maximum GVW for tractor-semi-trailers was increased from 37.5 tonnes to 46.5 tonnes (total axles increased from five to six)--a 24% increase, with a corresponding payload increase of over seven metric tons. The agreement also encouraged the use of B-trains by allowing them a total weight of 62.5 tonnes in comparison to the C-train's 58.5 tonnes (agreed to in 1991) and the A-train's 53.5 tonnes. B-trains and C-trains are more stable than the A-train. The B-train, at 62.5 tonnes, is the most important truck introduced (or "modified") by the 1988 agreement, at least for the heavier, denser commodities. These increases in axle loads and gross vehicle weights allowed payload increases of as much as 26% on the Prairies and over 20% in Atlantic Canada.

To summarize (and oversimplify), the 1988 agreement indirectly increased trailer cubes and made two particular large cube trucks more-or-less operational across Canada; it increased axle loads on the Prairies; and it increased GVWs in all but three provinces/territories. The potential carrying capacity of trucks, for both low and high density commodities, increased significantly in many parts of the country.

Potential Impact of the Agreement

Engineering and costing models can be used to show the consequences of allowing larger, or heavier, trucks. First, higher weights wear out bridges faster or require stronger bridges, hence bridge costs increase. Second, pavement wear may be affected; it depends on how the weight is distributed over axles. Third, larger trucks may have different handling characteristics than the trucks they replace and they may change the exposure of trucks to the possibility of an accident. Both factors have an impact on safety. Fourth, larger trucks can generally carry freight at a lower unit cost than smaller trucks. Fifth, lower trucking costs generally have an impact on truck/rail competition.

These five variables--bridge costs, pavement wear, safety, rates (or, as a proxy, truck costs), and any variable which measures truck/rail competition--are of direct interest in assessing the impact of the 1988 agreement. However, as a practical matter, it is easier to speculate on these five variables if information on the characteristics of the fleet (configurations, axle loads, gross weights) first can be obtained. For example, if it can be determined that there has been a switch from A-trains to B-trains, it then may be possible to infer that highway safety has improved.

Methodological Considerations

Locating data on these variables is not easy. Even if it can be obtained, it is difficult to isolate the impact of the changes in weight and dimension regulations from other factors affecting trucking. Consider, for example, deregulation, the recession, the Canada-United States Free Trade Agreement ("FTA") and the National Safety Code ("NSC").

DEREGULATION The National Transportation Agency, in its annual reviews and monthly bulletins, paints a gloomy picture of trucking over the past few years: bankruptcies are up, operating ratios have been hovering around one, and there is a great deal of over capacity. But even the NTA shies away from saying just how much of this is attributable to deregulation and how much to the recession, let alone the NSC, the FTA and changes in weight and dimension regulations. Deregulation is not only a causal variable in considering trucking performance, it also is a variable which likely had an impact on how the industry responded to the 1988 agreement. Poor financial statements and excess capacity probably influence the purchase of new vehicles configured to comply with TAC regulations.

RECESSION One figure gives a flavour for what the recession (and other factors) has done to trucking. According to Statistic Canada's *For Hire Trucking Survey*, trucking tonnages fell from 177 million tonnes in 1988 to 162 million tonnes in 1989 and to 149 million tonnes (preliminary) in 1990. (StatsCan, 53-224 and 50-002)

THE FTA While the FTA did not include any provisions on transportation, to the extent it influences trade patterns (north-south versus east-west) it had an impact on trucking. In particular, given that trucking across the international border is primarily influenced by American weight and dimension regulations (generally lower

weight limits), an increase in north-south trucking may lessen the impact of the agreement. Why buy a new TAC truck if it cannot be used on international hauls?

THE NSC Many of the new safety regulations are now in place, but it is still not possible to detect any change in highway safety. According to Transport Canada, "The information available does not allow one to determine if there are any changes in vehicle safety that could be attributed to regulatory reform, nor does the data allow one to determine what the changes, if any, were attributed to."[2] If it is not possible to determine whether the NSC has had any impact on safety, it is likely impossible to determine whether any changes in configurations resulting from the 1988 agreement had any impact. The **separate** impacts of both these changes is bound to be even more obscure.

In addition to these conceptual difficulties--isolating the impact of various causal variables--there is a problem with the availability of data. A number of possible sources may be tapped to determine changes in the fleet and, indirectly, in bridges, pavements, safety, rates and truck/rail competition. However, there are problems in either obtaining or using most of them. The following list contains a summary, no doubt incomplete, of known sources. The "variable" indicates whether the source is primarily useful in developing data on changes in the trucking fleet ("fleet") or whether it is useful in developing information on one of the variables of direct interest (bridges, pavements, safety, rates, truck/rail competition).

Source	Variable	Comment
registration	fleet	wide variety of formats from each province; difficult to develop consistent national statistics that show anything.
permit numbers	fleet	in a few provinces, permits make it possible to assess aspects of the impact of the 1988 agreement.
road-side surveys - provinces	fleet	bewildering variety of formats in each province; very difficult to integrate.
-national	fleet	two new surveys contain some useful information.
accident statistics	safety	available; gaps in coverage; difficult to determine causal factors.
StatsCan TOD	rates	possible to develop proxy for rates at the 3-digit SCC level
shippers/truckers	rates	for some commodities, it is possible to develop rate information which reflects changes in the fleet.
StatsCan	competition	modal freight flows and financial data; available, but difficult to relate to changes in trucking fleet.
Other	all	variety of other sources which may be worth investigating.

Available Data

Obtaining useful registration statistics is time consuming and expensive. For here, information from two provinces where data were readily available is used to give an idea of what the results of such an analysis might be. The following shows the change in the registered truck fleet in Newfoundland:[3]

Trucks by RGVW	1983		1985		1991	
	#	%	#	%	#	%
30 - 38 tne	150	18.5	150	12.8	165	10.3
38 - 45 tne	188	23.2	245	20.9	219	13.7
45 - 48.5 tne	204	25.2	202	17.2	131	8.2
48.5 - 52.5 tne	268	33.1	565	48.1	1 062	66.4
52.5 + tne	0	0.0	12	1.0	22	1.4

Other than noting the large growth of trucks in the 48.5-to-52.5 tonne range--they almost doubled between 1985 and 1991--it is not clear what these figures say about the Newfoundland truck fleet. The one thing that is certain is that there has not been a rush to register new TAC B-trains (from 58.0-to-62.5 tonnes). Whether and to what extent the 1988 agreement had anything to do with the growth in the numbe of trucks in the 48.5-to-52.5 tonnes range is unknown.

The following registration figures (year end in both cases) are from Ontario:[4]

	1984	1991	growth
total commercial vehicles	838 007	1 047 704	25.0%
over 50 tne	7 727	16 517	113.8%
over 60 tne	1 461	5 990	310.0%

The population of heavy trucks is growing at a faster rate than trucks in general in Ontario. This could be in response to the 1988 agreement: although the agreement did not increase axle or GVW limits in Ontario, it allowed truckers operating to the west and east to use heavier trucks. Alternatively, it is possible there has been a long-term trend to heavier trucks having nothing to do with the 1988 agreement.

Where provinces have not incorporated the 1988 agreement into their regulations, TAC trucks operate under permit. This is the case in New Brunswick and information from the province indicates there have only been a few such permits issued for TAC tridems (a close-spread 3-axle group), suggesting that the more common, and heavier tri-axle (a wide-spread 3-axle group or a tandem plus liftable) remains the preferred axle. A hundred or so permits have been issued for TAC A-trains, but this is a relatively minor matter: the dimensions of the TAC A-train are slightly different than those allowed in other regulations. The real significance is that for all of 1992 only 370 permits have been issued for TAC B-trains (213 for the 8-axle and 157 for the 7-axle). Further, since these are issued for tractors, the actual number of B-train trailers operating in New Brunswick--a corridor province between Québec and the rest of Atlantic Canada--is probably half this number. This does not suggest an overwhelming response to the 1988 agreement.[5]

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In other provinces, permit information is either more difficult to obtain or to interpret. Information from Québec suggests that by November 1989, there were close to 1,400 permits issued for what are understood to be the TAC B-train at 62.5 tonnes and over a quarter are from out-of-province carriers, primarily Ontario. There are no data after this date. These are significant numbers (although, again, there may only be half as many actual B-trains in operation as there are permits). Ir Ontario, even though this is not strictly a part of the 1988 agreement, there have been 2,400 permits allowed for 53-foot semitrailers. Permits for TAC B-trains have also been issued but there is no central repository for the number of such permits.

In June 1991, all provinces and territories participated in a roadside survey (CCMTA survey). This, along with a Statistics Canada transborder survey in the same year, was the first ever nation-wide survey where the methodology and timing produced results which could be used to compare all regions of the country. The following summarizes the information on tractor-trailers operating extraprovincially:[6]

	GVWs	Payloads	Doubles	B-trains
	% over 40 tne	% over 25 tne	as % of fleet	as % of doubles
Atlantic	27.6	25.2	2.4	26.3
Qué	27.1	22.3	5.7	69.3
Ont	19.5	22.5	11.2	67.7
Prairies	29.4	22.1	26.0	57.6
BC	35.3	27.1	31.1	75.7
Canada	26.8	24.3	15.2	63.8
Observations:	11 134	14 851	19 744	1 670

As shown, over one-quarter of the extraprovincial fleet is 40 tonnes or more in weight and this includes both loaded and empty trucks *and* trucks travelling between Canada and the United States where GVW limits are low (generally, 36.3 tne). These 40 tonne-plus trucks are almost certainly all six or more axle configurations. As also shown, nearly one-quarter of the payloads (including empties) are 25 tonnes or more. By comparison, anything over 25 tonnes is not possible under federal limits in the United States.

"Doubles as a percent of the fleet" is the number of double-trailer configurations as a percent of total tractor-trailers. Straight trucks, truck-trailers, deadhead tractors, and other configurations are not included. As shown, 15.2% of the extraprovincial fleet consists of double-trailer units. By comparison, Statistics Canada's transborder trucking survey in 1991 indicates that 6.7% of the tractor-trailers used on international operations are doubles.[7] This suggests, then, that the actual proportion of doubles in the CCMTA survey engaged just on *interprovincial* operations is higher than 15.2% (ie, the international component is lowering the overall figure). Finally, as shown in the last column, 64% of the doubles are B-trains.

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The CCMTA data have also been analyzed on an origin-destination basis. What this shows is that there are regional differences in the use of doubles. In Atlantic Canada, 51% of the doubles with an origin in or destination to Atlantic Canada are A-trains. In other places, B-trains are more popular. Here are the significant interprovincial routes for B-trains (percentages are "% of doubles"):

BC - Québec	100.0% B-trains	BC - Ont	75.0% B-trains
Qué - BC	100.0 "	Qué - Ont	74.1 "
Qué - Atlantic	83.3 "	BC - Prairies	71.4 "
Prairies - Ont	78.4 "		

Attempts have been made previously to collect and analyze road-side survey data from the provinces with a view to making observations on the truck fleet. A number of observations from this work follows. The difficulty in doing this is trying to ensure that the previous surveys are compatible with the CCMTA survey (ie, extraprovincial tractor-trailers only).

One piece of information from a 1976 Atlantic Canada survey can be used to make a comparison with the CCMTA survey[8] The figures suggest that there has been remarkably little change in the composition of the fleet over the last 15 years:

	Atlantic Canada 1976	CCMTA (Atlantic observations) 1991
tractor-semitrailers	98.0%	97.6%
doubles	2.0%	2.4%
% B-trains (of doubles)	22.2%	26.3%

An even more complete picture can be obtained in Ontario.[9]

	1978	1983	1988		1991 CCMTA
			all	3 CCMTA sites extraprovincial	
tractor-semitrailers	98.0%	94.6%	93.3%	90.8%	88.8%
doubles	2.0%	5.4%	6.7%	9.2%	11.2%
% B-trains (of doubles)	—	52.3%	43.9%	66.2%	67.6%

There is a clear trend towards the greater use of double-trailer configurations. Within the fleet of doubles, however, it is not so clear there has been any trend to greater B-train usage (the last two columns show extraprovincial traffic only). In fact, by just comparing the last two columns, it is not obvious that the 1988 agreement has had much impact (it may have something to do with the increase in the number of doubles, but does not seem to have had an impact on the relative mix of doubles). More detail on the last two columns is given in the following numbers:

	Ontario 1988 Survey			1991 CCMTA
	all data	3 CCMTA sites		
		all data	extraprovincial	
observations	88 005	4 489	3 989	3 204
% doubles	6.7%	8.9%	9.2%	11.2%
distribution of doubles				
- A-trains	49.8%	32.5%	32.7%	28.4%
- B-trains	43.9%	66.5%	66.2%	67.6%
- C-trains	6.3%	1.0%	1.1%	3.9%

The 1988 Ontario data from the same three sites used in the CCMTA survey have also been analyzed on an origin-destination basis and the results compared with the 1991 CCMTA survey. What this shows is that (i) the proportion of doubles used on Canada/US operations is low (as confirmed by other sources); (ii) the proportion of doubles used on hauls between Ontario and Western Canada is high--over a third of all tractor-trailers on some routes; (iii) surprisingly, however, there appears to have been a decline in the use of doubles to/from Western Canada between 1988 and 1991; (iv) but, within the population of double-trailer configurations, there has been an increase in the use of B-trains to/from Western Canada; (v) the number of doubles used between Ontario and Québec is somewhere between the figures for the Ontario/US and Ontario/Western Canada; (vi) while B-trains account for most of the doubles between Ontario and Québec, the evidence does not suggest any growing use B-trains after 1988; and (vii) less than 2% of the Atlantic Canada traffic consists of doubles.

A number of early road-side surveys in Western Canada also show how the fleet has changed. The following compares the importance of doubles for various years in the four Western provinces.[10]

	1973	1974	1978	1991 CCMTA
tractor-semitrailers	94.9%	97.8%	90.0%	72.2%
% doubles	5.1%	2.2%	10.0%	27.8%
distribution of doubles				
- A-trains	--	--	--	31.1%
- B-trains	--	--	--	59.3%
- C-trains	--	--	--	9.6%

More specific information is available from individual provinces although there are always difficulties making the comparisons match the data in the CCMTA survey. In Manitoba, the West Hawk scale near the Ontario border plays a unique role since virtually all of this traffic is interprovincial. The following compares observations a this scale with the CCMTA information from Manitoba:[11]

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	1981	1984	1991 CCMTA
tractor-semitrailers	88.3%	83.7%	79.1%
% doubles	11.7%	16.3%	20.9%
distribution of doubles			
- A-trains	100.0%	93.3%	41.7%
- B-trains	0.0%	6.7%	48.2%
- C-trains	0.0%	0.0%	10.2%

A more recent analysis of weigh scale data from the Prairies suggests: (i) as of 199] in Manitoba, 9.4% of the tractor-trailers on the highway had 6 axles (this is only three years after the 1988 agreement first allowed them!) and 19.4% were double-trailer combinations; (ii) of the doubles on Manitoba highways, 63.4% were B-trains and 9.8% were C-trains; (iii) as of 1992, 8.0% of the tractor-trailers at four sites in Saskatchewan had 6 axles and 25.4% were doubles; and (iv) of these doubles observed in Saskatchewan, 78.0% were B-trains and none were C-trains.[12]

In addition to registration data, permit information and road-side surveys, there are a number of sources of information on accidents. Transport Canada collects accident data on commercial vehicles. However, as noted previously, "the information available does not allow one to determine if there are any changes in vehicle safety . ." Here are the total accidents--death, injury and property--involving tractor-trailers (the 1988 agreement only concerned the weight and dimension regulations of these trucks) for the last five years in all of Canada except Québec:

1986	1987	1988	1989	1990
11 962	12 402	12 996	13 302	12 561

An initial look might suggest that, since trailer-trailer accidents have remained relatively stable, there is no evidence the 1988 agreement had any impact on highway safety. However, in the absence of suitable exposure data (eg, distance driven), it is not possible to reach this conclusion.

Another possibility is to look at accident rates in a province where it is known that many trucks changed as a result of the 1988 agreement. While hardly conclusive, the information on the number of heavy trucks involved in accidents on Manitoba public highways does not appear to indicate that the TAC trucks had much impact on safety:[13]

1978	1981	1986	1987	1988	1989	1990
286	280	242	267	293	302	278

Again, this conclusion is not strictly possible given the absence of exposure data.

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A source of information on truck/rail competition is the NTA's "Rail Freight Database." Assuming that rail intermodal traffic is the most directly truck competitive and, hence, the traffic about which the original predictions were made--a rail loss of between $232 and $409--the following numbers compare rail domestic intermodal volumes in two years (the years were selected on the basis of readily available information).[14]

	Rail Intermodal Freight (millions of tonnes)		
	1984	1991	Growth
total	6.4	12.2	90.4%
domestic	1.0	4.1	305.1%

While these numbers do not prove that the 1988 agreement did not shift traffic from the rails to the trucks (or, at least, lower rail rates), they certainly indicate that the railways are managing to increase their domestic intermodal volumes.

The above registration, permit, road-side survey, accident and rail tonnage statistics are the only sources which have been examined for this paper. There is still much work left to be done on these sources. In addition, there are other sources which have not been investigated.

First, StatsCan's *For-Hire Trucking Survey* contains information on freight flows that can be used to construct a proxy for trucking rates (revenues per tonne-kilometre) for narrowly-defined commodity groups on particular traffic lanes. By comparing relative rate movements in different regions of the country over time, the "disturbances" caused by other variables can be partly controlled. For example, (i) assuming deregulation, the recession, the FTA and the NSC had relatively similar impacts on two traffic lanes; and (ii) given that the 1988 agreement had a much larger impact on one of these lanes than the other; and (iii) if it could be shown that the relative change in rates on one lane is **lower** than on the other lane; then (iv) this would be fairly convincing evidence that the 1988 agreement had had an impact on trucking costs and, hence, rates. Candidate commodities for this investigation include such things as beer, lumber, grain, cement and other bulk commodities all with a cut-off point in terms of shipment weight so that only truckload quantities are captured. As the 1991 *For-Hire Trucking Survey* data are now available, enough time has elapsed--two to three years depending on when a province introduced the 1988 agreement--to allow for enough fleet changes to test these possibilities.

Second, it is possible to obtain rate information directly from shippers or truckers. This has been done in the past to show, for example, that fuel hauling rates in Saskatchewan reacted in almost a precise lock-step fashion to changes in weight and dimension regulations in the 1970s.[15]

Observations

While this review of available information sources does not completes the work that needs to be done, tentative observations on the likely impact of the 1988 agreement can be made.

RATE OF GROWTH OF LARGE TRUCK FLEET: The large-truck component of the fleet probably has been growing faster than the total population for some time. No evaluation of the 1988 agreement can be done without considering this point: large trucks (weight or dimensionally) were growing relative to other trucks prior to 1988 and it is not likely that the agreement itself is responsible for all the new large trucks on Canadian roads.

LARGE TRUCKS: Rates of growth aside, the evidence suggests that truck weights are high in Canada--more than a quarter of the interprovincial tractor-trailers are operating at weights above 40 tonnes. Presumably the 1988 agreement has been one of the factors responsible.

REGIONAL IMPACTS: There is no evidence that the 1988 agreement had much impact on trucking in Atlantic Canada. It appears to have had a significant impact on the use of heavy B-trains in Québec and (probably) to/from Québec, although the data are not entirely "clean." In Ontario, the evidence suggests that the agreement has had little impact except on movements to/from Western Canada and to/from Québec. The reasons why there has been little impact in Ontario are likely: (i) Ontario's existing regulations allow trucks which are larger and heavier than TAC trucks and (ii) transborder trucking is very important in Ontario. The 1988 agreement has had its largest impact in the Prairies where there has been a large-scale conversion of 5-axle tractor semitrailers to the new 6-axle variety and where the earlier trend to the use of doubles has been encouraged. In particular, the new TAC B-train--the "Super B-train" as it is called in Western Canada--has come to play a significant role in the hauling of heavy, bulk commodities. The impact of the agreement in British Columbia and the territories is less certain (given the data) although it appears that the B-train has become quite important in trucking between British Columbia and the Prairies.

WESTERN VERSUS EASTERN CANADA: There is a clear difference between Eastern and Western Canada in terms of the use of doubles. The explanation for this is complex and precedes the 1988 agreement: regulations in the Prairie provinces have only allowed heavy trucks where more trailers are added to the configuration; in Eastern Canada it has been possible to obtain higher GVWs by adding more axles to the trailer--axles with considerably higher loads than those allowed in the West.

TRANSBORDER (CAN/US) TRUCKING: The 1988 agreement has had little impact on transborder trucking. The proportion of double-trailer configurations on transborder operations is low. The exceptions to this are between the Yukon and Alaska and (possibly) between British Columbia and Washington. As for most of the other lower 48 states, the new TAC doubles or the 6-axle tractor semitrailer are either not

allowed or are only allowed at reduced weights. The significance of this is that 16% of all for-hire trucking revenues in Canada are earned on transborder business. (StatsCan, #53-222, 1989) In other words, the importance of transborder operations may be having a "spill over" impact in terms of the 1988 agreement's impact on domestic trucking.

B-TRAINS: Sixty-four percent of the observed doubles in the CCMTA survey are B-trains and, even without any pre-1988 figures with which to compare this, it seems reasonable to conclude that the 1988 agreement has been successful in encouraging the use of these configurations. While there are weaknesses in this CCMTA data, information from other surveys does confirm there has been a switch from A-trains to B-trains (and even to C-trains in a few places). This switch is most noticeable on the Prairies and on routes to/from the Prairies.

IMPACT ON THE TRANSPORTATION SYSTEM: Finally, it is also possible to speculate more generally on the impact of the 1988 agreement on transportation.

▸ BRIDGES Heavier trucks do have an impact on bridges but this is such a complex subject that only a full-scale study could really determine whether this impact has been significant.

▸ PAVEMENTS On the Prairies, the 1988 agreement may have resulted in heavier tandem axles (17 versus 16 tonnes) with the result that pavement costs increased. Several recent papers have suggested this.[16] The issue of pavement loadings, however, is more complex than just considering increased tandem-axle loads. While it may be true that some (perhaps many) trucks on the Prairies now have heavier tandems, the fact remains that the new trucks introduced to the Prairies as result of the 1988 agreement--the 6-axle tractor-semitrailer and the 8-axle B-train--**actually have the ability to carry freight in a more pavement-friendly manner than the trucks they replaced.** (They produce fewer ESALs per tonne of freight carried.) Since these trucks are the ones that tend to be used to haul the heavier, denser freights, it is not clear that the 1988 agreement really increased pavement loadings on the Prairies. Only large-scale empirical data can resolve this issue (although there may be a problem finding "pre 1988" data with which to compare any new information). In the rest of the country, TAC trucks have generally decreased pavement loadings.

▸ SAFETY Existing data are insufficient to prove much about the relationship between truck configurations and highway safety. This is both because the quality of the existing sources is poor and **because the importance of configuration type in accidents is relatively minor.** Factors such as driver behaviour, weather or animal strikes are more important. But there is one point that can be made about the impact of the 1988 agreement. To the extent the agreement encouraged the use of the new large B-trains--which have a carrying capacity of 20% or more than the trucks they replace in parts of the country--the use of the new B-trains has reduced the **exposure** of trucks to accidents. That is, fewer truck kilometres are required to

carry the same volume of freight. To this extent, and ignoring any intermodal shifts, the 1988 agreement has had a positive impact on highway safety.

▸ RATES and/or COSTS There is no current data source which shows unequivocally that the configurations allowed by the 1988 agreement have actually lowered trucking costs and, hence, rates. Nevertheless, it can easily be shown that the new trucks offer significant potential for lowering costs or rates. To the extent that the agreement has fostered the use of these trucks, it therefore can be anticipated that there was a relative decrease in transportation costs in parts of Canada.

▸ TRUCK/RAIL COMPETITION The 1988 agreement undoubtedly had an impact on truck/rail competition but it is unlikely this could ever be sorted out by looking at any known data source. At the same time the industry in parts of Canada was switching to the newer, more efficient trucks (thereby lowering unit costs and, presumably, competing more vigorously with the railways for long-haul traffic) there were so many other changes occurring that it is almost inconceivable that all the causes-and-effects can ever be sorted out. The railways themselves were embarking on a significant program to "re-capture" lost traffic: double stack cars, domestic containerization, sprint trains, roadrailers, purchases of railways in the United States, strategic alliances, etc. The trucking industry, while benefitting from the new trucks, had to contend with aspects of the new safety regulations which diminished there ability to compete on the long haul (hours of work being a good example).

Summary A lot of work went into the 1988 agreement on truck weight and dimension regulations and, from the perspective of understanding transportation policy, it is important to assess the impact of this work by trying to gauge the impact of the agreement on the transportation system. In particular, because the agreement represents one of the first major areas where the provinces demonstrated that they could "deliver" something approaching a national transportation policy, understanding how successful this policy has been is important for future policies on trucking. Can the provinces handle something that has national implications--particularly as the importance of the FTA and NAFTA grow--or do we need the federal government handling most aspects of trucking policy as it does rail, air and marine policy? Recognizing the importance of assessing the impact of the 1988 agreement, this paper has attempted to sort out some of the groundwork. Clearly, it is a difficult task and much work remains to be done.

ENDNOTES

1 The study analyzed one scenario, close to the regulations adopted, where costs and benefits were estimated as: reduction in trucking costs (+ $160 to $163 million); bridge costs (- $15.6 million); reduction in pavement costs (+ $2.7 million); and a net benefit of + $147.1 to $150.4 million. In addition, is was estimated that the railways would lose $122 to $133 million in "net contributions," ie, gross revenue minus any reduction in variable costs. (Irwin, N.A. and & R.A. Barton, 1987, *Economics of Truck Sizes and Weights in Canada*, RTAC, Ottawa)

2 Transport Canada, 1992, *Commercial Vehicle Safety in Canada: Report to Parliament for the Year 1990*, Ottawa, p v.

3 Sources for the 1983 and 1985 data are Nix, F.P., 1986, "Study of Vehicle Weight and Dimension Regulations and Canada's Trucking Industry, Background Paper #4, Analysis of Registration and Road-Side Survey Data", Transportation Development Centre, Montreal, Table 3. The 1991 data was provided by the Newfoundland Department of Works, Services and Transportation.

4 Source: Ontario Ministry of Transportation Licensing and Control Branch, *Registrant/Plate/Vehicle Population*, various years, Toronto.

5 Information was supplied by the Department of Transportation.

6 Developed from: Canadian Council of Motor Transport Administrators, 1991a, *CCMTA National Roadside Survey: In Scope Report*, preliminary; and, *CCMTA National Roadside Survey: Region Origin-Destination Profiles*, 2 volumes, preliminary, Ottawa.

7 Statistics Canada, 1991, *Transborder Trucking Survey: 1991*. The figure in the text is based on the "non FTE" count given on page 21–ie, 18,936 doubles and 265,545 single-trailer units. The majority (60.2%) of all of these doubles engaged internationally are operating between British Columbia and Washington.

8 Source of 1976 data is Nix (1986) Table 21. Intraprovincial trips are included.

9 Sources for 1978 and 1983 are Nix (1986) Table 30. Intraprovincial trips are included. The 1988 "all" figures are from the *1988 Ontario Commercial Vehicle Survey*. The figures for the three CCMTA sites were developed from the raw data.

10 Source: Nix (1986) Table 36 for the data from 1973 to 1978. The data are not "clean." In addition to containing intraprovincial movements, the figures shown for 1973 for doubles includes truck-plus-trailers. In the case of the CCMTA data, there were a total of 2,033 doubles observed; however, the type could only be determined in 1,061 cases.

11 Information for 1981 and 1984 is from Nix (1986) Table 46. The originals were only available to the nearest integer which makes the figures shown somewhat inaccurate.

12 Clayton, A., Fekpe, E., 1992, "Unpublished Weight Survey Data," University of Manitoba.

13 Clayton, A.M., M.R. Delaquis, F.P. Nix, and R.G. Thom, 1992, "Manitoba Truck Accidents," for Transport Canada, Ottawa. A "truck" is any articulated combination powered by a tractor (not a straight truck) having 4 or more axles. Some deadhead tractors (no trailers) may also be included. Given the 12 year time span and the likelihood that total distance driven by trucks increased over this period, a tentative observation that the truck accident rate has fallen seems possible. However, the impact of the 1988 agreement can only be judged by looking at the data between 1988 and 1990 and here exposure data (because of the downturn in the economy) is crucial.

14 The 1984 data are from M. Archambault, 1987, *Developments in Intermodal Transport in North America* Transport Canada, TP 8848, Ottawa, p 35. The 1991 data are from the NTA's "Industry Monitoring and Analyses Monthly Bulletin, Dec. 1992, p 4.

15 Nix, F.P., Sparks, G.A., 1987, "Study of Vehicle Weight and Dimension Regulations and Canada's Trucking Industry, Background Paper #7, Impact on Shippers", Transportation Development Centre, Montreal.

16 Anderson, K.O., J.A. Bervell and S. Teply, "Impact of Changes in Vehicle Weight Legislation on Pavements in Alberta, Canada." 3rd International Symposium on Heavy Vehicle Weights and Dimensions, Cambridge, UK. and Clayton, A.M., J. Robinson, and E. Fekpe, "Pavement Loads and Weight Limits: Canadian Experience," 3rd International Symposium on Heavy Vehicle Weights and Dimensions, Cambridge, UK.

THE EFFECT OF COMMODITY MIX ON YIELD AND UNIT LABOUR COST IN THE RAILWAY SECTOR

JEAN-PIERRE ROY*

Aggregate analyses of labour productivity reveal a substantial gap between Canadian and U.S. railroads. In 1990, for instance, the average labour productivity of CP Rail, measured in terms of tonne-kilometres (TK) per employee, was 42% of that of Burlington Northern (BN). Some of this differential is offset by higher salaries and fringe benefits, resulting in CP's unit labour costs being 68.5% higher than in the U.S. at an exchange rate of 80 cents.

About 70% of the Canadian rail traffic is theoretically insulated from U.S. competition, which would suggest that higher rail rates are sustainable on a large portion of the Canadian traffic. Thus the lower productivity of the Canadian railroads would translate into higher rates for most Canadian shippers, threatening their own viability in the long term. For instance, CP's average yield per TK is 45% higher than BN's.

However, the average yield of each railroad, used as a proxy for price, is greatly influenced by the mix of its traffic. Their productivity is also a function of the efficiency of carrying some traffic as opposed to other traffic. For instance, the transport of coal lends itself more easily to efficient methods of transportation (unit trains) than other traffic such as grain in Canada because of branch line costs. Coal traffic accounts for 27% of CP traffic against 41% for U.S. railroads whereas grain made up 19% of CP traffic against less than 10% for U.S. railroads. Conversely, grain freight rates will be higher than coal freight rates. For example, BN grain freight rates ($18.83 per tonne) are 69% higher than its coal rates ($11.13 per tonne).

In this paper we propose a methodology to measure the effect of the commodity mix on the average yield of rail carriers, so that more meaningful analyses of the freight rate structure of different carriers can be made. We also demonstrate that the same methodology can be applied to compare more effectively the productivity and unit factor costs of different carriers.

APPROACH TO ESTIMATE THE EFFECT OF THE COMMODITY MIX

Measuring the effect of the commodity mix of two carriers can be assimilated to an index measurement problem, to the extent that the analyst tries to cope

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with the effect of different products on the performance of the carriers. This is illustrated in the following theoretical case.

Suppose that we have two carriers, "A" and "B". Their revenue is equal to:

$$R^A = \sum_{i=1}^{N} T_i^A F_i \quad (1)$$

$$R^B = \sum_{i=1}^{N} T_i^B F_i \quad (2)$$

where "T_i^A" is the tonnage of commodity "i" by carrier "A";
"T_i^B" is the tonnage of commodity "i" by carrier "B"; and
"F_i" is the freight rate of commodity "i" for both carriers.

The yield (per tonne), Y^A and Y^B, for both carriers, is equal to:

$$Y^A = R^A / \sum_{i=1}^{N} T_i^A = R^A / T^A \quad (3)$$

$$Y^B = R^B / \sum_{i=1}^{N} T_i B = R^B / T^B \quad (4)$$

where T^A is the tonnage of "A" and T^B is the tonnage of"B"

Dividing Y^A by Y^B gives us:

$$Y^A/Y^B = \left(R^A / \sum_{i=1}^{N} T_i^A\right) / \left(R^B / \sum_{i=1}^{N} T_i^B\right) = \left(\sum_{i=1}^{N} T_i^A F_i / \sum_{i=1}^{N} T_i^A\right) / \left(\sum_{i=1}^{N} T_i^B F_i / \sum_{i=1}^{N} T_i^B\right) \quad (5)$$

The ratio of Y^A/Y^B measures both the price and commodity mix effects of carrier "A" compared to carrier "B". In our example, since all prices are assumed to be equal, the ratio measures only the commodity mix effect. This is a very rigid condition, which does not allow for special pricing strategies. The above condition can be relaxed by the commodity freight rate structure being similar between carriers.

The effect of the commodity freight rate structure can be simulated by standardizing the commodity traffic mix, i.e., by substituting, for instance, the traffic mix of carrier "B" in carrier "A". This can be done through the following steps:

- First we determine the share "**t**" of each commodity "**i**" in the traffic share of each carrier using the following formula:

$$ti^A = Ti^A / \sum_{i=1}^{N} Ti^A \qquad (6)$$

$$ti^B = Ti^B / \sum_{i=1}^{N} Ti^B \qquad (7)$$

- Second, we apply each share "ti^B" to "A" to estimate the traffic of "**A**" as if it had the commodity mix of "**B**"; thus:

$$T^{A*} = \sum_{i=1}^{N} (ti^B T^A) \qquad (8)$$

and

$$Ti^{A*} = ti^B T^A \qquad (9)$$

where the "*" denotes the estimated traffic of "**A**", with the commodity mix of "**B**".

The estimated revenue of "**A***" will be:

$$R^{A*} = \sum_{i=1}^{N} (Ti^{A*} Fi) \qquad (10)$$

Its yield will be: $Y^{A*} = R^{A*} / T^A$ (11)

Dividing (13) by (3) gives:

$$Y^{A*} / Y^A = (R^{A*} / T^A) / (R^A / T^A) = R^{A*} / R^A \qquad (12)$$

Substituting (1), (7) and (10) in (12), gives

$$Y^{A*} / Y^A = R^{A*} / R^A = \sum_{i=1}^{N} (ti^B T^A Fi) / \sum_{i=1}^{N} (ti^A T^A Fi) = \sum_{i=1}^{N} (ti^B Fi) / \sum_{i=1}^{N} (ti^A Fi) \qquad (13)$$

which measures the effect of commodity mix of carrier "**B**" imposed on carrier "**A**". The formula is equivalent to the computation of Laspeyres volume indices. The difference is that we compute the volume index of two carriers instead of two periods.

If the freight rates of the two carriers are different, then the relationship Y^A/Y^B also measures by reduction the effect of the freight rate structure. This can be expressed in the following relationship:

$$Y^A/Y^B = (Y^{A*}/Y^A) \times (F^A/F^B) \quad (14)$$

Where F^A and F^B represent the freight rate structure of each carrier.

Equation (14) can be re-written to become:

$$F^A/F^B = (Y^A/Y^B)/Y^{A*}/Y^A) \quad (15)$$

which means that the freight rate structure of "A" relative to "B" will be equal to the average yield of "A" to "B", i.e., Y^A/Y^B divided by the commodity mix factor between carriers "A" and "B", i.e., Y^{A*}/Y^A.

AVAILABILITY OF DATA

Limited data are available to test our approach. Detailed Canadian data are readily available in terms of origin-destination traffic data by commodity, and by tonnage, tonne-kilometre and revenue. Such data are not in the public domain in the U.S. except in aggregate form, which is not suitable for our purposes. A certain amount of commodity detail is available in the U.S. by carrier, but only in terms of originating traffic and gross revenue. Originating traffic of the U.S. carriers accounts for more than 70% of their total traffic and the associated freight revenue represents some 95% of the gross freight revenue received by U.S. carriers. This limits the issue of double counting involved with thesed data. Finally, the level of commodity detail is limited to 20 commodity groupings and data are available for total commodity traffic only.

Table I shows the composition of rail traffic for selected Class I North American carriers by commodity groupings. Average yield per ton by commodity is also presented for selected U.S. carriers. Some corrections were made for unduly high rates per ton (because of low traffic level) which were adjusted to the second highest rates.

ESTIMATION OF COMMODITY MIX ADJUSTMENT FACTOR

The standardization procedure developed in the above theoretical case was tested on the data from Table 1. The commodity mix structure of CN, CP and CN-CP combined was simulated on the average U.S. industry and each individual U.S. Class I carrier.

TABLE I

A: ORIGINATING FREIGHT TRAFFIC IN 1990, SELECTED U.S. AND CANADIAN CARRIERS

	CN	CP	CDA	US	BN	UP	SP
		IN %			IN %		
Grains	15.2	14.5	14.9	9.7	13.2	16.5	3.0
Other Farm Products	0.1	0.1	0.1	0.6	0.5	1.3	2.4
Metallic Ores	2.5	0.4	1.6	3.3	6.2	1.5	3.5
Coal	11.0	28.4	18.8	40.7	53.5	16.9	0.0
Aggregate Products	7.0	4.1	5.7	4.5	2.0	6.1	7.7
Non–Metallic Minerals	12.3	10.1	11.3	3.1	0.7	4.1	1.8
Grain Mill Products	0.7	0.6	0.6	3.1	1.9	3.0	2.7
Food Products	1.7	1.8	1.8	2.6	3.3	4.5	4.3
Primary Forest Products	6.0	2.5	4.4	2.0	1.1	1.0	1.7
Lumber and Wood Products	4.4	2.1	3.4	1.7	2.4	2.8	7.7
Pulp and Paper Products	7.4	5.7	6.6	2.3	1.7	1.4	4.9
Chemical Products	9.3	8.7	9.0	8.9	3.2	22.0	23.4
Petroleum Products	4.7	1.7	3.3	1.4	0.9	2.3	3.6
Non–Metallic Products	1.1	1.4	1.3	3.1	1.8	5.4	3.5
Coke	0.1	0.1	0.1	1.3	1.0	0.9	1.0
Metals and Products	3.4	2.4	2.9	2.7	1.1	1.9	5.9
Motor Vehicles and Parts	2.0	0.0	1.1	1.5	0.4	1.2	1.9
Waste and Scrap Materials	1.4	0.4	0.9	2.0	0.9	1.6	2.7
Forwarder Traffic	1.0	0.7	0.9	0.2	0.1	0.0	0.0
All Other	8.6	14.3	11.2	5.2	3.9	5.6	18.4
Total Carload Tonnage	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Non–Carload Shipments	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Tonnage	100.0	100.0	100.0	100.0	100.0	100.0	100.0

B: GROSS ORIGINATING REVENUE PER TON, SELECTED U.S CARRIERS

	CN	CP	CDA	US	BN	UP	SP
					U.S $ PER TON		
Grains		N/A		15.20	18.83	16.50	44.22
Other Farm Products		N/A		34.85	40.16	32.06	18.08
Metallic Ores		N/A		8.69	5.86	27.45	17.02
Coal		N/A		12.00	11.13	30.29	30.29
Aggregate Products		N/A		7.16	7.52	10.23	8.89
Non–Metallic Minerals		N/A		9.46	29.28	9.99	26.01
Grain Mill Products		N/A		19.88	20.09	29.29	43.82
Food Products		N/A		35.28	29.46	33.09	46.42
Primary Forest Products		N/A		9.80	19.73	15.73	11.36
Lumber and Wood Products		N/A		45.20	48.34	36.89	35.23
Pulp and Paper Products		N/A		45.03	42.47	54.58	53.99
Chemical Products		N/A		31.20	35.50	26.78	28.76
Petroleum Products		N/A		29.77	33.08	30.86	29.26
Non–Metallic Products		N/A		21.32	24.18	15.94	25.35
Coke		N/A		15.40	14.56	27.88	22.41
Metals and Products		N/A		26.67	40.00	47.51	33.17
Motor Vehicles and Parts		N/A		139.42	163.92	244.60	206.82
Waste and Scrap Materials		N/A		17.77	19.57	25.23	24.30
Forwarder Traffic		N/A		52.00	35.29	73.15	73.15
All Other		N/A		48.11	48.85	67.51	45.75
Total Carload Tonnage		N/A		20.89	18.08	31.07	36.95
Non–Carload Shipments		N/A		53.78	56.80	59.86	50.51
Total Tonnage		N/A		20.90	18.09	31.08	36.95

SOURCES: AMERICAN ASSOCIATION OF U.S RAILROADS, STATISTICS CANADA AND TRANSPORT CANADA

TABLE II
ESTIMATION OF CN AND CP
ADJUSTMENT FACTORS TO U.S. CARRIERS

	CN	CP	CN&CP	CN/CP
U.S.AVERAGE	1.217	1.098	1.164	1.109
EASTERN CARRIERS	1.288	1.176	1.238	1.095
WESTERN CARRIERS	1.226	1.041	1.143	1.177
CSX	1.427	1.277	1.360	1.117
NS	1.523	1.332	1.437	1.144
CR	1.098	1.048	1.075	1.048
ASTF	0.969	0.899	0.938	1.077
BN	1.668	1.441	1.566	1.158
UP	1.080	1.034	1.059	1.044
SP	0.984	0.937	0.963	1.051

The test results are illustrated in Table II above and are also summarized below:

- CN has a traffic mix which would earn 22% higher revenue than the traffic mix of the U.S. carriers. In other words, CN rail rates would be deemed to be higher than in the U.S. only if its yield exceeds the U.S. average by more than 22%.

- In the case of CP, the gap is reduced to less than 10%, which indicates that the traffic mix of this carrier affects only marginally its average freight revenue.

- Results vary with individual carriers, the adjustment factor for CN ranging from a high of 67% (BN) to being negative in the cases of the Southern Pacific and Santa Fe railroads.

A relationship between CN and CP can be inferred from their respective ratios to each individual U.S. carrier.It shows that CN has a traffic mix which would earn this carrier 10% more revenue than CP. The relative stability of this adjustment factor (coefficient of variation of 4% over 10 observations) demonstrates the robustness of the results.

ANALYSIS OF YIELD DIFFERENTIALS BETWEEN U.S. AND CANADIAN CARRIERS

As can be seen from Table III, the average yield of Canadian carriers appears significantly higher than U.S. based carriers. The nominal yield of the Canadian carriers, 2.42 cents per TK, is larger than the United States', 1.82 cents per TK. The 33% differential falls to less than 7% when U.S. yields are adjusted by an 80 cents exchange rate. Individual U.S. carriers show wide variations, BN's yield being the lowest at 1.7 cents per TK against 3.3 cents per TK for CONRAIL. Yields of CN and CP exhibit strongly similar patterns, within one percent of each other.

CN and CP base yields were standardized by the commodity mix adjustment factor estimated in Table II. The adjusted yields exhibit the net effect of the rate structure on average yields. On that basis, the rate structure of the Canadian carriers would be strongly competitive, in particular with the Eastern based carriers. Comparisons with the Western based carriers are not as favourable.

The case of BN best illustrates the difference between nominal and adjusted yields. Nominally, the yield differential between BN and the Canadian carriers exceeds 45%. However, after the commodity mix effect is removed, the Canadian carriers would appear to charge lower rates than BN.

It is interesting to note that, on the basis of these adjusted yields, CN's rate structure would appear somehow lower than CP's by about 9%.

We tested this approach on individual U.S. carriers with a view to estimating the impact of their commodity structure on their actual rate per ton. While BN's average revenue per ton is only 87% of the U.S. average, BN rates are marginally higher (3%) than the U.S. average, with the elimination of the commodity mix effect. In the case of Conrail, its average revenue per tonne is 29% more than the U.S. average. Yet when the commodity mix factor is discounted, the differential is reduced to 9%.

ANALYSIS OF UNIT LABOUR COST DIFFERENTIALS: APPROACH

The empirical analysis of the effect of commodity mix on unit labour cost differentials between Canadian and U.S. railways is conducted on the hypothesis that the relative labour efficiency in the movement of different commodities is inversely proportional to their relative freight rates. The validity of this hypothesis can be demonstrated, based on the economic theory of the firm operating in competitive markets and from the basic concepts of producing joint products.

TABLE III

A:COMPARISON OF RAIL RATE STRUCTURE, CANADIAN AND U.S. CARRIERS

	TOTAL	CSX	NS	CR	ASTF	BN	UP	SP
YIELD PER TK (U.S. CENTS)	1.820	1.979	2.309	2.611	1.817	1.333	1.719	1.627
YIELD PER TK (CDN CENTS)	2.275	2.474	2.887	3.264	2.272	1.667	2.148	2.034
				CN BASE YIELD = 2.426				
CN ADJUSTED YIELD	1.994	1.700	1.593	2.210	2.505	1.454	2.248	2.465
RATIO:CN/U.S.CARRIERS IN %	87.6	68.7	55.2	67.7	110.3	87.3	104.6	121.2
				CP BASE YIELD = 2.416				
CP ADJUSTED YIELD	2.201	1.892	1.814	2.305	2.686	1.677	2.337	2.579
RATIO:CP/U.S.CARRIERS IN %	96.8	76.5	62.8	70.6	118.3	100.6	108.8	126.8
				CN&CP BASE YIELD = 2.422				
CN&CP ADJUSTED YIELD	2.081	1.781	1.685	2.252	2.583	1.546	2.287	2.515
RATIO:CN&CP/U.S.CARRIERS IN %	91.5	72.0	58.4	69.0	113.7	92.8	106.5	123.6

B:COMPARISON OF UNIT LABOUR COST, CANADIAN AND U.S. CARRIERS

	TOTAL	CSX	NS	CR	ASTF	BN	UP	SP
UNIT LABOUR COST PER TK (U.S.CENTS)	0.745	0.873	0.921	1.053	0.771	0.505	0.767	0.599
UNIT LABOUR COST PER TK (CDN CENTS)	0.931	1.091	1.151	1.316	0.964	0.631	0.959	0.749
				CN BASE UNIT LABOUR COST = 1.383				
CN ADJUSTED UNIT LABOUR COST	1.136	0.969	0.908	1.260	1.428	0.829	1.281	1.405
RATIO:CN/U.S.CARRIERS IN %	122.0	88.8	78.9	95.7	148.1	131.4	133.6	167.7
				CP BASE UNIT LABOUR COST = 1.063				
CP ADJUSTED UNIT LABOUR COST	0.968	0.832	0.798	1.014	1.182	0.738	1.028	1.135
RATIO:CP/U.S.CARRIERS IN %	104.0	76.3	69.4	77.1	122.6	116.9	107.3	151.6
				CN&CP BASE UNIT LABOUR COST = 1.245				
CN&CP ADJUSTED UNIT LABOUR COST	1.070	0.915	0.866	1.158	1.328	0.795	1.176	1.293
RATIO:CN&CP/U.S.CARRIERS IN %	114.9	83.9	75.3	88.0	137.8	126.0	122.6	172.7

SOURCES: AMERICAN ASSOCIATION OF U.S. RAILROADS, STATISTICS CANADA AND TRANSPORT CANADA

Consider the simplest case in which a firm, for example, carrier A uses a single input (L) for the production of two outputs (T1 and T2).

The production function can be expressed as:

$$F(T1,T2,L)=0, \tag{18}$$

where T1,T2, and L are the respective quantities of T1, T2, and L. Assume that (18) can be solved explicitly for L:

$$L=f(T1,T2) \tag{19}$$

The cost of production in terms of L is a function of the quantities of the two outputs. Thus the isocost or the production transformation curve is defined as the locus of output combinations that can be secured from a given input of L:

$$L^{\circ}=f(T1,T2) \tag{20}$$

The slope of the tangent to a point on a product transformation curve (isocost curve) is the rate at which T2 must be given up to obtain more T1(or vice versa) which determines the rate of product transformation (RPT). The negative of the slope is defined as the rate of product transformation (RPT):

$$RPT=-\frac{dT2}{dT1} \tag{21}$$

The total differential of (20) yields:

$$dL^{\circ}=\frac{\partial f}{\partial T1}dT1+\frac{\partial f}{\partial T2}dT2, \tag{22}$$

where $\partial f/\partial T1$, $\partial f/\partial T2$ are the marginal costs of producing T1 and T2 in terms of L respectively.

Assume $\partial f/\partial T1$ = f1 and $\partial f/\partial T2$ = f2. Thus (22) can be rewritten as:

$$dL^{\circ}=f_1dT1+f_2dT2 \tag{23}$$

Since dL = 0, for movements along a product transformation curve, (23) becomes:

$$-\frac{dq2}{dq1}=\frac{f_1}{f_2} \tag{24}$$

Substituting (24) in (21) yields:

$$RPT=-\frac{dT2}{dT1}=\frac{f_1}{f_2}=\frac{MC_1}{MC_2} \tag{25}$$

Thus from (25) RTP at a point on a product transformation curve equals the ratio of the marginal costs of T1 and T2 in terms of L at that point.

Alternatively, RPT can be expressed in terms of the marginal products. Using the inverse function rule in (19), we have:

$$\frac{\partial T1}{\partial L}=\frac{1}{f_1},\frac{\partial T2}{\partial L}=\frac{1}{f_2} \tag{26}$$

where $\partial T1/\partial L$ and $\partial T2/\partial L$ are the marginal product (MP) of L for producing T1 and T2 respectively.

Substituting (26) into (25) we get:

$$RPT=-\frac{dT2}{dT1}=\frac{\partial T2/\partial L}{\partial T1/\partial L}=\frac{MP_2}{MP_1} \tag{27}$$

This implies that the RPT equals the ratio of the marginal product of L in the production of T2 to the marginal product of L in the production of T1.

From (25) and (27) one can write:

$$\frac{MC_1}{MC_2}=\frac{MP_2}{MP_1} \tag{28}$$

Now, we turn to presenting the relationship between output price and the marginal cost of producing two different outputs by using one input. Such relationship is obtained when total revenue is maximized subject to (2). Total revenue (R) from selling T1 and T2 is written as:

$$R=F_1T_1+F_2T_2 \tag{29}$$

Where F_1 and F_2 are the prices of T_1 and T_2.

Maximization of (29) subject to (19) yields:

$$\frac{F_1}{F_2}=\frac{MC_1}{MC_2}=RPT \tag{30}$$

Substituting (30) into (28) gives:

$$\frac{F_1}{F_2}=\frac{MC_1}{MC_2}=\frac{MP_2}{MP_1} \qquad (31)$$

The above equation implies, that in a competitive environment, the prices of goods or services are equal to their marginal costs and also equal to the inverse of the relative productivity of one good versus another.

However if the underlying production technology of a firm exhibits constant returns to scale, the long run average and marginal costs will be constant (and equal) over all the output range.[**]

In addition to the above point, under the assumption of perfect competition the output price(F) = average revenue(AR) = marginal revenue(MR)

Given the above two points, (31) can be written as:

$$\frac{P_1}{P_2}\left(=\frac{AR_1}{AR_2}\right)=\frac{MC_1}{MC_2}\left(=\frac{AC_1}{AC_2}\right)=\frac{MP_2}{MP_1} \qquad (32)$$

For the production of n commodities the above equation can be written as:

$$\frac{F_i}{F_j}\left(=\frac{AR_i}{AR_j}\right)=\frac{MC_i}{MC_j}\left(=\frac{AC_i}{AC_j}\right)=\frac{MP_j}{MP_i} \qquad (33)$$

where i= 1 ---- n, j= 1 ------ n, i≠j

which implies that the relative labour productivity in the movement of different commodities is inversely proportional to their relative freight rates (F_1/F_2). Conversely, the relative labour costs will be directly proportional to their relative freight rates.

At the optimal production level of the firm, the price (freight rate) of all commodities should be equal to their marginal cost and also their average cost.

Then one can write:

$$F_i=AC_i \qquad (34)$$

[**] *In most empirical studies including railroads, the long run average cost (AC) curve has been found to decline up to a point and then remain constant. There is no strong evidence that after some output level is reached, average costs start to rise.*

The overall average cost of carrier "A" and carrier "B" can be expressed as follows:

$$\bar{C}^A = \frac{\sum_{i=1}^{n} (F_i^A T_i^A)}{\sum T_i^A} \qquad (37)$$

and substituting (34) in (35) and (36) yields

$$\bar{C}^B = \frac{\sum_{i=1}^{n} (F_i^B T_i^B)}{\sum T_i^B} \qquad (38)$$

These two expressions are equivalent to the identities defined in (3) and (4). It follows that:

$$\frac{\bar{C}^A}{\bar{C}^B} = \frac{Y^A}{Y^B} \qquad (39)$$

$\bar{C}^A/\bar{C}^B$ measures both the efficiency and the commodity mix effects of carrier "A" in relation to carrier"B". The efficiency of carrier "A" over carrier "B" will be equal to the average cost of "A" to "B" divided by the commodity mix factor between carriers "A" and "B", i.e Y^{A*}/Y^A defined in (13).

ANALYSIS OF UNIT LABOUR COST DIFFERENTIALS: RESULTS

Again from Table III, it can be shown that CN base unit labour costs are the largest of all the carriers analyzed. Its costs exceed the U.S. average by almost 49%. The differential with CP and BN, deemed to be the lowest labour cost carrier, is respectively 30% and 119%. CP base unit labour cost is 14% greater than the U.S. average.

When the labour costs are adjusted by the commodity mix factor estimated in Table II, the labour cost differential of CN relative to the U.S. average is reduced to 22%. The largest discrepancy would not be with BN (+31%), but SP (+ 88%), which would suggest that SP is the lowest labour cost Class I carrier in North America. The large divergences of the unit labour costs of CN versus those of the western U.S. carriers are consistent with the lack of competitiveness of the freight rates of the Canadian carriers vis-à-vis carriers of this region.

CP adjusted labour costs would be only marginally higher (+4%) than the U.S. average. Its labour cost advantage over CN's would be reduced to less than 20%. When the comparisons are made with BN, the labour cost differential falls to 17%.

The interpretation of these results should be done with care. U.S. labour costs are more expensive than in Canada, especially because of fringe benefits. As a result, more work is being contracted out, which is reflected in the higher share of intermediate costs among U.S. carriers. For instance, before tax, the share of intermediate costs to total cost is 33% for CP, and, 41% for BN which is reputed to have maximized the use of contracting out. This should translate into a unit cost differential of about 0.10 cents per tonne-kilometre which would almost virtually offset the unit labour cost differential of 0.11 cents per tonne-kilometre between BN and CP.

U.S. cost of capital, because of lower interest costs, more generous capital depreciation allowances and lower income rates is cheaper than in Canada. The use of labour saving technologies is thus more attractive than in Canada.

These factors suggest a different allocation of factors of production between U.S. and Canadian carriers. The use of partial productivity measures and unit factor costs may somehow be misleading for assessing the relative efficiency of U.S. and Canadian carriers. More comprehensive analyses involving total factor productivity measurements are required in this regard.

SUMMARY OF FINDINGS AND CONCLUSIONS

In the context of continentilization of markets, the competitiveness of transportation services is taking a strategic importance. This is even more important for the users of rail services, since their cost of transportation tends to represent a significant component of the delivered price of their products. This applies to those shippers which have access to the U.S. carriers and as well to those shippers which are captive to the Canadian rail system.

The assessment of the competitive position of the Canadian railroads is thus gaining in importance. This assessment must rely on accurate, comprehensive and complex measurements. Aggregate data are easily accessible and simple to use, but one runs the risk of improper conclusions.

Aggregate analyses of labour productivity reveal a substantial gap (plus 75 per cent) between Canadian and U.S. railroads. Some of this differential is offset by higher (+30 per cent) salaries and fringe benefits, in the United States. These higher labour costs of the Canadian railroads would translate into what seem to be higher freight rates for Canadian shippers.

However, after applying an adjustment factor for the commodity mix, Canadian rail rates would be competitive with the U.S. average when the Canadian dollar is around 80 cents (U.S.). The same conclusion is reached when comparisons are made with Burlington Northern, even though the nominal yields of the Canadian carriers are superior to BN's by more than 80%.

The unit labour cost of Canadian carriers is nominally 34% higher than that of the average U.S. carriers. When commodity mix factors are accounted for, the labour cost differential between Canadian and U.S. railroads is reduced to 15% per cent. Comparisons with western U.S. railroads reveal a larger unit labour cost gap which corresponds to their lower freight rates.

Differences in the relative cost of input in Canada and in the U.S. suggest some variations in the mix of input utilization in the production function of the Canadian and U.S. railroads. This suggests that the use of partial labour productivity measures and unit labour costs may somehow be misleading for assessing the relative efficiency of U.S. and Canadian carriers. More comprehensive analyses involving total factor productivity measurements are required in this regard.

The results should be viewed with some prudence, as they are based on inferior data. Freight rates are measured by tonne instead of tonne-kilometer, which biases the results when lengths of haul are different. Regional factors in the measurement of freight rates are not accounted for. Finally, the conversion of the Canadian commodity classification to the U.S. major commodity groupings created further problems.

Yet, in spite of these caveats, the results are robust enough to support the use of the approach developed in this paper to carry out comparative analyses of the performance of American and U.S. railroads. Better data would make the results more certain.

Finally, the results presented in the paper are based on 1990 data and reflect the relative performance of the Canadian and American carriers. However, it should be recognized that performance is not static and different conclusions can be reached at different points in time.

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A Study of Rail Line Viability and Density

The objective of the present study was to develop and test a "rule-of-thumb" econometric model for the identification of unprofitable branch lines in the Canadian National system. This was accomplished through the use of detailed firm oriented data which is not generally publicly available. Using cost, revenue, and traffic data obtained from the Canadian National Railway (CN), an econometric cost-behavior model was developed showing the relationship between the volume of traffic on a railroad line and the line's profitability.

Based upon published research in the field of railway economics, the model can be used to predict the profitability of different lines - those segments which fall below a certain threshold of activity are likely not long-term profitable and should be abandoned. It also helps to show whether and to what extent economies of density exist.

Railroads in North America are faced with numerous challenges. In order to remain profitable and viable in the face of a highly competitive trucking industry, they have had to make major adjustments to the way they do business. The railroads have responded to competition by relying on more and more sophisticated technology to take the place of expensive unionized labour. They have begun to emphasize quality and service in order to attract new business and regain some of the business that has been lost to truckers. And, they have undertaken to reduce the huge amount of track inherited from the pre-war era, when passengers and freight moved almost exclusively by rail.

The railroads have traditionally been one of North America's most heavily regulated industries. In the past, railroads were regulated primarily as a means to prevent them from abusing their market power. Regulations ensured that railroads did not price at above a certain level to prevent them from taking unfair advantage of captive rail consumers. They were forbidden from pricing below variable cost[1], to prevent them from using predatory pricing to damage a competitor's business. And, they were required to submit to public approval any plans for changes in service and pricing. Today, with the passage of the Staggers Act in the US in 1980, and the 1987 National Transportation Act in Canada, railroads have more freedom to adjust to changing market conditions than ever before. Still, there are considerable regulatory barriers to network rationalization, line abandonment, and short-line creation which have made it difficult for the railroads to adjust their infrastructures as much as is necessary to be consistently profitable.

1. There are many interpretations of variable cost in the railway industry, beginning with long-term vs. short-term. This has been a source of much conflict between railways, shippers, and regulators.

Conventional industry wisdom has it that railways have a core of fixed costs which do not vary with the scale of operations. However the notion of a core of fixed costs and its accompanying economies of scale have been challenged in recent years by a number of researchers.[2]

The nature of the railway business is such that costs do not vary directly with any one output measure. There are generally considered to be at least three bases for railway fixed and variable costs:

1. fixed plant,
2. equipment (motive power and car fleet),
3. operating expenses.

Plant costs vary with output in the long run, but in the short run they are relatively fixed. Equipment costs are long-term investments and as such do not vary on a day-to-day basis with the level of output. Some operating costs are directly related to traffic levels, but others must be borne whether or not there is traffic at all. Despite this, railway cost studies and models often make simplifying assumptions which imply that there is a direct relationship between these costs and traffic. This is fine as long as the traffic volume and mix is relatively constant. But if the volume or mix changes significantly then costs can be greatly overstated or understated, particularly if systemwide average costs are employed.

Railway capacity is for the most part only variable in discrete increments. A rail line may be doubled-tracked, for instance, or a line may be upgraded to allow the passage of faster and/or heavier trains. In economic terms, this may be thought of as movement by the firm from one long run average cost curve to another. Joy argues that in the short run, capacity is determined not only by the physical plant but as well by the chosen operating pattern. This may result in movement between short run average cost curves along the LRAC envelope, say if the amount of equipment available is increased. Or, it may simply entail movement along the current SRAC curve, as labour is used to provide additional capacity with the same level of plant and equipment.

A principal problem on lines with low service levels (lines with once a day or less service) is that of adjusting capacity to low traffic densities. One way of making this adjustment is through reduced or deferred track maintenance [Harmatuck 1979, Joy 1989]. This makes identifying costs and spending patterns extremely difficult, as spending can be and is deferred due to temporary cash shortages, budget restraints, and the like.

Railway costs suffer from a fair degree of rigidity, especially with respect to downwards changes in traffic. Most costs will not automatically decrease with a decrease in the amount of business (output) - rather it requires some action on the part of management

2. See for example Keeler [1974], Harmatuck [1979], Caves [1985], or Barbera [1987].

to recognize decreased demand and respond to it by ordering a corresponding reduction in spending on maintenance of way, the car fleet, and labour hours. Thus there is a time lag between a drop in business and reduced spending on capacity.

It had long been thought that a railroad had a core of fixed costs which would not rise if the amount of business were to vary. The assumption of economies of scale has been at the source of many of the mergers seen in the North American railroad business in the past. However of late some researchers have concluded that, if anything, there are gross diseconomies of scale in the industry.

While economies of scale refer to a long-run average total cost (ATC) curve which declines in relation to the size of the firm, economies of traffic density, on the other hand, refer to the ATC curve as it relates to traffic density. Proponents of economies of density claim that an increase in traffic volumes will result in decreasing average total cost, given that the fixed plant (i.e. the number of miles of rail) remains constant. The existence of economies of density, like that of economies of scale, presumes a high degree of fixed costs - those of the plant infrastructure - over the short term. However in the longer term, when the railroad infrastructure is adjusted to take into account the changes in traffic, many of the short-run fixed costs become variable.

High traffic densities bring about operating efficiencies through reduced yard accumulation delays, and permit the running of more efficient-sized trains [Harmatuck 1979]. High densities also justify investments in labour-saving facilities such as hump yards. A recent study by Keaton [1990] shows that service levels, as measured by average transit time, tend to improve with increased density[3].

Current industry thinking is that short-line operators are able to run a low-density rail line more profitably than a large Class-I railroad. Overheads for a small railway are thought to be lower, for one. But the chief cost advantage of a short-line railway is that it is not bound by the same costly work rules and labour agreements.

Costing at CN is done using a combination of econometric methods, allocative accounting methods, and engineered costs in the development of unit costs. Costs which are known with certainty to be 100% variable and are directly related to the movement being analyzed are directly assigned to the movement. Costs which are considered to be related directly to other costs are assigned on a percentage basis. For example, pension costs are known to be a certain fixed percentage of wages. Simple and multiple regression is also used to determine a relationship between a cost and one or more independent variables. Engineered costs are used, for example, in determining switching costs.

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3. An interesting side-effect is that higher-density carriers will always have lower costs. If a carrier attempts to maintain the same service level at all densities, then average costs drop sharply at higher densities, and rise sharply at lower densities. Hence lower-density carriers are at a distinct cost disadvantage if they try to provide the same service levels as high-density carriers.

Inputs to the costing methodology include materials and labour price indices, financial statistics garnered from the railway's system of accounts, and operating statistics which measure freight operations output as well as yard and switching operations. These measures are used to ascribe costs to every aspect of the railway's operations.

Since at least the 1950s there have been steady advances in the understanding of railroad costs and the accompanying economies of scale, scope and density. George Borts [1960] laid the foundations for much of today's research. Ann Friedlaender [1969] showed how the existing regulatory situation was causing severe problems for the industry. Zvi Griliches [1972] showed how the use of allocated costs could distort railway and regulatory decision-making. The point made by much of this research was that railroad costs weren't simply a straight-line function of output, but rather that the underlying economics of the rail industry were much more complex.

Harris [1977] was one of the first to find that there were economies of traffic density in the railway industry. He went on to say that the cost of service on light-density lines was higher than generally believed. Harris found that this was due as much to high fixed operating costs as fixed capital costs. Keeler [1974] and Harmatuck [1979] found more or less constant returns to scale for Class I railroads in the US, while at the same time finding returns to density of between 1.72 and 1.92.

Barbera et al [1987] used cost and traffic data from thirteen Class Is between 1979 and 1983, and concluded that there were strong economies of density and length of haul, but essentially no economies of scale. The authors held that technology and regulatory changes had not substantially altered railroad cost structure over the years, as the findings of this study were consistent with others done previously (Borts, Healy, Griliches, Keeler, Harris, Harmatuck, Braeutigam, Caves).

Econometric analysis of AAR cost and traffic data for Class I railroads has shown that there is a very clear downwards-sloping cost-density curve for the industry as a whole. That is, significant economies of traffic density exist in North American rail system. When unit costs are plotted against traffic density, higher-density carriers clearly have lower costs.

Little work has been done in estimating economies of density on individual line segments within a railway. Rather, most research in this area has compared entire railway companies to one another. One researcher [Tolliver, 1984] has focused on economies of density as they apply to particular line segments. Tolliver contends that regulatory cost formulas used by the Interstate Commerce Commission are deficient for the purposes of long-run planning, as they tend to misstate certain line costs which fluctuate with the volume of traffic over the segment.

Tolliver contends that regulatory costing procedures misstate costs by ignoring the effects of density upon the way fixed costs per mile of track are allocated to specific car movements. He argues that traffic which moves over dense lines actually should bear a lesser part of these fixed costs than traffic which moves over less dense lines, but ignores

the fact that "fixed" costs per mile are different for each segment of the rail network. Railroad fixed costs per mile depend in large part on the capacity level at which the railway operates the line. Cost per mile varies based on geography, track structure and capacity, the capital value of the investment, and whether the line is urban or rural [Harris 1977]. All this should be taken into account if costs are to be fairly allocated to shipments in the manner proposed by Tolliver.

It is difficult to make assumptions about the form of a production function for railroads. This is partly due to the fact that nearly all railroad output is joint, by the very nature of the business. The endless combinations of origins, destinations, commodities, and service levels must be considered in measuring the output of a railroad.

According to duality theory, the cost function for a firm should have the same general form as the underlying production function. Because it is so difficult to identify the form of railway production and cost functions, many researchers have turned to flexible form functions. The transitive logarithm or translog form of the cost function has come to be widely used in research. The translog allows for testing of hypotheses concerning the relationships between economic inputs and outputs rather than imposing them mathematically [Bereskin 1989].

Cost regression analysis requires that we analyze the relationship between costs incurred and output. The output of a railroad consists of moving railcars of goods from one place to another. The combinations of origin-destination pairs with the numerous commodities moved makes for millions of joint outputs in the day-to-day operation of a railroad. This makes railway output difficult to measure. A few key metrics are commonly used which together give an indication of output. However these are broad measures which mask certain details in cost research. In order to provide greater insight and more accurate results, most studies express cost as a function of more than one output measure.

Another class of variable which is often of use in costing research is that of resource prices. Resource prices are particularly useful in separating out the influence of price changes over time, or the price paid by different firms for inputs, in longitudinal or cross-sectional studies respectively. Resource prices in rail economic research are generally considered to include fuel, labour, and capital.

Other variables may be introduced as well to account for differences across the sample. For example:

line type (main vs. branch)
traffic type (bridge vs. originating/destined)
type of traffic (bulk, carload, intermodal)

The present study uses a model similar to that used by Barbera, with some modifications. Costs used are:

online variable costs
offline variable costs
capital costs
line-specific costs, including operations, maintenance of way, and taxes paid.

Costs were obtained from the CN costing system, and reflect the best estimate of the true costs of line operation, used for internal decision-making purposes. The values are a mixture of direct costs and estimates or allocations obtained in a variety of complex calculations.

Factor prices for capital, labour, and fuel were left out of the final model using the following rationale. The cost of capital is implicitly the same for each of the observed data points, since all data is for one firm. National labour contracts assure that the price of labour is relatively constant across the observations. Because of the way fuel is accounted for at CN and due to the complexities involved in introducing fuel price as a factor in the regression, it was decided to make a simplifying assumption that fuel prices were a fixed factor during the study.

The following output measures were chosen, after the Barbera study and according to what was readily available at CN.

Route miles (MR). The length of each line segment in miles. This is a measure of the fixed plant - it may explain costs such as maintenance of track and roadway, signals and communications, real-estate taxes, and capital costs of ownership of the line.

Gross ton miles[4] (GTMs). This is a measure of all traffic on the line. Included are both local originating and destined traffic, as well as bridge traffic[5].

The ratio of GTMs to MR gives the density of the line, expressed as so many gross ton miles per mile. Gross ton miles provide a good measure of costs brought on due to traffic volumes, including maintenance of way, as well as fuel, running labour, locomotive expense, car expense, and the like.

Revenue freight tons (RFTs). A measure of local originating and destined (local o/d) traffic. This variable can provide a degree of insight into costs incurred due to the pickup and placement of cars, such as local switching and yard costs. Local o/d traffic also has an impact on offline costs - if the traffic were lost or abandoned there would be a corresponding drop in activity (and costs) both on and off of the line in question.

Each of the observations was divided by its sample mean to come up with an even distribution about 1. This technique, known as normalization, has two purposes[6]. First,

4. a gross ton mile, or GTM, is defined as one ton of freight and car equipment, moved over a distance of one mile.
5. traffic which passes over the line, but whose trip neither begins nor ends on the line.
6. see for example Braeutigam, Daughety and Turnquist, 1984.

it greatly reduces the problem of heteroskedasticity by centering the tightest part of the model's prediction confidence interval in the middle of the data set. Second, and perhaps more important, normalization helps protect the proprietary nature of the data. By concealing the sample means from publication the cost function can be publicly analyzed without ever divulging the actual cost levels. Normalization has the effect of changing the units in which variables are measured, from dollars, tons, and miles, to some arbitrary unit based on the sample mean. Thus normalization has no effect on the mathematical relationships present in the function, but rather only on the magnitude of the coefficients.

Another technique which can be used to help solve the heteroskedasticity problem is to deflate the various output measures by dividing them by a measure of firm size. Railway operating data, for example, are often deflated by miles of track or route miles. Griliches compared a number of straight-line regression models to the same models using variables deflated by miles. Not only were the regressions better without deflation (better R^2), but the coefficient of the deflator, miles, turned out to be insignificant in every case. Griliches argued that it is inappropriate and even misleading to deflate by miles of road, and that a far better transformation is to take the logarithm of the variable. This led to the use of gross-ton-miles, total cost, revenue tons, and miles of road for the cost function, rather than the deflated version which would be based on density (GTMs per mile), cost per mile, and revenue tons per mile.

The general form of the long-run cost function may be stated as:

$$C = C(Q_1, Q_2, W_1, W_2, W_3)$$

where

C = total long run cost,
Q_i = service measure,
W_j = measure of resource price (e.g. labour, capital, fuel)

The translog is one form of the general cost function. The translog function is a flexible form curve-fitting function which provides a second order approximation to any underlying function. The translog provides an excellent estimate of any linear or quadratic curve, as well as to other forms and hybrids. Thus it is well-suited to the problem of railway costing.

The general translog form in three variables is:

$$\ln C = \alpha_0 + \sum_{i=1}^{3} \beta_i \ln X_i + \frac{1}{2} \sum_{i=1}^{3} \sum_{j=i}^{3} \gamma_{ij} \ln X_i \ln X_j + \sum_{i=1}^{3} \sum_{j>i}^{3} \gamma_{ij} \ln X_i \ln X_j$$

or, multiplying and combining like variables:

$$\ln C = \alpha_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + 1/2\ (\gamma_{11}(\ln X_1)^2 + \gamma_{22}(\ln X_2)^2 + \gamma_{33}(\ln X_3)^2 + 3/2\ (\gamma_{12} \ln X_1 \ln X_2 + \gamma_{13} \ln X_1 \ln X_3 + \gamma_{23} \ln X_2 \ln X_3)$$

Replacing the X_i's with our variables g, r, and m, and substituting appropriately to simplify, we get the following translog equation:

$$\ln c = a_1 + a_2 \ln g + a_3 \ln r + a_4 \ln m + a_5 (\ln g)^2 + a_6 (\ln r)^2 + a_7 (\ln m)^2 + a_8 \ln g \ln r + a_9 \ln g \ln m + a_{10} \ln r \ln m$$

where,

c = normalized cost,
g = normalized traffic (GTMs),
r = normalized local freight (revenue tons),
m = normalized miles of road,

and a_1 through a_{10} are coefficients to be solved for using regression.

This function provides a second order approximation to an arbitrary cost function, and can be easily regressed with conventional techniques.

Profit or contribution of a line can only be determined if we have an estimate of the revenues generated by the line. We can then compare the revenues with costs to come up with an indication of the contribution. To this end, a segment revenue model was derived. Total segment-generated revenue was regressed against the same function of miles of road, local originating and destined traffic, and bridge traffic. Revenues were adjusted to allow for a bridge traffic contribution to fixed line costs.

The same variables were user for the revenue function as for the cost function, in order be able to compare and combine the cost and revenue equations without introducing systems bias. The revenue model is:

$$\ln r = b_1 + b_2 \ln g + b_3 \ln r + b_4 \ln m + b_5 (\ln g)^2 + b_6 (\ln r)^2 + b_7 (\ln m)^2 + b_8 \ln g \ln r + b_9 \ln g \ln m + b_{10} \ln r \ln m$$

where,

r = adjusted revenue,
g = traffic (GTMs),
r = local freight (revenue tons),
m = miles of road (all parameters are normalized).

Line profitability can be measured in more than one way. One method is to express profitability as a ratio of revenues to costs.

$$P = \frac{R}{C}$$

or,

$$P = \frac{rR'}{cC'}$$

where r and c are the normalized values of revenue and cost, and R' and C' are the sample means.

If P is greater than one then the line is predicted to be profitable. If it is less than one then the line is probably a money-loser. And if the ratio is very close to one then the line is marginal and further investigation is indicated.

The above equation can also be expressed as a logarithmic equation:

$$\ln P = \ln r + \ln R' - (\ln c + \ln C')$$

Substituting the cost and revenue expressions for lnr and lnc, and combining like terms, we get:

$$\ln P = (b_1-a_1) + (b_2-a_2)\ln g + (b_3-a_3)\ln r + (b_4-a_4)\ln m + (b_5-a_5)(\ln g)^2 + (b_6-a_6)(\ln r)^2 + (b_7-a_7)(\ln m)^2 + (b_8-a_8)\ln g \ln r + (b_9-a_9)\ln g \ln m + (b_{10}-a_{10})\ln r \ln m + (\ln R'-\ln C')$$

If		then the line is	
	$\ln P < 0$,		unprofitable,
	$\ln P > 0$,		profitable,
	$\ln P = 0$,		marginal.

The coefficients a_n and b_n can be obtained from the cost and revenue regressions, respectively. R' and C' are the sample means for revenue and cost, and g, r, and m are plgged in for each specific line segment for a prediction as to its profitability.

Data for the study were obtained as follows. CN provided 1991 revenue, cost and profitability information for all non-mainline[7] segments of the CN rail system. These were matched with 1991 CN traffic density data. In all, 178 line segments were analyzed, accounting for approximately 10,000 of the CN system's 18,000 miles.

7. CN's mainline network is considered to be the line or lines stretching from Halifax in the East to Vancouver and Prince Rupert in the West, as well as a number of connections to US railroads at various border points. The NTA defines mainline track as any line carrying over 2 million gross ton miles per year, or which is a) part of the transcontinental system; b) a vital import-export link; or c) a connecting line [Statistics Canada 1989].

Regressions for both cost and revenue translog models were run using 1991 data. SAS software was used to run the regressions on CN's host MVS computer system.

The cost model had an F-statistic figure of 236.42, significant to the 0.0001 level, indicating that there is a regression relationship between the dependent variable, cost, and the independent variables (GTM, RT, MR). The R^2 for the model was 0.9268, which indicates that the model accounted for over 92 percent of the variance in the cost figures. All of the first order terms were significant, and had the expected signs. The y-intercept value was found to be insignificant - the hypothesis that the y-intercept was zero could not be rejected. A number of the interaction terms were found to be significant, which indicates that use of the translog form likely added to the accuracy of the model. Collinearity diagnostics generated by the SAS system indicated that multicollinearity might be a problem for some of the interaction terms. No such problem was noted for the primary terms.

Table 1: Cost model parameter estimates

	a	Variable	Estimate	Std. error	t-stat	Significant
Primary	a_1	intercept	-0.00726	0.03751	-0.193	
terms	a_2	GTM	0.07951	0.03235	2.458	yes
	a_3	RT	0.73744	0.02779	26.533	yes
	a_4	MR	0.11305	0.05234	2.160	yes
Interaction	a_5	GTMSQ	0.01882	0.01404	1.340	
terms	a_6	RTSQ	0.05853	0.00521	11.238	yes
	a_7	MRSQ	0.09865	0.03837	2.571	yes
	a_8	GTMRT	-0.04468	0.01258	-3.552	yes
	a_9	MRGTM	-0.02298	0.03951	-0.582	
	a_{10}	MRRT	-0.05769	0.02380	-2.424	yes

The revenue model had an F-statistic of 347.33, significant to the 0.0001 level, which indicates that there is a strong relationship between the dependent variable revenues and the independent variables. R^2 for the revenue model was 0.9490. The revenue model accounted for almost 95 percent of the variability in the revenue sample. Of the first order terms, only one, revenue tons, was found to be significant. This is consistent with

the underlying reality - revenue is generated by revenue tons and not by, say, miles of road. The y- intercept value was found to be significant. Most of the interaction terms were found to be significant, perhaps indicating the non-linearity of the revenue function, as well as due to the adjustment for contribution from bridge traffic.

Collinearity diagnostics generated by the SAS system showed no significant multicollinearity problems for the primary term coefficients. However some multicollinearity was noted for the interaction terms. This does not affect to predictive capability of the model as a whole. However it does render individual analysis of the interaction terms suspect. When multicollinearity is present, small changes in the data can bring about large differences in any of the correlated terms, even though the result of the function (in this case, cost and revenue) remains valid.

All of the primary coefficients for the cost function are positive in sign, as expected for a long run cost function. An increase in any of the terms (GTMs, miles, or tons) will bring about an increase in cost, as one would expect. For the revenue function the sign of the coefficient for revenue tons is positive, as expected. The signs of significant interaction terms cannot be predicted with any certainty.

Table 2: Revenue model parameter estimates

	b	Variable	Estimate	Std. error	t-stat	Significant
Primary	b_1	intercept	-0.07290	0.03636	-2.005	yes
terms	b_2	GTM	0.03358	0.03136	1.071	
	b_3	RT	0.91857	0.02694	34.092	yes
	b_4	MR	0.02761	0.05074	0.544	
Interaction	b_5	GTMSQ	0.03057	0.01361	2.246	yes
terms	b_6	RTSQ	0.06008	0.00505	11.898	yes
	b_7	MRSQ	0.09057	0.03720	2.435	yes
	b_8	GTMRT	-0.09298	0.01219	-7.625	yes
	b_9	MRGTM	-0.04260	0.03830	-1.112	
	b_{10}	MRRT	-0.02273	0.02307	0.985	

In using cross-sectional data to estimate a long-run cost function, it must be assumed that all observations (usually firms, but in the case of the present study, line segments) are at long-term equilibrium. If the observations are not in fact taken at long-run equilibrium, then there is a danger of regression fallacy bias. Regression fallacy occurs because some firms (lines) are not producing at the planned cost-minimizing level. In graphical terms, this means they are operating at a point on the short-run average cost curve which is above the long-run average cost envelope for the firm or industry [Borts].

If the assumption has been made that firms are operating in a long-run cost-minimizing mode, and that is not in fact the case, then the regression-based cost function curve will lie above the true long-run cost function. Symptoms of long-run disequilibrium are chronic overcapacity and excessive regulation [Talley, p110]. Both are extremely likely to occur given the circumstances of the railroad industry in general and Canadian branch lines in particular. Therefore regression fallacy is likely to be encountered in this type of research. The results should be interpreted with this in mind. It is highly likely that the regression curve overestimates the true long-run cost of operation.

If we substitute the regression coefficients a_1 through a_{10} and b_1 through b_{10} into the viability model presented above, we get the following equation:

$$\begin{aligned}\ln P = &- 0.06564 - 0.045931\ln g + 0.181131\ln r - 0.085441\ln m \\ &+ 0.01175(\ln g)^2 + 0.00155(\ln r)^2 - 0.00808(\ln m)^2 \\ &- 0.04831\ln g \ln r - 0.019621\ln g \ln m + 0.03496 \ln r \ln m \\ &+ 0.09356\end{aligned}$$

where g, r, and m are normalized GTMs, Revenue Tons, and Miles, respectively.

This equation can be used to predict the viability of any given non-mainline segment in the CN system for the year 1991, by substituting the actual values of g, r, and solving for lnP.

This was done for the line segments in the study sample. Based on the computed value of P, each segment was placed into one of three categories. In order to provide for a margin of error, a range of +/-0.05 was established around the profitability ratio P. Thus, line segments with a profitability ratio P of between 0.95 and 1.05 are considered to be marginal. Further detailed analysis would be required to make a decision on their viability. Those segments with a P of less than 0.95 are probably not viable. And those with a P of 1.05 or higher are likely profitable. Table 4 summarizes the results of the viability model testing.

Table 3: Viability model results

	Marginal lines		Non-viable lines		Viable lines		Lines analyzed	
Region	n	miles	n	miles	n	miles	n	miles
East	10	773.4	30	1249.7	25	1187.8	65	3210.9
West	20	1378.3	65	4188.8	28	2030	113	7597.1
System	30	2151.7	95	5438.5	53	3217.8	178	10808

East = Atlantic, St. Lawrence, Great Lakes Regions

West = Prairie, Mountain Regions

The viability model indicates that the bulk of the branch lines studied were not profitable for CN in 1991. In the West, the high number of lines considered non-viable is reflective of the large Prairie grain network. Grain-dependent lines are protected from abandonment until the year 2000, by Order in Council. The 7600 miles of marginal and unprofitable branch lines identified by the viability model represent about 40 percent of CN's network.

Under regulations established by the National Transportation Act (1987), the railroads are permitted to abandon or sell off a maximum of 4 percent of their total network per year.

Canadian Pacific is responsible to its shareholders to maximize profits. Canadian National has also been mandated by its owner, the federal government, to act in a way as to maximize profits. Yet both CN and CP are handicapped by being forced to continue to operate lines which clearly are unprofitable, all the while competing in a global North American marketplace with US carriers. The implications for policy-makers are clear. If Canadian railroads are to be profitable, they must be permitted to withdraw service from markets where there is no profit to be made, and to provide other means of service to shippers, such as short lines, where it makes economic sense to do so.

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COMPETING IN THE NORTH AMERICAN MARKETPLACE—EMERGING TRENDS IN TRUCK AND RAIL TRANSPORTATION

by

J.M. Bowland

Peat Marwick Stevenson & Kellogg

This research assesses Canadian shippers' needs and competitiveness within the North American marketplace. It evaluates the relative importance of transportation regulation and other challenges that Canadian shippers face in the future. The research focuses on the rail and motor carrier modes, shifting traffic patterns and the need for a seamless transportation system.

The research was based on several sources including work recently completed by Peat Marwick Stevenson & Kellogg (PMS&K) for the National Transportation Act Review Commission (1), a proprietary survey done by PMS&K on the impact of the NAFTA initiative (2), and the author's evaluation of other relevant data.

A. Introduction

There are numerous factors affecting transportation patterns in the North American marketplace including new trade agreements, market competition, technology and transportation policy.

In 1988, Canada and the United States negotiated a free trade arrangement called the Canada U.S. Trade Agreement (CUSTA). Transportation as an industry, was not directly part of CUSTA. However, because transportation is a service industry, it was affected by the changing trade patterns that resulted. The Canadian transportation industry is adjusting to growing north-south trade patterns. This shift from traditional east-west movements has encouraged some motor carriers and the two national railways to expand into the U.S. market to successfully service existing and new customers. The Canadian trucking industry competes directly with U.S. motor carriers for these north-south product flows.

In 1991, the Canadian, U.S. and Mexican governments met to discuss expansion of the trade agreement. Final ratification is still pending. The North American Free Trade Agreement (NAFTA) includes some areas such as transportation services that were not covered in CUSTA. According to the current draft of NAFTA, access to transportation services will be phased in over a ten year time horizon. Currently, Canadian and U.S. motor carriers must turn freight over to, or receive freight from, a Mexican carrier at the U.S./Mexico border. This means that a Mexican carrier handles the freight within the borders of Mexico. Over time, Canadian and U.S. carriers will be able to invest in Mexican companies and operate in Mexico.

Federal transportation policy has an impact on the competitive position of Canadian carriers and shippers. Significant changes have taken place since the National Transportation Act came into effect. Shippers report more market competition, improved service and increased rate competition.

Logistics is increasingly being recognized by progressive enterprises as a means to gain a competitive edge. A highly efficient and effective logistics system and the role that transportation plays in this system need to do the following.

- Provide faster, on-time delivery to any location in North America.
- Have any product available when demanded.
- Be responsive and flexible to the demands of a wide range of customers.
- Provide accurate, timely and reliable information on the current status of shipments and orders.
- Deliver product at the lowest laid-down cost.
- Have a seamless transportation system including transfers between carriers, efficient international custom clearance and less administrative paperwork.

B. Objective and methodology

The objectives of this paper were as follows.

- Assess the role of transportation and logistics in Canadian shippers' ability to compete in the North American marketplace.
- Identify challenges facing the Canadian and U.S. rail and truck industry as they expand into the North American marketplace.
- Highlight changes to the Canadian legislation that could enhance Canadian shippers' competitiveness.

The findings are based on three sets of primary research conducted by PMS&K. The research draws upon a survey of 230 Canadian shippers conducted by PMS&K on behalf of the National Transportation Act Review Commission. This survey solicited input from shippers of varying sizes in all regions of Canada and in every major industry sector. The second data source was the results of interviews with 50 leading edge firms to discuss emerging trends in logistics and the impact of transportation deregulation. The third primary data source was a survey that targeted the top 1000 Canadian companies and the 100 fastest growing companies to solicit input on the NAFTA initiative and the implications for Canadian businesses. In this survey, some 313 useable surveys were returned. The results of these three surveys were drawn together to evaluate competition in the North American marketplace and the emerging trends in rail and truck competition.

C. Findings

The findings of our research are summarized under four topic areas. First we report on the relative importance of transportation in helping Canadian companies compete in the North American marketplace. Secondly we look at some of the challenges facing the railway and motor carrier industry in international markets. Next we highlight the effects of transportation legislation and regulation. Finally we assess the competitive position of Canadian and U.S. carriers.

1. Transportation is just one of many challenges for Canadian shippers

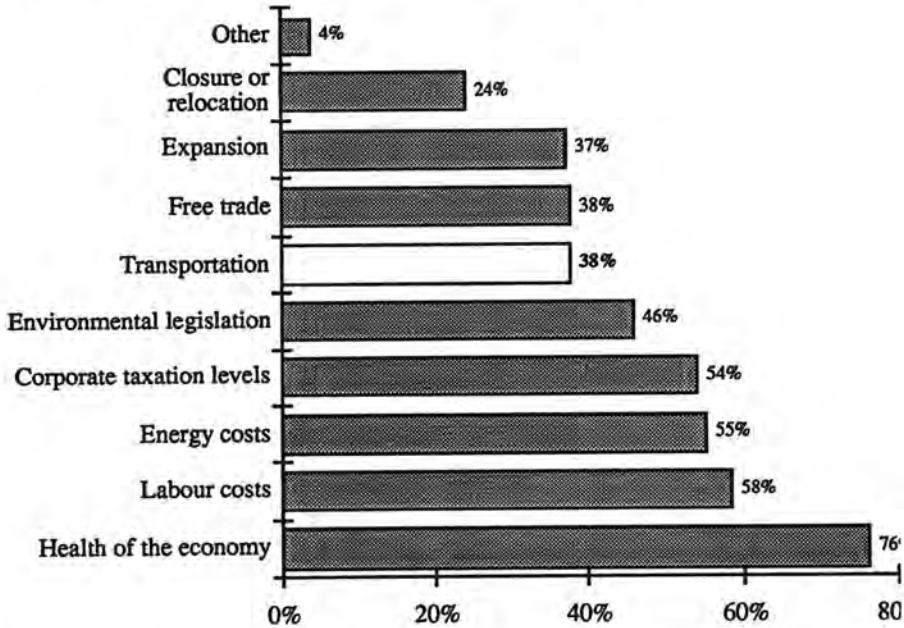
Canadian manufacturers, resource based industries, wholesalers and retailers face a number of common challenges that influence their ability to provide quality product at reasonable cost. Exhibit 1 shows the percent of respondents from our survey of Canadian shippers who reported various factors as being very important to their business over the next four years.

The factors covered a range of challenges including the general health of the economy, labour, taxation, the environment and transportation regulation and legislation. Out of a total of nine factors, transportation regulation and legislation tied for sixth place with free trade between Canada, U.S. and Mexico. Factors ranking ahead of transportation and free trade issues, by order of importance, were the general health of the economy, labour costs, energy costs, corporate taxation, and the environment. Given that the survey was conducted in the recessionary climate of 1992, it is not surprising that respondents rated the health of the economy as the most important factor to their business. Many respondents felt that all the factors were either important or very important.

Approximately 38% of respondents found transportation and regulation was very important to their business over the next four years. Some 43% of respondents found that it was somewhat important. As explained later, several transportation and logistics variables including freight rates, reliable delivery and total transit time are important to Canadian shippers.

Free trade was considered very important by 38% of the respondents. Some 34% of respondents found it somewhat important. Trade and competition in the North American marketplace are common themes for many industries. Transportation and logistics are important factors for Canadian companies as they try to compete in international markets particularly if the product is produced in Canada and exported to the U.S. and Mexico. U.S. companies have a natural geographic advantage due to their location.

Exhibit 1
Expected importance of general factors (next four years)



Many Canadian producers, manufacturers, retailers and carriers have evaluated the benefits of CUSTA and have made adjustments to compete in the Canada-U.S marketplace. Mexico is still an unknown for many Canadian companies but it does offer great potential for some industries. Mexico has a market of over 85 million people. Nearly two-thirds of Mexico's population lives in and around urban centres and fifty-seven percent of the population is under the age of 30. In 1991, the top ten exports from Canada to Mexico were motor vehicle parts, iron and steel products, newsprint, wheat, telecoms and related equipment and parts, sulphur, aircraft and parts, paper products, asbestos and wood pulp. The top ten imports from Mexico in 1991 were automotive parts and accessories, automotive vehicles, engines and engine parts, radio and related equipment, ignition sets, fruits, coffee and nuts, air conditioners and fans, vegetables, carpets and fabric and air filtering systems (3).

Some products, by their nature, lend themselves more to the rail or truck mode. According to 1991 statistics on international trade (value of goods), motor carriers handle close to 60% of Canada's imports from Mexico and approximately 50% of its exports to Mexico. Rail carriers handled 27% of Canada's imports and 14% of its exports to Mexico. As of yet, there is no reliable breakdown of the market share by the volume of goods moved.

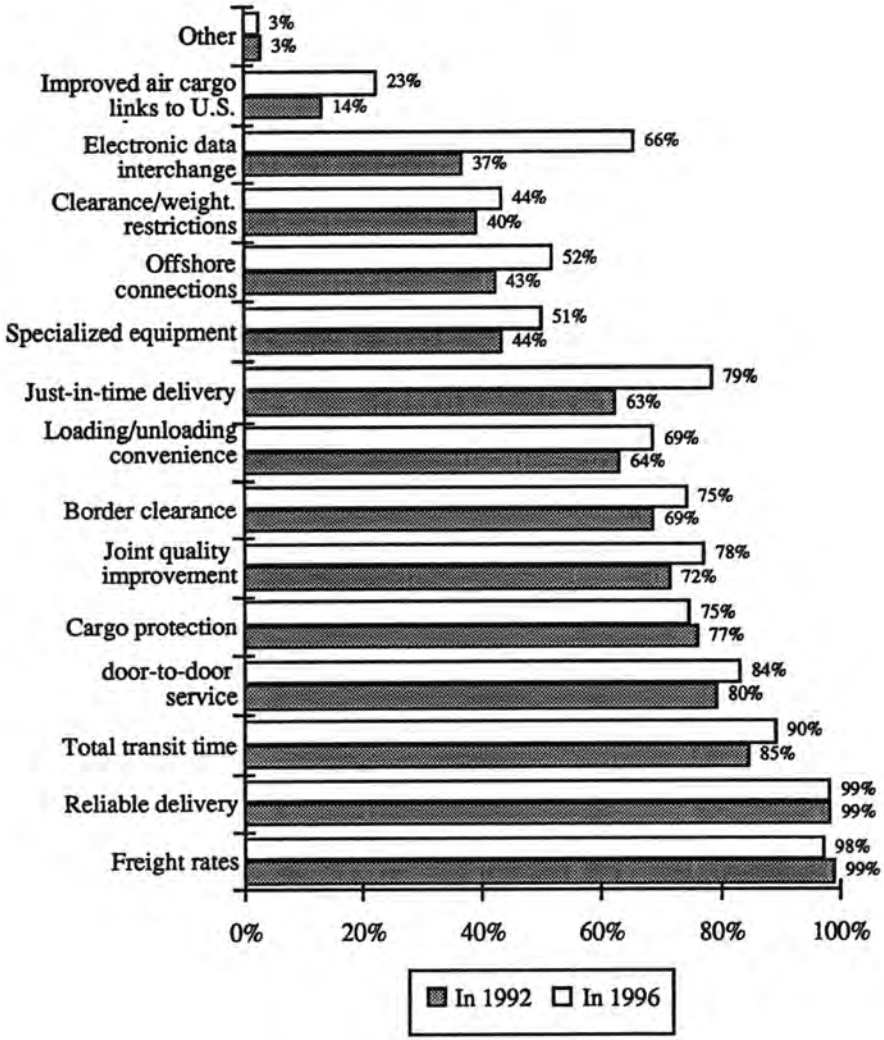
Our survey of Canadian business on the effects of the NAFTA initiative found that most leading Canadian companies support the North American free trade initiative and that many have sent representatives to Mexico to investigate business opportunities (4). According to the survey, Canadian companies expect significant market potential in Mexico in the following areas.

- Agriculture, forestry and fishing.
- Banking and financial services.
- Chemicals and plastics.
- Construction and engineering.
- High-technology and electronics.
- Insurance.
- Automobile products.
- Metals and metal products.
- Mining.
- Utilities.

In 1990, Canada imported approximately $1.7 billion (Canadian dollars) worth of goods from Mexico and exported approximately $0.6 billion (Canadian dollars) worth of goods to Mexico. Five years prior, imports totalled less than $1.2 billion and exports totalled approximately $0.4 billion. This represents growth rates of between 40% and 50% over the five year period prior to the NAFTA discussions. Substantial growth has taken place over the last two years and it is expected to accelerate following the ratification of NAFTA.

Regardless of what the commodity is or where the market is for a product, some aspects of transportation and logistics remain very important. In our survey of Canadian shippers, we asked respondents to indicate how important various factors were in meeting their present and future transportation and distribution needs. Exhibit 2 shows the per cent of respondents who reported various factors as being important or very important in 1992 and 1996. Nearly all shippers felt that freight rates and reliable, on-time delivery were important or very important in 1992 and 1996. In fact, reliable, on-time delivery was rated as very important ahead of freight rates (i.e., for 1996, 89% of shippers rated reliable, on-time delivery as very important and 75% of respondents rated freight rates as very important). Presumably these factors would carry the same weight no matter where shippers compete in the North American marketplace.

Exhibit 2
Importance of factors in transportation needs



2. Challenges facing railways and motor carriers in international markets

CUSTA already has, and NAFTA will, alter the patterns of demand for freight transportation services. Appropriate physical and business infrastructure must be available to support the seamless transportation of goods to and from Canada, the U.S. and Mexico.

Ultimately, the NAFTA initiative promises open investment for Canadian companies and harmonized standards to ensure safe, cost effective and competitive services for Canadian businesses and the opportunity for Canadian firms to grow and take advantage of expanding markets. These goals are not easy for Canadian carriers to attain given the current market and regulatory environment. For example, weight and dimension regulations for motor carriers are not even consistent within Canada let alone U.S. and Mexico jurisdictions. Other challenges facing Canadian transportation companies wanting to expand into the U.S and Mexico include the following.

- Sufficient human and capital resources to build the infrastructure and marketing presence required to successfully compete in these markets.
- Competition from low cost American carriers.
- The need to form strategic alliances with U.S. and Mexican carriers to successfully deliver product to destination.
- Long hauls to some American states and Mexico offer limited backhaul opportunities because of traffic flow patterns, geographic location and current regulations.
- Efficient border crossings, customs clearance and tracing of goods.
- Immigration issues.
- Quality of infrastructure in Mexico including the road network and toll roads.
- Language and local customs in Mexico.

The Canadian carriers are currently adjusting to the effects of deregulation, greater competition from U.S. carriers, poor financial results, the impacts of a recession and shifting trade patterns. Given these challenges, entry into the U.S. and Mexican markets may be over powering for some companies. However, some carriers have begun servicing these areas. CN North America and CP Systems have expanded their operations in the U.S and are setting up alliances with U.S. railways and Ferracarriles Nacionales de Mexico (FNM) to provide double-stack and other rail service to Mexico. Canadian motor carriers like Challenger Motor Freight, Kleysen, Trimac, Canada Transport and Day & Ross are considering expansion into Mexico.

3. Effects of transportation legislation and regulation

According to our survey of Canadian shippers, most shippers want either less transportation legislation or no change in the existing legislation. Only 13% of the respondents wanted more regulation. In evaluating the effects of the regulatory environment, the following general themes were discussed.

- Need for a level playing field for Canadian and U.S. carriers. Many shippers stated that Canadian and U.S. carriers should be given equal opportunity to compete. Shippers suggested reductions in taxes, lower licensing costs and more generous depreciation allowances.

- Need for a consistent transportation regulatory environment. Many shippers felt that inconsistencies in the transportation regulatory environment create inefficiencies and higher costs. For example, shippers want harmonious motor carrier regulations with similar enforcement across North America.

- Reduction in government involvement. Many shippers want less government involvement, thus letting the marketplace determine the outcome of events.

- Controlled access for U.S. carriers. Some shippers felt that government should control U.S. carriers' access to Canadian markets.

- Allow railways to manage their assets. Many rail shippers agree with the Canadian railways in that the carriers should be given more freedom to manage their assets. Shippers felt that this would make the railways more efficient and ultimately lower their freight costs.

- Maximize use of intermodal movements. Some shippers felt that intermodal traffic should be encouraged because it is cost-effective, service sensitive and environmentally friendly.

- Competitive labour environment. Some shippers commented on the disparity between Canadian and U.S. transportation labour costs.

4. Assessing the competitive position of Canadian and U.S. carriers

The competitive position of Canadian and U.S. carriers is influenced by many factors including their ability to adapt to the transportation and logistics needs of customers, cost structures, quality of service and transportation regulations.

Emerging trends in logistics should be considered in evaluating the competitive position of Canadian and U.S. carriers. The relative importance of transportation in logistics strategy depends on the value-added within the sector. For the products from primary industries with relatively low value-added, logistics is essentially transportation management. Other factors are considered in the higher value-added manufacturing sector. According to our survey of Canadian firms,

the following trends have a major impact on the cost and effectiveness of logistics systems.

- Network consolidation. Most logistics systems consist of line haul transportation, warehouse or distribution centres, inventory, and local delivery. In the past the need for low cost transportation and fast delivery resulted in several warehouses or distribution centres across the market territory. Recently, the focus in some industries on time compression and elimination of inventory has led to marked rationalization of distribution facilities.

- Direct store door delivery and cross-dock shipments. Increasingly, retailers are having goods delivered directly to the point of sale at the store, bypassing traditional breakbulk, warehouse or distribution facilities. This means that carriers must be able to handle direct deliveries to facilities in various North American locations.

- Carrier consolidation. Buyers of transportation are reducing the number of suppliers. This consolidation of transportation providers means more partnerships between shippers and carriers and alliances between carriers as they serve wider markets.

- Carrier and modal selection. Shippers are becoming increasingly sophisticated in their choice of and negotiation with carriers. Shippers are concerned about the trade-off between service and price.

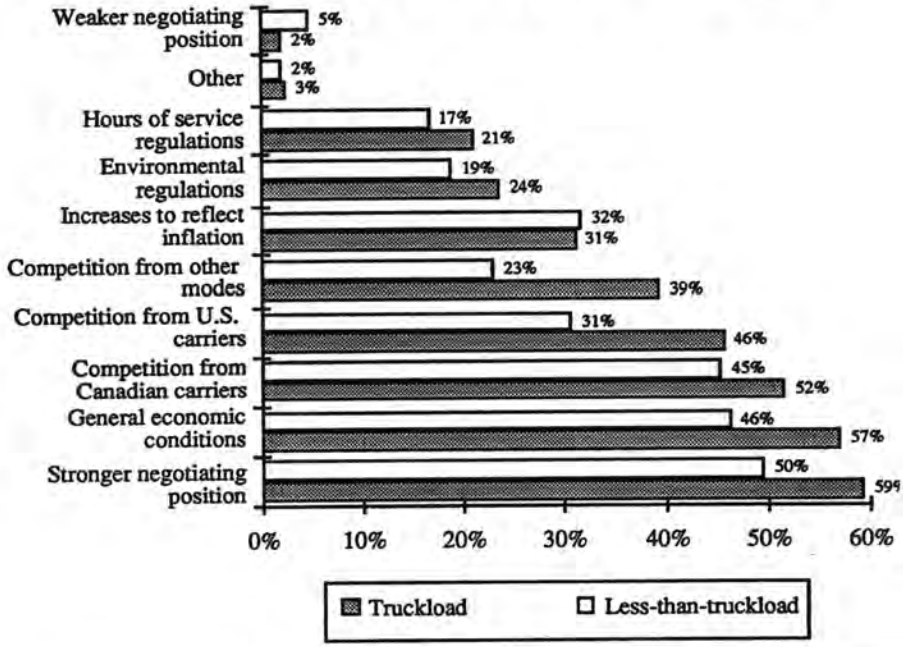
- Focussed factories. Focussed factories take advantage of product and process specialization. As transportation costs decrease relative to other component costs, it becomes profitable to ship product greater distances. As a result, many firms have one plant manufacturing a specific line of product for the entire North American market, and then transport these to other factories. For carriers to successfully bid for this traffic, they must service several North American locations.

- Electronic data interchange. EDI is slowly being integrated into Canadian operations. EDI can be used to track shipments, facilitate movement of goods at border crossings and for processing waybills and payments.

As illustrated above, emerging trends in logistics will have a direct impact on the demands of the transportation industry. Carriers must adjust to these trends if they want to be successful in the North American marketplace. Carriers must be able to handle direct deliveries to facilities in various North American locations, form partnerships with shippers and other carriers, and expand their EDI capabilities. These factors are important now in evaluating the relative competitive position of Canadian and U.S. carriers. In the future, these emerging trends will be even more important for those carriers competing in international markets

Carriers must balance several other basic factors in assessing their role in the North American market. As shown in Exhibit 2, price, reliability and quality of service are still very important to shippers. To illustrate this point, Exhibit 3 presents the results of our survey of Canadian shippers and their evaluation of truck rates. Exhibit 3 shows the per cent of respondents who reported various factors as being important or very important in determining their for-hire truck rates over the last four years. The top three factors included stronger negotiating power, general economic conditions and more Canadian carriers competing for their business. Use of, or competition from U.S. motor carriers ranked fourth. Similar issues were important in evaluating rail rates and service. Both modes of transport are influenced by the impact of the competition south of the border.

Exhibit 3
Importance of factors in changes to for-hire rates (past four years)



Taking all factors into consideration, Canadian shippers felt that Canadian carriers could be more competitive than they presently are. In addition to the predictable requests for lower rates and better service, shippers identified the following key points in their assessment of Canadian and American carriers.

- Canadian railways have made significant improvements over the past few years including developing partnerships with shippers to enter new markets, more consistent transit times, North American service, and better tracking of shipments. Railways still must improve their reliability, reduce turnaround times on some time sensitive traffic and be cost competitive with U.S. carriers.

- Canadian truckers have gained significant market share by providing quality service and competitive rates. Canadian carriers are presently losing market share in international markets (5). Movements to/from the U.S. and Mexico are expected to grow significantly as the new trade agreements come into full force and as the economy recovers. It will be more difficult for Canadian carriers to successfully compete in this market if their infrastructure is oriented in an east-west direction when traffic flows are moving in a north-south direction.

- Many shippers felt that the Canadian trucking industry has a poor image compared to U.S. truckers because U.S. carriers are seen to be more efficient, more aggressive in pricing, eager to adapt their service to the shippers' needs and better managed.

- Canadian carriers are slower to adapt to new technology such as EDI bar coding.

D. Concluding remarks

Transportation is just one of many challenges facing Canadian shippers. Shippers are more concerned about the general health of the economy, labour costs, energy costs, corporate taxation and the environment. Together these factors influence the competitive position of Canadian shippers in international markets.

Several factors affect transportation patterns in the North American marketplace including new trade agreements, market competition, technology and transportation policy. CUSTA already has, and NAFTA will, alter the patterns of demand for freight transportation services. Appropriate physical and business infrastructure must be available to support the seamless transportation of goods to and from Canada, the U.S. and Mexico. Carriers may have to form strategic alliances to successfully service markets like Mexico.

A number of emerging logistics practices point towards an overall trend in consolidation and specialization—in distribution networks, carriers hired, communications, and factory output. In their efforts to become more competitive in the North American marketplace, shippers need transportation services that fit smoothly with their logistics and corporate strategies. They require responsive, service-oriented carriers that contribute to efficient distribution flows.

Many shippers want changes to Canadian legislation and regulations so that rail and motor carriers can meet their needs more efficiently and effectively. According to shippers, government policy should encourage the following general principals.

- A level playing field for Canadian and U.S. carriers.
- Consistent transportation regulations between jurisdictions.
- Reduction in government involvement.
- Consideration of controlled access for U.S. carriers.
- Allow railways to manage their assets.
- Maximize intermodal opportunities.
- Competitive labour environment.

Canadian carriers are seen as lagging behind their customers in developing a North American business approach. Many Canadian carriers need to improve their presence in the U.S., market U.S.-based decision makers, and develop a more dynamic approach to customer service, management and information technology.

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THE EVOLUTION OF THE NEW BRUNSWICK LIVESTOCK FEED SUPPLY SYSTEM 1991 - 2000

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INTRODUCTION

This paper examines the New Brunswick livestock feed supply system as it existed in 1991 and projects the changes that could occur over the remainder of the 1990's. In 1991, the authors were retained by the New Brunswick and Federal Governments to conduct a study *to assess "the opportunities for lower cost livestock feed at the farm gate to ensure the long term viability of the New Brunswick agri-food sector".*[1] We have used the results of the 1991 Study and our imagination to predict the changes in the supply system over the 1990's. We have made assumptions concerning a number of factors that influence the supply system such as the livestock industry itself, transportation infrastructure, and various government policies. The impact of these changes are examined over the 1990's.

The paper begins with an overview of key factors that determine the livestock feed supply system in 1991. The changes in these factors in the 1990's are forecasted along with the impact on the supply system.

NEW BRUNSWICK LIVESTOCK SUPPLY SYSTEM IN 1991

The New Brunswick livestock industry, in 1991, had seen its cost competitiveness deteriorate relative to other regions in Canada, the U.S. and major producer areas elsewhere. A major contributor to this situation was the relatively higher cost of feed. The higher feed costs were a reflection of a number of factors including the additional transportation costs for imported feeds, higher prices of locally sourced feed, and the small size of the livestock industry relative to its wide geographic distribution.

Feed Requirements

The 1991 New Brunswick livestock industry required a feed grain supply of approximately 215,000 tonnes. The major feed grain consumers in New Brunswick were dairy cattle, hogs, broilers followed by beef cattle, layers, and turkeys. The 1991 consumption estimates are provided in Exhibit 1.

Exhibit 1

Estimates of Grain Consumption
(Tonnes)

Livestock	Grain Consumption
Beef Cattle	19,000
Dairy Cattle	73,000
Sheep and Lambs	1,000
Hogs	56,000
Layers	17,000
Broilers	43,000
Turkeys	6,000
TOTAL	**215,000**

Sources of Supply

Exhibit 2 summarizes the estimated 1991 sources of supply. Maritime grown sources accounted for 42 percent of the supply (mostly barley and oats), Ontario and Quebec supplied 30 percent (corn), the prairies 28 percent (mostly barley and oats).

Exhibit 2

1991 New Brunswick Feed Grain Supply

Crop	Feed Grain Supply Sources (Tonnes)				TOTAL
	Local Production	Other Maritimes	Quebec/ Ontario	Prairies	
Wheat	13,600	37	0	19,137	32,774
Oats	29,000	280	0	4,836	34,116
Barley	45,300	1,772	269	34,964	82,305
Corn	0	0	64,919	0	64,919
TOTAL	**87,900**	**2,089**	**65,188**	**58,937**	**214,114**

In addition to the feed grain there was a requirement for other feed ingredients principally, protein supplements in the form of soybean meal and canola meal. It is estimated that an additional 35,000 to 40,000 tonnes of protein supplements were imported into the Province from elsewhere in Canada and the U.S.

Locally available food processing by-products such as whey, potato peel, and spent brewers mash were utilized by a few livestock producers.

- Maritime Sources

Maritime grain growers market their production through grain co-ops or directly to mills and livestock producers, or it is used on farm by those grain growers that also raise livestock. Local grains are priced to be competitive with the delivered price of imported sources.

- Non-Maritime Sources

The principal existing imported supply systems for New Brunswick in 1991 were:

- Wheat, oats, and barley transported by rail from the Canadian Prairies and Ontario;
- Prairie wheat, oats, barley, and Ontario grains including corn transported by water from Thunder Bay and other ports in Ontario to Quebec City or Halifax with final delivery by truck; and
- Corn by truck from Ontario or Quebec.

1. Feed Grains by Rail from Canadian Prairies and Ontario

Prairie grains are usually transported directly from a prairie elevator to the final New Brunswick rail delivery point. The rail transportation of the grains from the prairies to the lakehead is subsidized by the Western Grain Transportation Act (WGTA). New Brunswick grain buyers are quoted a Thunder Bay price which is a combination of the Prairie price plus the WGTA rail rate to the lakehead.

The delivered cost of feed grain in New Brunswick is a combination of the "track" price in Thunder Bay (cereal grains), or Chatham (corn) plus the rail rate to the destination.

2. By Water from Thunder Bay or Ports in Ontario

Thunder Bay is the main loading point for western Canadian grains moving by water down the Great Lakes. As with the rail option the grain movement into Thunder Bay from the prairies is regulated by and subsidized under the WGTA. The elevator charges in Thunder Bay are also regulated, whereas the freight cost for the water movement is generally negotiated at the beginning of the shipping season each year. Elevator charges are not regulated at the feed grain facility in Quebec City. Final delivery in New Brunswick is a matter for negotiation with local truckers.

Ontario corn (and some other grains) shipped by water originated from elevators in Sarnia, Goderich, etc.

3. By Truck from Ontario or Quebec

Apart from truck movements that formed part of the transportation chain, i.e. linking in with water or rail, there is also some direct movements of eastern corn into New Brunswick. The Ottawa Valley is about the western most limit for such movements to occur.

The rate is very dependent on the type of equipment used, i.e. B-train or tri-axle, and the time of year. Spring weight restrictions in Quebec are fairly strict and have a major impact on the per tonne price.

1991 ALTERNATIVES SUPPLY SYSTEMS

The 1991 study identified and evaluated alternative supply systems. These alternatives were not being utilized in 1991 for a variety of reasons including lack of transportation/storage infrastructure, government policy, or they were not practical for the relatively small New Brunswick livestock industry. The alternatives included different feed types and sources as well as innovative transportation systems.

Evaluation of alternative feed grains and other feed ingredients is based on nutrition and price. A feed user/maker does not buy the single cheapest feed grain available but rather seeks a balanced diet for the specific animals to be fed.

The study examined the major alternative sources for feed grains and protein sources including:

- U.S. Corn, Feed Grains, soybean meal, sorghum;
- European Grains; and
- South American, African, and other sources of Sorghum, corn, cassava, and soybean meal.

Following are the transportation systems that were examined to transport existing and alternative livestock feed ingredients.

Great Lakes Ports to Gros Cacouna or Saint John

Feed grains could be shipped from a variety of ports including Thunder Bay, Goderich or Sarnia, or from U.S. ports such as Chicago or Toledo.

US Gulf Ports to Saint John

A movement of corn, protein, or other feed grains from a Mississippi port, such as Baton Rouge, was considered fairly representative of all Gulf ports. Distances to Saint John show little variance, i.e. Baton Rouge to Saint John is 2238 miles, whereas from Port Arthur or Houston the distances are 2235 or 2303 miles respectively.

US East Coast Ports to Saint John

East Coast ports such as Albany, Baltimore, or Norfolk were examined for the shipment of feed grains such as corn or barley to New Brunswick.

European Ports to Saint John or Gros Cacouna

In 1991 there was very little movement of grains westbound across the Atlantic. About 75,000 tonnes of barley was imported into the U.S., equivalent to about

1% of US consumption, but the US Dept. of Agriculture received many complaints about the movement. Specialty crops, i.e. Swedish oats are, on the other hand, were brought in quite regularly to the S.E. United States. In Canada, there is no record of any grain imports from Europe in recent years.

The most economical movement would be in bulk carrier of around 25,000 tonnes. This is a common size of ocean going vessel. A smaller parcel of grains would be unlikely for economic reasons while a larger shipment would overburden the storage capacity and consumption pattern in Atlantic Canada. A vessel carrying 25,000 tonnes could come directly to Saint John if there were offloading and storage facilities.

South American or Other Source Ports to New Brunswick

It may be possible that alternate feed grains could be imported from other producing origins in the world. Brazil or Argentina in South America could, for example, be a source of soybean meal, sorghum, or corn. The most convenient shipment to New Brunswick importers would be a parcel of say 5,000 to 10,000 tonnes as part cargo on a regularly scheduled sailing or alternatively as a full cargo on a small bulk carrier or general cargo vessel.

US Mid-West by Rail to New Brunswick

The U.S. Mid-west is a major potential source for feed grains, corn and soybean meal. Rail would be a potential alternative to marine transportation. The rail alternatives include the use of the U.S. rail system which is used to transport feed to Maine. From Maine, the connection could be made to CP main line for delivery to Saint John or MacAdam. Delivery to the mill or farm would be by truck as is being done for Canadian grains arriving by CP rail. Alternatively, truck transport could be used to connect with the U.S. railways in southern Maine. U.S. and Canadian trucks are interested in north bound bulk cargo to provide a backhaul for south bound salt, potash and other bulk cargo.

Summary of Supply System Alternatives

Exhibits 3 and 4 summarize the existing supply system and alternatives for the principal feed ingredients. Exhibit 3 refers to Southern New Brunswick & Exhibit 4 refers to Northern New Brunswick. The delivered cost is a combination of the selling price at the source along with the various transportation, handling and distribution costs along the way. Transportation cost includes any loading costs at the point of sale that is not included in the selling price plus the estimated freight rate for the marine, rail or truck transport. Distribution cost includes any handling costs associated with the transfer from rail or marine vessel to truck along with the final delivery cost by truck. Where one mode of transport is used from point of sale to the feed mill or farm, no distribution costs are incurred. This is generally the case for truck transport and some of the rail movements. Marine transportation, understandably, incurres a distribution cost in all cases. No allowance is made for storage and carrying cost which could be significant for the marine shipments.

The comparison of alternatives indicates that the actual transportation system employed to transport feed grains is competitive with the other alternatives examined.

The foreign sources of feed grains are not competitive with the existing sources due to the purchase price and the effect of the Feed Freight Assistance Subsidy. However, for many of the foreign sources, transportation and distribution costs would be lower (ie EEC, U.S. East coast, U.S. mid-west).

Exhibit 3
Comparison of Alternatives Imported Livestock Feed for Southern New Brunswick, September 1991

FEED TYPE	SOURCE	TRANSPORTATION SYSTEM	DISTRIBUTION SYSTEM	(tonnes) MINIMUM VOLUME	PURCHASE PRICE	TRANSPORTATION COST	DISTRIBUTION COST	DELIVERED COST	FFA**
barley*	Thunder Bay	rail	direct rail	80	$85	$45		$130	$22
barley*	Thunder Bay	water to Hfx.	truck from Hfx.	5,000	$85	$29	$24	$138	$22
barley	Thunder Bay	water to S.J.	truck from S.J.	10,000	$85	$31	$13	$129	$22
barley	Duluth	water to S.J.	truck from S.J.	10,000	$88	$29	$13	$130	
barley	France	water to S.J.	truck from S.J.	25,000	$98	$15	$13	$126	
barley	France	water to Hfx.	truck from Hfx.	10,000	$98	$15	$24	$137	
barley	US east coast	water to S.J.	truck from S.J.	10,000	$106	$14	$13	$133	
wheat*	Thunder Bay	rail	direct rail	100	$92	$45		$137	$22
wheat*	Thunder Bay	water to Hfx.	truck from Hfx.	5,000	$92	$27	$25	$144	$22
wheat	Thunder Bay	water to S.J.	truck from S.J.	10,000	$92	$27	$13	$132	$22
wheat*	Quebec	truck	direct delivery	30	$106	$38		$144	$11
wheat	Duluth	water to S.J.	truck from S.J.	10,000	$120	$27	$13	$160	
wheat	France	water to S.J.	truck from S.J.	25,000	$108	$14	$13	$135	
wheat	France	water to Hfx.	truck from Hfx.	10,000	$108	$14	$24	$146	
corn*	Chatham	rail	direct rail	95	$103	$35		$138	$18
corn	Chatham	water to S.J.	truck from S.J.	10,000	$103	$25	$13	$141	$18
corn	Toledo	water to S.J.	truck from S.J.	10,000	$119	$27	$13	$159	
corn	Argentina	water to S.J.	truck from S.J.	10,000	$117	$27	$13	$157	
corn	Chicago	GTW & CN rail	direct rail	95	$117	$50		$167	
corn	Chicago	US rail to Maine	truck from Maine	1500	$117	$30	$15	$162	
corn	US Gulf	water to S.J.	truck from S.J.	10,000	$130	$15	$13	$158	
sorghum	US Gulf	water to S.J.	truck from S.J.	10,000	$118	$15	$13	$146	
sorghum	Argentina	water to S.J.	truck from S.J.	10,000	$104	$27	$13	$144	
MEAL									
soybean	Chicago	water to S.J.	truck from S.J.	10,000	$246	$33	$13	$294	
soybean	Decatur	U.S. rail	truck from Maine	80	$248	$35	$15	$298	
soybean*	Decatur	GTW & CN rail	direct rail	80	$248	$55		$303	
soybean	Brazil	water to S.J.	truck from S. J.	10,000	$240	$32	$13	$285	
soybean*	S. Ontario	rail	direct rail	80	$268	$35		$303	
soybean*	Quebec City	truck	direct truck	30	$281	$38		$319	
canola *	Montreal	truck to N.B.	direct truck	30	$184	$45		$229	
canola *	Montreal	rail to N.B.	direct rail	80	$184	$40		$224	

* Existing Supply System

** Feed Freight Assistance Subsidy Applicable to Various Movements. Transportation Cost Reflects the FFA.

Exhibit 4
Comparison of Alternatives Imported Livestock Feed for Northwestern New Brunswick, September 1991

FEED TYPE	SOURCE	TRANSPORTATION SYSTEM	DISTRIBUTION SYSTEM	MINIMUM VOLUME (tonnes)	PURCHASE PRICE	TRANSPORTATION COST	DISTRIBUTION COST	DELIVERED COST	FFA**
GRAINS									
barley *	Thunder Bay	rail	truck	80	$85	$43	$4	$132	$11
barley	Thunder Bay	water to G.C.	truck from G.C.	10,000	$85	$22	$17	$124	$11
barley *	Quebec	truck	direct delivery	30	$109	$20	$0	$128	$11
barley	France	water to G.C.	truck from G.C.	25,000	$98	$14	$17	$129	
wheat *	Thunder Bay	rail	truck	100	$92	$43	$4	$139	$11
wheat	Thunder Bay	water to G.C.	truck from G.C.	10,000	$92	$22	$17	$131	$11
wheat *	Quebec	truck	direct delivery	30	$106	$20	$0	$126	$11
wheat	France	water to G.C.	truck from G.C.	25,000	$108	$15	$17	$140	
corn *	Chatam	rail	truck	95	$106	$35	$4	$145	$9
corn	Chatham	water to G.C.	truck from G.C.	10,000	$106	$18	$17	$141	$9
corn	Toledo	water to G.C.	truck from G.C.	10,000	$119	$19	$17	$155	
corn	Chicago	GTW & CN rail	truck	95	$117	$45	$4	$166	
corn	Argentina	water to G.C.	truck from G.C.	10,000	$117	$27	$17	$161	
corn	US Gulf	water to G.C.	truck from G.C.	10,000	$130	$35	$17	$182	
sorghum	US Gulf	water to G.C.	truck from G.C.	10,000	$118	$35	$17	$170	
sorghum	Argentina	water to G.C.	truck from G.C.	10,000	$104	$30	$17	$151	
MEAL									
soybean *	Decatur	rail	truck	80	$248	$45	$4	$297	
soybean	Brazil	water to G.C.	truck from G.C.	10,000	$240	$30	$17	$287	
soybean *	S. Ontario	rail	truck	80	$268	$30	$4	$302	
soybean*	Quebec City	truck	direct delivery	30	$281	$29		$301	
canola *	Montreal	truck to N.B.	direct trucking	30	$184	$28		$212	

* Existing Supply System

** Feed Freight Assistance Subsidy Applicable to Various Movements. Transportation Cost Reflects the FFA.

1991 LIVESTOCK FEED SUPPLY SYSTEM ISSUES

Lack of Port Facilities

A number of the supply system alternatives listed in Exhibits 3 and 4 are not feasible because of the lack of port facilities to handle ship loads of feed ingredients. For southern New Brunswick the availability of a grain receiving facility at either the port of Saint John or Bayside would be an advantage. Equally, a grain receiving facility at the port of Gros Cacouna would be very useful to the farmers in Northwestern New Brunswick.

Commodity Movements Other Than Grain

Competitive rates for the long haul transportation of livestock feed ingredients require backhaul commodities. This is particularly true for the truck and marine modes. The Study identified that a northbound movement of grain could be an attractive proposition for the marine sector dependent on the amount to be shipped, the suitability of vessels employed on the East Coast, and their ability to fit in a grain voyage. Likewise, there are opportunities related to overseas trades to Europe, South America, or elsewhere. The examination of the trucking industry also identified potential complementary commodity movements such as salt, lumber, and potash.

The railways in Canada are more constrained in the way they can use other commodity movements to complement their feed grain business. The availability and control of their grain hopper cars seems to be as much a problem as finding suitable backhaul movements from the Maritimes.

Vessel Availability and the Freight Market

Vessel availability is a key consideration in terms of the movement of feed grains within Canada. At this time there are only three Seaway size Canadian 'lakers' that could operate to Saint John, namely the Nanticoke and Halifax of Canada Steamship Lines and the Algoport of Algoma. The Halifax is employed on a fairly regular basis bringing both export and feed grain to the port of Halifax and returning with gypsum. The Nanticoke and Algoport are not as suitable for grain as their hopper gates had suffered abuse from other cargoes and would need substantial investing to have them refurbished. The fragility of the system was demonstrated in 1990 when the Halifax ran aground and was out of service for a considerable period of time. The Nanticoke was pressed into service on the grain trade as the only back-up vessel available, but was not really satisfactory.

If grain is loaded in the Lakes from a US port such a Duluth, Chicago or Toledo, circumstances change in that a foreign flag vessel could be employed. Their availability is not certain by any means, however. Many foreign flag vessels enter the Lakes, quite often in ballast, seeking cargo such as grain. The drawback from New Brunswick's point of view is that most vessels are handy sized bulk carriers, i.e. loading say 20,000 tonnes within the Lakes and then perhaps topping off at the St. Lawrence elevators outbound. Such vessels also seek relatively lengthy employment, for example a voyage to South America or

Africa, and not a short coastal voyage. For grain imported from the US Gulf or the US East Coast, the same general argument holds true.

Feed Freight Assistance Program (FFA)

This federal government program provides transportation subsidies for Canadian feed grains shipped to feed deficit regions (includes all of Atlantic Canada). Most feed grains and corn are included in the program but the protein supplements are not eligible. Payment is made to the livestock producer or feed mill that purchases the feed. Feed grains produced in the Atlantic Provinces are also included in the Program.

The FFA was established to assist both the livestock industries in feed deficit areas and also to ensure additional markets for feed grain producers. The level of subsidy does not equate feed prices across Canada. However, the level of subsidy does provide a distinct advantage to Canadian grain grown relative to grain from other countries.

Grain Import Permits

The federal government, through the Import Permit Measures Act, requires permits for the importation of grains from other countries. For New Brunswick to access EEC, American and other sources of barley and wheat, permits have to be obtained. The Canadian Wheat Board (CWB) is responsible for the issuing of the import permits.

The Free Trade Agreement with the United States addresses the trade in grains. Tariffs on agricultural trade will be eliminated within ten years. Canada will also eliminate the requirement for grain import permits once grain support levels are equivalent in both countries.

Atlantic Livestock Feed Initiative

The federal and provincial departments of agriculture are actively working together to make Atlantic Canada self-sufficient in feed grains by 2000. If this target is met, there will not be the need to import feed grains. However, there has not been significant progress over the past five years towards this objective.

The pricing of local feed grains is based on the delivered price of imported feed. The price that local grain producers receive is thus a combination of the purchase price for Prairie or Ontario grains plus the appropriate transportation cost. To some degree, local grain producers benefit from high transportation costs and would be adversely affected if a more economic supply system could be put in place.

Corn Countervail

Canada imposed a countervail import duty on American corn in 1986. This was in response to claims by Canadian producers that U.S. producers had an unfair advantage in terms of subsidies. The duty is approximately $18 per tonne.

At the time the countervail duty was imposed, U.S. corn was starting to come into New Brunswick. U.S. corn could be transported into New Brunswick by rail or by bulk vessels at a competitive cost to Ontario corn arriving by rail. However, the imposition of the duty had the intended affect of making U.S. corn uneconomic in Canada. This has also been achieved through substantiate reduction of Ontario corn.

Canada Shipping Act

The Canada Shipping Act, in general, restricts employment in the "coasting trade"[2] to vessels registered in Canada. Such vessels may be built in Canada or may be built overseas and then imported upon payment of duty of 25 percent of the vessels value plus seven percent GST. The net effect is to make the capital cost of Canadian vessels relatively high in relation to foreign flag vessels. The judicious purchase of second hand foreign built vessels may keep costs down even after the payment of the duty, but such imported vessels would be considered "new" vessels and would have to meet all applicable international maritime conventions as well as all applicable Canadian steamship inspection requirements. This could be a costly exercise. Furthermore, when operating under the Canadian Flag, the shipowner is also obliged to employ Canadian crews, which again can add significantly to the overall cost.

The major impact of the Canada Shipping Act on the New Brunswick livestock industry was that it limits the supply of vessels available to transport grains from Great Lakes and St. Lawrence ports to Saint John, Halifax, Gros Cacouna and other possible points. This has a number of potential impacts on the industry:

- limitation on the choice of type and capacity of vessels;
- reduced level of service in terms of availability of vessels;
- higher transportation costs due to the lack of carrier competition and the higher operating costs of Canadian vessels.

Geographic Distribution of the New Brunswick Livestock Industry

The New Brunswick livestock industry is widely dispersed throughout the Province. The two major feed consuming areas are Madawaska County and the Moncton-Sussex-Fredericton corridor. The Regions of the Province have developed different feed supply systems based on their proximity to alternative supply sources. The Northwest Region of the Province relies heavily on Quebec's feed supply system and the use of truck transport. The Southern Region imports feed grains and corn directly from Western Canada and Ontario by rail. Producers close to Nova Scotia are also in a position to access feed grains transported by water through Halifax.

Feed Industry and the Existing System

The New Brunswick feed industry is dominated by three large feed companies that account for 70 to 80 percent of the volume of commercial feed grains and manufactured feed. These companies, along with a number of other smaller feed companies compete actively for their shares of the New Brunswick market. The companies are involved in a high risk industry and are constantly seeking ways to minimize risk. Furthermore, the profit margins are small relative to other retail sectors. While the individual companies are constantly looking for cost

advantages over their competitors, they are very reluctant to experiment with new feed sources and supply systems until they become proven and accepted. A feed company gains very little by taking a risk on a new feed source or transportation system. If the experiment fails, the feed company could loose millions of dollars, credibility, market share etc. On the other hand, if the new system succeeds, the competitors would be quick to copy it.

All the feed companies are tied into confidential rail contracts. Some worked with both CN and CP rail. These contracts require a volume commitment by the feed companies in exchange for a substantial discount over the published tariffs. This arrangement works well for both the railways and the feed companies. However, it leaves very little flexibility to try new alternatives unless they include the continued use of the railways.

The rate negotiations that the railways and feed companies enter into are primarily based on alternative transportation systems and the requirement for cost competitiveness. In other words, the railways offer rates that are just low enough to stop the feed companies from using another carrier or mode of transportation. It is suggested by the feed industry that the major competition for the railways in

New Brunswick is the Halifax Grain terminal. If it did not exist rail rates would be higher.

Market System for Feed Grains and other Ingredients

The major feed grains and protein supplements are traded world wide on commodity exchanges, principally the Chicago Exchange. In general, prices are established on a global basis. Price differences between different sources of the same commodity usually reflect differences in transportation cost, quality and availability. Short term price bargains arise when sellers are particularly interested in making sales due to over supply or loss of a traditional market. However, these opportunities usually do not last long. This is the reason that grain traders and buyers monitor prices around the world and buy from the source that is cheapest on that particular day.

New Brunswick, is generally locked into Canadian sources due to its small volume, transportation alternatives and the FFA. However, the Canadian prices generally tracked the other prices worldwide. New Brunswick is at a disadvantage because it is not in a position to take advantage of the short term bargains offered by non-domestic supply sources such as the case when sellers temporarily drop their price below the current price in order to move some product.

Risks and Additional Costs of Large Volume Shipments

A number of the alternative supply systems examined require the purchase, transportation, and storage of much larger lots of feed grains and other feed inputs. Most grains are transported in vessels with capacities of 25,000 to 30,000 tonnes. These volumes are substantially greater than the 500 to 1,500 tonne lots that New Brunswick feed companies normally purchase on a frequent basis. The possibility of handling much larger feed shipments less frequently present the feed companies/livestock producer with additional costs and risks.

The wide fluctuations in the prices of the feed ingredient commodities over the run of a year would expose each buyer to tremendous risks if he was only in the market a few times per year compared to being in the market every day to fill two cars a day.

LIVESTOCK FEED SUPPLY SYSTEM DEVELOPMENTS 1991 - 2000

This section identifies possible changes to the N.B. livestock feed supply system over the period 1991-2000. The impact of these changes are discussed.

Transportation Infrastructure

Three infrastructure changes are likely during the 1990's that will influence the livestock feed supply system.

- Port of Saint John Bulk Terminal

The Port of Saint John has plans to construct a bulk terminal designed to handle a wide range of bulk commodities such as salt, fertilizer, potash, grains, and aggregates. The terminal is designed to be flexible in terms of commodities it can handle, vessels, and expandibility. It is expected that the major commodities that will be handled will be salt and fertilizer. However, it will be suitable for import shipments of feed grains from the U.S. and off-shore.

The major impact of this new facility, on the livestock industry, will be to ensure that the existing feed supply system is cost competitive with other potential systems.

The port charges for grain shipments will likely be in the $6 to $8 per tonne based on 30 day storage.

- Continued Rail line Abandonment

CN and CP will continue to close low rail lines across Canada. New Brunswick will see the elimination of all CP operations. The CP Saint John to Sherbrooke mainline will be sold to a shortline operator. CN will continue to operate its mainline through New Brunswick and Nova Scotia. All other CN lines in New Brunswick will be abandoned. Rail shipments of feed grains will still be made to Moncton, Truro, and Halifax.

This new, smaller and more focused rail system will be able to provide better service at more economical rates than was possible when the line was a mere appendage to a national system.

- Highway Improvements

The Atlantic Provinces will rely even more heavily on its highway system for passenger and freight transportation. It will increase spending in highway reconstruction. This will result in minor improvements to truck transportation service. It will also allow for the more widespread use of large combination trucks which will reduce truck operating costs by 10 percent.

Government Policy

- International Trade

The 1990's will see significant improvements in trade relations in North America and between North America and the EEC. This will result in the elimination of the Corn Countervail, and Grain Import permits and duties. There will still be trade disputes and the need for countervail duties when dumping occurs.

These reductions in trade barriers will allow New Brunswick livestock producers to seriously consider other feed grain sources such as the U.S., EEC, and South America. However, the offshore sources dictate large ocean vessels which will prove to be impractical for the small livestock industry. The occasional shipments of U.S. grain will arrive at the New Bulk Terminal in Saint John. These occasional shipments will occur only when a "bargain" deal coincides with availability of small vessels looking for a backhaul.

- Canada Shipping Act

The Canada Shipping Act will not be eliminated before 2000. This will continue to restrict the available supply of vessels for shipments of Canadian grains from the Great Lakes. However, this will have a limited impact on the New Brunswick livestock industry as shipments of grains out of the Great Lakes to New Brunswick is generally impractical, except in the rare case (ie bargain freight rate from a small vessel).

- Feed Freight Assistance

This transportation subsidy will be phased out. A government/industry study will conclude that this subsidy program is not an efficient use of public funds. This change will be consistent with action taken on other transportation subsidies. The funds will be "reallocated" to federal/provincial infrastructure development programs.

The elimination of this transportation subsidy is expected to result in higher feed costs initially ($5 to $10 per tonne), however they should be offset by lower rail and truck rates due to efficiency/productivity gains, and access to new supply sources.

- Atlantic Livestock Feed Initiative

The program will make progress in terms of increasing the quality and quantity of Atlantic grown feed grains. However, the factor that will contribute the most to increased supply will be the increased crop rotation practices of the New Brunswick potato industry. As well, the potato industry is evolving such that there are fewer but larger operations. The larger land holdings will allow for more crop rotation and more efficient grain production.

New Brunswick Livestock Industry

The New Brunswick livestock industry will reverse the decline it experienced during the 1980's. Over the period 1995 to 2000 production will increase by 15 percent. However, the increases will not be uniform. The hog industry will

expand thanks to the development of a number of very large operations in the Northwest and the Sussex area. The poultry industry will experience sharp declines. New Brunswick will continue to be self-sufficient in egg production, but slowly lose its broiler industry. The size of the dairy herd will be unchanged, however, consumer pressure will result in improved cost efficiencies. This will occur primarily through the elimination of a number of small dairy operations, improved breeding, and general cost control. On a brighter note, the problems encountered by the early deer and elk industries will be overcome. Medical evidence will clearly demonstrate that meat from these animals is healthier. This will result in the rapid growth of this rather small industry.

THE 2000 LIVESTOCK FEED SUPPLY SYSTEM

This section describes the impact of the previous forecasts on the livestock feed supply system as it will exist in 2000.

Feed Requirements

Exhibit 5 summarizes the 2000 feed requirements by the New Brunswick livestock industry. The total feed grain requirement has increased slightly (215,000 tonnes in 1991 to 230,000 tonnes in 2000). As mentioned above, the industry is evolving such that there will be few producers, however, the operations are getting much larger.

Exhibit 5

2000 Estimates of Grain Consumption (Tonnes)

Livestock	Grain Consumption
Beef Cattle	20,000
Dairy Cattle	75,000
Sheep and Lambs	1,000
Hogs	65,000
Layers	20,000
Broilers	35,000
Turkeys	4,000
Deer, Elk etc.	10,000
TOTAL	**230,000**

The total protein requirements will also increase slightly. It is estimated that 40,000 to 45,000 tonnes of soybean and canola meal will be required.

Sources of Supply

Exhibit 6 summarizes the estimated sources of supply. Maritime grown sources will account for 42 percent of the supply (mostly barley and oats), Ontario and Quebec will supply 30 percent (corn), the prairies 28 percent (mostly barley and oats).

Exhibit 6

2000 New Brunswick Livestock Feed Supply by Source (Tonnes)

Crop	New Brunswick	Quebec/ Ontario	Prairies	Other	Total
Wheat	18,000		17,000		35,000
Oats	33,000		2,000		35,000
Barley	50,000		30,000	10,000	90,000
Corn		54,000		16,000	70,000
Soybean/ Canola Meal		10,000		35,000	45,000
TOTAL	**101,000**	**64,000**	**49,000**	**61,000**	**275,000**

The sources of supply will experience some subtle but significant changes. The most significant change will be the increase in local production of wheat, oats, and barley. The other major change will be the sourcing of feed grains outside Canada. A number of the large hog and poultry producers will develop a new feed buying cooperative. The cooperative will generally use the traditional Canadian sources of feed grains as they will continue to be cost competitive. However, there will be occasions where U.S. sources will be cheaper. Two small shipments of barley and two of corn will be made through the Port of Saint John's bulk terminal in 2000. These will be "one shot" deals set up by a broker. These grain movements will occur primarily because of the need for backhaul movements for vessels loading bulk commodities in Saint John. The relatively small shipments, in marine transportation terms, represent very large shipments for the livestock industry and result in considerable risk. However, after deducting storage and carrying charges, producers will save $7 per tonne.

Cost

World grain and protein prices will continue to experience great volatility. However, on whole, purchase prices will increase 5 to 10 percent over the decade due to reduced government price support programs everywhere. Transportation costs will decrease slightly. While input prices such as fuel, wages and equipment will increase, these will more than be offset by efficiency improvements such as fuel efficiency, larger payloads, improved roads, and equipment reliability and longevity.

In summary, the New Brunswick livestock industry will be able to maintain its competitive position relative to feed costs despite the loss of the Feed Freight Assistance subsidy.

SUMMARY AND CONCLUSIONS

1. The New Brunswick livestock industry will respond to increasing competition and reduced government support by forming larger more efficient operations and pursuing every cost saving opportunity.

2. Governments' shift away from direct subsidies in favour of provision of infrastructure and reduced regulations will result in a more efficient agriculture industry served by a more efficient transportation system.

3. In 1991, the major impediments to lower livestock feed in New Brunswick were thought to be tariff and non-tariff barriers on foreign feed grains. The elimination of these barriers will not result in a major change in feed grain sourcing. However, the greater choice of potential feed sources will be effective in maintaining competition throughout the supply system.

ENDNOTES

1. ADI Limited, New Brunswick Livestock Feed Supply Alternative Study Final Report, October 1991.

2. The coasting trade is the transportation of goods by water from one Canadian point to another.

RAILROAD REGULATION IN THE COMPETITIVENESS ERA

by Eugene M. Ludwick [1]

INTRODUCTION

With ever-declining or negative returns, increasing foreign competition, changing consumption patterns, and pervasive government regulation in many aspects of business, one must wonder why firms are in business at all. Adam Smith explained the entrepreneur's motivation over 200 years ago and commented on how the arrangement seemed to work out in the best interests of society:[2]

> "Every individual is constantly exerting himself to find out the most advantageous employment for whatever capital he can command. It is his own advantage, indeed, and not that of society, which he has in view. But the study of his own advantage naturally, or rather necessarily leads him to prefer that employment which is most advantageous to society."

More recently, free enterprise thinker and renowned University of Chicago economics professor Milton Friedman tells us that the pursuit of self-interest or maximum profits is still, as in Adam Smith's day, the most logical and efficient way to run a business and the only way to preserve a free society:

> "Few trends could so thoroughly undermine the very foundations of our free society as the acceptance by corporate officials of a social responsibility other than to make as much money for their stockholders as possible."[3]

The study of how firms organize themselves to make as much money as possible by competing in the market place and making investment, production and pricing decisions is known as industrial organization economics (IO). IO as a subdiscipline of economics began in earnest in the 1950s with the work of Harvard University professor Joe Bain[4] who pioneered IO by developing the "structure-conduct-performance" paradigm. The paradigm basically states that an industry's market structure determines the conduct of the industry's firms, and that the firms' conduct in turn determines their performance. The principal elements of market structure include the number of firms or sellers in the market, the extent to which their products are different from each other, the degree of vertical integration with suppliers and distributors, etc. Conduct relates to price levels, research and development, investment, advertising and other strategies used to gain market share. Performance which results from market structure and the conduct of firms is discussed in terms of efficiency, ratio of price to marginal cost, product variety, innovation rate, profits and distribution.[5]

The key factor which guides public policy makers in deciding whether or not to

regulate is structure. To understand how IO and resultant competition policy have treated railroading, the four basic market structures that economists work with in their analyses, ranging from the greatest to least degree of competition, are described:

1. Perfect Competition - The products of the very large number of firms in this structure are identical and perfectly substitutable. All buyers and sellers possess complete information about prevailing supply and demand conditions which are the only determinants of price and production. No one buyer or seller is large enough to influence prices and anybody can get into or out of the business freely without major financial penalty.

2. Monopolistic Competition - The main distinction between monopolistic and perfect competition is that firms can differentiate their products from one another just enough for buyers to prefer one firm's product or service over another - consumers must make price/quality trade-offs in their purchasing decisions. An element of monopoly is introduced because through product differentiation, a firm may have temporary influence over market share and profit levels. New competitors see opportunities to enter the business profitably, drive up supply and the downward pressure on prices returns profits back to normal levels.

3. Oligopoly - Key features of the market structure that characterizes much of North American industry are control of the market by a small number of fiercely competitive firms and significant artificial and/or natural barriers to entering the industry. Examples of oligopoly structures include automobiles, appliances, and soft drinks among consumer goods, metals and chemicals among industrial goods and, among services, banking, grain handling and rail transport.

4. Monopoly - A pure monopoly is said to exist where there are no competitors - i.e., effectively, there are no substitutes for the goods or services produced. In these circumstances, the monopolist has the ability to charge whatever it wants (at arbitrarily high prices which economists sometimes call "economic rent") and earn outrageously high (supra-normal) profits.

RAIL REGULATION: ECONOMIC THEORY AND PRACTICE [6]

A long standing given in economics has been that the public interest is best served when there is as much competition as possible; the most desirable market structure is one which is as near as possible to perfect competition. However, most markets, indeed most of private business, are characterized by departures from perfect competition (i.e. "market imperfections") and in varying degrees such departures have been viewed as threats to the public interest. Therefore, an important preoccupation of economists and public policy makers has related to their need to harmonize the behaviour of private business with the public interest. In most cases competition, market forces and antitrust laws are sufficient. However, where monopoly elements interfere with the normal working of competitive markets, firms or industries have been designated as public utilities or public policy instruments and have been subjected to surveillance, regulation and manipulation by a governmental regulatory agency. Generally speaking, the primary concern of public utility regulators is the level and structure of prices or rates charged. Moreover, economic regulation often covers other

matters such as entry and exit from the industry, mergers and acquisitions, the quality and quantity of service provided, the financial condition of the regulated firm or industry and even accounting practices.

Governments throughout Canada and the United States have one or several special agencies with regulatory authority over public utilities such as electric power corporations, gas distribution companies, telecommunications firms and various types of transportation services. In the case of transportation, federal governments are charged with the regulation of airlines, national railways and, to a degree, inter-state/province motor carriers. Canadian provinces in varying degrees are responsible for the regulation of intraprovincial motor transportation (truck and bus) and lately appear to have become responsible for regulating intraprovincial railways.[7] Municipal governments are concerned with regulation of urban public transportation systems.

The first steps to regulate monopolistic industries and firms of any kind in North America was in the 1830s when several states established railway commissions, which increased in number throughout the 1800s. In the United States, the first major federal incursion into public utility regulation was the creation of the Interstate Commerce Commission in 1887 to regulate that nation's railroads. The federal government has regulated Canada's national railway system at least as early as 1888 when the Railway Act of Canada was passed. Federal regulation of transportation expanded to ocean (in some countries) and air transport in the next century and eventually to motor carriers with the development of automotive technology and highways.

As the North American economy and associated transportation modes and services not only evolved but matured, particularly in the second half of the twentieth century, the need for economic regulation of transportation modes was becoming less evident. For example, the widespread availability of faster and more convenient trucking services compared to rail transport at similar if not more competitive rates substantially mitigated the monopolistic features of railway transport. Further, trucking's impact on railway volumes and viability lead to rationalization and concentration to a point where, at least in the United States, railways no longer required protection from ruinous rate competition among themselves. In the 1960s and 1970s, the increasing abundance of competition in motor transport coupled with the U.S. railways' financial difficulties requiring them to become more and more specialized lead to a revisitation in many circles of the notion that transportation modes should be viewed as public utilities.

Owing to major railroad insolvencies in the 1960s and 1970s and culminating with the passage by the United States Congress of several pieces of railroad legislation (most notable of which were the Railroad Revitalization and Regulatory Reform ('4R') Act of 1976 and the Staggers Act in 1980), old laws and regulations protecting both shippers and carriers were replaced with new legislation emphasizing market forces (i.e., competition rather than governmental agencies) as the appropriate regulator of business conduct. This effectively ended an era where railway companies were viewed as public utilities which needed to be controlled as a matter of the public interest moving more toward the concept that railways and other transportation companies are much the same as any other type of enterprise. In the second half of the 1980s, Canada moved towards a harmonization of its transportation regulatory regime with that of the United States by passing the National Transportation Act, 1987. However, while moving in a direction which relies more than previously upon market forces to reconcile

the interests of railroads with those of the shipping public, a number of the new and innovative measures invoked to give shippers greater access to competitive alternatives have served to limit competition by artificially constraining the ability of new and current railway entrepreneurs from getting into and out of the business.[8]

The Rationale for Regulating Certain Industries

Generally speaking, industries subjected to public regulation are those which are considered to have important "public interest" characteristics. An argument can be made to regulate practically any industry on the grounds that it has public interest ramifications. However, the electric power, gas transmission, telecommunications and transportation industries at one time shared certain characteristics which historically made them prime targets for regulation.

The most obvious of such characteristics as flagged by market structure is that these industries tended to be **natural monopolies**, natural oligopolies or simply monopolistic. What distinguishes these industries and firms from their non-regulated counterparts is their size. The **minimum optimal scale of production is so large** that there is room in a given market for only one or a few firms to be able to achieve all production and distribution scale economies. For such firms, the long run unit cost function continuously declines out to a volume of output which can more than saturate demand. A single firm (i.e., monopolist) therefore can enjoy much lower costs (and be forced by regulators to charge lower rates) than can an industry composed of a number of smaller scale competing firms. Regulation is imposed to ensure that the cost advantage of size can be secured without the risk of rates increasing to exploitive levels.

In railway transport, the tendency toward natural monopoly historically could be attributed to the indivisibility of the infrastructure and the perceived safety risk of allowing more than a single railway to operate on a set of tracks. Coming back to the idea of scale economies, huge volumes of freight can be carried before it becomes necessary to duplicate capital investment in right-of-way.

A second reason for regulating certain industries is that, in the absence of regulation, their **cost structures could lead to pricing practices considered detrimental to the public interest**. Typical regulated industries can employ nearly four times as much capital per dollar of sales than would the average industry which uses the public utility's goods or services. The implication of this high capital intensity is that fixed costs are high in relation to variable costs in situations where the firm is running under capacity. In such situations, if any degree of competition existed, potentially "ruinous" price cutting could occur unless it was prevented by a regulatory body.

Once governments decided they had to regulate utilities, they had to figure out a way to assess prices. "Social welfare/general equilibrium" economics was in its infancy in the early stages of public utility regulation and had little or no place in public policy debates. As the "science" developed and as economists were asked increasingly to assist in the determination of "just and reasonable" rate levels, the view that **utility prices should be equal to marginal cost for the purpose of maximizing social welfare** gained widespread support. Moreover, in practice, marginal cost pricing yielded persistent losses in the case of natural monopolies[9] with the result that such companies had an impossible time obtaining from investors the capital required to establish, operate and expand.

The regulators' problem then became one of finding price (rate) determination theories and formulas which would assure "fair" prices to customers and adequate returns to utilities. One solution was to use marginal cost pricing but to compensate the utilities for their losses through government subsidization. Another way for regulators to get around the dilemma was price discrimination. That is, at least for products and services where demand is somewhat elastic, it may be possible to obtain higher prices from affluent customers while selling to buyers on the margin at a price approximating marginal cost. Despite the efforts of public utility regulation to prevent price discrimination of a kind which would result in some shippers paying more for moving the same goods over shorter distances than would some of their competitors, rail (and later motor) carriers discovered that they would not be challenged if they charged different rates because the goods being hauled were "different". Thus, in the past, rail rates were often based on what the market would bear. Firms shipping high-valued goods historically have paid more both in absolute dollars and in relation to marginal cost than firms shipping low valued commodities. In Canada and the US, so-called value of service pricing was sanctioned by the Interstate Commerce Commission and the Canadian Transport Commission. This disguised "whatever-the-market-will-bear" philosophy served regulators and those regulated well for many years until the deregulation movement arose in the 1970s and 1980s.

Regulators have always faced the dichotomy between the problem of rate levels (i.e., the relationship between utilities' costs and the prices charged to customers) and the problem of the rate structure (i.e., the extent to which rates are uniform or discriminatory). These two problems were among the most contentious and cumbersome facing regulators. Once a regulatory body became involved in serious economic regulation it must of necessity become involved in the issue of fair return on fair value, the problem of regulated firms' abilities to attract sufficient new capital, incentives for cost control, optimal capital intensity and a host of other economic issues.

In summary, once an industry (such as the railway industry) became the subject of regulation, the regulator became involved and exerted its influence, if not control, over every conceivable activity of the regulated firm/industry. What were started up as ordinary business investments became public policy instruments. These in turn often became public and political playthings with the unfortunate result that in 1993 people still cannot seem to shake the notion that a regulated firm or industry is theirs to manipulate, even if the reasons for which regulation was initiated have long since disappeared or ceased to have validity.

THE NEW COMPETITIVE DYNAMICS OF THE RAILWAY TRANSPORT BUSINESS

While the regulation of railways served a purpose years ago, the business world in which railways and their customers compete today is vastly different from the days when the North American economy was developing and railways' task was to open up new frontiers. Gone are the days when a firm's competitors were located across the street, upstate or even on the other side of the country. Similarly, gone are the days when railroad owners could determine through the rates they charged whether a factory in one town could compete against a similar factory in another state or province. Long gone are the days when railroads were the only available means of transportation.

In the economy of the 1990s and beyond, competitive quality and price can only be achieved through strategic partnerships with teams of suppliers that a producer can trust. Pricing transport services at monopolistic levels or providing less than superlative quality means loss of income either through removal from the "team" (by being substituted for another carrier or combination of modes and carriers) or by causing the

team to be uncompetitive, resulting in the loss of income for all involved.

The removal or reduction of trade barriers around the world means that today's competitors often are not located in the same country. The competitive dynamics of trade and transportation have become global. The Toronto widget manufacturer has now become the sole Canadian-based widget manufacturer who must compete with the American, Japanese and German widget manufacturers to supply widgets to some developing country which is trying to get its own infant widget industry off the ground.

James Gillies, Dean of York University's Faculty of Administrative Studies, summarizes some of the changes which have occurred in the last decade: "The central fact of economic activity in the world is that the institutional changes which have taken place in the past decade or so ... combined with the great technological changes in transportation and communication, have created one single place in which to do business - the world ... With the exception of agricultural products and a few other goods and services, there are no longer any highly-protected markets. The obvious and already apparent consequence of this change is the development of true global competition for most products and services. And those firms which can produce products at the lowest possible price will survive; those that cannot will not."[10]

Producing at the lowest possible price however is still no guarantee of success if quality standards are not met or exceeded. The Conference Board of Canada also pointed out recently that the international competitive playing field has widened significantly and companies around the world are re-evaluating the way they operate and what it takes to be successful. "The challenge for business, government, labour and education is to manage the organization so that all its employees and its total resources can satisfy customers better than the competition... Today's customers demand quality in the actual "product", in the delivery of the product, and in all their dealings with their supplying organizations."[11]

In a recent study[12] on the contribution that transportation makes to their company's global competitiveness, senior executive commentators from some of Canada's largest firms (annual sales over $1 billion) highlighted the role that railways are expected to play in this environment. To quote two of them:

> "In this highly competitive world, we need to be able to structure deals with our customers where products are delivered on time, damage free and at a competitive cost. We need to make strategic alliances with our carriers so they can help us satisfy our customers from a total quality point of view."
>
> "Customers demand quality and every link in the supply chain must be driven by quality. In order to provide quality, we and all of our suppliers including carriers must step up to the challenge by becoming more efficient. If Canada cannot supply total quality, our competitors will. In our industry, our products are becoming so similar that it is only possible to distinguish between quality of service, so transportation effectively becomes the key."

Since the mid-1970s the world supply of bulk resources such as metals, forest

products and petrochemicals has increased tremendously relative to demand, and price competition has intensified. Bulk resources are what railroads excel at hauling and these commodities have been key contributors to railways' revenues. Railroads in Canada and the United States, (as well as the major transportation suppliers of other countries) are keenly aware that the rates they charge and the services they provide must be as efficient and as economical as possible for their export shippers to succeed in global markets. Loss of business by a railroad's customers means loss of business and income to the railroad; increasingly it is in railroads' interest to help their shippers succeed. However, while railroads in the United States and major providers of transportation services in other countries have benefited from substantially reduced regulatory burdens, Canada continues to mitigate its railways' efforts to become more efficient and competitive through certain aspects of its regulatory regime.

Canada's transportation record did not escape the attention of Michael Porter, Harvard Business School professor and president of Monitor Company Inc., in his recent competitiveness audit of Canada. He notes that between 1967 and 1979 total factor productivity (TPF) growth in the Canadian rail transport industry was more than twice that of the U.S. industry, reflecting in part, Canada's less restrictive regulatory structure. However, from 1980 when the U.S deregulated extensively, to 1984, total factor productivity growth in Canada was only 1.4 percent annually, versus 4 percent in the U.S. Not surprisingly, higher prices relative to the U.S. for similar services have resulted from more aggressive U.S. deregulation, putting Canadian providers of these services at a disadvantage vis-a-vis their American competitors. Many Canadian firms have responded by routing their transport ... through the United States. Currently, about 60 percent of container shipments destined for central Canada is brought in through Washington state ports and shipped across the continent via U.S. routes. Cross-continent shipping via U.S. routes [is] a common practice in many industries ... because Canadian transportation is not competitive.[13]

International trade between Canada and other countries can be routed through American ports just as easily as American imports and exports can be routed through Canadian ports.[14] Such traffic diversions have taken place roughly coincident with the time periods mentioned by Porter. Presently, the relative competitiveness of the Canadian versus American surface and port transportation systems is such that responsible Canadian exporters find themselves more frequently choosing routings and carriers which minimize the involvement of Canadian services and infrastructure.

Fred Pitre, Immediate Past Chairman of the Chartered Institute of Transport, Canadian Division recognized this problem and advises: "What we Canadians must do today is become more and more competitive. Our enormous and increasing dependence on international trade leaves us no choice. Our fight is no longer just for greater prosperity, but for survival as a developed nation...Canada cannot win this economic fight without the most efficient transportation network in the world."[15]

However, what Stephen Van Houten, President of the Canadian Manufacturers' Association, says about the constraints facing Canadian manufacturers in their race to become competitive, applies equally well to the situation faced by Canada's railways:

> "Ultimately, being competitive means you getting the order instead of the other guy. It means having a busy plant, a full order

book and a productive work force. It means making a profit, providing a fair return to your shareholders and putting some money by [sic] to reinvest in new products, new processes and other innovation. It means providing satisfying, well-paying jobs for your people, and having enough money left over to pay the taxes that provide a solid economic and social infrastructure.

We have the propensity in this country to look at the economy backwards. First we define the standard of living we want, the number of jobs we wish we could have, at the wages we think we deserve, and with the social programs and benefits we take for granted. Then we load on a high level of regulation and taxation, turn to business and say, 'Get out there and compete!'

That approach just isn't realistic."[16]

It is no more realistic for railways than it is for manufacturers or resource exporters.

A MODERN PUBLIC POLICY TOWARDS RAILWAYS

New Approaches to Competition Economics

To argue that the economic theories and resultant public policies of an earlier decade or generation are inappropriate for today's economy is not to state that such theories and policies were inappropriate in their own time. Joseph Schumpeter, late renowned Harvard University economics professor, was a leading proponent of the view that just as the manifestations of competition undergo constant change, so does our study and understanding of them. Moreover, what has not really changed over time is man's psychological reaction to competition: "[competition] acts not only when in being but also when it is merely an ever-present threat. It disciplines before it attacks. The businessman feels himself to be in a competitive situation even if he is alone in his field. In many cases, though not in all, this will in the long run enforce behaviour very similar to the perfectly competitive pattern."[17]

Without necessarily imputing any psychological motives to entrepreneurs' actions, John Clark also saw competition as a dynamic process.[18] He postulated that the evolving competitive dynamics of an industry ultimately would result in prices and costs that would obtain in a market structure of perfect competition. Industries where such results were possible Clark referred to as "workably competitive." Other economic thinkers built on the theme of workable competition in an attempt to explain the conduct and resulting performance of industries deserving (or not) of public policy makers' attention. The progress of economists' thinking on the dynamics of competition especially as it relates to railroads is traced well by Edward Fitzsimmons in his 1987 article[19] in which he concludes that railroads can compete with one another in a way that serves the public interest. Most importantly, Fitzsimmons poses the question we alluded to earlier - if workable competition can be maintained, do workably competitive industries like railroading require continuing economic regulation?

A more recent breakthrough or uprising, as it is referred to by Princeton University economics professor William Baumol[20], in the analysis of competitive market

structures and the need for public utility style economic regulation is due to Baumol, Panzar and Willig who put together their theory of "contestable markets" in 1982.[21] The fundamental tenet of the analysis is that two firms can be enough to guarantee optimal competitive behaviour. The analysis generalizes the concept of a perfectly competitive market to one the authors call a "perfectly contestable market". The perfectly contestable market is characterized by optimal behaviour and yet applies to the full range of industry structures including perfect competition, monopolistic competition, monopoly and oligopoly. It is not so important that an actual competitor exists; the threat of "potential competition" or the possibility of "hit-and-run" entry will suffice to make the existing firm or firms in an industry charge competitive prices.

Some of the more important conclusions of the theory are:[22]

- A contestable market is one into which entry is free and exit is costless in the sense that the entrant suffers no disadvantage in the eyes of customers relative to the incumbent(s) and the profitability of entry can be evaluated on the basis of pre-entry prices.

- A contestable market never offers more than a normal rate of profit even if the market is oligopolistic or monopolistic because if profits are too high, the entrant can produce the same level of output as the incumbent at the same cost but charge slightly less and still earn a profit. In a perfectly contestable market, any excessive profits earned by an incumbent become the earnings opportunity or target for an entrant who will hit and, if necessary, run as Baumol says "....counting his temporary but supernormal profits all the way to the bank".

- Price must always be at least equal to marginal cost - a concern of competition and regulation economics. No cross-subsidy is possible and therefore no predatory pricing can be used as a weapon of unfair competition.

Of all of the conditions and findings of market contestability theory, the most critical is the freedom to exit the industry which is the only way to attract entry. In other words, if a prospective entrant cannot leave the industry as easily as he entered it, he will never enter it or "contest" it. Prospective new entrants must be able to leave the industry without impediment and in the exit process recoup any costs incurred in the entry process. That is, as long as the interloper can sell or reuse all capital without loss other than normal wear and depreciation, risks associated with entry are eliminated; entry will occur as long as pre-entry profits are satisfactory and it is possible to get out when price retaliation results in price declines. This is a disturbing result for policy makers who continue to insist that exit from the railway business - also known as system rationalization or line abandonment is detrimental to society. In most other industries, firms have the ability to open or shut stores (or plants, mines, mills, offices, etc.) on the basis of their current and expected future profitability, that is to enter and exit freely. Firms make these kinds of decisions to help them stay competitive and profitable, rather than to manifest power conferred by any particular market structure.

How does the monopolist or oligopolist incumbent prevent entry? "...they can only do so by behaving virtuously, that is, by offering to consumers the benefits that competition would otherwise bring. For every deviation from good behaviour instantly makes them vulnerable to hit-and-run entry."[23] The American railroad regulatory

regime inherently recognizes the merits of potential competition in that the modern rate-making powers of the Interstate Commerce Commission extend only to those situations where "market dominance" occurs. "Rate ceilings are designed to ensure that consumers (shippers) pay no more for a service than if the service were supplied competitively. Rate floors are designed to prevent cross-subsidies by reflecting the same economic incremental costs that would set the floors on competitive rates. In between these floors and ceilings, railroads are generally free to select their own rates based on their assessment of market demand."[24] The ICC calls this arrangement "constrained market pricing". Relying on the theory of contestable markets, the idea is to set rates only in cases where no competitive alternative is available at levels which simulate the presence of an alternative.

Where Canada's railway regulatory legislation differs substantially, is that regardless of the availability of inter- and intra-modal alternatives in a given market, several legal venues exist to force a railway to give the shipper the deal he wants. These include final offer arbitration, public interest investigations, competitive line rates and joint running rights. In the terms used in contestable markets theory, what Canada offers shippers is: the ability to challenge a railway's rate even if competitive alternatives exist; through 'competitive line rates', a non-reciprocal Canadian Government-sponsored mechanism for American railroads to compete with an incumbent railway on a 'hit-and-run' basis; and, constraints imposed only on incumbents from exiting the industry.

The implications of the approach to the competitive behaviour of firms on antitrust/competition policy and governments' approach to regulation as pointed out by Baumol, Willig and Panzar are startling.[25] The notion that potential competition (or the threat of hit and run entry) results in beneficial corporate behaviour "tells us that a history of absence of entry in an industry and a high concentration index may be signs of virtue and not of vice[26]...and, then, efforts to change market structure must be regarded as mischievous and antisocial in their effects. A second more obvious conclusion is the questionable desirability of artificial impediments to entry, such as regulators were long inclined to impose...Thus we must reject as perverse the propensity of regulators to resist the closing down of unprofitable lines of activity."

The applicability of these findings to the railroad industry was readily apparent to authors Willig and Baumol who noted the progress made by U.S. railroads since regulatory reform in that country. "Returns to capital have risen and investment has responded, arresting deterioration in railroad capital and service quality. This has been made possible by eliminating many of the destructive regulations that controlled the railroad industry during this century and by reforming the regulations that remain... The new regulatory regime has produced a renaissance of the railroads in terms of their physical condition, their market orientation, and their ability to serve the freight transportation needs and the demands of the public... Increasingly, a railroad's commercial success is determined by its skill in marketing and operations rather than its skill in manipulating regulation."[27]

The railroad industry has evolved dramatically in a century and a half from one characterized by oligopoly or, in certain markets, monopoly to one in which competition abounds because substitutes have become amply available . First and most obvious is truck competition whose economic range has extended to distances long thought to be within the exclusive domain of rail transport. This is especially true for high value

added manufactured goods. Much greater use has also been made of intermodal competition, specifically, COFC (container on Flat Car) and TOFC (Trailer on Flat Car) whereby intermediaries buy railway flat car space wholesale and retail it back to shippers. Regulatory reform in the 1980s to a large degree was made possible by the realization that shippers had come to have numerous options to rail transport. Another phenomenon which has encouraged good competitive behaviour by railroads is the increasing concentration of their customer industries through merger and acquisition. Firms who use railway services to any major degree often have many plants or production facilities and reasonable freight rates for one apparently captive location can be secured by using the leverage of withholding or awarding freight at other locations where transportation alternatives are more abundant.[28]

As concerns competition between railroads, examples of shippers creating competitive alternatives also abound. In several cases, companies shipping bulk liquids who are served by a single railway have constructed pipelines over short distances to access a competing railway. Certain American railroads have been very aggressive in soliciting Canadian traffic to originate by truck or even barge in order to access their systems for furtherance of goods into U.S. markets or ports. Thus increasingly in the last 5 to 10 years, it has been possible to observe new types and levels of intra/intermodal competition which ideally fits Baumol's hit and run competition scenario: that is, accessing an alternative competing railroad by using another mode for the short haul to/from the competing carrier's system and in Canada's case, by the regulatory body threatening to hand over the lion's share of a long haul rate to an American or the competing Canadian carrier.[29]

Apart from the artificial ones (i.e., those forced by the regulatory body in Canada), these kinds of alternatives can only emerge as long as there is no collusive behaviour among railroads. In a collusive live-and-let-live environment, these kinds of alternatives would not emerge as they dampen supernormal profits in the absence of regulation. In the circumstances of global trade, the interesting question which industrial organization economists must address by such behaviour is - what is the industry? Is it the railroad industry in Canada or America? Is it the railroad industry in Canada and America? Is it the sum total of all transportation suppliers in all modes and/or using various combinations of modes in either or both of the two countries? Is it the sum total of all transportation suppliers in all modes and/or using various combinations of modes in any country or regional grouping of countries from which a bid for the supply of a commodity or finished good may emanate? The answer to this question may be found in the earlier observation that a firm no longer competes with a producer of a like product across the street or on the other side of the country; competition can come from anywhere in the world. To the extent that transportation is nothing more than a factor input to the production of such products, we can say that freight transportation in all its manifestations and dimensions is a global commodity itself. Viewed in that context, it has become all the more critical for transportation suppliers of all kinds everywhere in the world to govern themselves in a competitive manner.

A final comment on entry, exit, transportation alternatives and modern approaches to economic regulation deals with short line railroads. These have been a prominent feature of the rail landscape in the US for many years but are very few in number in Canada. Moreover, as short line railways re-emerge in Canada and as these small railways become released from Canadian federal control into the regulatory

jurisdiction of provincial governments, provinces are modernizing their archaic railway legislation. Because the evolution of federal rail regulation in Canada has been a continuous activity for years, public policy makers have come to consider the regulation of railroads to be as natural as breathing air or paying taxes. However, provincial governments' need to become involved again in the regulation of in-province railways (after an absence of over 60 years in some jurisdictions) raises the important question of whether today's new provincial railway enterprises bear a resemblance to their historical forebears strong enough to treat them like public utilities such as the power and telecommunications monopolies. Before a province passes new (or updates old) legislation it should be asking whether the economic world in which modern railways operate bears any resemblance to the conditions that prevailed when economic regulation, railway acts and regulatory bodies were deemed necessary.

Protecting the Public Interest in the Competitiveness Era

As discussed earlier, the United States has recognized that the public interest and indeed the national economy are best served by a railroad (and other transportation) industry that is as efficient and competitive as possible; this result was considered most likely to occur when the business behaviour of railroads and their customers was governed by the forces of supply and demand. Assuming that the goal is a transportation system that gets shippers' goods to market reliably, efficiently and cost-effectively, the American approach to deregulation seems to have worked. While Canada also has moved forward with its own regulatory reforms, as Canadian exporters are struggling to become competitive in global markets, it is obvious that Canada's archaic views on the role of railways and the public interest, national unity, regional development etc... are restraining railways from becoming efficient and competitive .

Michael Porter observes that Canada's use of transportation as a policy instrument or political tool has not been supportive of the country's global competitiveness. "Regional politics and historical patterns of development have resulted in a plethora of hidden subsidies to the transport sector in Canada. The continued use of both direct and indirect subsidies, together with the inconsistent application of cost recovery programs, has distorted inter-modal competition. These distortions undermine the overall efficiency and productivity of the Canadian transportation system and the industries that rely on it." [30]

From the perspective of major shippers, industries which rely on railway transportation realize that their global competitiveness depends not only on deregulated pricing structures but also upon deregulated railway cost structures from which Canadians were shielded in the 1987 National Transportation Act. The following quotations from some of Canada's key global exporters illustrate the point:[31]

> "We support the railways' freedom to manage. They should be getting rid of branch lines but have not been abandoning their four percent allowed limit because of the legal, bureaucratic and political constraints. If Canadian industry is going to be competitive, the railways that serve them must be as efficient, well managed and competitive as possible."
>
> "Viable shippers on viable lines indirectly pay for the railways having to pay for administrative and overhead costs due to uneconomic and even

unused branch lines...If Canadian railways are to be competitive, they must be given the freedom to manage their assets and operations."

"The main impediment stopping railways from becoming cost-competitive are political forces such as cross-subsidization, [and] imposed but uncompensated obligations to keep open lines which the regulator does, but railways do not, consider to be uneconomic..."

"We want a transportation system that will offer competitive rates and that at the same time will give the railways a big enough return that will make them want to haul our traffic and keep their systems in good shape. The only way this can be done is to allow the railways to speed up line rationalization."

Although it is hard to believe in this age of high technology and a service economy, Canadians' fixation with the retention of even unused branch lines relates back to the pioneering notion that railway transportation is the key to regional economic development. This should really be the subject of another paper but three points are in order. First, having conducted large-scale surveys of manufacturers on transportation topics for over 18 years, we have observed that the relationship between regional economic development and transportation (of any kind, let alone rail) has been dissipating for some time. Second, companies who can present grounds to blame their poor financial performance on transportation costs can be discovered to have erred when making their production location decisions or to have used an erroneous set of assumptions. Finally, it should be recalled that transportation, often called a derived demand good, really is nothing more than an input of production whose cost can be relatively minor compared to that of other inputs. [32]

Maureen Melville, President of the Western Transportation Advisory Council, points outs the challenge faced by transportation policy makers in Canada:[33]

"You face the challenge of trying to reconcile two apparently incompatible goals that have always existed in formulating transportation policy in Canada. One is to have the transport system operate to promote regional, social and political ends, and the other is to have an economically efficient and viable system."

We submit that responding to this dubious challenge instead of recognizing that we have painted ourselves into a corner of political rhetoric is holding Canada back from getting on with the job of making rail transportation-reliant industry globally competitive.

Further to the views expressed by senior managers concerning the contribution that transportation makes to their global competitiveness, the need to reexamine our impositions upon the railway industry also comes from other important sources:

"The CMA supports the right of railways to discontinue non-profitable line operations. Railways have stated concerns about remaining rigidity, scope and delays in the existing abandonment process. The CMA supports an examination of those claims in order to make the abandonment process more efficient. We also support the operation of

short line railways providing very specific regional needs." [34]

"Political intervention in the area of taxes and the operation of low-density trackage is considered to be critical in improving the competitiveness of Canadian railroads."[35]

It is highly unlikely that a Canadian railway will be allowed to shut down a line if it is felt that current or hypothetical future industry on that line might be negatively affected. However, no government to our knowledge has ever ordered an uneconomic factory to stay open on the grounds that the traffic loss will adversely affect a railway. More likely, governments at all levels will continue to tax railways shamelessly because they know that the railways are unable to pick up their tracks and leave.

CONCLUDING REMARKS

We have attempted to explain why railroads were considered so different and special from a competition policy point of view in the last century and we have argued that the economic rationale for constraining railways no longer holds. The trap that policy makers historically had fallen into, and in which Canadian policy makers are still held by at least one leg, is to believe that promoting inefficiency in one sector of the economy - rail transportation - will somehow lead to the success of other sectors. The truth is that a country's economic and ultimately social survival depends on all industries being as efficient and competitive as they possibly can.

Perhaps in deference to his sceptical regulation-oriented colleagues, Baumol allows that "where competition is not effective, there is likely to be a role for regulation."[36] The difficulty with this conclusion is that it ignores the definition of what constitutes the industry in favour of capitulating to those who remain convinced that government regulation can solve all of our problems. Perhaps a more appropriate definition of an industry is by market - i.e., an industry is constituted by the sum total of all incumbent and potential players in a given market.

When do we or at least should we regulate? We regulate when we have a competition problem. So where we do not have a problem, let us not regulate. If the competitive playing field is the world, is it appropriate to legally force railroads to ensure that firms who have made what turned out to be uncompetitive location decisions are kept artificially competitive in saturated markets? A positive answer to this question is possible only in the minds of those who argue that the availability (but not necessarily the use) of rail transportation is the "make or break" determinant of a firm's or industry's competitiveness. In this shrinking world of international trade agreements, if a government wants to make a certain industry artificially viable and the railroads and the industry cannot come to terms, let that government subsidize the industry directly and wait for the reaction of the trade tribunals of the world.

In considering how we should deal with railroads, let us not forget that a substantial body of competition policy exists to regulate all business and that it is available to effectively regulate railways. As an example, the Canadian Manufacturers Association points out that: "Compensatory rates have become a fixture in railway pricing. The main reason for the provision of compensatory pricing is to counteract predatory pricing, particularly in a duopoly. Since predatory pricing is protected against

in the Competition Act, it is questionable whether compensatory pricing should continue to exist in legislation. Its use is certainly unique to the rail transportation industry."[37]

Competition or antitrust legislation should be sufficient to ensure that railroads live up to what we expect of businesses of all kinds. If the goal is competition, one must ask, what makes formal economic regulation more effective than antitrust legislation? Stated another way, what is it about railroads today that makes them worthy of formal economic regulation rather than being subjected to antitrust/competition laws as are their customers. Economists and policy makers have devoted a great deal of attention to finding effective ways to regulate transport...maybe the time has come to devote our efforts and governmental resources to other activities. Where competitive alternatives exist, let us not burden railroads, and ultimately their customers, with public policy objectives beyond those required of any other industry.

END NOTES

1. Eugene M. Ludwick is president of E. M. Ludwick & Associates Inc., a management consulting firm specializing in trade and transportation based in Alberta.

2. Adam Smith, An Inquiry into the Nature and Causes of the Wealth of Nations, 1776.

3. Milton Friedman, Capitalism and Freedom, Chicago, 1962, p.133.

4. See J. Bain, "Economies of Scale, Concentration and Entry" in American Economic Review, Vol. 44, p. 15-39, 1954 and J. Bain, Barriers to New Competition, Harvard University Press, Cambridge, Mass. 1956.

5. More detailed descriptions of the structure-conduct-performance paradigm and of IO economics can be found in: Jean Tirole, The Theory of Industrial Organization, The MIT Press, Cambridge, Mass. 1989.

6. A review of these principles is found in "Public Regulation in Theory and Practice" in Frederic Scherer, Industrial Market Structure and Economic Market Performance. Rand McNally & Chicago, 1973.

7. State regulation of railroads effectively is prohibited. See USDC Southern District of West Virginia, Association of American Railroads versus West Virginia Senate (re Bill 278) June 1986.

8. As is discussed later in this paper, even though a new competitor sees a potential to earn profit, he will not enter if it is too costly due to sunk investment costs or too onerous due to regulatory prohibitions or impediments to exit the industry or market.

9. In most utilities, fixed costs are very high and marginal costs are continuously declining with the result that average variable costs are higher than marginal costs for all or the better part of production.

10. James Gillies, Introduction to "Creating a Competitive Canada", in Inside Guide, December 1991, Volume 5, number 6, Toronto, Ontario, p.7-9.

11. Canada Awards for Business Excellence and The Conference Board of Canada, "Prosperity Through Quality: The Competitiveness Challenge", published by Industry Science and Technology Canada, 1992.

12. E.M. Ludwick & Associates Inc., The Route to Competitiveness: Senior Management Views on Transportation's Contribution, prepared for Industry, Science and Technology Canada, June, 1992.

13. Michael Porter, Canada at the Crossroads: The Reality of a New Competitive Environment, Monitor Company Inc. 1991. p. 157.

14. An examination of articles in the last 20 years of the papers/proceedings of the Transportation Research Forum and the Canadian Transportation Research Forum reveals a host of articles on diversion of Canadian traffic through American ports or American traffic through Canadian ports.

15. Fred Pitre, in Canada in Transit, "A Message from the Chairman", Naylor Communications, Winnipeg, Canada, 1991, p.6,7.

16. Stephen Van Houten, Introduction to "Creating a Competitive Canada: Manufacturing", in Inside Guide, December 1991, Volume 5, Number 6, Toronto, Ontario, p. 33-35.

17. Joseph A. Schumpeter, Capitalism, Socialism and Democracy, Harper and Brothers, New York, 1942.

18. J.M. Clark, "Toward a Concept of Workable Competition", American Economic Review, June 1940, p.241-256.

19. Edward Fitzsimmons, "Can Railroads Compete with Each Other" in Transportation Quarterly, Vol. 41, No.3, Eno Foundation for Transportation Inc., Westport, Connecticut, July 1987, p.365-380.

20. W. J. Baumol, "Contestable Markets: An Uprising in the Theory of Industry Structure", in American Economic Review, Address of the President of the American Economic Association December 29,1981, published March 1982, p.1-15.

21. W. Baumol, J. Panzar, and R. Willig, Contestable Markets and the Theory of Industry Structure, Harcourt Brace Jovanovich, New York, 1982.

22. For a comprehensive critique and theoretical evaluation of contestable markets theory as it applies to railroads see: Tye, William B., The Theory of Contestable Markets: Applications to Regulatory and Antitrust Problems in the Rail Industry, Greenwood Press, Westport, Connecticut, 1990.

23. W. Baumol. op. cit., AER, p.14.

24. Willig and Baumol, op. cit., p.33.

25. W. Baumol. op. cit., AER, p.14.

26. In a recent study of the concentration of Canadian industry, V. Dickson concludes that "in aggregate for Canadian manufacturing, price-cost margin regressions do not show that high concentration is harmful. Public policy that seeks to generally limit concentration because of collusion effects...is not supported by these results. V. Dickson, "The Relationship between Concentration and Prices and Concentration and Costs", in Applied Economics, Vol. 23 No. 1A, 1991, Chapman and Hall, London U.K., p. 101-6.

27. R. Willig and W. Baumol, "Using Competition as a Guide" in AEI Journal on Government and Society, 1987, Number 1, p.28-35.

28. The interesting corollary to this observation is that many industries served by railroads have become more concentrated than the railroad industry. This has not necessarily occurred out of a desire to engage in rent-seeking behaviour but out of the need to become efficient global scale competitors.

29. In Canada, a shipper can use the competitive access provisions of the National Transportation Act to force the originating carrier to exchange the cars at the nearest point of interchange with a competing railway in order to gain access to competitive routings and rates. There have been very few instances of the use of these provisions, but shippers maintain that their existence helps bring about more meaningful negotiations with railways than were considered possible before their implementation in January, 1988.

30. Porter, op. cit.

31. E.M. Ludwick & Associates Inc., op. cit.

32. As reported by Vivian Wei in Transportation Costs in the Production and Distribution of Canadian Goods, (Transport Canada, Ottawa, March 1991), the importance of transportation costs to total production costs varies by industry. A majority of Canadian goods-producing industries have total transportation costs accounting for less than 5 percent of the value of their outputs; for about 15 percent of industries transportation costs represent between 5 and 10 percent of total cost, and in about 7 percent of the industries, transportation costs contribute over 10 per cent of their output values.

33. President, Western Transportation Advisory Council as quoted in Louis D. Hyndman, Getting There: The Interim Report of the Royal Commission on National Passenger Transportation, Ottawa, Ont., 1991, p.203.

34. CMA, op. cit.

35. Moody's Corporate Credit Report on the Canadian National Railway Company, April 1992.

36. W. Baumol, AER.

37. CMA, op. cit.

CANADIAN TRANSPORTATION: A NATIONAL SECURITY ANALYSIS

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INTRODUCTION

> *National security is defined as the preservation of a way of life acceptable to the Canadian people and compatible with the needs and legitimate aspirations of others. It includes freedom from military attack or coercion, freedom from internal subversion and freedom from the erosion of the political, economic and social values which are essential to the quality of life in Canada.* (*Course Handbook*, National Defence College, Kingston, 1992)

National security has generally been interpreted as freedom from military attack, coercion and internal subversion. The militaristic tone of national security's traditional definition has been muted recently to reflect a need to protect all of the aspects of Canadian life. In today's increasingly turbulent economic environment, security does not necessarily mean protecting national industries from international competitive forces. Indeed in an era of increasing free-trade and open borders, such an approach is counter-productive.

This paper focuses on economic security - particularly within the transportation sector. The aspects addressed include: the significance of Canadian transportation; key developments in the global and continental economy; actions taken by governments and industry to enhance Canada's transportation competitiveness; and, appropriate government roles within an increasingly turbulent global and continental economy.

The focus on economic security rather than military security is appropriate as many analysts argue the main battle ground between the world's major nations has shifted to an economic rather than a military confrontation. Lester Thurow in his recent book on international economic conflict, *Head to Head*[1], argues the thawing of the Cold War has led the three economic superpowers of the United States, Japan and Europe into a struggle for economic supremacy. "Without a pause, the contest has shifted from being a military contest to being an economic contest."[2]

This paradigm shift from world military supremacy to economic supremacy has been reinforced recently by the U.S. Clinton administration's invigorated economic agenda:

> ... the new National Economic Council (NEC) under [Robert] Rubin will be modelled on the National Security Council and will coordinate all economic policy decisions that require Clinton's personal attention .... The

> creation of the [NEC]... is intended to put economic policy on an equal footing with national security policy within the White House.... [3]
> (emphasis added)

Growing turmoil and increasing uncertainty about the future has become the hallmark of the current industrial era. As we continue to pass through the transition into a "post-industrial" society (Toffler's *Third Wave*[4]), turbulence in the operating environments of public and private sector organizations continues to affect us. A suggested by Peter Drucker in *Managing in Turbulent Times*: "managers cannot assume that tomorrow will be an extension of today, on the contrary, they must manage for change; change as both an opportunity and a threat."[5]

Turbulence demands change in Canadian transportation firms. It is increasingly apparent that all firms must become "learning organizations", in which business is based on continual learning at every level within the system. Learning organizations are characterized by their ability to learn, to act, to glean knowledge from the outcomes of their actions, to self-correct, and to continue producing effectively in a fast-paced, changing environment. Learning organizations are constantly seeking a better fit between themselves and their environment to achieve success.[6]

Government faces difficulties maintaining the security of economic activities in a turbulent environment. Constant and unpredictable change is the pervasive feature of economic environmental turbulence. Thus seeking to secure and protect a national transportation system is fraught with danger. Protective steps such as limiting the incursion of foreign carriers, establishing non-standard regulations and non-tariff barriers aimed at supporting national industries and other similar policies often prevent indigenous firms from benefiting from external competition. As Michael Porter has suggested in *Canada at the Crossroads*[7], such protective steps leave firms ill-equipped to respond to the pressures of a rapidly changing competitive environment. Today's national economic security needs reflect the demands of effective international competition in the global and, in Canada's case, the continental, marketplace. The government's role is changing from protectionism to one of supporting a free-market economy, free trade (by reducing tariffs and other non-tariff barriers to trade), and enhancing competitiveness through actions encouraging efficiency and productivity in the Canadian transport industry.

TRANSPORTATION IN CANADA

Canada's geography and physical development dictate the importance of transportation in the nation's development. Canada is the world's second largest land mass with the majority of its population strung out in a relatively thin line along the country's southern border for a distance of more than five thousand kilometres. Serving the mobility needs of this dispersed population and its economy has resulted in an extensive and efficient transportation system. Government's involvement in transportation evolved from two main public policy thrusts - nation building and promoting regional development. The earlier initiatives to build a transcontinental railway and subsequent involvement in other transportation modes reflected a desire to bind Canada together through a national transportation network. Subsequently, the provision of adequate transportation

infrastructure was a key element in the economic development of Canada's peripheral regions. Transportation systems were essential in the nation's ability to export resource based commodities, often located in remote regions.

By the 1960's, the government reconsidered its dominant role in economic regulation and at times, management of Canada's transportation system. In 1961, the MacPherson Royal Commission on Transportation examined the railway's freight transportation system and criticized government policies that limited the railways' ability to compete with other freight transport modes - primarily trucking.[8] The Commission's findings influenced the 1967 *National Transportation Act* (NTA) - the first federal statute to encompass all modes of transportation. The 1967 NTA promoted competition between air, rail, truck and bus modes to achieve an "economic, efficient and adequate transportation system." Although the NTA provided for competition between modes, it maintained economic regulation within transport modes.

During the 1970's and 1980's, governments came under increasing pressure to reduce transportation regulations. Initial steps were taken in the U.S. with the virtual wholesale deregulation of its transportation system in the early 1980's. Canada followed the U.S. lead with a process of regulatory reform. Initially, regulatory reform focused on the air sector. This was followed by the 1987 *National Transportation Act* and companion legislation that further shifted Canadian transportation into a free-market, competitive stance.

GLOBAL AND CONTINENTAL ECONOMIC TRENDS

> *The talk today is of the 'changing world economy'. I wish to argue that the world economy is not 'changing'; it has already changed - in its foundations and in its structure - and in all probability the change is irreversible.* (Drucker, 1986)[9]

Throughout the world, economic activity is becoming more "internationalized" and, significantly, more "globalized". These two terms are not synonymous. "Internationalization" refers to the geographical spread of economic activities across national boundaries - similar to the spread of U.S. subsidiary firms into Canada in the late 19th and 20th centuries. The more recent phenomenon of "globalization" of economic activity refers to an enhanced degree of functional integration among internationally dispersed economic activities.[10] Operating on a world scale, manufacturers and others are able to take advantage of a new global division of labour. Instead of worker specialization in different parts of the production process within one plant, the production process is now spread over many countries to achieve economies from various types of labour and resource inputs with the final product being assembled in yet another country. All of this is occurring within a framework of improved technology leading to rapid increases in productivity. In effect, "the traditional international economy of traders is giving way to a world economy of international producers."[11]

Thurow contends that part of the "head to head" struggle in the 21st century will be between two different styles of capitalism: "the individualistic Anglo-Saxon British American form of capitalism is going to face off against the communitarian German and Japanese variants of capitalism."[12] North Americans tend to champion individual efforts while the Europeans and Japanese focus more on group or team effort. These differences in economic strategy will undoubtedly effect the development of the global economy.

Economic globalization has been aided by the General Agreement on Tariffs and Trade (GATT) - an international trading system established as part of the postwar world economy. The basic aims and objectives of GATT were: reduction in tariffs; prohibition of non-tariff barriers to trade; and, elimination of trade discrimination. Despite problems with specific countries acting outside of GATT, the process reduced tariffs and encouraged an increasingly free-market in world trade. In 1940, the average tariff on goods was about 40 percent; today, the average tariff is around 5 percent.[13] The economic success of nations involved in open trade attests to the success of GATT.

Developments in telecommunication and transportation reinforced the growth of global trade and economic activity. Rapid advances in communications technology including world-wide satellite systems permitting instantaneous communications are revolutionizing the international business world. Financial transactions and the flow of investment capital are being rapidly shifted from one location to another by electronic transmission. Increasingly, logistical processes involving the shipper, carrier, and consignee involve electronic data interchange (EDI) rather than slower paper exchanges for ordering and supplying goods on a global basis. Just-in-time (JIT) inventory systems, essential in today's era of minimizing production costs, would not function without effective electronic communications.

Similar revolutionary changes have occurred in the international transportation field. The widespread use of containers as a means of efficiently handling general cargo was introduced in the late 1960's. Since then, the shipping world has witnessed tremendous advances in the way cargo is handled. Purpose-built cellular container ships have become ever larger achieving economies of scale and reducing shipping costs; today, container ships have increased in size to the point where they no longer fit within the Panama Canal. These super-container ships operate in only one ocean rather than offering a round-the-world service. This constraint is justified by effective land-based intermodal rail "land-bridges" carrying containers from coast to coast.

Railways and trucking firms in North America and elsewhere adapted their equipment to handle both international and domestic containers. Technology improvements led to innovations such as double-stacked trains (DST) handling two layers of containers in specially designed, low bottom rail cars. Similar to larger container ships, DSTs achieve significant economies of scale in high volume routes. DST routes throughout the U.S., and increasingly in Canada, are attracting cargo to/from the Far East via West Coast ports rather than by the all-water route through the Panama Canal. These rapid changes have had significant impacts on Canadian and U.S. ports.[14]

TRANSPORTATION SYSTEMS IN A CONTINENTAL CONTEXT

Until the late 1970's, the transportation sectors in both the U.S. and Canada operated under strict government economic regulation. Tariffs were filed with appropriate government regulatory agencies and bureaus established to publicize rates. Competition tended to be limited to quality of service amongst transport firms rather than price. In many cases, the norm was a monopolistic system of a single supplier of transportation services in a regulated pricing environment. Such a non-market sensitive system could not survive the external pressures for competition from shippers, international carriers

and others in the global economy. Hence the U.S. and Canadian governments took steps to reduce their interventionist role in the transportation sector.

Growing continentalism in the transportation network seemingly implies a harmonization of the values and approaches in the two nations involved (and in the future, Mexico). Looking below the surface of the apparent similarity of capitalistic systems reveals differences. Canada and the U.S. are not twins. The differences between the two nations can be found in their approach to government, the economy, society, and law enforcement. These differences can often lead to misunderstandings between industrial partners in each country. This may reduce some of the benefits of joint initiatives and means that models and techniques developed in one country may not be as effective in the other.

American Deregulation

U.S. transportation systems are better postured than Canadian firms to compete in the free-market continental economy as they restructured earlier to cope with economic deregulation. In the airline industry, the U.S. government deregulated domestic air services through the *Airlines Deregulation Act* of 1978. Deregulation of the transportation industry was carried further in 1980 with the passage of the *Staggers Rail Act*, and the *Motor Carrier Act*. In 1982, the *Bus Regulatory Reform Act* further reinforced minimized government intervention in the transportation sector. This was followed by the *Shipping Act* of 1984. These transportation statutes reduced government regulation to a far greater extent than occurred with later legislative changes in Canada. As a result of these earlier changes, the U.S. carriers were forced to adapt to their markets and increase their levels of efficiency to the point where they have a distinct competitive advantage over their Canadian counterparts.[15] With the exception of the *Bus Regulatory Reform Act*, all of these legislative changes have significant effects on the continental transportation industry.

Canadian Regulatory Reform

Reacting to global and continental pressures encouraging more competitive transportation systems and following the deregulation lead in the U.S., Canada modified its domestic and international air services in 1984, published a White Paper on Transportation entitled *Freedom to Move* in 1985, and adopted reformed regulations in 1987 with the passage of the *National Transportation Act* (NTA), the *Motor Vehicle Transportation Act* (MVTA), and the *Shipping Conference Exemption Act* (SCEA). Unlike the U.S.'s approach of rapidly thrusting its transportation industry into a completely deregulated environment, Canada took a more moderate step - one of regulatory reform.

Regulatory reform is a slower evolution towards full deregulation providing Canadian industry with time to adjust. Canadian airlines were deregulated domestically while internationally negotiations continue on adopting a more liberal "open skies" bilateral agreement with the U.S. Significant changes were made to Canadian railway operations to enable effective competition with other modes including U.S. railways. Entry limitations in the trucking industry were eased and removed after a five year period. The SCEA enabled shippers to negotiate contracts directly with conference carriers.

Regulatory reform is currently under examination by the National Transportation Act Review Commission. Based on its findings, transportation legislation may be amended to either move Canada closer to a fully deregulated system or back to increased economic regulation by government. Although further deregulation is expected, there are concerns over the viability of the Canadian air industry leading to private sector calls for increased government intervention to force a reduction in domestic overcapacity.[16]

Transportation System Impacts

FTA and potentially, NAFTA have re-oriented Canada's traditional east-west transportation system increasingly into a north-south direction. Although it is still too early to determine definitive trade shifts, there is a growing recognition of regional spheres of activity, particularly in the trucking industry where triangular routings are being developed to achieve better load balances.

Regional developments in a north-south direction make more sense in a free-market economy. Canada's linear east-west routing does not lend itself readily to the more efficient hub and spoke system. The emergence of regional systems may come to resemble Joel Garreau's provocative predictions in his text, *The Nine Nations of North America*, in which Canada and the U.S. are divided into nine distinct regions in the future.[17] As trade links and transportation systems evolve under the FTA and NAFTA, some of Garreau's predictions may come to border on reality.

Canada's major railway companies have acquired trackage within the U.S. to capture some of the developing north-south trade. CP's transborder tonnage grew by 15 percent between 1987 and 1991. By 1991, 25 percent of CP's total tonnage were transborder movements.[18] In 1990, the transborder traffic by Canadian railways amounted to 23 percent of their total tonnage contributing about 21 percent of annual revenues. Further, "from the east-west and north-south traffic analysis, it is found that the transborder segment has been growing faster than domestic rail movements since 1984, especially during the 1988-1990 period."[19]

Both Canadian railways own subsidiary operations in the U.S. and both have now integrated their American operations into their North American network. For example, "Canadian Pacific has responded to these forces [FTA and deregulation] by consolidating its holding in the Soo Line, acquiring the D&H Railway, and integrating its North American operations as CP Rail System."[20] CN has established itself as CN North America by integrating its Canadian operations with its three U.S. subsidiaries. In addition, CN has entered into strategic alliances with Union Pacific, Burlington Northern, and Norfolk Southern Railways.[21]

The air mode is tied to earlier international bilateral agreements. Negotiations continue with the U.S. towards developing an open skies approach. Coastal shipping is protected by cabotage restrictions in both Canada and the U.S.

In the rail industry, harmonized standards are becoming a reality in both Canada and the U.S. Canadian railways are reaping the benefits of regulatory reform as the federal government relaxes earlier rigid rules regarding train operations. For example, Canadian railways now operate caboose-less trains, a benefit the U.S railway system enjoyed a number of years earlier. The major concern affecting the Canadian railways is the perceived unevenness in the taxation regimes of both Canada and the U.S. CN has called for a "Truly National" transportation policy. One in which the tax policies of the

federal, provincial and municipal governments would not place Canadian railways at a competitive disadvantage with respect to either Canadian and U.S. trucking or U.S railways. Further, such a national policy would recognize the true economies of all modes and allow market forces to prevail in the selection of the best mode to use. Such a policy would treat the railways like other business enterprises - with minimum government regulation.[22]

There is a need to harmonize trucking legislation across Canada as well as ensuring the provision of a level playing field with respect to taxation policies and regulations with the U.S. and in the future with Mexico.

Canadian transportation has traditionally been supported through the provision of public subsidies. While these subsidies aided in developing both infrastructure and the industry, they often biased the market place and created distortions in economic development.[23] Throughout the transportation industry various subsidies continue to effect revenue generation and operations. As an example, some subsidies in Atlantic Canada: Feed Freight Assistance; Maritime Freight Rates Act (MFRA), a subsidy to railways for the movement of goods; and, Atlantic Region Freight Assistance Act (ARFAA), a similar subsidy to trucking firms.

Other subsidies include ferry assistance and VIA passenger rail subsidies. In the latter case, VIA uses the infrastructure of the two major Canadian railways providing them with a source of operating revenue. In Western Canada, the Western Grain Transportation Act (WGTA) provides revenue to the railways for the carriage of wheat and other grains. Operators of Great Lakes shipping lines believe the WGTA is biased in favour of west-bound movements to the detriment of grain movements on the St. Lawrence Seaway leading to a decline in water-way traffic.[24] The railways are concerned about the perceived subsidy provided to their primary competitors - the trucking industry - by way of a publicly provided infrastructure - the highway.[25] To create a truly market driven, competitive transportation system, all government subsidies should be removed.

Increasingly, environmental protection is the watchword of the 1990s. Transportation systems contribute considerable pollutants to an already fouled atmosphere. Concerns for environmental economics and the problems of enforcement have plagued the NAFTA negotiations. In the U.S., concerns have been raised about the use of inter-state highways by long-haul trucking. These concerns are reflected in state highway construction referenda being defeated by the public. Environmentalists often turn to railways as a means of reducing the environmental impacts of competing transportation modes.

The Royal Commission on National Passenger Transportation addressed some of these environmental concerns. They argued in favour of a system that automatically gives weight to environmental protection; through the provision of an environmental costing mechanism. If users must pay for the damages they inflict on the environment, then they should change to modes with lower environmental costs. In addition, carriers will change their equipment to minimize environmental damage as their environmental costs will decrease. In the short-run, the Commission recommended that emission charges be applied equally to all modes of transportation on an as close to a per-unit-of-emission basis as possible.[26] Other approaches to reducing the impact of transportation on the environment include: establishing a carbon tax (similar to an emission charge); use of alternative fuels; shift in mode used; improved fuel efficiency; and so forth.[27]

COPING STRATEGIES IN A CONTINENTAL CONTEXT

> *It is evident that Canadians need to concentrate more energy on technological innovation; developing new partnerships between business, labour, educators, a variety of interest groups and government; reducing internal trade barriers; finding more effective ways to raise investment capital; and improving our education and training system.*[28]

Strategic Alliances in the U.S.

Coping with increasing continental competition has forced Canadian carriers to posture themselves strategically within the U.S. market. As discussed above, both of Canada's major railways have integrated their U.S. subsidiaries into their Canadian operations and formed strategic alliances with other U.S. railways. Similarly, both of Canada's two major airlines have linked with U.S. air carriers to improve transborder services. In the event of an open skies bilateral agreement, the airlines should gain advantage from the evolving free-market. Canadian trucking firms involved in transborder operations have also entered into alliances with U.S. firms through appropriate interlining and terminal arrangements. This has enabled U.S. firms to enter the Canadian market without necessarily investing in new facilities and similarly, provided Canadian carriers access to the U.S. market. Cabotage restrictions currently limit the internal activity in which each country's trucking firms can engage.

Domestic Business Alliances

The development of business alliances among competing firms enable them to better cope with external competitive pressures. This approach has led to the economic success of Japanese and European firms. In both cases, although domestic competition continues to drive the firms to innovation and excellence in product and service development, these same firms have recognized the need for strategic cooperation to reinforce a national approach to international competition. The Canadian strategy typically has been myopic - focusing on fierce internal competition without acknowledging the need of maintaining strong domestic industries to compete internationally. The recent destructive fare wars between Air Canada and Canadian Airlines International has left both airlines vulnerable in an international setting. Despite government efforts to force a merger of the two airlines, the bitterness created between the two organizations prevented this seemingly rational solution to their problems. Instead, each airline continues to seek survival with the aid of capital infusion from a U.S. partner (if permitted by the federal government).

There is better news from the rail industry. Both CN and CP have announced joint initiatives aimed at reducing the inefficiencies of operating transcontinental railways in the Canadian environment. The railways propose to establish a joint rail operating company to provide a single main line between the Ontario-Quebec border and North Bay.[29] Both railways will operate and compete on this one line rather than maintaining two lines through this isolated portion of Ontario. Further studies of rail rationalization affecting both firms are ongoing. Another approach to achieving cooperative business development is to share pre-competitive research on innovations affecting the Canadian transportation industry. Cooperation could lead to more efficient research and development in the transportation industry under the aegis of industry associations and their member firms in cooperation with government and universities.

Ports Canada, CN North America and CP Rail System have recently linked together to cooperatively develop a seamless transportation system known as "Advantage Canada". Advantage Canada promotes the greater use of Canadian transportation routings by developing a coordinated "quality assurance" program for the Canadian transportation industry. The alliance is designed as a commercially driven organization with participation from major stakeholders in the transportation industry including federal and provincial governments.[30]

Restructuring for the Competitive Edge

The competitive forces impacting the Canadian transportation industry is forcing organizational restructuring. Both major Canadian railways are rationalizing their systems and shedding excess labour. CN, expecting a loss of $90 million in 1992, has announced it will cut 10,000 employees over the next three years. CP is also looking to reduce its labour force.[31] Similar restructuring is occurring in other transportation firms. Canadian trucking firms are not competitive with U.S. firms due to poorer management infrastructure and higher taxes.[32] Innovative steps must be taken to enable the Canadian trucking sector to survive and flourish in the new competitive environment. Canada's two major airlines have also announced major job losses as they both seek to stem their financial difficulties.

In the Canadian ports sector, government restructuring is overdue. Currently, ports come under federal jurisdiction in a number of ways: as members of the Canada Ports Corporation (a federal crown corporation); semi-independent harbour commissions; and, Transport Canada public harbours. In several situations, these same government facilities compete with one another rather than focusing on international competition. The current Canadian ports structure is no longer appropriate in the increasingly competitive, continental trade environment. All of the commercially viable ports could be converted into semi-autonomous harbour commissions, unfettered by centralized controls from the federal government.[33]

TRANSPORTATION AND GOVERNMENT

> *In the past, government has regulated the economic aspects of passenger transportation systems and has provided much of the infrastructure. We believe these systems should be open and accessible, and that government should confine its role to being a referee and policy setter.*[34]

The role of government in the Canadian economy is shifting to limited intervention. In the transportation industry, government has reduced its economic regulations. However, in the Canadian context, there is a continuing conflict over the purpose of government. Is it in place to merely serve as a referee or a policy setter in an open economy, or are there specific transportation security needs that must be addressed by government? Some economists argue that the true role of government is to open up the nation's borders so that its citizens will have access to the best products at the lowest prices.[35] Others argue that governments should provide guidance to its citizens and businesses on surviving in the changing economy.[36] Still others call for government to actively influence economic development to ensure employment and a high standard of living through a strong industrial strategy.[37]

Level of Intervention

Government involvement in the Canadian transportation range from the extremes of full regulation and, at times, ownership to total non-intervention in the free-market. The initial scenario of full government involvement has fallen into disrepute with the economic collapse of the state-run enterprises (including transportation) in the former Soviet Union. A return to government involvement in transportation appears unlikely in the near future.

The alternative scenario of non-intervention with the exception of key areas such as safety, environmental protection and maintaining competition appears more feasible. Indeed this has been the direction of government during the 1980's:

> In the space of six years the Mulroney government has introduced more changes to existing programs and policies than any other government in the last forty years.... Across a broad front ... the government has moved persistently and systematically to reshape the institutional and legislative character of Canada.[38]

A non-interventionist strategy implies minimum regulations, but does require government support for economic foundations such as: effective education and training; support for a variety of generic industrial initiatives including research and development, assisting small firms, aiding Canadian companies to branch into the international market place; and so forth. Non-intervention can be interpreted as economic deregulation - an unfettering of the market place. The danger is that freeing the market may lead to monopolistic industrial practices that forced government economic intervention in the latter part of the 19th century. Like the economic cycles that businesses are attuned to, one could question whether or not the current fascination with deregulation and government non-intervention is not merely a swing of a long-term pendulum - one that may lead to increased government involvement in the long-run.

A minimalist intervention strategy for government encompasses a number of factors including: the degree of economic regulation required; enhancing competition in the transportation sector; providing the foundations - education and training; ensuring access to capital; supporting innovative partnerships; removing subsidies; and, restructuring government departments.

Providing public support for economic activities and an open business environment must not be done at any cost. Competition is the driving force for innovation in an open economy; government has an obligation to ensure that competition continues and is not distorted by monopolistic and oligopolistic practices.

Security

The primary question for transportation policy makers is whether or not the shift to a rationalized continental network is good for Canada as a whole? Shippers benefit through access to alternative routings and competitive freight rates for the movement of their commodities. In turn, lower transportation costs reduces the price of consumer goods in the Canadian domestic market, as well as more competitive Canadian exports. On the other hand, Canadian carriers must compete with larger, more cost efficient, better managed, and productive U.S. firms.

If Canadian carriers cannot compete effectively, will this mean a loss of Canadian-flag carriers? Will their passing be noticed other than by those individuals directly affected in terms of employment? As an independent, sovereign nation, can Canada afford to permit its transportation system to be eroded? Can the Canadian transportation industry become competitive in a continental context? Is there a role for government in providing a degree of minimal security to the Canadian transport industry?

These questions are based on the degree to which Canada wishes to maintain its independent sovereignty within a growing continental trading block. Sovereignty is not a trivial concern. There are many instances in history where Canada and the U.S. exercised conflicting foreign policies and where a unified continental system may have acted against Canadian interests. For example, in both World Wars, Canada entered the fray several years before the U.S. Canada might not have been able to supply her allies as readily with an integrated continental transportation system.

More recently, Canada has adopted a policy of maintaining trade with Cuba where the U.S. has strictly enforced an embargo against its neighbour to the south. The Cuban trade issue has effected Canadian transportation firms. In October 1992, the U.S. passed into law the *Cuban Democracy Act* seeking to strengthen and expand the existing trade embargo. Under the *Act*, subsidiaries of U.S. companies in Canada and in other nations may be prosecuted if they trade with Cuba. In addition, ships carrying cargo to or from Cuba are prohibited from visiting U.S. ports for six months - a concern to any Canadian coastal vessels serving both the U.S. and the Caribbean. The "extraterritorial" application of U.S. laws in other nations was opposed by Canada and Mexico (partners with the U.S. in the NAFTA) and others in a United Nations General Assembly Resolution in late November.[39]

As Canadian foreign policy does not always match those of her main trading partner, then some degree of independence in Canada's transportation system is needed to reduce the country's vulnerability to the vagaries of U.S foreign policy. The question, of course, is how much security is required?

Entering into the FTA and, potentially NAFTA, has led to growing pressure from the transportation industry and others to harmonize taxation and fiscal regimes, standards, and other matters that affect relative competitiveness in a continental context. Does increased harmonization weaken Canada's independence or does it make sense in today's increasing "borderless" world? In the continental context, given the size of the American partner, it is likely of the taxation and standards modifications will be made by the smaller partner - Canada.

To reduce vulnerability and ensure an ability to maintain an independent foreign policy, Canada must establish a minimum national transportation network, as part of, but also independent of, the continental system. This means defining and maintaining an essential, connected network of highways, railways, ports, and airports.

Some steps in this direction have already been taken. An essential highway network has been proposed by the Federal-Provincial Council of Ministers Responsible for Transportation and Highway Safety. Their National Highway System designates a network of highways linking provincial and territorial capital cities, other main population centres, major ports, and U.S. border crossings.[40] Similar steps to define and ensure the continuation of a national railway network is required along with defining an essential ports and airport system. The Royal Commission on National Passenger

Transportation called for similar steps in their recent report. Rail lines subject to abandonment should be kept in the public domain to provide for recreational opportunities as well as possible future use, particularly if technology changes do not reduce environmental degradation caused by other transportation modes.[41]

In addition to defining and maintaining essential transportation infrastructure, the degree to which Canada needs to preserve national carriers in all modes should be determined. To ensure the continued carriage of Canadian goods and passengers, a minimal number of Canadian-flag carriers are required. What the minimum number should be is open to debate. In the shipping industry, most Canadian shipping lines operate under foreign flag-of-convenience with the exception of the coastal trade (under cabotage protection). Unlike the U.S., Canada does not have a requirement that Canadian vessels, regardless of their flag, be subject to recall for Canadian purposes in times of emergency. This approach may be feasible both for the Canadian off-shore fleet, as well as for other major domestic carriers operating in the continental network. Adopting this approach, however, may lead to difficulties as Canada has recently amended its tax laws to encourage foreign shipping lines to establish their headquarters in this country (particularly aimed at attracting Hong Kong shipping lines to relocate in Vancouver). These shipping lines may be reticent to provide their fleets for Canadian purposes.

Maintaining Canadian-flag carriers implies a continuation of east-west trade. One means of ensuring such trade is the removal of current inter-provincial trade barriers. Presently, it is often easier for Canadian firms, in specific sectors such as beer, to sell their product in the U.S. than in other parts of Canada. Harmonization of Canadian trade laws and standards amongst provinces would contribute to the development of the Canadian transportation fleet.

A second key element of securing a Canadian transportation network is to provide a degree of redundancy in the system. This implies having more than one means of moving goods and passengers between two points in Canada. Providing redundancy reduces the possibility of trade loss due to natural catastrophes or acts of domestic terrorism. However, given the continental nature of the transportation system, such redundancy does not have to be fully maintained within Canada, alternative routings via the U.S. transportation network would provide adequate access in the case of a Canadian emergency. Again, as in the case of most security related issues, the questions remain - how much "insurance" is needed? And at what cost?

CONCLUSION

Increased international trade enhances the economy of individual trading nations. Economic security in our increasingly globalized world requires further trade liberalization and the transportation and communication systems necessary to support it. Canadian economic security implies an increasingly deregulated transportation system able to compete effectively in a continental and global market place.

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PUBLIC SECTOR SUPPORT FOR TRANSPORTATION RESEARCH AND DEVELOPMENT*

INTRODUCTION

The *Corporate Review of Research and Development in Transportation* was initiated in November 1991-to be completed by the end of 1992-as part of the reorganization of the Ministry of Transportation, Ontario. It sought to establish a foundation for a responsive, efficient and productive program of technological, human sciences, economic and systems research, and focused on defining the organizational structure for the Ministry's research and related activities that would best achieve this. The review has, as its **purpose**, a long term strategy for sustainable transportation research and development. It was assumed that this strategy must advance the objectives of the Government of Ontario and the policies of the Ministry.

RESEARCH AT MTO

The Ministry is the prime beneficiary of the research it conducts, and no other Ontario organization has the capability to replace it at this time. At some $16 million, MTO's research and development program represents 0.8% of the Ministry's budget. MTO's research extends to virtually all areas of the Ministry's responsibility. Ontario leads the nation in commitment to transportation R&D. The annual cost of MTO's research program is dominant among expenditures for all Canadian government supported transportation research. Bench mark ratios show Ontario's research and development as a reasonable proportion of Ministry expenditures, but only a minor contribution when measured in the context of Ontario's transportation sector estimated at $29 billion per year. Further, federal and the aggregate of provincial expenditures

* This paper is based on a Discussion Paper prepared by the Corporate Review Committee. The author was the Project Director of the committee. The Research and Traffic Group provided consulting services.

are roughly equal, and Canada's total surface transportation research efforts - federal, provincial and private - are far below those of the U.S. expressed in relative terms. For both Canada and the U.S., this vital indicator is below targets of approximately three percent generally accepted for technology intensive nations.

Approximately 130 members of the Ministry staff are employed in or in support of the research function, and 30% of the $16 million is conducted under contract outside of the Ministry - more than half of it contributed by other partners.

The Ministry's current research programs are the product of 40 years of adaption to departmental regrouping, policy shifts (from a strictly highway to a multimodal outlook), and the emergence of issues such as environmental preservation and accessibility to persons with disabilities. This evolution has resulted in research programs performed by at least six units, under the management of three Assistant Deputy Ministers. MTO's research program can be classified as:

- primarily related to applied natural sciences;
  - o highway engineering development, and
  - o transportation/systems technology development
- primarily related to the social sciences;
  - o safety/human factors, behaviourial and sociological research, and
  - o socio-economic analysis and policy research.

The scope of research activities at MTO is very broad and not framed by an overall corporate strategy. A natural consequence of the 40 years evolutionary process is a striking diversity and distinctness among the elements of MTO's transportation research, not only in content but also in the approaches taken and procedures followed.

It is important to note that in some instances the researcher also drafts the policy paper. This is particularly true in the economic policy and human resources areas, and for vehicle regulations. In this situation the same person performs the roles of both researcher and client. In the other groups at

MTO, the research may be conducted and the policy paper drafted within the same group although by different individuals. This has caused a situation where strategic socio-economic research has not been clearly identified within the Ministry.[1]

The Corporate Review has concluded that MTO has:

- *comprehensive* but *not cohesive* technological research programs, and
- *skeleton* and also *not cohesive* strategic socio-economic research.

The R&D elements of MTO lack the stature that a more cohesive unit could achieve; has a low corporate profile, only a modestly visible impact on the Ministry overall; and has a weak claim on priority within the Ministry.

The review process included focus group consultations with staff directly concerned (users and providers of research) and a number of concerns were identified including:

- Recognition of, and reward for, professional expertise (as distinct from managerial advancement), bringing in notions of education, peer contacts, sabbaticals, and advisory roles;
- Stability of research funding and the recruitment and retention of high calibre research staff, including staffing mechanisms applicable to the research function;
- The role of and access to laboratories;
- A perception that the many individual groups engaged in research need to be given a common direction and a common set of priorities;
- Research-client relationships and the development of partnerships instilled with team spirit;
- Research function integration and focusing, and a higher profile for research with senior management; and

- The need for a much more intensive effort to explain and market research:

    - o at its inception by involving clients;
    - o during the research in marshalling resources and participants; and
    - o when results are implemented within the client organizations.

MTO'S RESEARCH OBJECTIVES AND THEIR REALIZATION

Research within and under the auspices of the Ministry must provide strong leadership and support for:

- MTO's operations,
- Ontario's municipalities, transportation industries, travellers and shippers, and for
- the Government of Ontario's broader economic and social policies.

Principal objectives identified for MTO's research are:

- higher quality and capacity but lower cost transportation infrastructure,
- improved competitiveness of Ontario's transportation industry
- accelerated economic renewal through lower transport cost,
- safer, more accessible and lower cost travel in and to Ontario, and
- protection and improvement of Ontario's environment.

To realize these objectives, the Corporate Review concluded that MTO's approach to research and development must:

- foster excellence and expertise;
- be flexible;
- be interdisciplinary;
- emphasize coordination;
- establish partnerships; and
- focus on Ontario's special needs but with a broad interpretation of them.

PRINCIPLES ADOPTED

As a practical path to the achievement of the objectives and imperatives identified, **specific principles were adopted:**

- The Ministry's R&D programs must contribute in a tangible way to the improved movement of goods and people in, from and to Ontario;
- Successful research must influence the development of policy;
- The Ministry's primary role is in applied research and development, and its implementation;
- Research is a value-added activity;
- Investment in R&D programs must have a positive expected pay-off; however, good research does not guarantee a positive pay-off for each research project;
- Research is a long-term activity which needs:
  - o commitment, stability, long-term financing and a critical mass of human resources
- Research at MTO cannot survive in a vacuum; it must:
  - o reach beyond the Ministry,
  - o be sensitive to, but not dominated by, the Ministry's immediate agenda, and
  - o serve as a building block for corporate excellence;
- Research must be an integral part of the strategic planning process;
- Investment in research and development should be an integral part of the Ministry's investment strategy; and

- MTO's research must be closely associated with education, particularly university post-graduate studies.

CHALLENGES TO THE ORGANIZATION

Change is inevitable based upon by a critical examination of organizations and research strategies elsewhere in Canada and worldwide. Force for change can be summarized as:

- New realities concerning sustainable funding must be faced.
- Increasingly, research tasks are multifaceted and require multidisciplinary attention.
- Research is not exempt from the pressures on all government activity; there are long-term threats to stability. More than ever before, the need for partnerships and cooperation will have a major effect on the research function in the Ministry.

The review identified a number of issues to be addressed within the new organizational framework:

- Resource allocation and funding, including the paucity of strategic socio-economic transportation research;
- Responsiveness to client needs and the development of partnerships with industry clients and research organizations;
- Technology and knowledge transfer including the need to explain and market research:
  - o At its inception and during the research by involving prospective clients;
  - o During implementation by the client;
- Research quality control and management;
- Research integration and the assembly of multidisciplinary research teams;

- ORSO's research role, the avoidance of duplication, and the need for human behaviour skills and a safety focus within Ministry research teams;

- Information dissemination including intimate cooperation with the library, publications and other communications functions;

- The role of and access to laboratories;

- A corporate mechanism for research associations with educational institutions; and

- A common direction and a common set of priorities for all MTO research initiatives.

The Corporate Review has identified ambitious objectives for a revitalized transportation research and development program to meet Ontario's future needs.

The research program must be proactive and provide vision, and it must:

- ***Directly Support MTO's Operations,*** through:

  - o Selective dissemination of information on innovations,
  - o Identification of long range opportunities and threats,
  - o Efficiency/effectiveness/productivity improvement research,
  - o Developing a better understanding of the basic needs for transportation,
  - o Safety enhancement research,
  - o Environment protection research, and
  - o Training transportation professionals;

- ***Support Ontario's Transportation Industry,*** through:

  - o Data support,
  - o Information system development,
  - o Technology partnership,
  - o Opportunities advice, and
  - o Training transportation professionals;

- ***Support Ontario's Economic Renewal,*** through:

  - o Better understanding of transportation markets,
  - o Efficient, effective, suitable and integrated transportation,
  - o Access to world markets for Ontario goods,
  - o Enhancement of tourism,
  - o Opportunities for transportation related industry, e.g. equipment manufacturers, ship yards;

- ***Support Ontario's Travellers and Communities,*** through:

  - o Efficient, effective, suitable and integrated transportation,
  - o transportation system socio-economic impact assessment,
  - o Improved safety,
  - o Accessibility to persons with disabilities;

- ***Protect and Improve Ontario's Environment,*** through

  - o Energy efficiency and conservation
  - o Health protection,
  - o Natural Environment:
    - Protection, and
    - Restoration;

- ***Contribute to Canada's Collective Welfare,*** through:

  - o Sharing the attack on common problems,
  - o Dissemination of transportation-related information,
  - o Improved interprovincial transportation, and
  - o Training transportation professionals; and

- ***Contribute to Global Progress***

  - o Collective research on multinational problems, and

- Advance developing peoples through:
  - Improved transportation, and
  - Training transportation professionals.

MTO has a responsibility to ensure that forward looking transportation research is conducted at Ontario's universities. Since transportation is multi-disciplinary, it is often overlooked when university research funding is allocated. MTO can assist the development of transportation by:

- Dedicating a portion of its consultant budget to projects at educational institutions;
- Creating project opportunities for sabbaticals or summer projects for professors and students;

Several factors motivate substantial change to the positioning of MTO's strategic socio-economic and technological research and development. They include:

- Pressures from an increasingly nationally and internationally competitive construction industry;
- An industrial strategy which points towards the establishment of Ontario-based firms with international capabilities;
- Increasing fiscal pressures on government resources;
- Changing perspectives on social objectives; and
- Increasing pressures for environmental protection.

In light of the above motivating factors, government and industry-led research project responsibilities should differ in their scope:

- Private sector activities should primarily focus on the development and manufacturing of new materials, technology and methods for construction and operations; and

- Public sector activities should primarily concentrate on safety, environmental preservation and standards, and the economic-social policy sphere.

ORGANIZATIONAL OPTIONS

From the examination of successful organizations elsewhere, the Corporate Review Team recognized that quite different organizational structures for transportation related research have been successful under a broad range of circumstances. The choice of a structure for the future of Ontario's transportation research programs is a question of balance among MTO's priorities. Six possible approaches, including what is essentially the status quo, were evaluated:

- All Ministry research activity, classified as full-time, united under common leadership in a single multidisciplinary MTO research branch;

- MTO's technological, systems and human behaviour research united in a single unit, with a separate group responsible for strategic socio-economic research in support of the policy function;

- Decentralized responsibility for research and development according to divisional mandates;

- Research facilities and staff remain decentralized, but with a corporate unit responsible for coordination, information dissemination, and program assessment and funding;

- All substantiative research contracted as needed to universities, the private sector, and national and international transportation research institutions, with a skeleton MTO research organization providing project management, information dissemination, technology transfer and marketing services; and

- An "arms-length" Crown corporation established as a Schedule IV agency and reporting to the Minister of Transportation.

These options have been the topic of substantial discussion and analysis and they were the principal foci of deliberation by the Corporate Review Team and comment by other interested Ministry staff. Evaluation centred on the capability of each option to deliver comprehensive client-focused programs in an increasingly internationally competitive climate where MTO will concentrate on broad strategic topics and performance specifications.

CONCLUSIONS

It is concluded that a successful MTO research program will be based on the following fundamental principles:

- A strategic socio-economic research structure combined with some technological research capability is essential for successful policy formulation;
- Consolidation is necessary for successful technological and systems research and development;
- Multidisciplinary project management is a prerequisite for client-focused research and development programs and effective technology transfer;
- Formal recognition of the need for a close working relationship between researcher and client promotes an emphasis on technology and knowledge transfer and marketing, and thus value from the research and development;
- Joint routine testing and research laboratories can achieve efficiencies and help develop synergy among experts.

RECOMMENDATION AND CORPORATE DECISION

The Ministry should work towards more multidisciplinary, coordinated and cooperative research and development programs, and consistent and effective technology and knowledge transfer. Adjustment from the present organization is needed, but it must be balanced so that MTO's well

recognized centres of expertise and self motivated research teams are not disrupted.

It is decided that restructuring of MTO's research and related activities should be based on two premises:

- The current research and development program content will remain intact at this stage; and
- There is a need for the long term positioning of MTO's research and development activities as they relate to the Ministry's programs and Ontario's transportation sector more generally.

Further, it is decided that restructuring and positioning be affected in two steps:

(1) Proceed to reorganize MTO's technological research and development resources into a single branch, and to establish a strategic socio-economic transportation research branch;

(2) Further reorient MTO's research program and it's organization based on a *Strategic Review and Evaluation* of MTO's current research and development functions by the end of 1993.

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[1]**Some socio-economic analysis is incorrectly perceived as research.** In the policy analysis areas, there must be a capability to provide answers on socio-economic issues with a *quick turnaround*. This activity may be perceived as socio-economic research; however, although it is socio-economic analysis it should not be confused with the strategic socio-economic research function. It is necessary, however, that MTO's strategic socio-economic researchers be prepared to provide quick turnaround response (advice/opinion) to those responsible for policy analysis, and thus to assist policy formulation and decision making.

Strategic socio-economic research is longer-term in nature and require insulation (but not isolation) from the quick-response demands of the organization. This research also requires close researcher/user linkages to ensure relevance and that state-of-the-art techniques are used in the Ministry's policy analysis. As a consequence, for many socio-economic areas, it is important for policy decision-makers to have staff who

understand and monitor the policy implications of the strategic research.

Strategic socio-economic research request special studies and surveys of transportation users. To understand the social and economic impacts and needs of transportation users, some research must concentrate on these users. Direct contact with users is frequently achieved through techniques such as surveys, focus groups and reaction testing. Such activities must meet certain government-wide criteria and follow government-wide procedures relating particularly to freedom and privacy of information.

A RETROSPECTIVE VIEW OF CANADIAN AIRLINE DEREGULATION[1]

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1.0 INTRODUCTION:

In a series of earlier papers, we argued that the problems which have emerged in deregulated airline systems would have been forseen had appropriative models (instead of strict neoclassical models) of industry behavior been employed. Different policies and implementation strategies would have emerged, ones which employed prices and/or taxes to avoid the worst aspects of what transpired. We did not argue that deregulation was a bad policy decision. Rather, we argued, and continue to argue that it should have been implemented differently. In that way, the benefits arising from deregulation would have been increased.

Central to our argument is the idea that the deregulated airline markets are subject to overexploitation due to preclusive competition.[1] Firms view their actions in a vacuum, ignoring the effect of their actions on the industry as a whole and on the passenger pool. As a result, there is a tendency toward an excess capacity in the industry due to excessive appropriative activity as measured by the number of flights. We also argued that there would be continuing financial losses due to excessive costs in the industry, and that airport congestion would develop at least at central hub airports. We envisaged both problems being resolved by the same mechanism : the use of the tax system to restrain the number of flights to the socially optimal level.

Reaction to these propositions was essentially negative. Instead, it was argued, the deregulation would result in the provision of high quality, low cost service by a financially strong industry. It was further assumed that congestion could be addressed through the expansion of the airports and airways systems. The events of the ensuing years prove the fundamental soundness of our position: the airline industry still tends toward excess capacity relative to the size of the passenger pool, towards large losses and to a tendency toward congestion as well. A new assessment approach is required to assess not only the impact of deregulation but also the behaviorial patterns of deregulated firms. This would permit the development of policies which resolve present

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[1] The financial assistance of the National Science and Engineering Research Council is gratefully acknowledged. The opinions expressed herein are those of the authors alone.

difficulties.
A first step in developing an alternative approach is to define the relevant output unit. It is not unusual in analyses of the airline industry to find emphasis placed on the production of available seat miles (ASM) or flights. Such measures are simply empty boxes in that they measure capacity and not output. Within the limits of fleet availability and the capacity of the relevant airports in a system, one can increase both ASMs and flights. While costs are incurred in so doing, nothing is, in fact, produced in the absence of the passenger. The passenger is an integral part of the process of producing the trip in question regardless of trip purpose. The output of the airline industry must be measured either in terms of revenue passenger miles (RPMs) or in terms of passenger trips. Recognition that the passenger is an integral part of the process of production explains many of the difficulties which have been experienced by the industry during the past decade.

Having made its decisions on the levels of capital and labor utilized, the firm is in a position to attempt to attract customers. It can do this by manipulating certain customer-specific selling costs (such as advertising), by altering the quality or frequency of service delivery, or by developing strategies designed to strengthen the bond between it and its customers. Airlines produce a variety of services,[2] and these types of response may be seen clearly in the deregulated U.S. airline industry (Brander et al. 1989b).

Airlines are, of course, in competition with one another for the pool of potential passengers at any airport location or in any city-pair market. The volume of such passengers is finite, though its availability at any point in time can be influenced to some extent by airline behavior. An airline might alter fares, conditions of carriage, or various qualitative dimensions in an attempt to attract customers from its rivals, or perhaps to attract new passengers into the market from other travel modes or other activities. Viewed from this perspective, the customer is the prize which the selling activities of the airlines seek. A difficulty immediately emerges: attempts to attract passengers create adverse interactions among those airlines competing in a given market. Adverse interactions arise because property rights to the customers are not specified and they are available to the carrier which is best able to attract (appropriate) them.[3] This is preclusive competition in that once attracted to such a carrier, they are not available to any other competitor per time period. Property rights issues and appropriative activities are therefore relevant in assessing why the goals sought by the policy of airline deregulation proved in the final analysis to be unattainable. It may also contribute to an understanding of the forms and impacts of remedial action.

2.0 PROPERTY RIGHTS, ACCESSABILITY AND THE AIRLINES:

Property rights define claims to scarce resources, helping to determine how they will be allocated in the productive process[4]. Any redefinition of property rights will result in a reallocation of resources. In the process, as Tullock[5] has observed, there may be transitional gains and losses.

Property rights were readily identifiable during the regulatory period in North America. They took the form of operating authorities on specific routes, and were protected by a system of entry controls. Prior to entry, potential competitors had to prove public convenience and necessity. Various opportunities were afforded existing firms to protect both their markets and their financial position. There was little price competition, but non-price competition existed. (In passing, it might be noted that even under this regulatory protection, there was a tendency toward excess capacity as witnessed by the existence of CAB-sponsored capacity agreements in the U.S.). From the present perspective, deregulation abolishes the values attached to operating authorities. Markets are now characterized as open access. We have argued that, in effect, the customers in air transportation markets become common property, and markets can be considered from that perspective.[6]

Our original theoretical paper[7] utilized a framework developed by Copes[8] who followed the lead of Carroll, Ciscil and Chisholm[9] in focusing attention on the imperfect specification of property rights, and the negative externalities which this creates for firms. Copes used that framework to demonstrate that under conditions of open access, there will be overexploitation of the market. The process will continue until such time as all of the economic rents (perhaps the Marshallian term "quasi-rents" is preferable) are squeezed out. Excess capacity develops, and both output and capacity will be above the socially desirable levels.
In a given market, the industry will establish a level of output which equates price and average social costs. Should output be below this level, economic rents will exist. This results in the entry of new firms and/or the expansion of existing carriers. Entry/expansion continues until all rents are dissipated. This result follows from the open access and common property characteristics of airline markets under deregulation. Firms make their decisions on the basis of their marginal private costs (MPC) which, following Walters[10] are also their average social costs (ASC). All economic rents are dissipated and congestion costs arise. Across markets, the process will continue until profit ratios are equalized (at zero). Specific firms may be more or less efficient than average. Thus some may earn a positive intramarginal rent, or suffer an economic loss. All markets will move toward the rent-exhausting level of output in the absence of constraints.

Such an outcome aptly describes a deregulated airline industry. For a given passenger volume, increases in the number of flights on a given link will occur, constrained only by the number of available landing slots. Economic rents will be dissipated as the industry expands capacity (flights and/or available seats) above socially optimal levels. Copes' conclusion that with open access, both the number of firms and the amount of capacity will be excessive applies. While restricted entry to the market will increase the social surplus, it may have adverse effects on the consumer. In effect, the gains to the firms may exceed the losses to the customer, even while social welfare increases.

3.0 THE TENDENCY TOWARD MARKET OVEREXPLOITATION:

For considerable time, the low profit ratios of the airlines have been observed. Economists frequently commented that the industry had an inherent tendency to compete away the economic rents which might otherwise have been generated. Such erosion it was thought, was brought about by head-to-head scheduling. This was seen as an outcome of the regulatory preclusion of price competition. Industry consensus was that the best way for an airline to increase its passenger loadings (and hence, under the generally accepted thinking, its profit) was to match departures to those of its competitors. There is a considerable element of truth in that position. However, the usual explanation, relating the tendency to price and entry controls, is incorrect. It is a natural outcome of the desire of firms to maximize profits.

Long ago, Hotelling[11] sought to determine the best location strategy which could be followed by a new entrant into a market. His example involved the case of a ribbon settlement currently served by one store located precisely at the midpoint. Hotelling concluded that the optimal strategy for a new entrant would be to locate next to the existing firm. This results in its maximizing the number of customers, and, given constant costs, profits. This phenomenon, known as clustering, is readily observable.

From the perspective of the airlines, the argument can be either temporal or locational, but the concept is the same. A schedule change is an example of relocation in time. Entry into a new market is an example of spatial relocation. Barriers to relocation may exist. If start-up costs are ignored, in neither case is relocation difficult or costly. Increased costs may delay entry into new markets, but they will not preclude such entry. Clustering of flights is observed in the industry, and is prima facie evidence that the Hotelling clustering theory is valid. Head-to-head scheduling is an thus an inherent characteristic of the industry. It contributes to excess capacity, and to the dissipation of the economic rents which could be earned.

4.0 APPROPRIATIVE BEHAVIOR:

The objective of deregulation was the establishment of a highly competitive airline industry, providing high quality service at low fares. The phrase "highly competitive" can be interpreted in a variety of ways. In one sense, such an industry is desirable for a variety of efficiency reasons. In this regard, one thinks of the perfectly competitive model in which price equals marginal cost. On the other hand, there exist a set of competitive (some say anti-competitive) activities. While the central theme here is the evolution of the industry under deregulation, much more is involved than a discourse on recent history. One must begin by briefly considering the notion of a "competitive industry" in a broader sense.

McNulty[12] distinguishes between competition as an *activity* of the firm and perfect competition as a *market structure*. Activities such as (to use airline industry examples)

frequent flyer programs, airport presence, and computer reservations systems constitute competitive actions. In fact, any activity by a firm to increase product differentiation (and hence market share and control over price) would be so considered. Such activities are often regarded as "anti-competitive". They should instead be regarded as competitive and appropriative activities. However, given that they are viewed as anti-competitive, it is only a small step to suggest that they should be "controlled" through the application of the anti-trust laws. Concerns over the use and benefits accruing from the computer reservations systems developed by the megacarriers are a case in point here.

The other concept here is the notion of competition as a market structure. We fail to recognize is McNulty's point that "perfect competition is a state of affairs quite incompatible with the idea of any and all competition". It is apparently in this sense that proponents of deregulation were using the phrase "highly competitive". Price is, of course, market determined and the firm is a quantity adjustor. All initiatives on the part of management are precluded. Given the unattainability of such a market structure, the contestability hypothesis becomes a relevant substitute in those cases where the markets are contestable.

It was apparently competition as a **market structure** which was sought by the framers of the Airline Deregulation Act. However, it is **competitive activity** which better characterizes the industry over the past decade. It is instructive to ask why one rather than the (desired) other emerged. The answer is that the incumbent firms had the option of reacting in a variety of ways to protect their market shares following deregulation and the ensuing new entry. They attempted (with varying degrees of success) to do so. It is the more successful of these defensive actions, initiated to enhance their economic power, which are now regarded as anti-competitive.

A second, even more troublesome problem with the perfectly competitive market structure is the implied concept that the new entrant will do exactly what the existing firms are now doing. Again, there is apparently little scope for innovative action. This may be more important than it appears at first glance, since casual observation suggests that it is the new entrant who is the mover and shaker. Both Laker and People Express are cases in point. Both had a more profound impact on the industry than either their size or longevity (as independents) would have suggested possible.

A more realistic interpretation of the events which have occurred in the deregulated industry is found in the property rights literature. Hirschleiffer (1) indicates that property rights are well-defined if all resources are appropriated (belong to someone) and if the property rights are perfectly and costlessly enforced. When such rights are not well-defined, appropriative activity in the form of preclusive competition or rent-seeking arises. In this context, we believe that property rights have not been "well-defined" in the airline industry. Rent-seeking activity in the regulated era was the norm as airlines sought to protect their markets (operating authorities). This was due to

imperfections in the assignment of property rights (public decision processes). In the deregulated era, preclusive competition has arisen because resources are no longer appropriated.

Several authors suggest that negative externalities arise if it is impossible to fully define property rights. If property rights are fully specified in an atomistic world, firms are fully independent of one another, and adverse interactions are impossible. We have argued that there can never be a complete specification of property rights where the service sector is concerned.[13] The basic problem is that the customer is a factor input, and that there is a limitation on the total number of customers in a given market. Diminishing returns to selling effort at the industry level, and hence rising opportunity costs of effort are thus inevitable. This line of reasoning suggests that even if the constaints of landing slots and internal airport space could be removed, adverse interactions among firms would continue because of both the limited availability of passengers and the activities of firms designed to increase their market share.

Such a model is more applicable to the present situation in that it allows a variety of competitive actions not only by new entrants but also by the incumbent carriers as they attempt to increase their share of the traffic, their market power and their potential profits. An immediate by-product of such activities is to raise costs of rival carriers, since competitors are forced to respond in kind or suffer traffic losses. In the extreme, this competitive behavior results in the dissipation of all market rents. Only intramarginal rents remain for the most efficient firms. This outcome is consistent with the observed data. In the deregulated environment, carriers *on average* have tended to have weak profit performance while within the group, there have been varying degrees of accounting profit (i.e. intramarginal rent).

While there are those who refer to these events as unpleasant surprises[14], we feel that the tendencies if not the specifics should have been anticipated. The use of neoclassical models did not permit recognition of the fact that incumbents might develop defensive strategies and engage in rent-dissipating activities. This is not to suggest that the present (perceived) difficulties could have been avoided. However, had they been anticipated, different kinds of implementation strategies might well have been developed. There are indications of unease in the U.S. with the evolution of the industry. In the extreme, this suggests that some interference with the freely functioning market may well occur in the future. Still, we should not rush the matter. Benefits will accrue if the pace is more leisurely. One approach is to assess the merits of available policy options in the context of the past decade.

5.0 CANADIAN AIRLINES PERFORMANCE UNDER DEREGULATION:

This section of the paper concentrates on costs and revenues in the industry related to appropriative activity. Of particular interest in this analysis is the bahavior of costs

through time. Our interest is centered primarily on the bahavior of those costs which relate to the sorts of appropriative behavior discussed above. In particular, we are interested changes in those costs related to increased selling effort in a deregulated environment. These would include, among others, those costs associated with the development and use of reservations systems, costs of servicing passengers, costs of additional flights and, of course, all of the related administrative costs.

The review of the performance of the industry extends, of course, beyond the time frame of Freedom To Move. In full, it covers the period from 1980 to 1991. The first year was chosen to provide a basis for comparision which was not tainted by a recession. The first intermediate point is 1985. It will be recalled that at the CTRF Jasper Conference in 1984, the airlines were (in effect) told by the Minister of Transport that each should combine all of their separate licences into a single licence. This, of course, would permit incumbent carriers to expand their geographic coverage by offering services on new links. It was decided to use 1985 as a midpoint not only because it provides the first full calendar year of data after that announcement, but also becasue it allows adjustment time for the carriers. The year 1988 was chosen as the second midpoint, being the first full year after the passage of the 1987 NTA. The final year, 1991, represented the last full year of available data.

5.1 The Macroeconomy:
It is necessary to assess the performance of the Canadian airline industry over this period against the background of the economy as a whole. A variety of indicators were selected to provide this background for the periods above. Their rates of change are set out in Table 1.

TABLE 1
PERCENTAGE CHANGE IN SELECTED ECONOMIC INDICATORS
VARIOUS PERIODS
(1986=100)

PERIOD	GDP	CONSUM -PTION	EMPL	EX. RATE	PRICE CHANGE	PIT.
1980-85	15.29	-15.21	4.79	-14.37	42.86	25.71
1985-88	12.96	1.15	9.13	10.91	13.12	33.98
1988-91	0.11	-7.67	0.78	6.52	16.21	14.94
1985-91	13.08	-6.61	9.97	18.14	31.46	54.00
1980-91	30.37	-20.82	15.2	1.17	87.80	93.59

SOURCE: BANK OF CANADA STATISTICAL REVIEW, Annual.

Over the entire period, the Canadian economy, as measured by real GDP, expanded by less than 2.5 per cent per year.
There were significant intersectoral shifts in the economy during that time. In real terms, personal consumption expenditures declined by almost 21 percent. The expansion of the public sector may be measured by the increase in personal income taxes paid. These increased in each subperiod, and the percentage increase overall was more than three times that of real GDP. Employment grew by about 1 per cent per year, and the price level increased substantially. Overall, there was a slight appreciation in the exchange rate, with the two major subperiods being radically different. The exchange rate dropped sharply up to 1985, rising more sharply between 1985 and 1991. Of all of these changes, the dampening of real consumer spending had, perhaps, the most negative potential for the airline industry deregulated or otherwise.

5.2 Industry Costs and Revenues:
The analysis here is pursued at two levels. Initially, the costs and revenues for the industry as a whole (defined as all Level I through IV carriers) is considered in the same time frame as used above. Following that, the Level I segment of the industry is considered by itself.

The industry volume of passengers, total operating expenses and revenues, as well as unit toll revenues are shown in Table 2. The data reveal that, for the period as a whole, the number of passengers carried grew, and that all of the expansion took place between 1985 and 1988.

TABLE 2
PERCENTAGE CHANGES IN
PASSENGERS AND SELECTED COSTS AND REVENUES PER PASSENGER
LEVELS I-IV CARRIERS, VARIOUS PERIODS
(CONSTANT (1986) DOLLARS)

PERIOD	PAX	OPER. COSTS	OPER. REV.	UNIT TOLL REVENUES
1980-85	-13.98	26.38	22.66	24.75
1985-88	46.62	-24.44	-22.96	-27.22
1988-91	-10.30	14.65	6.86	7.34
1985-91	31.51	-13.37	-17.68	-21.89
1980-91	13.13	9.48	0.98	-2.56

SOURCE: STATISTICS CANADA, Canadian Civil Aviation, #51-206.

With regard to total operating expenses per passenger, the table reveals that for all of the sub-periods, the signs of the changes in total operating expenses are the opposite of those for the changes in passengers. The cost changes do not appear to relate to the average trip distance. In the first sub-period, this declined by almost 10 per cent, rising by varying amounts in all other periods and for the period as a whole. The signs attached to the total operating revenues per passenger match those of the cost side, as do the signs of the changes in unit toll revenues per passenger except for the total period. Further discussion of these apparent anomalies is warranted, but will be deferred until the Level I segment of the industry is considered. The data for the Level I carriers appear as Table 3.

TABLE 3
PERCENTAGE CHANGES IN
PASSENGERS AND SELECTED COSTS AND REVENUES PER PASSENGER
LEVEL I CARRIERS, VARIOUS PERIODS
(CONSTANT (1986) DOLLARS)

PERIOD	PAX	OPER. COSTS	OPER. REV.	UNIT TOLL REVENUES
1980-85	-9.45	28.28	23.98	30.84
1985-88	10.25	-5.52	-3.79	-9.29
1988-91	-11.92	11.30	2.22	7.54
1985-91	-2.89	5.16	-1.65	-2.45
1980-91	-12.07	34.90	21.93	27.63

SOURCE: STATS CANADA, Canadian Civil Aviation, # 51-206.

For the early periods, the patterns for the Level I carriers mirror those of the industry as a whole at least with respect to the direction of change. Both groups lost passengers in the first period, and experienced increases in real costs and revenues per passenger. In the second period, while the direction of change is the same in all cases, the size of the change is significantly greater for the total industry. It is in the periods 1985-91 and 1980-91 that the differences between the two groups emerge most clearly. In the case of passengers carried, the Level I carriers witnessed a decline in both periods while the industry as a whole saw an increase. These diverse trends may well reflect the development of the "partners" systems on the part of both the mainline carriers. For the 1985-91 period, the industry saw a decline in total operating expenses per carrier while the Level I carriers saw a modest real increase. For the former, this may well reflect increases in passenger density as they assumed larger parts of the parent's network. The latter may well reflect increased stage length. In both of these sub-periods, both groups of carriers experienced declines in both total operating and unit

toll revenues expressed in real terms.

The percentage decline was larger for the industry as a whole than for the Level I carriers. For the total study period, the Level I carriers experienced substantial increases in both real revenue categories, while the total industry saw almost no real change in total operating revenues and a slight decline in unit toll revenues, both measured per passenger.

5.2.1 Costs Considered Further:
For the purposes of this dicussion, operating costs will be divided into three components: aircraft operating costs, general service and administration costs and other costs. As in the analysis above, all costs have been converted to constant dollar terms using the GDP deflator. For the purposes of comparison, changes in total operating expenses are again provided.

The percentage changes in these cost elements per passenger for the industry as a whole are shown in Table 4 for various periods. The data underlying this table reveal that for the period as a whole, the real total operating expense per passenger increased by about $17 to $199.49.

TABLE 4

PERCENTAGE CHANGE IN VARIOUS COST ELEMENTS
LEVELS I-IV CARRIERS
(CONSTANT (1986) DOLLARS)

PERIOD	TOT COST	SERVICE/ ADMIN COST	AIRCRAFT OPERATING	OTHER COSTS
1980-85	26.38	36.05	23.88	13.41
1985-88	-24.44	-16.39	-32.09	-26.94
1988-91	14.65	14.22	18.59	8.55
1985-91	-13.37	-4.50	-19.46	-20.69
1980-91	9.48	29.93	-0.22	-10.05

SOURCE: STATS CANADA, Canadian Civil Aviation, # 51-206.

This increase was caused exclusively by genral services and administration cost increases which totalled $21.42 in real terms. By 1991, these costs accounted for almost 46 per cent of total operating expenses of the industry as a whole, up from 38 per cent. As the table above shows, the balance of operating costs fell in the period.

With respect to the two deregulation periods, it can be seen that the first, 1985 - 1988, carried substantial benefits in that all categories of cost fell sharply on a per passenger basis. The second such period, 1988 - 1991, saw a reversal of this trend, with all rising, and the aircraft operating cost increases leading the way. While the current recession may be blamed for part of this negative turn of events, more appears to be involved. From 1985 through 1988, total operating expenses per passenger declined continuously, reaching $174.00 in 1988. In real terms, they increased by $7.84 the next year, then by $6.72 in 1990, and finally by $10.91 in 1991. More is involved than the recession.

Equivalent data for Level I carriers are found in Table 5. For these carriers, real total operating expenses per passenger increased from $58.72 to $226.99 between 1980 and 1991, an increase of almost 35 per cent. As one might expect, there are similarities between the situation here and that for the industry as a whole. The most notable is that the cost category "general services and administration" accounted for most of the increase. For the study period as a whole, it increased by $44.04 per passenger in real terms, about three-quarters of the total increase. Increases in real aircraft operating

TABLE 5

PERCENTAGE CHANGE IN VARIOUS COST ELEMENTS
LEVEL I CARRIERS
(CONSTANT (1986) DOLLARS)

PERIOD	TOT COST	SERVICE/ ADMIN COST	AIRCRAFT OPERATING	OTHER COSTS
1980-85	28.28	30.86	32.71	14.23
1985-88	-5.52	6.25	-16.92	-13.67
1988-91	11.30	12.94	10.60	7.29
1985-91	5.16	19.20	-8.12	-7.37
1980-91	34.90	57.02	21.93	5.82

SOURCE: STATS CANADA, Canadian Civil Aviation, # 51-206.

costs per passenger accounted for only about 22 per cent of the total. In all study periods, on a per passenger basis, these services and administration costs increased. In the first deregulation period, aircraft operating costs per passenger declined; in the second, they rose. For the total deregulation period (1985-1991) the decline in aircraft operating costs was just over 8 per cent.

If one wishes to find an explanation for the weak financial performance of the Canadian airline industry in the period since deregulation, it appears prudent to begin by exploring the forces behind the increases in general service and administration expenses. In 1991, these accounted for over 53 per cent of the total operating expenses per passenger, and were significantly greater than the real cost of aircraft operations per passenger. Whether the cost reductions should be sought in general administration, sales and public relations, passenger services or airport and traffic services has not been explored to date.

5.2.3 Revenues Considered Further:
Over the total study period, real total operating revenues per passenger increased by $38.61 to $214.67, while real unit toll revenue per passenger rose by $38.89 to $179.61 for the Level I carriers. This revenue performance is, however, misleading. Both revenue measures, in fact, reached their maximums in 1983. In that year, the former stood at $233.78, while the latter stood at $196.95. In constant (1986) dollar terms, neither level has again been attained.

Between 1980 and 1991, presumably as a consequence of increased competitive pressures as reflected in service scheduling, the Level I carriers expanded their capacity (as measured in terms of available seat kilometers) by about 16 per cent. This long period can be divided into three sub-periods. Between 1980 and 1985, the Level I carriers expanded capacity by only 8.8 per cent. In the next three years, capacity was expanded by 13.2 per cent. In the final period, 1988 to 1991, capacity declined by about 6 per cent, leaving the overall increase noted above. This expansion was carried out in the face of a real decline in consumer spending of about 21 per cent, only modest growth in real GDP, and significantly higher personal income tax levies.

These capacity changes mirror (and in reality explain) the pattern of real air fares through time. In this instance, fares are measured in terms of unit toll revenue per passenger kilometer. Between 1980 and 1985, fares so measured rose by almost 20 per cent. It will be recalled that this was a period in which the carriers operated under the authority of numerous licences, competition was constrained, and fares were established according to fare formula. Between 1985 and 1988, real fares, measured as before, fell by almost 23 per cent in the face of the increased competition. It is interesting to note that in the final period, the modest reduction in capacity resulted in a 9 per cent increase in fares as measured here.

5.3 Policy Implications:
The above analysis suggests that public policy might have a role to play in resolving the difficulties faced by the industry. These are more extensive than this statistical review indicates, and include, inter alia, congestion at certain airports. From our perspective, the proper role for government in dealing with the airports and airlines

problem is to employ the tax system (in the form of time-based congestion landing fees) to mitigate the inherent tendency on the part of the industry toward capacity expansion.

Such government action, however, will not resolve all of the difficulties. There must be further actions taken by the carriers themselves to increase efficiency and lower costs. The prime target for such activity must be that family of expenses falling under the heading of general services and administration.

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2. Several classes of passenegr service may be produced. In addition, there are air freight, air express and airmail components of airline operations. Only passenger service is considered relevant here.

3. In the case of goods production, the firm can appropriate sufficient amounts of capital and labor to produce the desired level of output. While airlines can appropriate these two factor inputs as well, they cannot appropriate the third input (the passenger stock) required to generate passenger trips. It is this inability to specify property rights which creates the adverse interactions.

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Inter Carrier Productivity Differences between U.S. Airlines

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I. INTRODUCTION

The rapid increase and subsequent decrease in the number of firms in the U.S. airline industry has generated considerable discussion over the degree of contestability these changing numbers have implied and considerable confusion has arisen over the nature of the market being contested [Brander, *et al.* 1989]. Rather less attention has been paid to the characteristics of the particular firms which have failed or been absorbed and those which survive and prosper in varying degrees.

There are a number of ways in which investors and others may hope to identify potentially ailing firms via their annual statements, stock behaviour, and other financial information [see for example, Altman, *et al.* 1981]. Much work remains to be done in this area. However, the present paper attempts to lay the foundation for a different analysis. Specifically, it is concerned with an approach to the question of whether the extinct airlines in some way less technically efficient than their surviving counterparts.

Technical efficiency consists of the extraction of the maximum output from the minimum inputs and at the single input - single output level requires little comment. However for multiple input - output firms such as airlines, increased analytical sophistication brings greater ambiguity in results. Two broad approaches may be distinguished. An econometric analysis such as Cornwell, *et al.* [1990] requires a predetermined production function to be fitted to input-output data across the industry and/or over time. There are well established methods for this approach, and results may be evaluated using recognised statistical tests. Alternatively if no production function is assumed, efficiency may be evaluated directly using data envelope analysis (DEA). It is this approach which is proposed in the current paper.

Section II provides a brief summary of the development of DEA with some of its principal variations. The section concludes with some comments on the relative merits of DEA and econometric analysis for the current purpose. In Section III the basis of the current preliminary study is outlined

including the data used and the method of analysis. Results are described in Section IV and some comparison is made with those obtained by econometric studies on overlapping data sets. The concluding section offers comments on the problems encountered in the current study and the prospects for a more extensive study covering the whole period of deregulatory expansion and contraction to date.

II. DATA ENVELOPE ANALYSIS

DEA models are a nonparametric, nonstochastic techniques used to construct a multi-product frontier relative to which efficiency measures of the decision making units being studied are derived [Yue, 1992]. The efficiency frontier is generated by the data and all observations are enveloped by the frontier. Broad applications of DEA are summarised in Banker, *et al.*, 1990. While Yue [1992] credits the operations research work of Charnes, Cooper and Rhodes [1978] with the acronym DEA, the foundations of the approach are in production economics and the discussion here is limited to a model of DEA specific to efficiencies of production.

The current model is derived from Farrell's [1957] technical efficiency model, the extensions to this efficiency model [Fare, Lovell and Zieschang, 1983] and the Russell measure of efficiency as postulated by Fare and Lovell [1978]. The standard, or most efficient production frontier is determined by observation of the input/output functions of each firm. Technical efficiency of an individual firm is measured in terms of the changes in either inputs or outputs necessary to move it to the frontier. Proportionate changes in all inputs or all outputs yields the K Radial Efficiency Ratio [Farrell, 1957].

As an illustration, consider the single-input, single output situation depicted in Figure 1. The firms represented by observation points F_1, F_3, F_4 and F_5 have a technical efficiency ratio of 1. A firm such as F_2 is inefficient since its input-output mix could be modified to move it into an efficient position along the EE′ production function. The efficiency frontier firms represent K Radial Efficiency Ratios of 1. Firm F_2's K Radial (input) Efficiency Ratio is x^*/x, and the K Radial (output) Efficiency Ratio for Firm F_2 is y/y^*.

Scale Efficiency recognises that every position along the efficiency frontier does not necessarily represent the optimal scale. With constant returns to scale for example, the reference technology for production function EE′, is OH. The Scale Efficiency Ratio represents the losses resulting from mis-sizing given the relevant production technology. Hence, for firm F_2, producing y using x^*, there is still a scale efficiency loss, since x^{**} is the optimal input usage for output y, but because of scale problems x^{**} is not available to F_2. The Scale Efficiency Ratio, W for firm F_2

is x**/x* [Fare and Lovell, 1978].

The Russell Efficiency measure cannot be discussed in the single input, single output context. [Fare, Lovell and Zieschang, 1983]. It is an extension of the K Radial Efficiency Ratio which allows disproportionate changes of one input or one output from amongst multiple inputs and outputs. The Direct Russell Measure is based on a Pareto-like criterion in which one or more inputs are reduced as long as output is maintained and no input is increased beyond its observed level. Holding inputs constant and increasing one or more outputs yields the Implicit Russell Measure.

Figure 2 illustrates the functioning of the Direct Measure for a two input, single output case. P represents an observed input vector, and EE' is the efficiency frontier, obtained as before. Following the radial approach, if P is reduced proportionately, it will intersect EE' at R and the efficiency ratio will be derived taking R as the basis for comparison. If, however, inputs are reduced disproportionately, the final reduction may be at any point on the frontier to the southwest of P. While the choice of Q as a reference point is immediate in this case, for a complex multi-input, multi-output technology it may be less obvious. In the present study all inputs are weighted equally.

Cornwell, Schmidt and Sickles [1990] (CSS) extended their earlier econometric study of efficiency in the airline industry [Schmidt and Sickles 1984] using the data for 1970 to 1981. More recently, Kumbhakar [1992] (SK) has estimated allocative distortions in the industry over the period 1970-84. These studies serve as a useful basis for comparison with the DEA technique proposed here.

While econometric estimation requires assumptions on the particular form of the production function not used in DEA, the CSS analysis introduces cross-sectional and temporal variation in production, which allows for a comparison of these results to the preliminary DEA results reported here. Similarly, SK provides for a separate constraint caused by 'noncost-minimizing behaviour by the airlines, lags in the adjustment process of a price change, dynamic considerations in the choice of some inputs, and control of fares, routes and frequency of flights, etc. by the regulatory agency' (page 724).

With a larger overlapping data set some inference might be drawn concerning the suitability of the production function used in each case.

III. THE CURRENT STUDY

For a preliminary assessment of the DEA technique on airline data, the study considered the ten largest U.S. carriers over the period 1977 through 1984: American, Braniff, Continental, Delta, Eastern, Northwest, Pan American, Trans

World (TWA), United and Western. Annual data was used with five input variables: available ton miles (ATM) and available seat miles (ASM), collected from the Civil Aeronautics Board; air crew hours and ground crew hours, collected from the International Civil Aviation Organization; and fuel consumption and oil consumption, collected from the Federal Aviation Administration. The six output variables: revenue passenger miles - scheduled (RPM-S) and non-scheduled (RPM-NS), revenue ton miles - scheduled (RTM-S) and non-scheduled (RTM-NS) and mail revenue, were obtained from Form 41 (Civil Aeronautics Board).

The analysis consisted of the evaluation of two radial measures and two Russell measures for each carrier over three different data sets. Input and output vectors for firm k denoted by X^k, Y^k respectively and hence X, Y are the n row matrices of all industry inputs and outputs. Where cross sectional and temporal data are mixed X and Y will contain one column for each firm in each year. Each measure was determined using a linear programming formulation as follows:

1. Output Based Measure of Technical Efficiency, K_k (k=1,..,10)

maximise θ

such that:

$$\mathbf{S}.\mathbf{Y} \geq \mathbf{Y}^k\theta$$

$$\mathbf{S}.\mathbf{X} \leq \mathbf{X}^k$$

$$\mathbf{S} \in \mathbf{R}^{10}_{+}$$

$$\theta \geq 0$$

The technical efficiency of firm k is measured by the ratio $K_kY^k/S^*.Y$ where S^* is the optimal solution the linear program.

2. To incorporate scale, program 1 was re-run with the added constraint that $\Sigma S_k=1$. If the corresponding efficiency measure for this program is $W_k=Y^k/S^*Y$, then scale efficiency is given by $S_k=K_k/W_k$.

3. Russell Implicit measure, R^Y.

Here the program uses a vector $\theta=(\theta_1,\ldots,\theta_Y)$ to determine if firm k could have produced more of at least one output with the same inputs.

maximise $\Sigma\theta$

such that:

$$\mathbf{S.Y} \geq \mathbf{Y^k\theta}$$

$$\mathbf{S.X} \leq \mathbf{X^k}$$

$$\mathbf{S} \in \mathbf{R^{10}_+}$$

$$\theta_j \geq 1 \quad j=1,\ldots 6$$

Efficiency is measured as before by $\mathbf{R^y=Y^k/S^*Y}$.

4. Russell Direct measure, $\mathbf{R^x}$.

Corresponding to the output measure is an input measure $\mathbf{R^X}$ in which the vector $\theta=(\theta_1,\ldots,\theta_j)$ is applied to the inputs.

minimise $\Sigma\theta$

such that:

$$\mathbf{S.Y} \geq \mathbf{Y^k}$$

$$\mathbf{S.X} \leq \mathbf{X^k\theta}$$

$$\mathbf{S} \in \mathbf{R^{10}_+}$$

$$\theta i_j \geq 0 \quad i=1,\ldots 5$$

Thus $\mathbf{R^x=S^*X/X^k}$ measures the extent to which the same output $\mathbf{Y^k}$ could have been produced with less of at least one input.

IV. THE RESULTS

Each of the measures was computed using three different subsets of the data as a basis for the reference technology. In the unpooled measure the performance of each firm was compared only with that of other firms in the same year. Pooled dated used the current year and all preceding years' data for comparison to extend the small data base and since it may be argued that firms have access to any technology used in a previous time period. However since the industry was subject to considerable upheaval during the test period and in the framework of any extended study, a third set of results was calculated using the current and two preceding years as a pooled reference base. No major differences were apparent as a result of limiting the amount of pooling.

Since the results are of a preliminary nature over a highly limited data set a representative selection are presented graphically in the Appendix.

Comparison between CSS and the present study

CSS use quarterly data from 1970Q1 through 1981Q4, for eight airlines: American, Allegheny, Delta, Eastern, North

Central, Ozark, Piedmont and United. The analysis uses four input variables: capital, labour, energy and materials; and one output variable: available ton miles. Three separate sets of results are reported, a generalised least squares model (GLS), estimates based on the analysis of covariance (WITHIN) and an instrumental variable approach (EFFIV). All results indicate considerable change over time: relative efficiency levels of 82% in 1970Q1 growing to 95% in 1981Q4. Within the very limited comparison possible, the results from both analyses are surprisingly similar. Further confirmation over a broader data base would lend support to the functional form used by CSS.

There are four firms overlapping the two studies: American, Delta, Eastern and United. CSS efficiency levels (5) for 1975Q1 and 1980Q4 based upon each reported statistical method appear in the table followed by the DEA analysis for the same carriers and years.

CARRIER	GLS	WITHIN	EFFIV	K	W	Russell	
						impl.	*dir.*
American	95 93	90 93	93 94	100 100	100 100	100 100	100 100
Delta	99 99	91 94	93 93	98 94	98 94	49 6	90 82
Eastern	92 92	81 88	84 87	100 100	100 100	100 100	100 100
United	92 100	84 100	88 100	100 100	100 100	100 100	100 100

Comparison between SK and the present study

SK uses annual data from 1970 to 1984 for 19 airlines. An aggregate measure of output is used with three inputs, a capital index, a labour index, and fuel. As mentioned earlier, inefficiencies are recognised through an additional constraint on the cost minimisation. SK reports results for only one year which is also included DEA study period, 1984.

Since SK estimates different quantities, and DEA essentially compares the airlines with each other, the studies may conveniently be compared by looking at which of the carriers common to both studies are indicated as being least efficient by each method in 1984.

Five least efficient airlines by:		Least efficient airlines in terms of scale by:	
DEA	*allocative distortion (SK)*	*DEA*	*SK*
American	American	American	American
Continental	Eastern	Delta	Northwest
Delta	PanAm	Eastern	PanAm
Eastern	TWA	*	TWA
Western	United	*	United

Only three airlines were shown as scale inefficient by the DEA study. While SK shows scale inefficiencies for all carriers the estimates are small and SK notes that "except for only a few, the airlines are found to have exhausted economies of scale" (page 737). The lack of agreement between the two approaches requires further investigation. The most obvious distinction between the two methods is that since SK minimises a cost function it requires input price data which the DEA analysis does not. One of the purposes of the current research is to attempt to examine physical and financial effects separately.

V. CONCLUSION

Gong and Sickles [1992] tested various methods of studying efficiency, including maximum likelihood, GLS, within, and DEA, amongst others. Their results indicate DEA as second only to the Constant Elasticity of Substitution Translog Method for efficiency estimation. They suggest that the lack of dollar based data in DEA makes it less liable to the correlation problems which interfere with most other methods. However, extreme care is needed in the specification of inputs and outputs to ensure the DEA efficiency measure is not contaminated by either mispecification of variables or missing variables.

A tentative review of the current results suggests that the technique is of interest when applied to airline data. The differences between pooled and unpooled data are not great in most cases and do not warrant dropping either approach at this stage. Possibly a larger data set over a longer time period may be more revealing. The Direct Russell measure has considerable intuitive appeal since it permits some recognition of an inappropriate input 'mix'. However, even over the small dat set considered here, the implicit Russell measure appears to be unreliable. It seems plausible that output expansion, at least over the short term, is more likely to be constrained by demand side factors, rather than

problems of technical efficiency.

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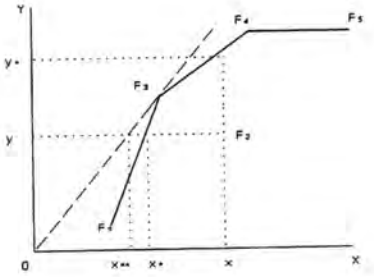


Figure 1.

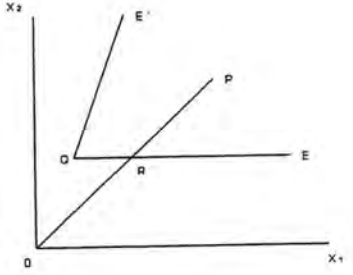
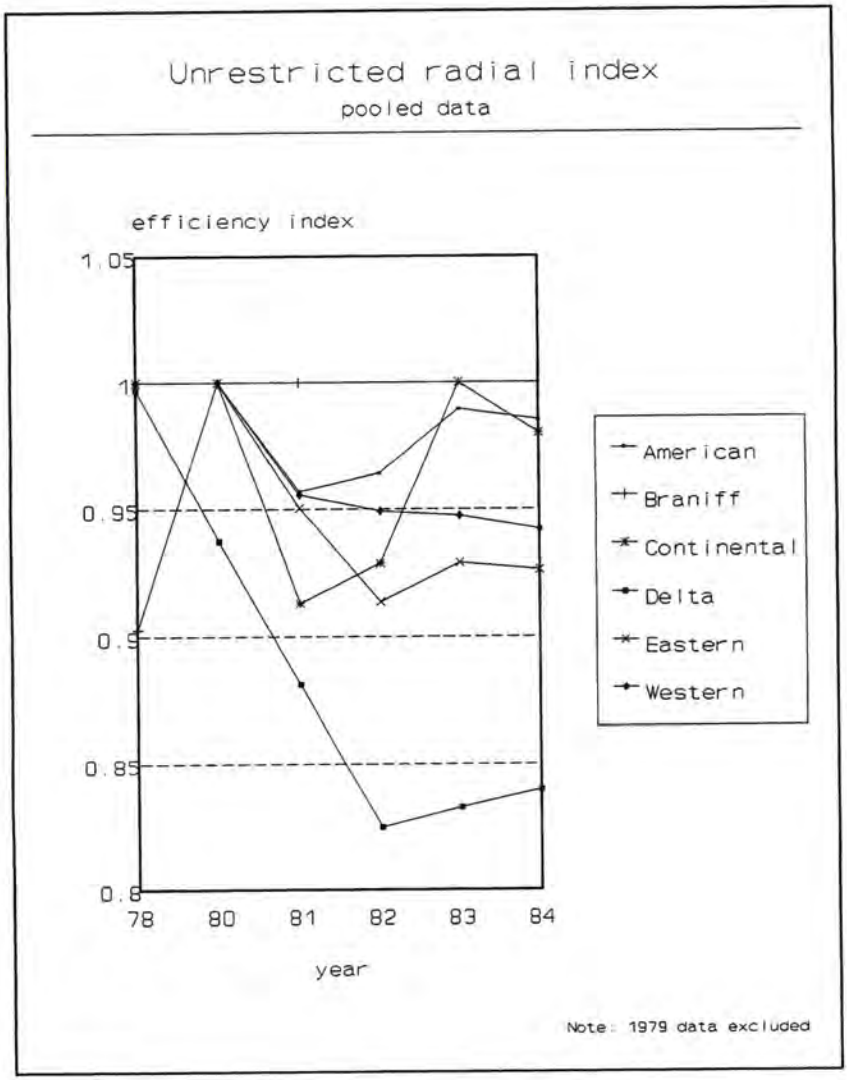
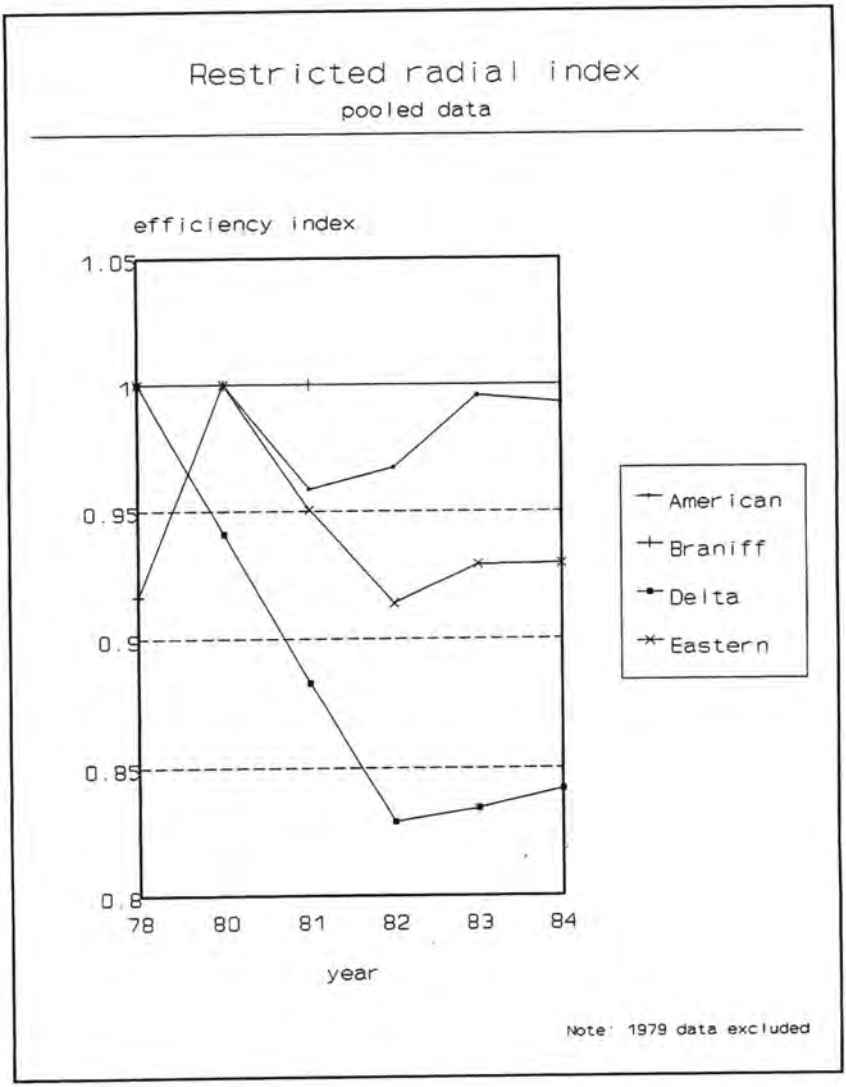
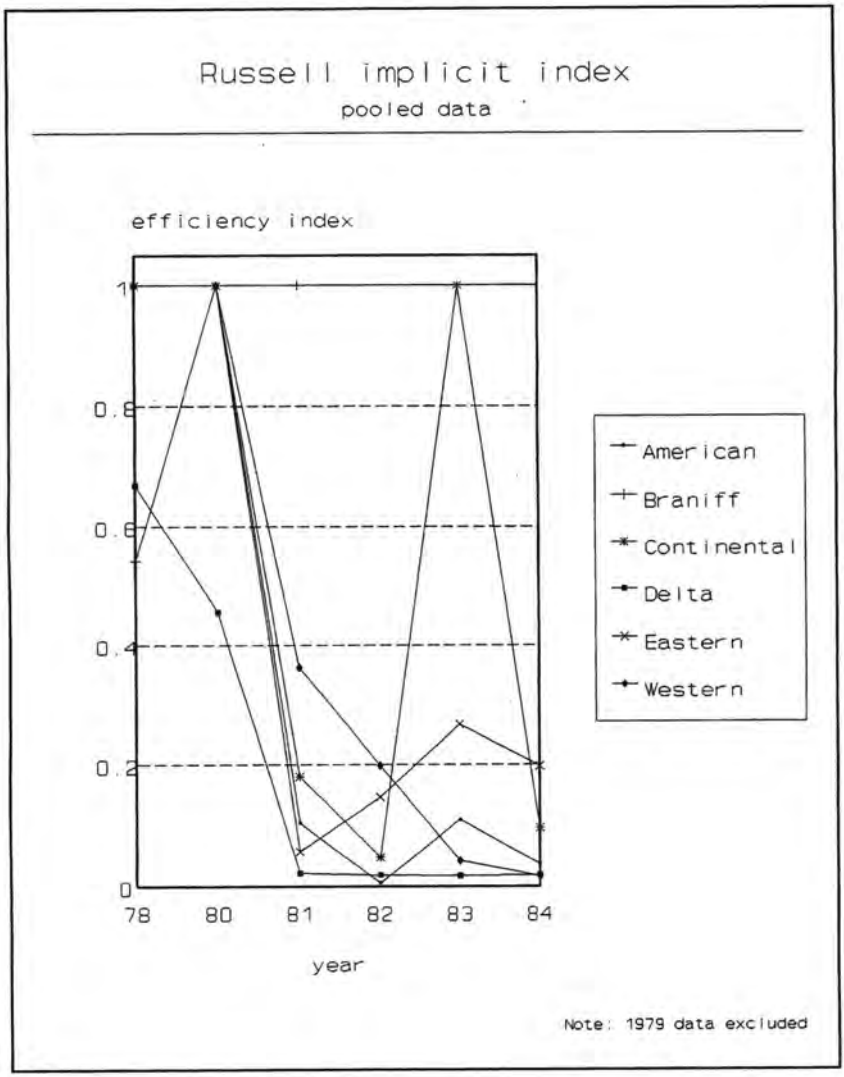
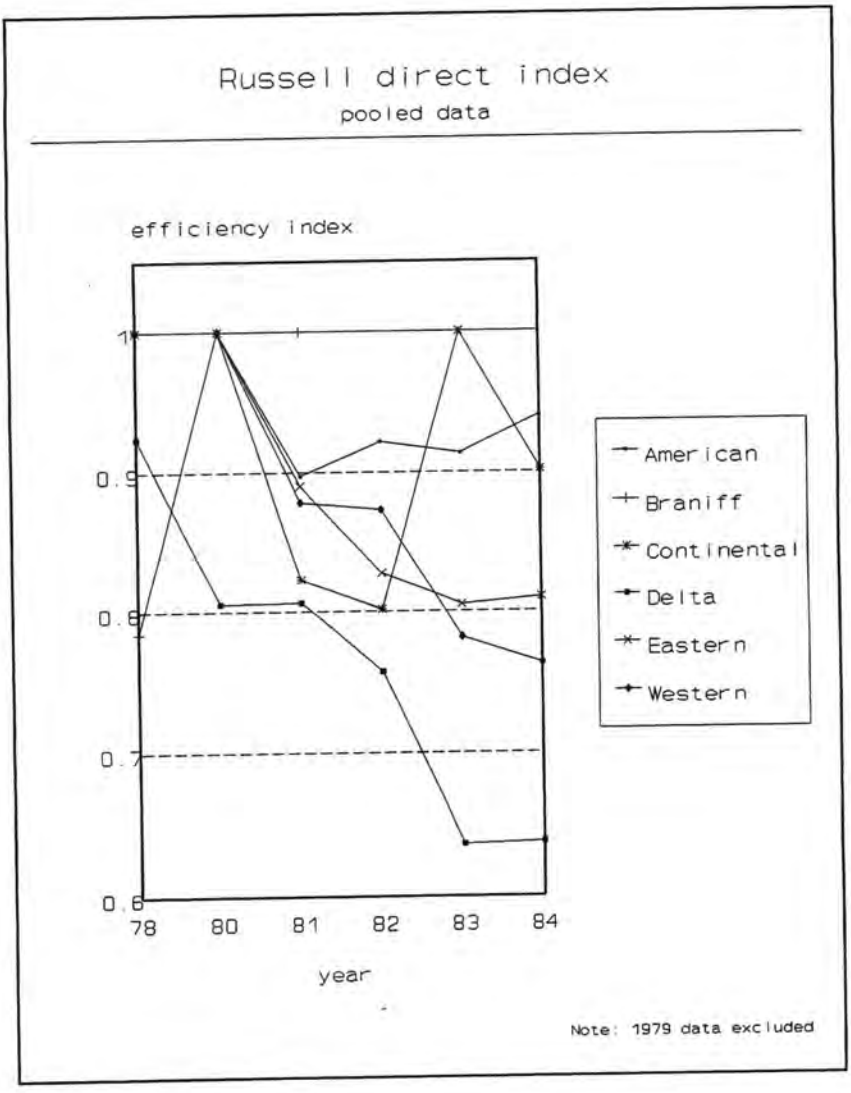


Figure 2.


Unrestricted radial index
pooled data
efficiency index
1.05
1
0.95
0.9
0.85
0.8
78
80
81
82
83
84
year
American
Braniff
Continental
Delta
Eastern
Western
Note: 1979 data excluded


Restricted radial index
pooled data
efficiency index
1.05
1
0.95
0.9
0.85
0.8
78
80
81
82
83
84
year
American
Braniff
Delta
Eastern
Note: 1979 data excluded


Russell implicit index
pooled data
efficiency index
1
0.8
0.6
0.4
0.2
0
78
80
81
82
83
84
year
American
Braniff
Continental
Delta
Eastern
Western
Note: 1979 data excluded


Russell direct index
pooled data
efficiency index
1
0.9
0.8
0.7
0.6
78
80
81
82
83
84
year
American
Braniff
Continental
Delta
Eastern
Western
Note: 1979 data excluded

THE TURBULENT NINETIES
HOW THE CANADIAN AIR CARRIER SYSTEM SURVIVED.

C.H.Glenn
C.H.Glenn Consultant Inc.

Preamble

As I stand here today in June of the year 2000, I marvel at how the Canadian airline industry survived the 1990's having been on the brink of total collapse at one point. We did not know in early 1990, that we were entering a long painful recession, being told regularly by the politicians in Ottawa that the downturn in the economy would be short lived, and that prosperity was just around the corner. In fact, it was not until 1994 that the Canadian airline industry started to grow again, although as I will show later, from a substantially lower base. With 1993 domestic passenger traffic being about the same as that of 1989, we had lost about four years of growth, a situation similar to what the Canadian airline industry experienced during the recession of the early 1980's.

In the 1991 to 1993 period, the Canadian airline industry was in a very sad financial state due mostly to the recession, but partly due to its own actions. P.W.A., the parent company of Canadian Airlines International Ltd.(C.A.I.L.) had made a few unfortunate decisions back in the 1986 to 1989 period, the results of which it could not have forecast as being so disastrous. First, it acquired CP Air which had not yet recovered from its acquisition of two regional carriers, Eastern Provincial and Nordair, and then Wardair, after it had collapsed in 1989. With CP Air and Wardair, P.W.A. also acquired a very heavy debt load. Air Canada had become fully privatized in 1988, but had not yet started to act as if it was not still a crown corporation. The management seemed to believe that market share and revenue growth were of higher priority than net income. As well, it had ordered three expensive B747-400 airplanes for Asian routes, one of which, Canada/Japan, it had not received authority to operate.

When the recession started in 1990, caused mainly by the Gulf War, both carriers had no experience in how to cope with prolonged negative growth rates. They both had an excess of airplanes, and rather than reduce capacity to cope with the reduced demand at profitable load factors, they elected to offer for sale large numbers of surplus seats on their domestic services at unprofitable fares. So many seats were available at discounted prices, that many business travellers who usually travelled on higher fares, had no difficulty getting a cheap seat without suffering any travel inconvenience. In all fairness, the two carriers had been led by the government to believe that the recession was just about over and probably would not have done the things which they did, had they known that the recession would last so long. Thus, the two large domestic carriers accumulated huge deficits as well as leading passengers to believe that large numbers of seats at discounted prices would continue to be available in the future. The smaller commuter carriers owned or partially owned by the two large carriers also felt the impact of excessive discounted fares, and many suffered financially as well.

Back in 1992 Air Canada and C.A.I.L. studied the possibility of merging their domestic services, however gave up for of a number of reasons. The major reason was the inability to integrate their debt structures etc, but other reasons included the expected opposition from the public at not having a choice of carriers, problems with merging union seniority lists, the location of the main maintenance base, the different cultures of the employees etc.

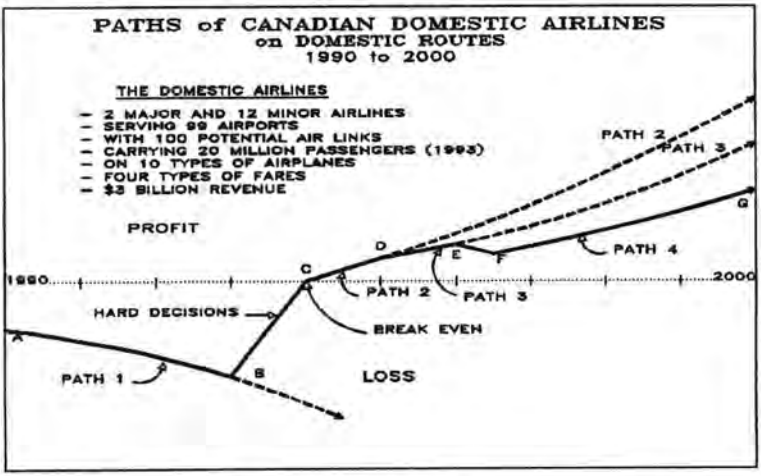
Paths through the 1990's.

It would be difficult to dissect the year 2000 to show how the industry moved through the 1990's, so I have elected to describe the various paths which our domestic carriers started down with their domestic operations, how they had to change, and how they ended up where they are today. This is depicted in the diagram below. The transborder and international operations of the carriers followed different paths, but I will not attempt to describe them.

Path 1 was the direction which the domestic carriers as a group were following until the 1993/1994 period. It was a path which could never have led to the year 2000, as in the early years it would have led to the bankruptcy of the two large carriers.

Path 2 was one which was followed after some hard decisions were made to avoid financial collapse. If two other disturbing situations described below had not developed, **Path 2** would have led to a very profitable year 2000.

Path 3 was in the same general direction of **Path 2**, but with significant adjustments necessary to cope with the gradual loss of a



large percentage of their business travellers to competition from **"video-conferencing"**.

Path 4 was a continuation of **Path 3** except the industry had to adjust to the losses of passengers due to the separation of Quebec from Canada, and the relocation of some major facilities.

Over the past decade, the progression of the Canadian domestic carriers on their domestic routes has been, **A** to **B** to **C** to **D** to **E** to **F** to **G**, in the diagram.

The Situation During 1992/1993

During the 1992/93 period, the Federal Government could see the possible collapse of both C.A.I.L. and Air Canada. It knew that most of the world's airlines were experiencing heavy losses, however, in terms of their sizes at that time, the losses of the large Canadian carriers were disproportionately high. It also knew that the major cause of these losses on their domestic operations was too much capacity and the associated fare wars. But short of going back to regulation, how was it going to influence the two carriers to reduce capacity? In the case of C.A.I.L., a reduction in domestic capacity of 15% was tied to a $50 million loan guarantee by the government to P.W.A. But what could it do with Air Canada?

By the fall of 1993 it became evident that Quebec was going to separate from Canada. This meant that, being a sovereign state, it would have control over its own air services, be able to negotiate a bilateral agreement with Canada and designate its own carriers on a number of routes. The Canadian Government would also be able to designate its major carriers on these routes, seven of which would be very profitable, however all but one route had insufficient passenger volume to justify more than one carriers from each state, that is "single designation". The Government let it be known that, when it came to the designation of its carriers, it would look favourably on those airlines which could become profitable on their domestic services by the end of 1994. Both Air Canada and C.A.I.L. received the message loud and clear, and "profit rationalization" became the objective for the domestic services of both carriers.

The other factor in C.A.I.L. becoming profitable was that the two American Airlines (A.M.R.) members on the P.W.A. board, would not necessarily disapprove capital expenditures or operating plans which did not result in the improvement of the net income, but they had the ability to influence such decisions. For C.A.I.L. this meant a reduction in domestic capacity, reducing the number of discounted seats offered, and operating at a higher average passenger load factor. The Air Canada board was a little slower to react, but was able convince the appropriate members of the Air Canada management that bottom line, without sacrificing passenger service, came ahead of market share objectives.

Some Details of the Various Paths. (See Appendix A for assumptions and statistical data)

Path 1/93. (Read **Path 1** for 1993) This represents the situation which existed in 1993 on **Path 1** before the "profit rationalization" process began, that is, with the total losses of the domestic services of the carriers, including their commuter subsidiaries, being an estimated $315 million before tax, (on a revenue of about $3 billion). On this **path** the airlines would have continued to operate at excess capacity, and offer almost 50% of its domestic passengers, fares reduced by as much as 70%.

Path 1/20 represents what **Path 1** would have led to by the year 2000, had no significant changes been made in how the domestic carriers conducted their businesses. The annual losses would still have been $325 million, including about $140 million in interest on the $2 billion borrowed to cover the losses of the previous seven years. **This would never have been allowed to happen.**

Path 2/93 represents the results of the combined "hard decisions" made by the two large carriers, and some of the smaller ones, back in the 1993/94 period. The core of these hard decisions was to down-size their domestic services by the reduction of frequencies on many flight legs, without withdrawing service from any points. To accomplish these reductions and to lower costs, the airlines decided to a) reduce by 20%, the percentage of discount seats offered, b) increase the average passenger load factors by about 2 percentage points, c) reduce the labour element of the overheads by 15%, d) reduce the non-labour elements of the overheads by 10%. and e) increase all fares by 5%. These fare increases resulted in fewer passengers travelling at discounted fares, but had a minimal impact on those travelling at the higher fares. The above resulted in an average break even before tax by the end of 1994, for the combined operations of the scheduled domestic carriers.

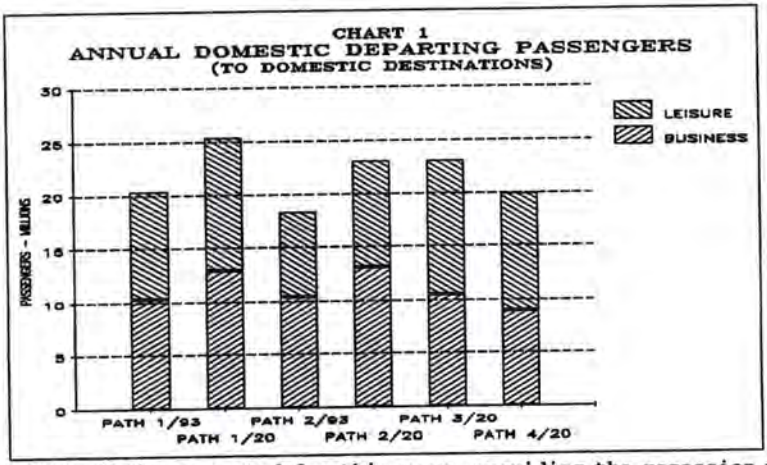
The "hard decision" adjustments which were made would have been the same had Air Canada and C.A.I.L. been successful in merging their domestic operations.

Path 2/20 represents what would have happened on **Path 2** by 2000 had there been no further major negative factors affecting the passenger market, from 1993 to 2000. During this period there would have been no fare increases higher than the inflation rate, a wage and salary freeze for all personnel until 1997, and a replacement of

B737 & DC9 airplanes by more fuel efficient types. By today, the year 2000, a reasonable total income before tax of $415 million could have been achieved.

Path 3/20 represents what today would have been had **Path 2** been influenced only by the gradual loss of 20% the "business" passengers due to the increasing popularity of "video-conferencing" with the larger Canadian corporations. The actions by the domestic carriers to compensate for these losses were to a) stimulate the numbers of discount passengers through small fare reductions so that the total number of passengers would not be reduced, b) increase the seating in their jet airplanes and c) further increase the passenger load factors. A reasonable net income before tax of $298 million could still have been achieved.

Path 4/20 represents the impact for the year 2000, of the loss of passenger traffic due to "video-conferencing" **and** reductions in operations due to the separation of Quebec from Canada. This scenario is the same as **Path 3** with adjustments for changes in operating patterns, reduction in revenue and costs, as well as the relocation of the Air Canada headquarters and maintenance facilities etc. Considering these changes, there still is a reasonable net income of



$228 million expected for this year, providing the recession which we now seem to be entering, is short and not too deep.

Observations - The Canadian Scheduled Carriers

- Had the domestic operations of the Canadian domestic carriers grown without regard for achieving profitability, the average rate of growth of passenger departures within Canada would have been 3.2% p.a. to the year 2000. With the rationalization of the supply of seats for discount passengers and the reduction in the number of business class passengers brought about by competition from video-conferencing, the annual growth rate, including the growth in the Quebec passenger market, has been still been 3.3% from 1993 to 2000, but from a two million passenger lower base associated with fewer passengers travelling on discount fares. (See Chart 1 above)

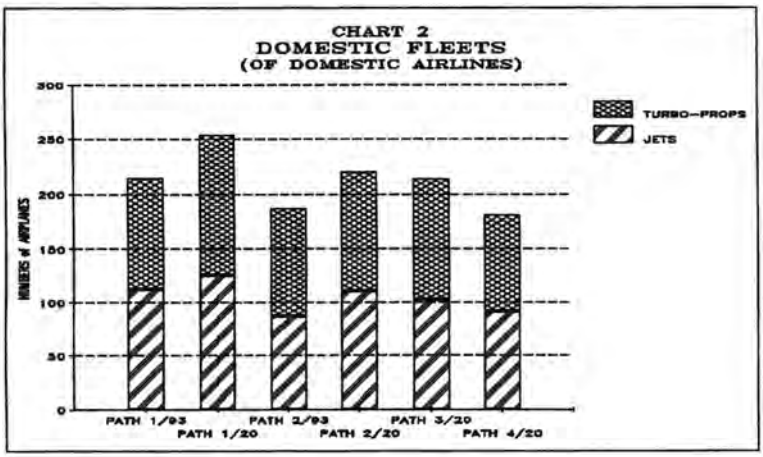
- The reduction in domestic operations back in the 1993/94 period required to allow the airlines to become profitable, led to a 13% reduction in the domestic fleets of the Canadian carriers, of 27 airplanes (13 jets and 14 turbo-props). Such a reduction meant fewer flight and cabin crews, fewer mechanics for maintenance, fewer departures and arrivals requiring fewer ground handlers, lower user fees, lower total lease costs etc, hence lower total costs. The excess airplanes at that time were either sold or returned to the

lessors.

By the year 2000, had Quebec not separated, the total fleet would have grown back to the pre "profit rationalization" level. The turbo-props would have increased by 9 airplanes, but there would have been 10 fewer jets. See Chart 2 below. The ability of the airlines to hold down the size of their domestic fleets has resulted from a) operating at higher load factors, b) higher seating densities in the jets and c), the replacement of the B737 and DC9 fleets in the mid-nineties, by the A320/B737-500 airplanes which are larger.

Back in the early nineties, the major airplane manufacturers were forecasting that the world's airlines fleets would double by the year 2000. Although there has been a replacement program for some of the jets because of noise regulations, the total fleet growth for the Canadian domestic carriers on their domestic routes has not materialized due to rationalization of services for profitability reasons. By 1993 the major aircraft manufacturers and leasing companies were in trouble because of the massive cancellations of orders by the world airlines. They are just now starting to recover.

- As shown in Chart 3 on the following page, the annual aircraft departures of domestic carriers from Canadian airports



today, had Quebec not separated, would be about the same as they were back in 1993 before the profit rationalization. At Pearson airport however, domestic departures, including to Quebec, are 3% fewer today than back in 1993, for the domestic airlines operating on their domestic routes, although the average aircraft seating is 11% greater, for airplanes operating on domestic routes.

- The total revenue and expenses for all the scheduled domestic airlines, on their domestic routes, for the various paths for specific years are shown in Chart 4 on page 7, which does not include domestic charter operators. As mentioned above, the expenses for the year 2000, for **Path 1** includes $140 million of interest for the $2 billion accumulated losses over the seven year period. The difference between revenue and expenses (profit) for **Paths 3 and 4** for the year 2000, indicate that the domestic carriers have been able to turn their airlines around, without having a major impact on passengers in the long term. As will be shown later, the impact on airline employees, and the airline infrastructure has been significant. See Appendix A for details.

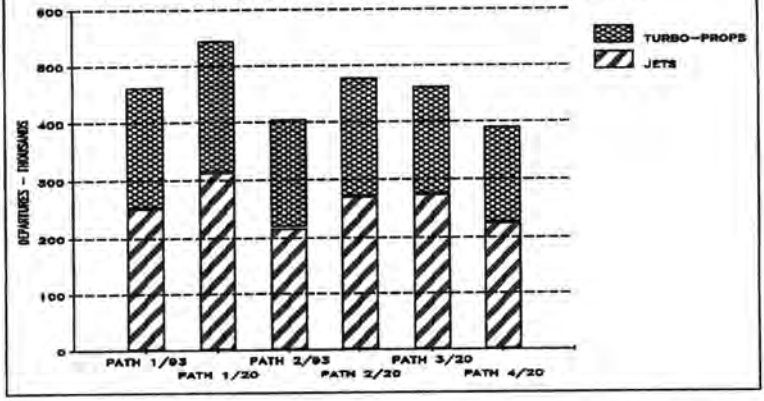
- The non-labour element of the overhead expenses has not reduced significantly over the years due to the move of Air Canada from nearly written off facilities at Dorval, to newer costlier

facilities in Toronto. Because of the actual reduction of the jet fleet, existing hangar facilities at Vancouver, Winnipeg and Toronto can handle the overhaul and check work required, and with the new engine and unit overhaul plant due to open soon at Starview, Ontario, the adjustments due to the separation of Quebec will be completed.

- The "rationalization" of operations in 1993 and 1994 necessary to make the Canadian airlines profitable on their domestic routes, resulted in a short term reduction of 14% in the unionized labour force. This came about by the reduction in numbers of flights, operations at higher load factors and reduced seats available for discount passengers. During this period, management and clerical staffs were reduced by 15% as shown on Chart 5 on page 8.

By the year 2000, had Quebec not separated, the unionized labour force would still not have been back to the pre-rationalization level, and the wages paid, in 1993 dollars, would have been about 9% less, due to the wage freeze of 1993 to 1996 inclusive. Now, after the separation of Quebec, the remaining airlines' unionized labour force stands at 80% of the 1993 pre-rationalization level.

CHART 3
ANNUAL AIRCRAFT DEPARTURES
(DOMESTIC CARRIERS from CANADIAN AIRPORTS)



Today the numbers of employees in management and clerical classifications, stands at 65% of the 1993 pre-rationalization levels, the drop being a combination of improvements in the efficiency of management, and the reductions resulting from the loss of those Air Canada employees who elected to stay in Quebec after the moving of the Air Canada headquarters from Montreal, at the time of the separation of Quebec.

- The profit rationalization of the 1993/94 period which reduced the seats available for passengers travelling on discounted fares, changed the percentage of leisure passengers from about 49% to 43%, (2 million fewer passengers) while the percentage of the business passengers increased from about 51% to 57%. By the year 2000 the situation is now reversed with business travel lower due to competition from video-conferencing and leisure travel stimulated through fare decreases. The percentages are now 54% leisure and 46% business.

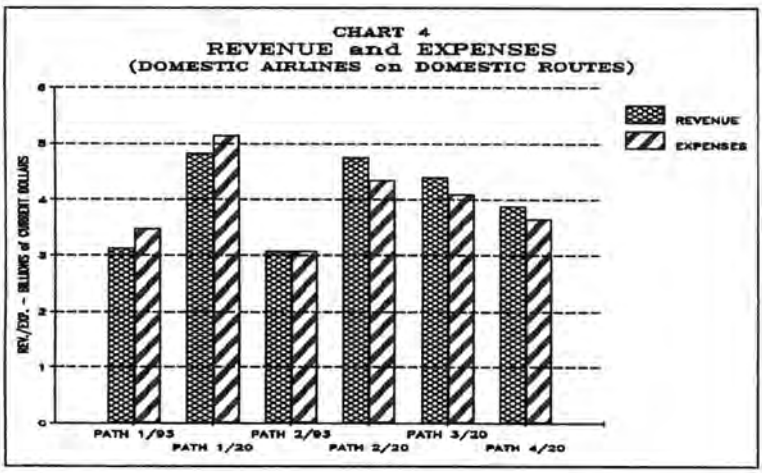
- With Canadian carriers, the leisure passenger traffic peaks during the summer months, with the business traffic declining a small amount. The change in the distribution between business and leisure resulting from video-conferencing, makes the total summer peaks worse, necessitating the expansion of the winter markets in the south in order to maximize the utilization of labour and equipment.

- With the separation of Quebec and the setting up of its own airlines, the resultant loss of Canadian origin/destination passengers has been about 14%. This assumes that Quebec carriers have been sharing equally with Canadian carriers those passengers flowing over the forty bilateral routes between the two countries.

- Although there was an initial drop in the **number** of passengers travelling on discounted fares during the "profit rationalization" period, the number of passengers travelling on discounted fares today, including those travelling on the Quebec airlines, is about the same as it would have been had there not been the profit rationalization. The fares are also about the same, after allowing for inflation. This means that the leisure traveller has not suffered in the long term. On the other hand, business travel is down about 20%, with the fares about the same, allowing for inflation.

Impact on the Infrastructure - Canada

- As a result of the reduction in the numbers of discount passengers back in the 1993/94 period, and the loss of 20% of the



business travel since that time, the revenue from the Air Transportation Tax for domestic operations today is about 11% lower than it would have been, had there had not been the "profit-rationalization" and the separation of Quebec.

- Today, had Quebec not separated, the revenue received by the airport operators from domestic carriers, would have been about $27.7 million less than what was expected back in 1993 before the reduction in air operations due to the "profit-rationalization" program. This amount, or $1.20 per passenger, is not enough to justify the airport operators imposing a "departure tax". Instead, the operators have passed this loss of revenue back to the airlines, in the form of increased rentals.

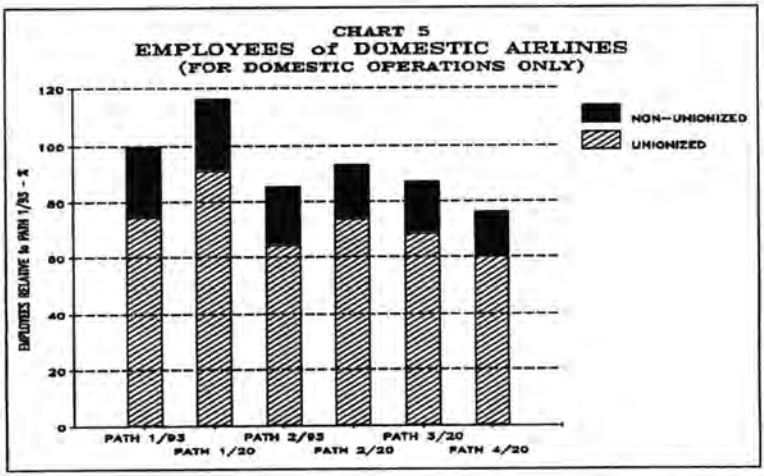
More important, the airport concessionaires are suffering from the loss of revenue due to changes in the type of passenger passing through the terminals. The passengers are now made up of a higher percentage of leisure passengers, who do not spend as much in the terminals as the business traveller.

- Travel agents' revenue, as with the transportation tax revenue is about 11% lower than would have been expected, although the revenue per passenger is slightly higher than back in 1993, allowing for inflation.

- The overall fuel efficiency of the domestic fleets of jet and

turbo-prop airplanes has improved by 17%. In fact, the total consumption of aviation fuel within Canada in the year 2000 on domestic routes is less than the pre-rationalization consumption in 1993. Although the improvement in fuel efficiency has benefited the airlines, it has meant a loss in revenue for the oil companies and less than expected fuel tax revenue for the governments.

- With Quebec now being a sovereign state, passenger arrival and departures at Canadian airports to/from Quebec are from the international areas of the terminals. This has not been a problem at the main airports in Western Canada which already have inspection services for international and transborder operations. At the smaller airports in the Maritimes, there has been a reluctance on the part of the Federal authorities to install facilities for inspection services at all airports, so the airlines have been forced to consolidate the flights to/from Quebec at Halifax and Moncton. This means that services to Charlottetown, Saint John and Frederiction are through Halifax or Moncton. In Newfoundland, the only services to/from Quebec are at St.John's.



Although Pearson Airport has a large international and trans-border departure/arrival area, it is now, in the year 2000, handling about 6600 more departures and arrivals per day through those areas due to the transfer of passengers to/from Quebec, from the domestic departure/arrival area. This has resulted in higher construction costs for the terminal operators and has caused a fragmentation of Air Canada's Rapidair services at Terminal 2.

Quebec's Scheduled Airlines

Although "open skies" exists between Canada and the U.S.A and between Quebec and the U.S.A., it does not yet exist between Quebec and Canada. Air services between the two states are now operated through a bilateral agreement signed by the two, some of the elements of which are as follows:

a) On all routes between the two states, each can designate its own carriers to provide 50% of the capacity, based on the projected passenger flows. Where volumes are so small that an airline from each state would provide too much capacity, the bilateral allows for only one carrier on that route.

b) No cabotage is permitted by either state. For example Canadian carriers would not be permitted to operate between points in

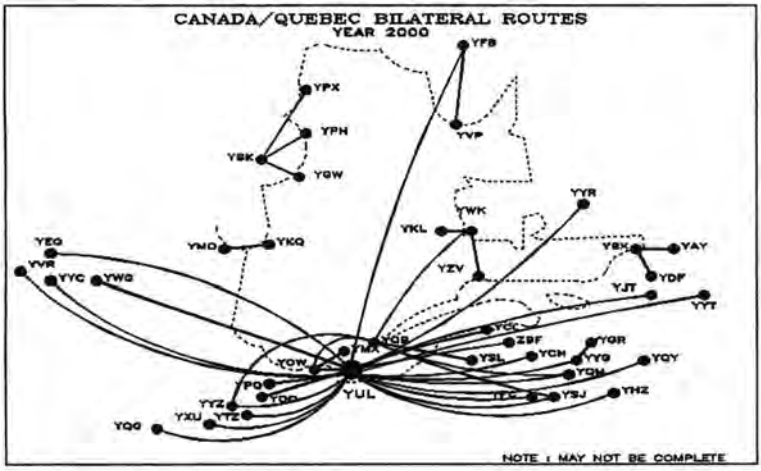
Quebec, and vice versa.

c) Neither state is permitted to carry passengers from the other's airports to a third state, i.e fifth freedom rights, and vice versa. Neither state is allowed to operate charter flights from airports in the other state, to points in third states.

d) Foreign ownership in Quebec's airlines is limited to 25%. (This meant that Air Canada had to reduce its 75% ownership in Air Alliance, to 25%.)

The bilateral routes are shown on the diagram below and the following are the cities/towns/airports associated with the city codes shown:

YAY St Anthony	YBX Blanc Sablon	YCH Chatham	YCL Charlo
YDF Deer Lake	YEG Edmonton	YFB Iqaluit	YFC Fredericton
YGW Kuujjuarapik	YHZ Halifax	YJT Steph,ville	YKL Schef'ville
YKQ Waskaganish	YMO Moosonee	YMX Mirabel	YOO Oshawa
YPH Inukjuak	YPQ Peterbor.	YPX Povungnituk	YQB Quebec Cty.
YQG Windsor	YSJ Saint John	YSK Sanikiluaq	YSL St Leonard
YTZ Toronto Isl.	YUL Montreal	YVP Kuujjuaq	YVR Vancouver



YWG Winnipeg	YWK Wabush	YXU London	YYC Calgary
YYG Charl'towne	YYR Goose Bay	YYT St. John's	YYZ Toronto
YZV Sept Iles	ZBF Bathurst	YGR Iles de la Madeleine	

The airlines of Quebec currently operate a total of 37 airplanes on Quebec and Canadian routes, 24 of which are turbo-props and 13 of which are jets. The jets consist of B757s, Canadair Regional Jets and B737 Combi's. The major routes within the sovereign state of Quebec, are shown on the following page.

On a revenue of $494 million, the combined income before tax for operations on the domestic and Canadian routes of the Quebec carriers, is expected to be $63.6 million this year. (See Appendix A) This high percentage of income relative to the revenue, is due to the lower labour rates than those of the Canadian carriers, the use of the old Air Canada hangar facilities, and the operation of a very large, efficient hub and spoke system centred at Dorval.

The Quebec airlines have a larger percentage of business class passengers than the Canadian airlines, as the Montreal/Toronto route represents a larger percentage of its total domestic and Canadian operations than for the Canadian carriers.

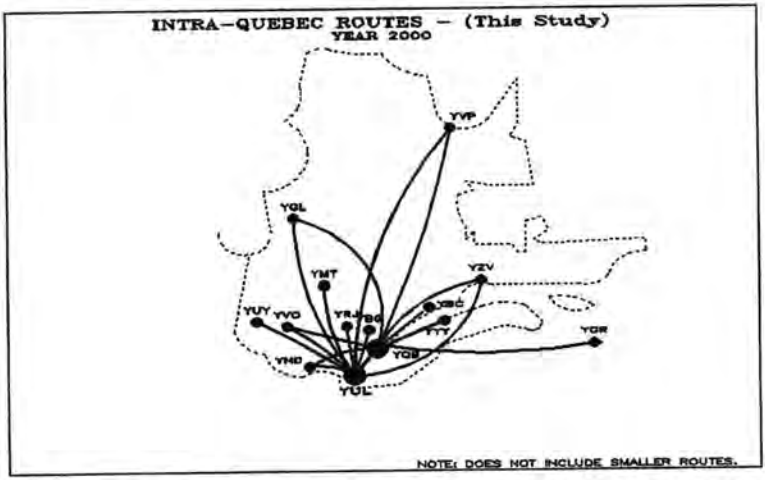
Infrastructure - Quebec

- At the Dorval airport arrivals areas, about 5100 passengers per day who were formerly domestic passengers, are now arriving at the international/transborder end of the terminal, requiring major terminal renovations. Arrivals at the domestic end of the terminal have been reduced by 75%.

- Quebec now operates its own air traffic control system and has a new sophisticated training centre at St.Jean, Quebec.

Conclusions

After major adjustments along the way, the Canadian domestic air carriers have survived the past ten years and are reasonably healthy. Those operating transborder and international routes had some rough times competing in these markets, however, the world,s airlines had to cut capacity and make the same types of adjustments that the Canadian carriers had to make in order to become profitable, and to expand/modernize their fleets. The "hard decisions" made back



in 1993 by the Canadian carriers, particularly with respect to the reduction of capacity, have paid off.

Quebec's carriers appear to be profitable and are looking to the day when there is an "open skies" agreement with Canada.

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APPENDIX A

This study applies only to the domestic operations of scheduled Canadian air carriers and only looks in detail at the years of 1993 and 2000.

ASSUMPTIONS

a) Base Year Passenger Origin/Destination Data

The passenger origin/destination flows within Canada have been declining over the last several years, however they should level out in the near future. In that it may be more than a year before we know more about the current passenger flows, it was decided to use 1989 data as a base for 1993, derived from Statistics Canada Catalogue 51-204 for 1989. To these data adjustments were made to reflect the fact that there has been growth during the recession in some parts of Canada, particularly in B.C., and that passenger statistics on many of the lower density routes operated by the smaller carriers, were not reported to Statistics Canada. The domestic passengers carried by domestic charter carriers have not been included, however a large percentage of the "Domestic Portion of International Journeys and Canada/U.S.A." has been.

It has been necessary to "flow" a significant percentage of the O/D passengers to the closest hub and this results in some double counting. For example there are not enough passengers flowing between Prince George and Toronto to justify a non-stop flight during the 1993-2000 time frame at reasonable forecast growth rates. Thus these passengers must be included in the Prince George/Vancouver leg statistics as well as for the Vancouver/Toronto leg - hence, double counting.

The following is the breakdown of the passenger departures, in millions, estimated for the base year of 1993 and used for this study:

Reported Origin/Destination	12.8	(about 98% of that in 51-204)
Adjustments for some growth and passenger not reported	2.6	
Domestic Portion of Int'l and Transborder journeys	1.7	
Double Counted	3.3	
Total	20.4	

b) Points Served in this Study

Vancouver	Victoria	Prince George	Whitehorse
Castlegar	Penticton	Kelowna	Kamloops
Ft.St.John	Quesnel	Williams Lake	Smithers
Terrace	Prince Rupert	Sandspit	Port Hardy
Campbell River	Comox	Nanaimo	Powell River
Calgary	Lethbridge	Medicine Hat	Lloydminster
Edmonton Int.	Edmonton Muni.	Fort McMurray	Rainbow Lake
Peace River	Grande Prairie	Fort Smith	Cranbrook
Yellowknife	Saskatoon	Prince Albert	Regina
La Ronge	Winnipeg	Kenora	Dryden
Red Lake	Ste Therese	Island Lake	Gods River
Norway House	Gillam	Thompson	The Pas
Churchill	Rankin Inlet	Lynn Lake	Flin Flon
Trenton	Kingston	Toronto(Pearson)	Pembroke
Sarnia	Windsor	London	Sudbury
S.Ste Marie	Timmins	North Bay	Thunder Bay
Toronto(Island)	Iqaluit	Oshawa	Buttonville
Chatham	Chibougamau	Goose Bay	Kuujjuaq
St Leonard	Roberval	Charlo	Sept-Iles
Bagotville	St.John's	Deer Lake	Moncton
Saint John	Fredericton	Baie Comeau	Quebec City

Gatineau	La Grande	Mont Joli	Rouyn
Val d'Or	Halifax	Charlottetown	Sydney
Stephenville	Yarmouth	Iles de la Mad.	Gander
Mirabel	Montreal	Ottawa	

The Airline Simulation Model used in this study provides for a total of 200 non-stop route legs between these points. Passengers travelling to/from cities/towns/airports not included in the above, are not included in the O/D data base, or the detailed calculations.

c) Carrier Operations

The assumption is made that Canadian Airlines International Ltd. and Air Canada are operating separately, although the actions necessary for them to become profitable in the short term, would be the same if they were merged. This model also includes most of the operations of the large commuter airlines which currently operate in various regions in Canada and feed passengers to the existing carriers. Also included are the operations of some of the smaller scheduled carriers operating airplanes with seating up to 19.

d) Fleet

The following is a list of the ten airplane type classes used in this study.

Code	Seats	Airplane Types
B76-3	222	B767-300
B76-2	188	B767-200 (B757 for sovereign Quebec)
A320	135	A320
B737	100	B737,DC-9
B73-C	72	B737 Combi, B727 Combi
F28	65 (44)	F28 (Regional Jet for sovereign Que)
BAE-2	77	BAe 146-200
DH8-3	50	Dash8-300, ATR42, HS748
BH8-1	37	Dash8-100, SD360
J31	19	Jetstrean 31, Twin Otter, Beech C99 Beech 1900, EMB 110 & 120, Metro/Merlin

The assumption is made that by the year 2000,

i) The B737's and DC9's would be replaced by the A320. A few B737 Combis, would be kept for operations into the North.
ii) The F28 would be replaced by the BAe 146,
iii) The Dash8-100 would be replaced by the Dash8-300 on many routes and,
iv) The J31 types would be replaced by the Dash8-100 on many routes.

e) Growth Rate

The basic annual growth rates, (including economic growth, population growth and disposable income growth etc) not influenced by price elasticity, for the various parts of Canada, from 1993 to 2003 were assumed as follows:

B.C.and Yukon	3.9%
Alberta and Arctic West	3.2
Saskatchewan	2.2
Manitoba	2.8
Ontario	3.6
Quebec and Arctic East	3.5
Maritimes	2.6
Newfoundland and Labrador	1.0

The basic growth rates for passengers travelling between two of the above regions was assumed to be the average of the two regions.

For all of the paths examined, the annual increase in the Consumer Price Index was assumed to be 3% per year.

f) Fares and Fare Types

For each of the 200 pairs of points, there are up to four fare types available: 1) Business class, 2) Regular Economy, 3) Shallow discount and 4) Deep Discount. Some of the pairs of points do not have Business Class fares available. For each fare type, for each pair of points, there is a percent distribution. In addition, there is a dilution factor or 35%, to allow for discounts available within each fare type, and for the proration of fares due to interlining.

g) Basic Escalation (1993 to 2000)

Airline labour, contract ground handling, food & beverage and miscellaneous,	3.0%
Maintenance material, landing fees and G.T.F's	3.5%
Fuel	3.1%

5) Sources of Data.

- Boeing
- Aviation Planning Services
- Airbus Industrie
- Newspapers such as the Globe and Mail and Financial Post.
- Air Canada Annual Reports.
- C.A.I.L. and Air Canada public timetables.
- Statistics Canada Reports 51-204 and 51-205
- Relevant Transport Canada documents.
- Gemini CRS (for regular economy fares).
- Confidential data held in the files of C.H.Glenn Consultant Inc.

6) Statistical Results

There was a very large amount of statistical data produced in this study, for example:

- for each pair of points flown, the weekly frequencies for each airplane type, the onboard passenger load, passenger load factor, the revenue generated, the average fare etc.
- for the system for each airplane type, the weekly departures, available seat miles, block hours, average flight length, fuel consumed, fleet required, passenger load factor, etc.
- for the system, the total passenger enplanements, passengers and revenue generated for each fare type, etc.
- for each airport, the airplane departures for each airplane type, average seating etc.
- for each airplane type there was a complete listing of costs etc, and for the system, all the non airplane related costs and overheads, plus a profit/loss statement.

It is not practical to present all the above data, however selected statistics for the Canadian airlines on their domestic routes are shown on the following page, and the comparable statistics for the Quebec airlines for the Quebec Separation scenario, are shown on page A-5 The percentage of employees relative to **Path 1** for 1993 are estimated numbers based on file data, and not produced directly by the Airline Simulation Model.

7) Comments

Those examining the statistical results who do not believe that the province of Quebec will separate from Canada, should consider, for the year 2000, only **Paths 2 & 3**. Those who believe that there will be no loss of business passengers to video-conferencing, and that Quebec will not separate, should consider only **Path 2**. It is not practical to consider **Path 1** to the year 2000.

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STATISTICS - DOMESTIC SCHED.AIRLINES on DOMESTIC ROUTES

	PATH 1		PATH 2		PATH 3	PATH 4
YEAR	1993	2000	1993	2000	2000	2000
A.S.M.(BIL.)	20.38	25.58	17.67	22.16	22.16	19.91
R.P.M.(BIL.)	13.29	16.68	11.85	14.92	15.14	13.66
P.L.F.%	65.20	65.21	67.07	67.32	68.31	68.60
FUEL(BIL.LIT)	1338.4	1508.6	1164.5	1316.6	1210.8	1080.5
PASS.(MIL.)						
FT#1*	2.167	2.695	2.159	2.710	2.167	1.914
FT#2	8.278	10.337	8.305	10.475	8.396	7.077
FT#3	5.138	6.416	4.110	5.154	6.507	5.652
FT#4	4.809	5.939	3.835	4.754	6.006	5.336
TOTAL	20.394	25.386	18.410	23.093	23.076	19.978
% PASS.						
FT#1	10.6	10.6	11.7	11.7	9.4	9.6
FT#2	40.6	40.7	45.1	45.4	36.4	35.4
FT#3	25.2	25.3	22.3	22.3	28.2	28.3
FT#4	23.6	23.4	20.8	20.6	26.0	26.7
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
YIELD($/R.P.M.)	.221	.271	.243	.298	.272	.266
FLEET SIZE	215	254	188	221	214	182
SYST. AIRCRAFT DEPARTURES (THOUSANDS)	463.1	546.5	406.5	478.5	462.6	393.3
SYST. SEAT DEPARTURES (MILLIONS)	33.23	41.31	29.09	36.29	35.68	30.70
SELECTED EXPENSES & REVENUE - $MILLIONS						
UNION LAB.	714.1	1075.4	614.7	864.8	809.5	712.3
MAN./CLER.LAB.	280.6	345.1	238.5	268.4	255.0	225.0
TOT.LAB.	994.7	1420.5	853.2	1133.2	1064.5	937.3
L.FEES & GTF'S	92.3	146.8	80.9	129.4	119.1	103.5
A/C LEASES	681.9	988.1	588.1	861.2	803.9	701.3
FUEL	425.4	575.9	370.2	502.6	462.3	412.5
TOT.EXP.	3490.6	5027.7	3087.0	4357.8	4121.4	3669.0
PASS.REV.	2937.8	4515.4	2880.5	4451.9	4122.5	3635.6
CARGO REV.	211.5	325.1	207.4	320.5	296.8	261.8
INC.BEFORE TAX	-314.3	-327.1	0.9	414.6	297.9	228.4
EMPLOYEES REL. TO PATH 1/93	100	117	86	94	88	77

* FARE TYPE #1 (BUSINESS CLASS)

STATISTICS - QUEBEC AIRLINES vs CANADIAN AIRLINES

	CANADIAN CARRIERS		
	PATH 3	PATH 4	QUEBEC CARRIERS
YEAR	2000	2000	2000
A.S.M.(BIL.)	22.16	19.91	2.11
R.P.M.(BIL.)	15.14	13.66	1.40
P.L.F.%	68.31	68.60	66.36
FUEL(BIL.LIT)	1210.8	1080.5	130.9
PASS.(MIL.)			
FT#1*	2.167	1.914	0.254
FT#2	8.396	7.077	1.179
FT#3	6.507	5.652	0.799
FT#4	6.006	5.336	0.616
TOTAL	23.076	19.978	2.828
% PASS.			
FT#1	9.4	9.6	9.0
FT#2	36.4	35.4	41.7
FT#3	28.2	28.3	27.5
FT#4	26.0	26.7	21.8
TOTAL	100.0	100.0	100.0
YIELD($/R.P.M.)	.272	.266	.333
FLEET SIZE	214	182	37
SYST. AIRCRAFT DEPARTURES (THOUSANDS)	462.6	393.3	80.6
SYST. SEAT DEPARTURES (MILLIONS)	35.68	30.70	4.63
SELECTED EXPENSES & REVENUE - $MILLIONS			
UNION LAB.	809.5	712.3	82.3
MAN./CLER.LAB	255.0	225.0	17.7
TOT.LAB.	1064.5	937.3	100.0
L.FEES & GTF'S	119.1	103.5	14.7
A/C LEASES	803.9	701.3	90.3
FUEL	462.3	412.5	50.0
TOT.EXP.	4121.4	3669.0	430.8
PASS.REV.	4122.5	3635.6	466.4
CARGO REV.	296.8	261.8	28.0
INC.BEFORE TAX	297.9	228.4	63.6
EMPLOYEES REL. TO PATH 1/93	88	77	N.A.

* FARE TYPE #1 (BUSINESS CLASS)

Public Policy Considerations in the Adoption of User-Pay Highway Financing

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I. INTRODUCTION

> The third and last duty of the sovereign or commonwealth is that of erecting and maintaining those public institutions and those public works, which, though they may be in the highest degree advantageous to a great society, are, however, of such a nature, that the profit could never repay the expence (sic) to any individual or small number of individuals, and which it therefore cannot be expected that any individual or small number of individuals should erect or maintain.
>
> It does not seem necessary that the expence (sic) of those public works should be defrayed from that public revenue, as it is commonly called, of which the collection and application are in most countries assigned to the executive power. The greater part of such public works may easily be so managed, as to afford a particular revenue sufficient for defraying their own expence (sic), without bringing any burden upon the general revenue of the society.[2]

This quotation, whose content parallels modern works on the subject of highway financing through user charges, is from Adam Smith's The Wealth of Nations. Despite being published in 1776 (over 200 years ago), Smith's

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[1] This paper represents the viewpoint of the author, and should not be construed as a policy document or position of the Government of British Columbia.

[2] Smith, 1904:244-245 (Chap. V). The Article which follows the quotation from Smith addresses means of defraying the costs of highway capital and maintenance through weight-related user charges on the basis that higher weight vehicles impose greater damage and should therefore bear more of the costs.

user-pay philosophy towards the provision of highway infrastructure is enjoying a renaissance within Canadian federal and provincial government ministries responsible for highway infrastructure, and ministries of finance, for reasons related to budgetary constraint and transportation demand management. The technical issues regarding user-pay highway financing, cost allocation, and pricing are all well developed in the literature. Advances in vehicle monitoring technology is making the application of highway charges technically and administratively feasible, especially where access and egress from facilities can be controlled. On the pragmatic side, the Final Report of the federal government's Royal Commission on National Passenger Transportation and the Prosperity Initiative both argue that a "more market-based approach to the prices governments charge for the use of public infrastructure could play a valuable role in helping to ensure that governments are providing the mix and quality of infrastructure goods and services that Canadians require"[3].

Policy development with respect to user-pay highway financing is now occurring within many governments. The intent of this paper is address some of the public policy considerations in the decision to implement user-pay highway financing at the provincial government level.

II. PUBLIC POLICY CONSIDERATIONS

What is public policy? There have been many answers[4] to this question, however for purposes herein public policy is defined as policies designed to achieve socially desirable objectives regarding the allocation, distribution and stabilization of scarce resources. Trade-offs exist within each of these objectives and public choice theorists suggest various means by which these conflicts are resolved. The public choice function of government matches individual preferences against one another in making collective choices. Government intervention in the marketplace in the form of regulation, the provision of public goods, and crown corporations, is justified on the basis of market failure. Increasingly, governments are being criticized for policies which result in an inefficient allocation of resources - particularly in the transportation sector. In most cases, however, the intent of the policies in question was not to promote an efficient allocation of resources, but rather to achieve other, non-economic goals, such as province building, regional development, and equitable access to transportation facilities. The lack of a price mechanism with respect to highway infrastructure served to achieve these goals. But what about today? Governments must now devise

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[3] Prosperity Through Competitiveness. Prosperity Initiative Consultation Paper. Government of Canada. 1991:24.

[4] Peter Aucoin, "Public-Policy Theory and Analysis" in Public Policy in Canada.

transportation policies which address both economic (competitiveness, budget constraints, increased demand on highway infrastructure) and non-economic (congestion, environmental externalities, not-in-my-backyard) issues. Increasingly, governments are being forced to assess user-pay highway infrastructure policies to address both sets of issues. In short, the adoption of the price mechanism as a policy instrument in the financing of highway infrastructure is seen by some as a means of achieving multiple objectives with respect to governments' allocative and distributive roles in society.

A decision to implement a user-pay highway financing policy can be based on three policy determinants: direct infrastructure financing (cost recovery for road wear), transportation demand management (efficient allocation of road capacity), and internalization of externalities through a price mechanism (internalization of social externalities). Each of these determinants represents a deviation from the status quo policy of relatively free access to highway infrastructure. This relatively free access forms a significant feature of the prevailing political economy with respect to Canadian transportation infrastructure.

Direct Infrastructure Financing

From an normative economic perspective, highway infrastructure has historically been perceived and financed throughout Canada as a "public good"[5], with capital, maintenance and rehabilitation costs funded through annual appropriations of general tax revenues to responsible ministries or departments. This form of appropriation is based on the philosophy that elected representatives should appropriate and be held accountable for expenditures of public revenues. Therefore, despite the levying of charges (motive fuel taxes) which positively correlate with infrastructure usage, these revenues are not directly available for infrastructure related programs through revolving accounts. From a public finance perspective, the available "tax room" in which to raise additional public revenue through taxation is limited. Given budgetary constraints faced by all provincial governments, and increasing expenditures for health, education and social services, there is no political incentive nor reward for ministers and ministries of finance to dedicate scarce tax revenues to the highway transportation function.

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[5] The term "public goods" is an abstract economic concept in the discipline's attempt to establish, through polar comparison, the characteristics of "private goods". There is no universally accepted definition. One definition has public goods, also known as collective consumption goods, exhibiting characteristics of non-rivalry and non-exclusivity in consumption. From a public policy perspective, public goods are associated with the incidence of market failure, which supports the need for government production because private markets will not produce such goods.

It may be both politically and publicly palatable, however, to charge direct fees for access to the highway system, or components of it, as a means of financing future capital, maintenance and rehabilitation costs. The "tax room" argument then becomes a matter of perception: would the public perceive user fees as a form of taxation if it were known that revenues would be dedicated to the provision and maintenance of local or proximate highway infrastructure?

The public policy consideration here is important. A policy which advocates user-pay financing of highway infrastructure deviates, in some respects, from the strict Samuelsonian definition[6], and current public perception, that highway infrastructure is a public good and therefore must be supplied by provincial governments through indirect tax revenues. Steiner offers a more workable definition of a public good for basing policies which advocate user-pay highway financing:

> Any publicly induced or provided collective good is a public good. A "collective good" in my definition is not necessarily a collective consumption good. Collective goods arise whenever some segment of the public collectively wants and is prepared to pay for a different bundle of services that the unhampered market will produce. A collective good thus requires (1) an appreciable different in either quantity of quality between it and the alternative the private market would produce, and (2) a viable demand for the product. (underlining added) (Quote from Steiner in Mulvey, 1974:392)

The key to this policy, however, is that revenues generated through user fees in one highway corridor should not be diverted to finance improvements in other corridors. There must be a perceived linkage between the fees paid and the benefits received by infrastructure users, similar to if users were purchasing private goods.

Transportation Demand Management

Due to the rapidly increasing need for highway infrastructure capital funding in most provinces, and the inability of provincial budgets to provide such funding, user-pay policies are seen as a means of effecting transportation

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[6] In article subsequent to his first exposition on public goods in 1954 titled "The Pure Theory of Public Expenditure", Samuelson admits that his concept of public goods is to be regarded as an extreme polar case in order to bring out the essence of the case for government intervention.

demand management - that being the allocation of scarce infrastructure facilities through a price mechanism. Such is necessary to avoid the "tragedy of the commons"[7] occurring on urban highway infrastructure. The tragedy of the commons denotes a situation in which increasing numbers of utility-maximizing individuals, in order to maximize their individual economic utility, consume incremental portions of a shared, fixed resource (the commons) freely available to the public. The tragedy occurs in that as consumption of the resource increases due to the lack of an economically efficient price allocation mechanism, negative externalities[8] arise which detract from utility. This concept applies to highway infrastructure that is available at little or no charge, and whose quality deteriorates with intensity of usage. Congestion pricing has been advocated by economists as a means of allocation scarce highway capacity, particularly during peak traffic periods:

> The only way around the fundamental law of traffic congestion is to make pear-hour automobile driving less attractive through some means that does not entail significant social waste. One way to do that is to replace the existing deterrent, congestion itself, which involves enormous deadweight loss in the form of wasted time and frustration, with a monetary price that, aside from collection costs, represents a simply a transfer of purchasing power with negligible loss of resources.
>
> Sound pricing principles call for pricing the scarce capacity of highways to provide peak-period trips, just as we price other scarce goods in a modern economic system. (Small et al, 1989:86)

From an economic perspective, congestion pricing is well developed in the literature. Figure 2 denotes efficient infrastructure pricing given fixed capacity (supply curve S). As capacity demand increases from demand curve D to D*, the market-clearing price rises from P to P*. Consequently, the rising price reflects the scarce nature of capacity, and provides signals to both users and suppliers of the capacity. Increasing demand, evidenced by

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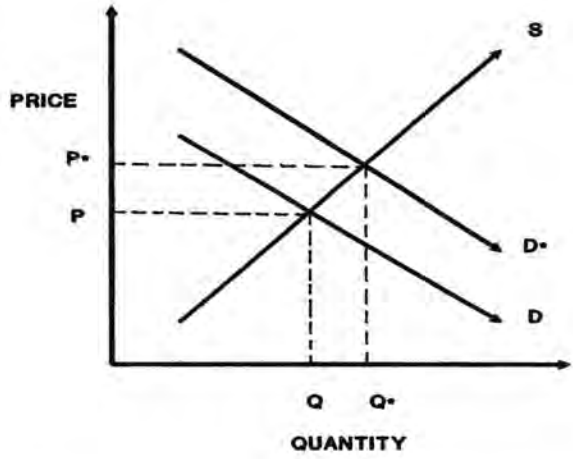
[7] Garrett Hardin, "The Tragedy of the Commons", Science, Vol. 162 (1968), pp. 1243-48.

[8] Negative externalities arise in either production or consumption of a good or service when the marginal social cost of production/consumption exceeds the marginal private cost, the latter of which is the usual transaction cost in a freely competitive market based on economically efficient pricing principles. As a consequence, societal costs associated with negative externalities are not accounted for in the transaction price, and therefore not incorporated into the market demand or supply curve for the good or service.

users' increasing willingness to pay, provides a signal to government that capacity expansion funding may be warranted.

FIGURE 1

EFFICIENT INFRASTRUCTURE PRICING



Although the literature supports the adoption of user-pay highway financing, from a public policy perspective, and more importantly a political perspective, it has been traditionally unacceptable. The public policy consideration in using the price mechanism as a form of highway transportation demand management is important. In the Canadian political economy, the free use of highway transportation infrastructure is perceived by the public as a collective entitlement or birthright, similar to the relatively free provision of health care and education. There is no direct linkage between benefits incurred and costs borne by users. This perception will be difficult to change in the short-term as infrastructure users would perceive user charges as a usurpation of an historical entitlement.

Internalization of Externalities

The negative externalities associated with highway usage consist of (1) congestion externalities, and (2) environmental externalities. In theory, the societal costs associated with these externalities can be estimated and allocated to infrastructure users through a price mechanism. Such costs could be charged to users absent the incorporation of capital recovery

charges into the price structure. Given that such externalities are apparent to infrastructure users, particularly during peak traffic period, externality-based charges may be more acceptable in a political economy increasingly expressing concerns about the environment - and the need for government policy direction regarding the environment.

FIGURE 2

ENVIRONMENTAL/CONGESTION EXTERNALITY

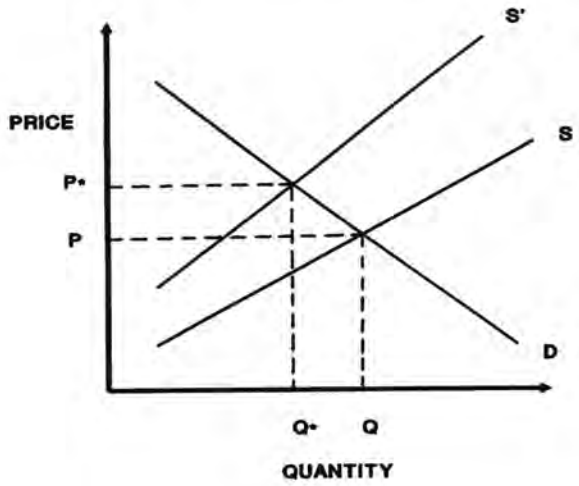


Figure 2 provide an economist's classical perception of negative externalities in terms of a differential between marginal private costs and marginal social costs. In such cases a negative externality results because societal costs are not included in the market transaction for a good or service, and therefore not included in the market supply curve.

Figure 2 denotes a negative environmental (vehicle exhaust emissions) or congestion externality. If the economic costs associated with the externality

were reflected in the price mechanism, the price would rise from P to P*[9]. Given the demand curve, the supply of resources (eg., highway capacity) is economically efficient where the supply curve S* intersects with demand curve D.

The public policy consideration here is important. Prevailing public policy is to permit relatively free access to highway infrastructure. Negative externalities in the consumption of highway infrastructure are not reflected in any price mechanism. A policy decision to internalize these externalities through a user-pay mechanism would represent a form of quasi social environmental policy - using highway infrastructure as the means to achieving such an end. Currently, there are few jurisdictions in Canada which assess some form of "environmental fee" associated with the consumption of infrastructure or services. Given increasing concern about the environment being expressed in the Canadian political economy, externality related user charges may be both publicly and politically palatable. The question remains, however, as to how any revenues collected through such user charges would be used to mitigate environmental damage resulting from highway consumption.

Moving from an normative analysis to real life, the dollar costs of congestion are significant. The Transportation Association of Canada (TAC) reports that the cost of highway congestion adds

- $1.9 billion/year - or an extra 40% - to goods movement through the Greater Toronto Area.
- $40-$50 million/year to goods movement in the National Capital Region.
- $39-$51 million/year to commuter movement in the National Capital Region.
- US $9 billion/year to the motoring public on U.S. urban freeways.
- £15 billion/year to the British economy.[10]

TAC also comments on the importance of the Canadian political economy in developing a shared vision as a starting point to address the congestion issue:

> Meeting the challenge of creating a common vision will have profound social implications. It will require: much greater public awareness, understanding and support; the combined

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[9] Price P represents the marginal private cost associated with the free-market determination of the level of resource consumption. The differential between P and P* represents the marginal social cost generated by consumption, which is the externality.

[10] Transportation Association of Canada Briefing, May 1992.

> determination of government agencies, private companies and citizens; and political will to follow through.[11]

IV. CONCLUSIONS

Traditionally, provincial highway capital programs have been funded on a "pay-as-you-go basis", from the general revenues of the province. Although transportation-related revenues make up a portion of the general revenues, those revenues are not dedicated to transportation purposes. In contrast, public infrastructure programs in the United States rely partially on dedicated user fees (including highway tolls), and on long-term financing, to meet capital demands. Recently, the use of capitalization for highway infrastructure has increased dramatically, as needs have outpaced the capacity of ongoing revenue sources.

Faced with urban highway congestion and deteriorating infrastructure, provincial ministries responsible for the highway function can no longer rely on general revenue allocations to finance and manage infrastructure. Public policies which advocate the adoption of user-pay highway financing must have a basis in economically efficient pricing so as to effectively regulate demand for, and externalities incurred in the consumption of, infrastructure.

It is important for public policy makers to view user-pay highway financing not as an end in itself, but as part of a broader range of policies designed to promote a better allocation of resources and effect both transportation demand management and the internalization of environmental externalities. The challenge in all cases is to establish a delicate balance between the role of the price mechanism in government policy and the legitimate role of the government in social decision-making. The role of government is to make social judgments about the type of society which we want to live in, and that *given* these decisions about desirable ends, market processes (user-pay) may provide a particularly effective means for their achievement - but the market should not be an end in itself. The adoption of user-pay highway financing requires that governments state explicitly the social goals to be achieved, whether they be simply capital financing/recovery, transportation demand management, or internalization of externalities.

As was stated earlier, the provision of highway infrastructure by provincial governments, in the form of indirectly funded quasi public goods, is perceived by the Canadian political economy as an historical entitlement. The adoption of user-pay highway financing will require reliance on sound public policy reasons to avoid being perceived as another revenue "grab".

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[11] Ibid.

As succinctly stated by the Economic Council of Canada (1982:24):

> Society can go about dealing with market failure in two quite different ways. It can try to isolate the causes of the failure and restore, as nearly as possible, an efficient market process. Or it can put matters completely into governmental hands, supplant the market, and directly determine the outputs it wants. In other words, social intervention can be *process-oriented*, seeking to correct the faulty process, or *output-oriented* seeking to bypass the process and determine directly by regulation or other device. (Economic Council of Canada, 1982:24)

User-pay highway financing, as a policy instrument to effect capital financing/recovery, transportation demand management, and internalization of externalities, should be designed to replace the current output or supply oriented highway policies with a process-oriented, multiple-goal related, policy approach.

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Beyond the Boundaries: Transit in Transition

by
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As we wend our way through the beginning of the last decade of the century, the predominant theme being played out is an economic downturn. Yet, its impact on the transportation systems within our urban centres has been somewhat paradoxical. While transit has suffered (not unexpectedly) devastating ridership losses, our urban road networks just grow more congested each year.

Transit in Crisis

After an extended period of generally increasing transit ridership in our cities, the trend has suddenly reversed itself. A quick survey of the transit ridership statistics across the country indicate the depth of the current crisis. Between 1990 and 1991, transit systems across Canada lost over 82 million revenue passengers, a drop of over 5%.[1] This single year loss was particularly devastating in larger urban areas.

A case in point are the various transit systems in the Greater Toronto Area (GTA) which together experienced a dramatic drop of over 37 million riders in that two year span. Compare that figure to trips by car which have been increasing steadily, rising from 1.72 trips per person daily in 1986 to 1.92 trips per person daily in 1991. As a result, transit modal splits have tumbled from 17% to 14% at a time when overall travel has grown 21% .[2]

Similarly in Greater Montreal, the transit share of trips has fallen from over 30% in 1982 to under 28% in 1987, a period in which the portion of all trips made by cars increased from around 55% to over 60%.[3] Overall, the Montreal area suffered a loss of over 38 million riders, a devastating plunge of 10%, in 1991.

While transit ridership has declined in cities of many different sizes, the greatest drop has been in the largest cities, those with populations over 400,000. In fact, as Figure 1 shows, rides per capita actually increased slightly between 1990 and 1991 in the smallest cities, those under 50,000 in population. Although the total rides per capita is still much greater in larger cities due to their considerable existing infrastructure and more comprehensive schedules and systems, the overall trend is still troubling.

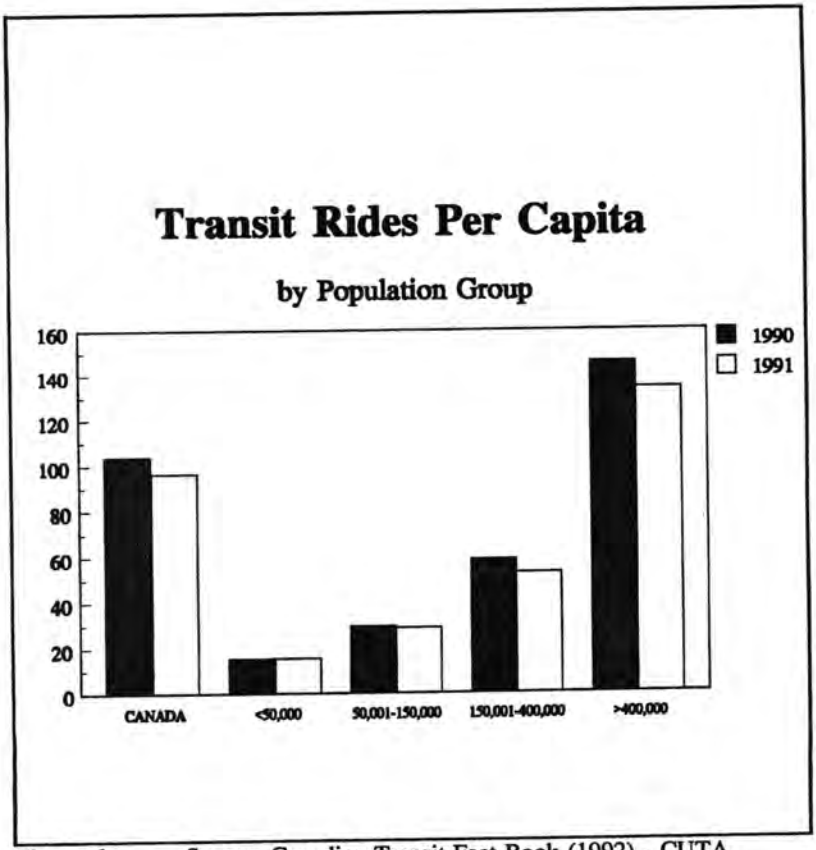


Figure 1 *Source*: Canadian Transit Fact Book (1992) - CUTA

The explanation for this trend has been varied. An unemployment rate bulging over 11% would certainly seem to contribute to fewer transit riders travelling to jobs than was the case a year or two earlier. Yet, the upward trend in car ridership as well as increased transit ridership in smaller cities would undermine this as a primary explanation.

A number of demographic trends have been identified as potential factors in this modal shift. For instance, an aging population tends to use less transit, have a higher incidence of driver's licences, and own more cars. These all contribute to a tendency for increased auto use. Similarly, as more females have entered the work force, their likelihood of obtaining drivers licences and owning a car has increased dramatically.

Impacts of Increased Auto Usage

Whatever the root cause, the inevitable outcome of this shift from transit to cars continues to be a downward spiral in transit ridership caused by, and leading to, further cutbacks to transit services. This particular chain of events sets off another negative sequence as it invites increased car usage. Cars, being the most inefficient means of urban transportation, create more road congestion and its attendant consequences.

The complete extent of these consequences are rarely recognized on an individual level. They range from environmental degradation concerns such as increased air pollution caused by emissions of solid particles, the greenhouse effect, and noise pollution, through to the health costs and consequences of vehicle accidents, deaths and injuries. Not to be ignored are the increasing impacts on the quality of life caused by the stress of daily driving through congested streets, and the loss of an individual's limited time for being with friends and family.

Even the impact on the economy is alarming. Congestion in the Greater Toronto Area alone is estimated to cost shippers a staggering $2 billion annually due to delays. Since the transportation component of the price of goods and most services are in the 5-15% range, this adds substantially to their end cost throughout the GTA.

Seeking Solutions

With urban space at a premium, and heightened social and environmental awareness, it is unlikely that constructing new or wider roads offers much of an option. Even in those rare urban locations where space and funding could be made available for road expansion measures, this tact is ultimately self-defeating. Any new or wider roadways will quickly attract yet more traffic and consequently further add to the overall congestion of the system as more vehicles enter via arterial roads.

While transit offers perhaps one opportunity for stemming the ocean move towards auto use, the recent drop in ridership levels are a clear indication that it is failing to fully meet this mandate. If effective actions are not taken soon, eventually our urban centres may only be rescued by drastic restrictions on auto use. Various environmental groups have already urged measures such as prohibitively high user fees or complete bans on cars entering the city core.

But the challenge in the near term -- by the year 2000 -- is to transform transit into the sort of alternative that will begin to attract people from their cars. If we are successful then we may never have to resort to some of the more drastic auto-restrictive measures being proposed.

While setting an ambitious goal is easy, its achievement is particularly challenging. Indeed, large amounts of money have been directed towards transit in recent years, often at the expense of roads, in an attempt to attract more riders. Across Canada, total transit operating expenses went from $2.84 billion in 1990 to $2.98 billion in 1991, an increase of five percent in a period when ridership **dropped** by the same percentage. So even increased spending has failed to reverse the trend. In a time of fiscal retrenchment, it is unlikely that similar increases will continue to be directed into transit just to keep doing things the same way.

Some might argue that if the root cause of this trend is largely demographic, then significant behavioral changes may beyond our means. However, there does appear to be another compelling theme developing in our urban centres which may allow room for us to manoeuvre.

Shifting Settlement and Travel Patterns

Most larger urban centres have incessantly expanded far beyond their original city boundaries. In response to this rapid suburban expansion, largely spurred by the high cost of land in the central city core, larger political entities were created. Yet even these expanded metropolitan areas no longer reflect current settlement patterns. Sprawling development continues to spread residential tracts further and further beyond even these metropolitan borders, which up until only a few years ago represented the absolute limit of continuous dense urban settlement. In other words, these political boundaries have become obsolete. Yet they still serve to define the limits of most urban service delivery, including public transit.

As a result, to the car driver, these artificial political boundaries are nothing more than a faint reminder of a time long past. But to the transit user, each municipal boundary often represents a very real barrier. A successful crossing of this barrier requires extra money, perseverance, pre-planning, and often, a modicum of luck. For in all likelihood, adjoining municipal transit systems do not have co-ordinated service, schedules or fares.

The Greater Toronto Area is a prime example of this trend. Due to the shifts in settlement and employment patterns, trips across the Metropolitan Toronto border increased by 50% between 1981 and 1991. Yet this exploding market has been so poorly served by transit, that 90% of all new trips are by car even though the peripheral roads are often saturated (see figure 2). Similarly, the organization of mass transit in Montreal presents major obstacles such as double fares and compulsory transfers to most users entering from outside the city.

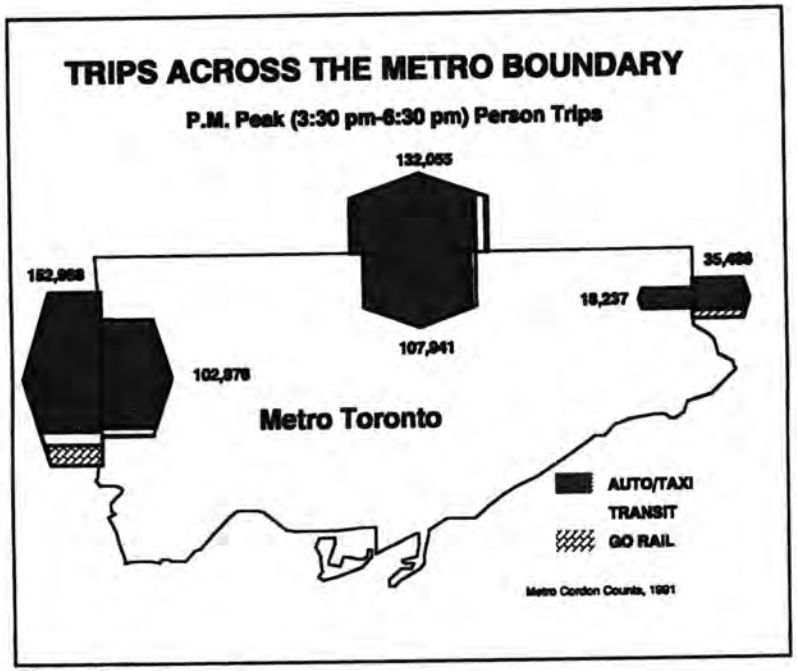


Figure 2

Are the experiences of a transit rider travelling across a metropolitan border that different from that of the car driver? The following composite is typical of the experiences faced by many people living in the fast-growing communities just outside of Metro Toronto and commuting to work within Toronto.

The Cross Boundary Commuter: The Case of Tony

> *Tony lives in a new development just over two kilometres outside of Metropolitan Toronto and works within Metro. How does he get to work? He could take transit. He attempted this once but it required a good 15-minute walk to the closest bus stop, then a wait of 10 minutes for the suburban bus. After a 10-minute ride he then had to exit at the Metro border, cross a major intersection and walk two more blocks to the nearest TTC bus stop. The wait there took another 5 to 10 minutes.*

Already, almost an hour had elapsed and he had just started the Metro Toronto portion of his trip.

When he takes his car, the same distance takes no more than five minutes. Since his employer offers free parking, his out-of-pocket costs (for gas) is negligible compared to the approximately $2.50 ($5.00 roundtrip) it costs him for the double fare by transit. When he took the two different buses, both those fares had to be paid by fumbling for exact change, or by finding locations to purchase the two different appropriate types of tickets beforehand.

In addition, depending on the time of year, Tony could have been walking to the bus stops in a howling wind, a driving rain, blinding snow, slush, intense heat, etc. His waits at both stops might have been accompanied by bitter cold or humidity and searing sun. Taking a car, he travels almost totally within a temperature controlled micro-environment.

When Tony drives to work, only the occasional sign along the roadside alerts him to the fact that he has passed a municipal boundary. There is no discernible change in the nature of the road surface, traffic rules, or general street environment. But as a transit user, a municipal boundary presents itself as a formidable barrier. It will require a change of vehicle, a significant walk and then waiting time in the outdoors and -- to add insult to injury -- a second full fare will be demanded.

It is revealing to contemplate for a moment a scenario in which the auto user is required to stop at each municipal boundary and pay a toll, or worse, change to another vehicle. One can anticipate a reaction that would be swift and loud. But the transit user has been expected to quietly put up with these very conditions.

Given this reality, it is hardly surprising that the modal split for transit across municipal boundaries tends to be significantly lower than the transit modal split within cities. Failure to address this issue will only further aggravate already serious arterial road congestion. Indeed, the traffic across one major Metro Toronto boundary is projected to **triple** in the next few years if nothing is done.

Changing peoples travel behaviours is a difficult task, often requiring a good deal of lead time. Once a person decides to purchase a car, they are entering into a financial and psychological commitment to a particular mode of travel for a number of years. Similarly, if they make the decision not to buy, or go so far as to sell their car, they need to be assured that a viable transit alternative exists.

It is becoming abundantly clear that solutions to the current situation will require new ways of thinking about urban transit. The multiplicity of independent systems within urban areas do not serve the purposes of the travelling public who increasingly need to travel across municipal boundaries in an efficient and comfortable manner.

A number of sources have identified integrated transit services as the best opportunity to efficiently realize this goal. Transit integration means transit planning and services reflecting the actual travel patterns of people rather than artificial political boundaries. Achieving this goal can result not only in improved transit service, but also cost-savings by reducing inefficiencies and abating impacts on the environment by offering a viable alternative to the reliance on cars.

Experiences Elsewhere

Quite a number of European metropolitan areas, through new political arrangements, have successfully moved towards transit integration. To gain a flavour of what is possible, consider the following scenario of a commuter in Hamburg, Germany.

> *Katherine lives in a suburb a few kilometres outside of Hamburg, Germany and works in central Hamburg. How does she travel? She could drive. But traffic congestion and gasoline prices seem to increase all the time and what little parking is available downtown is quite expensive. The transit system is much more reasonable. By dialling the central transit information centre, a computerized passenger information system provides optimal travel information for her destination on any combination of modes. A local feeder bus stops within a few metres of her house. The bus will travel directly into a U-Bahn (subway) station for a synchronized connection. Katherine's transit pass -- which automatically renews by mail monthly with a direct bank withdrawal -- allows her unlimited rides on all local buses as well as the U-Bahn and the trams.*

Much like our imaginary compatriot Tony, Katherine lives just outside the metropolitan area of a large urban centre. However, Katherine benefits from living in an area which can count itself amongst the earliest successes in transit integration in Europe.

In our Hamburg scenario, Katherine's decision to use transit for her daily commute is a logical outcome of the policies put into place by the

creation of the HVV (Hamburg Transit Association). Prior to 1967, Katherine would have been faced with a multitude of separate transit carriers, each with its own fare structure, competing schedules, and information. With all the confusion and effort involved she would have likely relied on her automobile for the trip.

The inception of the HVV had an immediate impact on commuters. A framework was created that ensured a high degree of service orientation, greater efficiency, fair revenue sharing, equity in decision making and region-wide planning. Within two years, the steady downward trend in transit ridership had halted and a significant four percent increase was registered.

Munich

A similar situation exists in other large German urban areas. For instance, up until 1972 public transit in the Munich region was provided by over 40 different companies, each with its own routes, schedules and fare system. As a result, the car was increasingly becoming the mode of choice. In response to mounting traffic congestion and environmental pollution a General Transport Plan was developed which led to the organization of a regional transit authority, the Munich Transport and Fares Authority (MVV).

The MVV introduced a common fares system which applies to the entire service area and to all of the local transit modes operated within it. Transit users can purchase universal strip tickets or passes which allows them to travel on rapid rail, trams or buses. With a small staff of 85 persons, the MVV manages the basic research, data collection and public relations for all the operating companies.

Through its broad planning approach, the MVV has reorganized and rationalized service such that trams and buses can act as feeders to commuter rail (S-Bahn) and subway (U-Bahn) systems, and generally improved connections throughout the entire region. This reorganization of the regional bus network means that even those people who do not live directly adjacent to S-Bahn lines now have access to an integrated transit network, a coordinated service timetable and a common fare system.[4]

By closely tailoring service to meet demand, the MVV has experienced a steady increase in ridership, a full 70% growth since its inception. As a result, the transit modal split in Munich has increased from 37% to 50% overall, and to an astounding 70% in the central core.

Paris

While a number of German cities have long been recognized as leaders in transit integration, urban centres in other European countries are also well advanced in this regard. For instance, in 1973, Paris introduced a pass called the Carte Orange which is valid on the Metro, city and suburban buses, commuter trains, and intercity lines. Fare collection is largely automated and fully compatible between all local, regional, urban and suburban operators.

Stockholm

Similarly, the lack of transit integration became an acute problem in the Stockholm region in the early 1960s with many separate private and municipal operators competing in an uncoordinated manner. In response, the national government stepped in and instituted a centralized Greater Stockholm Transport (SL) in 1964. [5] The SL has experienced great success in the integration of the various transit modes, including a common ticketing arrangement for all operations in what are the 24 most populous counties of the country, the coordination of timetables between buses and trains, and the design of stations and terminals to make transfers as convenient as possible.[6]

North America

The success in reducing costs, increasing ridership and improving transit services for riders which European centres have realized over the past two decades through transit integration have not been as ambitiously pursued in North America. It is unclear as to whether this can be attributed to the greater transportation problems faced in denser European cities, or the different nature of political relationships between local and national/regional levels of government (much of the European action was initiated by strong central government), or a host of other factors. Whatever the cause, the North American record on transit integration has been sparse.

San Diego

San Diego has long been considered a leader in transit integration on this continent due to its early creation of a regional transit authority, the Metropolitan Transit Development Board. Because of strong state leadership, the MTDB since 1975 has been able to develop a well coordinated transit system in the greater San Diego area including service planning, fares, fare media, customer information and marketing.

Canadian Experiences

Montreal

Within Canada, Montreal has had some movement towards integration due to pressure from the province. An early government proposal to set up a regional transit authority with a coordinated structure and full fare integration was rejected in the early 1980s. But over the years the need for improved transit integration has become increasingly apparent. Due to lack of further movement on the issue by 1989, the Quebec cabinet forced the issue by calling for the creation of a regional transit authority. Faced with an imposed solution, the municipalities hurriedly developed their own tenuous agreement. Through it, they were able to introduce some innovations such as a 1990 fare integration agreement between three major operators on joint passes.

A new *Conseil metropolitain de transport en commun* (CMTC) board came into existence in 1991 with responsibility for policy matters such as budgets for inter-regional operations and inter-regional fares. But the very limited scope of the CMTC -- such as its lack of jurisdiction over local or internal transit operations, failure to address the problems of financial redistribution, and the absence of the intermunicipal transportation boards (CIT) -- seriously hampers its ability to introduce any far-reaching improvements such as full service coordination. Indeed, the various transit corporations in the Montreal area have been moving in very divergent directions lately, further undermining any remaining potential by CMTC for transit integration.

Toronto

Over the past decade in the GTA, some scattered projects on transit coordination have been introduced. Since 1988, the Ontario Ministry of Transportation has had a fare integration and service coordination initiative which has achieved some notable successes such as a joint monthly *Twin Pass* between the commuter GO rail system and the local TTC network in Metro Toronto. In addition, a number of municipal systems outside of Toronto have worked out agreements whereby they will accept transfers from adjoining municipalities. Agreements have also been entered into by about a dozen municipalities with GO Transit to allow passengers free local bus service to/from the GO station with a valid ticket.

While these, and a handful of other, fare integration efforts have been introduced in the GTA, they only serve a limited portion of cross-boundary transit users. These efforts have required the unusual cooperation of the different systems in the absence of any formal co-ordinating body. In the more significant cases, such as the GO-TTC Twin Pass, it has required the specific leadership of the province to reach an agreement.

Significantly, no fare integration scheme has been successfully introduced where the problem is the most acute: between the TTC and any of the surrounding municipalities. Indeed, the problem is so severe, that it is estimated that people walk a significant distance across the northern Metro boundary alone **three million** times each year just to avoid paying a full double fare for a short bus trip.

Efforts in terms of service co-ordination have also been scarce. In the rare instances when they have been implemented, the lack of any formal structural arrangement has meant no ongoing monitoring and subsequently any future adjustments to one route are not co-ordinated with the other route. Very little progress has been made in areas such as joint infrastructure planning or information and marketing. [7]

Obstacles to Integration

Clearly, as some of the examples from abroad have shown, there are many things which can be accomplished. The possibilities are only limited by a lack of imagination or motivation. While there are obstacles, many have to do with the usual resistance to change. It is critical that we become fully alert to the risk associated with continuing in our current path.

Often in the past, the failure to progress towards transit integration was a result of local municipalities' narrow view of their mandates. If the primary goal is to provide transit service to people travelling within your own boundaries, then it does not matter if your bus routes terminate a kilometre from the boundary even if it happens to inconvenience those entering from the next municipality. Working with a limited amount of funds, it makes sense to avoid burdening local taxpayers with the costs of providing service to "outsiders." (That local residents would also suffer by likewise not being able to easily travel to the next municipality was besides the point.)

Experience elsewhere has shown that ultimately, leadership usually needs to come from upper levels of government to overcome this narrow focus. However, sensitivity to the individual needs and identities of local municipalities is critical to the successful implementation of transit integration.

Towards a Vision for 2000

Despite all the obstacles, truly integrated transit systems in large urban areas are well within our reach by the end of the century. The key pieces of an integrated transit system have been indicated in the earlier survey of

experiences elsewhere: seamless service, universal fare system, centralized customer information, region-wide capital and service planning.

Of these key pieces, it is the universal fare system which has the greatest potential for visually impacting transit service for the cross boundary transit user. Yet it is also perhaps the most challenging of all. Many issues will need to be resolved due to different fare structures, existing infrastructure diversity, revenue distribution requirements, cost allocation concerns, and so forth. But, thanks to rapid technological advances in fare collection and card systems, the possibility of an efficient and easy to use common fare system, which until now was just beyond our reach, is quickly becoming a reality.

Automated fare systems are clearly the wave of the future in transit. It allows a flexibility in fare systems and access to data that are simply impossible with ticket or token based systems. A number of prototype automated fare collection technologies are about to be introduced in some major transit systems around the globe. They range from simple magnetic stripe stored value cards (SVC) to sophisticated smart cards with imbedded computer chips. It will be instructive to follow the progress of these demonstrations in cities such as New York, Los Angeles (SVC), San Francisco (SVC) and Manchester (smart card) over the next few months.

One of the greatest advantages of this new fare technology is in the way it can support the other pieces of an integrated transit system such as seamless service. Furthermore, the transactional data base it affords will be an invaluable tool in addressing one of the more difficult obstacles: the settlement of revenues between various operators.

Putting the various pieces together, it is worth contemplating how life might be for our friend Tony in the year 2000.

Tony in the Year 2000

Tony boards a small feeder bus that stops within a short walk of his house just outside of Metro Toronto. That bus will whisk him to the new gateway station where a number of other similar feeder buses are synchronized to meet a larger trunk route bus. In a weather-protected enclosure, Tony will easily and swiftly enter the larger bus which will then proceed along its route (in a special lane) through suburban Toronto to drop him right near his office.

Tony's transit MetroCard is similar to a credit card and paid for by direct withdrawal from his bank account, for which he receives a partial rebate from his employer. It is valid on the entire transit network in his neighbourhood, as well as in certain surrounding zones, including the places he usually travels to in Metro Toronto. He no longer has to worry about exact

change, or different fares. (On the rare occasion when he travels outside the limits of his particular pass, he only needs to debit a modest add-on fare.)

Tony finds it a real convenience to just flash his MetroCard when he boards originally, and then not have to think about it again for his entire trip. The card bounces a radio signal to the on-board computer which then beeps and indicates the amount deducted for his trip. If he desires, he can push a button to issue him a receipt indicating his remaining balance and debits to date.

Not only does Tony use his MetroCard for transit, he can insert it in public telephones to make calls, into vending machines to purchase snacks or a newspaper, or even to buy his groceries at the local supermarket which just recently installed terminals at the checkout counter in its move towards eliminating all cash transactions. The MetroCard acts as a debit card, and he can add value to it anytime by electronically transferring funds from his account at his bank's automatic teller machines throughout the city. In fact, Tony finds he can leave home without any cash in his wallet these days and rely on his MetroCard for almost any purchasing needs.

A single phone number (1-800-TRANSIT), toll free from anywhere in the GTA, allows Tony to find out everything about travelling by transit. The best route to take, the total travel time, the times of the next few buses near his house, the connections, the last bus back -- all are available instantly. He also has one of the new computer generated, custom-made area transit maps which details all the routes, hours and frequency of service for the entire area in which he and his family travels.

Tony's workmate John habitually arrives to the office a good 45 minutes later than Tony even though he lives in the same neighbourhood and leaves home at the same time. John was one of the last holdouts in the office who still insisted on driving to work. Increasingly frustrated by the seemingly endless hours sitting behind the wheel contending with the traffic congestion, the rising cost of gas (that just went up again this week to $2.85/litre), and the $8-per-day non-deductible parking fees, John was actually considering selling his car and joining his co-worker Tony on his relaxed, relatively inexpensive, and swift commute. They decided to go out to lunch together to discuss the matter.

John is hesitant to drive to the cafe and sacrifice his precious parking spot, (he doesn't want to mention to Tony the increasing bite of the costly gasoline required). So Tony offers to treat him to a ride on the new LRT line recently completed with revenues from the increased transit ridership. They enter the comfortable low-floor vehicle (John is amazed that he doesn't have to even step up to board) and Tony debits two rides.

Since they will be travelling back within an hour, the return trip will be free, and even this trip is reduced in price because it is off-peak. The computerized fare system is able to make these and many similar calculations in a micro-second. This optimizes the transit system usage in a way that maximizes revenues and decreases costs to the operators. But to the riders it is just as an extra incentive to use the system for those discretionary trips in mid-day when the transit vehicles happen to be less crowded.

By the end of lunch, John is convinced that his car is an unnecessary burden. He realizes that he can use his wife's car for the occasional trip, but for daily commuting, transit makes much more sense. The money he will save in insurance and the newly-instituted vehicle emission permits alone will more than pay for all his transit needs this year. He is feeling wealthier already. Unfortunately, he is a bit short on cash just now, so Tony offers to put the tab on his MetroCard.

1.*Canadian Transit Fact Book* (1992). Canadian Urban Transit Association.

2. *Transportation Tomorrow Survey* (1991). Data Management Group, Joint Program in Transportation - University of Toronto.

3. *Progress Report* (January, 1993). Task Force on Greater Montreal.

4. "The integration and rationalisation of public transport (p.107-111). In *Cities and Transport*, (1988) OECD.

5. Elmberg, C.M. (1984). Planning and managing public transport in Sweden. *Ekistics, 306*, 180-191.

6. Jansson, K. & Wallin, B. (Jan, 1991). Deregulation of public transport in Sweden. *Journal of Transport Economics and Policy, 25*, pp. 97-108.

7. No mention has been made in this discussion about the special problems faced by people with disabilities when they need to cross municipal boundaries by specialized transit. While this is a large topic in and of itself, it should be noted that the prospects of attempting to coordinate a connecting ride between two separate specialized transit systems, each requiring advance booking, can be especially daunting.

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