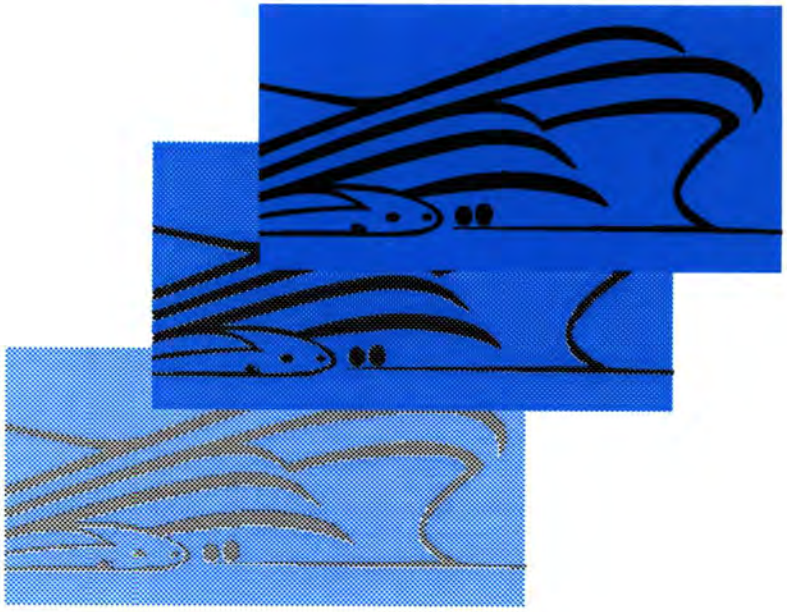
CANADIAN TRANSPORTATION RESEARCH FORUM
LE GROUPE DE RECHERCHES SUR LES TRANSPORTS AU CANADA



EVOLUTION IN TRANSPORTATION

Quebec City, P.Q.

May 28-31, 1991

PROCEEDINGS

of the 26th Annual Meeting of

THE CANADIAN TRANSPORTATION RESEARCH FORUM

LE GROUPE DE RECHERCHES SUR LES TRANSPORTS AU CANADA

Theme:

EVOLUTION IN TRANSPORTATION

EVOLUTION EN TRANSPORT

Quebec City, Quebec

May 28 to 31, 1991

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Welcome to CTRF's 26th Annual Conference in Quebec City. Bienvenue.

The theme of this year's conference — Evolution in Transportation — reflects the dynamic environment we all face as we move into the 1990s. The world is changing at a pace which is faster than that experienced in previous decades; industry is slimming down, becoming "lean and mean" at a time when deregulation and trade liberalization on global scale are exerting increasing competitive pressure on Canadian companies. Both shippers and carriers are looking beyond their traditional markets for the means to survive. We are in the throes of an evolution, one which will change the way we conduct business, the way we do research, the way we educate the next generation of transport managers, and the way we fund these activities.

The conference and these *Proceedings* will provide a forum for exploring these issues so that, with understanding and new ideas, you may be better armed to deal with this evolution. The growing participation in the conference of our colleagues in TRF is evidence that the boundaries of the issues have spread beyond the borders of Canada and I welcome their contributions.

CTRF as an organization has also been evolving in the past year. The Board has given careful thought to a number of issues relating to who we are, what our role is and what our role should be. That process is not over. As our Immediate Past-President, Eugene Ludwick, said at last year's conference, "considerable time may pass before our passage to firm but higher ground is over." The Board appreciates your continuing support through this evolution. Je voudrais personnellement remercier les membres du GRTC pour leur appui indéfectible qu'ils ont manifesté au cours des 26 dernières années et je souhaite ardemment qu'ils persistent à la soutenir pour les années à venir.

Finally I would like to thank this year's conference organizers, Michel Boucher and Jean Galarneau, for the devotion and hard work they have volunteered to make this conference a success. Merci beaucoup pour tous.

Mary R. Brooks
President

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PROSPECTS FOR HIGH-SPEED RAIL IN CANADA

BACKGROUND

Interest in high-speed rail is being generated in Canada as a way of revitalizing passenger rail and solving some of the transportation problems that exist.

VIA has been studying high-speed rail intermittently for ten years. Two major feasibility studies were conducted using recognized experts in the field. The studies were rigorous and comprehensive and are considered to be credible by the industry. Indeed, the Ontario-Quebec Rapid Train Task Force's own staff and consultants are relying heavily on this body of work.

The focus of the studies was the Quebec City-Windsor corridor, which has a population of 15 million and is expected to grow by 25% over the next 20 years. The studies evaluated high-speed rail not only in and of itself, but in comparison with other possible roles for passenger rail services. VIA developed possible roles for passenger rail using a market-driven approach: the constant preoccupation of the analysis was to find ways to meet the needs of the market. When new rail technology was considered, it was kept in mind that the purpose of the studies was not simply to apply available rail technology, but to select whatever technology was appropriate to meet market needs and provide the most financially attractive return.

The central corridor is really a grouping of services rather than one large route. The characteristics, density of traffic and population of city pairs vary considerably. Three segments must therefore be examined individually: Montreal-Ottawa-Toronto, Quebec-Montreal and Toronto-Windsor.

SUMMARY OF FINDINGS

The findings of VIA's studies are clear: there <u>is</u> potential for high-speed rail in the Quebec City-Windsor corridor - particularly in the Montreal-Ottawa-Toronto triangle, the most travelled network in Canada.

For the medium distance intercity markets (300 to 600 km), VIA's studies concluded that:

- Passenger rail can only succeed if it offers trip times and frequencies that are competitive with air (3 hrs for Montreal-Toronto, 2.5 hrs for Ottawa-Toronto and Toronto-Windsor; at least 12 trains a day in each direction).

- Only technologies capable of maximum speeds of 300 km/hr are able to achieve this.

- Of these technologies, the most financially attractive is the steel wheel on steel track technology, as opposed to magnetic levitation.

- The 300 km/hr technology generally requires exclusive trackage because the track must be built and maintained to very stringent standards, not compatible with North American freight operations.

For the short distance intercity markets (less than 300 km), VIA's studies concluded that:

- Passenger rail can only succeed if it offers trip times shorter than the automobile by about one half, and competitive frequencies and convenience (station access, comfort, etc.). Applicable markets include: Quebec City-Montreal, Montreal-Ottawa and Southwestern Ontario.

- The 300 km/hr technology achieves this.

HSR Service Level Improvements

Expected at 300 km/hr

	Station to Station Travel Time		Trains per Weekday Return	
	Current Fastest Time	HSR Fastest Time	Current Frequencies	HSR Frequencies
Montreal-Toronto	4 hr 30 min	3 hr	10	24
Montreal-Ottawa	2 hr	1 hr	6	24
Ottawa-Ontario	4 hr	2 hr	6	24
Toronto-Windsor	4 hr	2 hr 10 min	8	24
Quebec-Montreal	3 hr 05 min	1 hr 50 min	6	12
Toronto-London	2 hr 10 min	1 hr 05 min	9	28

Note: HSR fastest times include suburban and intermediate stops

FINANCIAL RESULTS

High-speed rail does not achieve the same financial returns on each of the three segments of the corridor, although each would make an operating profit from the outset.

VIA's studies revealed that routing the Montréal-Toronto high-speed train through Ottawa would increase the project's financial attractiveness. Revenues would double, while the length of the route (which determines capital and operating costs) would increase by only 7%. The initial investment is estimated to be $2.7 billion. The rate of return, estimated to be about 8%, would be less than that required to attract private investors.

With high-speed, rail's share of the total corridor market would increase from 6 to 22%. On the three largest city-pairs, the number of passengers would increase by over four times for those cities served by high speed compared to today's rail carryings, mostly by diverting automobile and air users.

In the case of Montréal-Québec City, it was found that major improvements to current services are less attractive financially. Because Montréal and Québec City are close geographically and the highway system is well developed, it would be difficult for rail to capture a large enough share of the market to make the approximate $1 billion in capital costs financially attractive. Also, unlike the Montreal-Ottawa-Toronto route which shares capital costs over three city-pairs, the Montreal-Quebec route must itself justify all the capital costs on its own. Demand forecasting technology is such, however, that it tends to underestimate ridership growth when the current market share is very low. It is thus possible that further analysis would show that the demand forecast models currently available underestimate the demand for high-speed rail in this particular market.

Nor is Toronto-Windsor as financially attractive as Montréal-Ottawa-Toronto, even though it is the fastest growing region in Canada, with a relatively high population density and problems of transportation cengestion. This is because distances between major population centers are short and no single route could serve all the major population centers due to a more diffuse population pattern. Again, further analysis and/or different - service parameters may lead to different conclusions.

The following table summarizes the VIA results in 1990 dollars:

WITH HIGH-SPEED RAIL:	South Western Ontario	Montréal Ottawa Toronto	Québec City Montréal	Total
Investment ($ Million)	1,730	2,730	970	5,430
Operating profits ($ Million)	11	160	4	175
Rate of return[1] (IRR in %)	1.0	8.3	0.4	5.0
Grant required to achieve the threshold of 15% IRR[2] ($ Million)	830	930	450	2,210
CURRENT RAIL SERVICES[3]:				
Federal Government annual subsidies ($ Million/year)	40	100	20	160
Federal Government subsidies over 20 years[4] ($ Million)	500	1,250	250	2,000

1 Internal rate of return, including an assumed 5% annual rate of inflation.
2 Includes an assumed 5% annual rate of inflation.
3 Adjusted for the January 1990 service cuts.
4 Net present value, inflated at 5% and discounted at 10% per year.

With an 8.3% internal rate of return (IRR), the Montréal-Ottawa-Toronto is nearest to achieving the commercial IRR threshold of 15%. A public contribution of $930 million up front, would make the project commercially viable and attractive to private investors. The government contribution could take many forms, such as a one-time grant, annual subsidies or tax concessions.

If the subsidy for Montréal-Ottawa-Toronto was split evenly among the governments of Québec, Ontario and Canada, the federal government's share would be $310 million, replacing the annual $100 million subsidy.

The findings do not include additional income from spin-off benefits, such as revenue from aerial rights from real estate developments, particularly near the stations, and from leasing of rights-of-way for fiber optic cables.

EXTERNAL IMPACTS

A high-speed system would also have important impacts on the travelling public and the community at large. These socioeconomic benefits include the following:

- **Providing passenger benefits and increasing mobility**

  Competition between the modes would increase with a strongly competitive rail product. For the consumer, this would mean better choices, better service and lower prices, and, if so, it also generates what is known as "consumer surplus". This is the value of those benefits which are passed on to the consumer and not captured in the price, such as time savings.

- **Improving energy efficiency and reducing pollution**

  Electrified high-speed rail is the cleanest and most energy-efficient mode of passenger transportation. By drawing people out of their cars, energy consumption and pollution would be reduced.

- **Increasing safety**

  High-speed rail is the safest means of passenger transportation. Therefore, because fewer trips would be made by car and more by rail, this would diminish fatalities, injuries, property damage and associated costs to society.

- **Creating employment and export opportunities**

  Bringing high-speed rail service into existence would involve investment in new rail, signal systems, rolling stock and other infrastructure. This would create employment in the manufacturing, construction and engineering sectors, as well as spin-off employment. As well, Canadian manufacturers and engineering firms involved in such a project would be in an excellent position to exploit opportunities throughout North America.

- **Creating regional benefits**

  High-speed rail would help achieve a more balanced distribution of economic growth and settlement pattern within the Québec City-Windsor corridor. An example is the transfer of economic activity and population from Toronto to smaller cities such as Kingston, London, and Windsor. This type of major economic development occurred in Lyon, France, when the Paris-Lyon High Seed-Rail service was introduced in the early 1980s.

- **Reducing congestion and minimizing land use**

  Travellers in the corridor are already confronted with congested airports and highways. Future population and travel growth in urban centers such as Toronto and Montréal will require innovative solutions to these problems. Pressure on governments to increase the capacity of the overall passenger transportation network will rise. A high-speed rail system could be a cost-effective way to increase capacity and prevent further congestion. The land required for a new, dedicated right-of-way High-Speed Rail system is about half of what is needed for a major highway and about two-thirds of what is needed for a large new airport, and is not concentrated near urban centers as airports are.

THE MARKET

VIA used prominent experts in the field for its market studies, including:

- High-speed rail specialists from the French and Japanese railways;
- Canadian, American and British consultants;
- well known academics specializing in mathematical modelling for market forecasting;
- VIA practicioners;
- Ontario and Québec government specialists;
- federal government specialists;

Several independent analytical approaches were used, including:

- three demand models to forecast ridership;
- an expert review panel to validate the assumptions used and assess the results;
- a review of foreign railway experience;
- determination of transport preferences in the Canadian corridor through one of the most exhaustive travel market surveys ever performed in Canada:
  - 21,000 travellers (air, road, bus, rail)
  - 2,000 detailed questionnaires
  - 2,500 in-home interviews
  - several focus group sessions in major cities

Major conclusions of VIA's market studies

Frequent, convenient same-day return service at a competitive price makes rail the predominant public mode between major city-pairs in the corridor. This market penetration occurs at specific travel time thresholds. The travel time thresholds are indicated below:

City Pairs	Distance	Travel Time Threshold
Montreal-Toronto	576 km	3 hrs
Montreal-Ottawa	172 km	1 hr
Ottawa-Toronto	404 km	2.5 hrs
Toronto-Windsor	359 km	2.5 hrs
Toronto-London	179 km	1 hr
Quebec-Montreal	277 km	1.5 hrs

- Train ridership between these six largest city-pairs of the corridor would reach 4.6 million passengers in the first year of operation, over four times today's carryings.
- The ridership on the high-speed rail system would derive from the current rail mode (25%), from other modes - mainly auto and air - (55%), and from new traffic induced by the creation of this new convenient travel option (20%).
- As a result of the changes in modal choices of travellers, air trips would be reduced by 20%, automobile trips by 5%, and bus trips by 8%.
- Maximum revenue potential would be attained at fare levels set at 50% above current prices, all in 1990 dollars.
- The market shares that would be achieved by high-speed rail are indicated below:

City Pairs	Share of the Total Market	Share of the Public Modes*
Montreal-Toronto	38%	50%
Montreal-Ottawa	12%	44%
Ottawa-Toronto	21%	56%
Toronto-Windsor	22%	66%
Toronto-London	13%	66%
Quebec-Montreal	13%	68%

* Excludes the automobile

THE OPERATING CONCEPT

VIA's proposed operating concept provides a safe, reliable operation at the least cost. Construction of fully signaled, electrified high-speed track is the highest single capital cost item, representing 55% of total project costs. It is possible to reduce the initial cost of track while providing the required service attributes. This can be done by operating the high-speed trains on a single track with passing tracks. The passing tracks constitute the equivalent of a double track for one-third of the entire route.

This layout defers the need to build and maintain some 800 km of track until demand justifies more than 12 to 15 frequencies a day. The result is lower capital and maintenance costs than would be the case for a full double track system. The infrastructure put in place (subgrade and other critical structures) would be constructed to accommodate the expansion to double track at any time, without major traffic disturbances or higher incremental costs.

Relying on a fully computerized train control system, featuring track-to-train transmission and cab signalling, the single track with passing track layout is safe and sufficiently flexible to cope with unexpected delays. The concept was reviewed for safety and reliability by experts from the French national railway (SNCF) and found to be practical. Single track schemes are currently envisaged by SNCF for medium traffic high-speed lines in France and Turkey.

ROUTE SELECTION

VIA's assessment of possible routes used a two-phase approach:

- 19 possible routes were identified in the three corridor segments between Québec City and Windsor, and studied on the basis of alignment, curvature and gradient.

- The 11 routes with the best potential for high-speed rail were then selected for in-depth examination and conformity to high-speed rail specifications, including detailed cost assessment of:

  - bridges;
  - grade separations;
  - subgrade material requirements;
  - existing railway interference;
  - operational safety;
  - signalling, telecommunications, electrification and track work.

- 75% of the recommended alignment along the Québec City-Windsor corridor (including 90% of the Montréal-Ottawa-Toronto route) was evaluated on a location specific basis.

- Access to downtown stations, using existing rights-of-way, also was evaluated on a location specific basis.

- While the specific route suggested by VIA is probably the optimum route, track geometry can be improved. Some realignment may be required when environmental factors are taken into account.

Factors influencing route selection

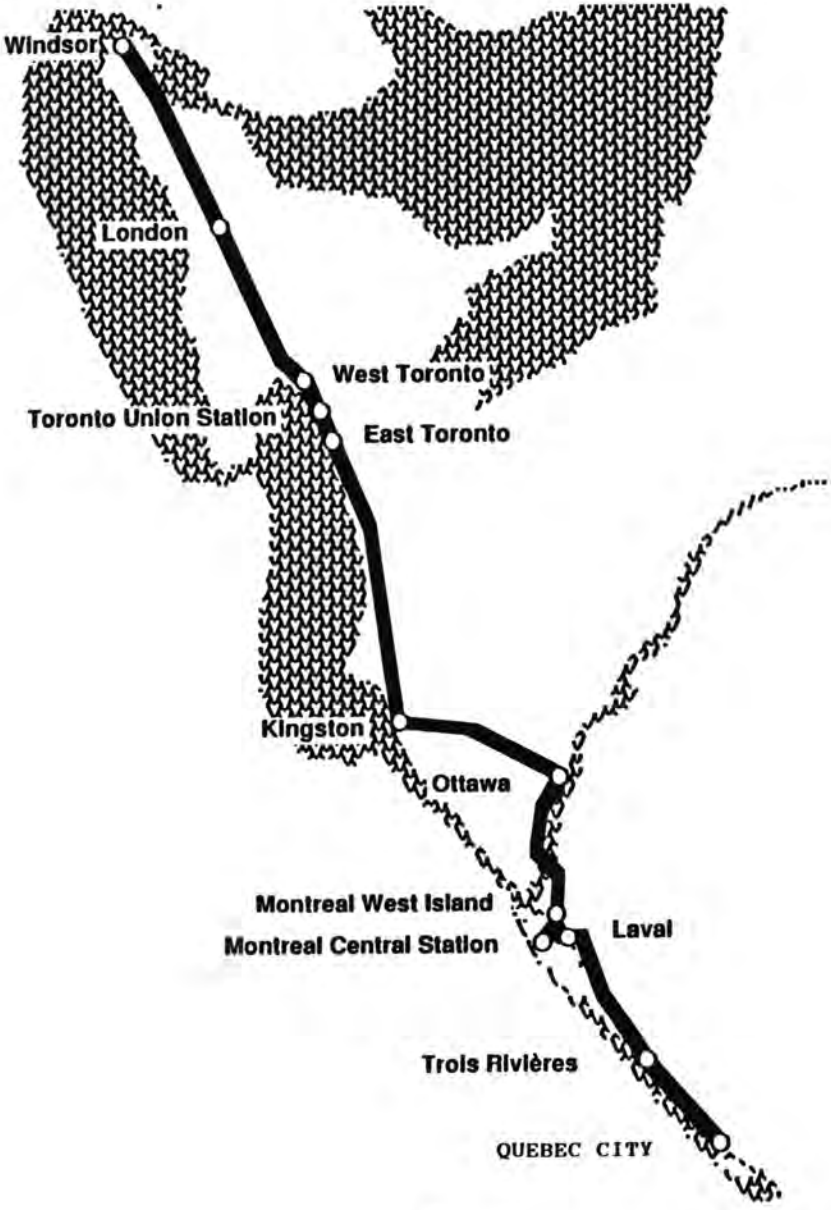
When tracks are shared with freight:

- Passenger rail is severely constrained by several factors which prohibit high speed. These include:

  - the existing track geometry, which limits top speed to freight rules and regulations (i.e. superelevations on curves);

  - the existing track construction and maintenance standards which also restrict top speed within permissible NTA safety limits;

  - two types of traffic which are very different in nature, which affect signalling, dispatching, throughput and maintenance.


Windsor
London
West Toronto
Toronto Union Station
East Toronto
Kingston
Ottawa
Montreal West Island
Montreal Central Station
Laval
Trois Rivières
QUEBEC CITY

PAQUETTE

When rights-of-way are shared with freight:

- The cost of building the high-speed rail line is very high due to the need to:
  - widen the platform so as to provide greater clearance between adjoining high-speed rail and freight tracks, resulting in expensive civil engineering works (e.g., retaining walls);
  - span the entire right-of-way when building the new structures required to eliminate level crossings;
  - design rail overpasses to accommodate freight axle loads;
  - build very costly rail flyovers to eliminate high-speed rail and freight track crossings at grade;
  - immunize the freight signalling system and existing telecommunication systems from the electromagnetic effects of the new 25kv high-speed rail contact wire;
  - provide full fencing between passenger and freight tracks.

When making exclusive use of rights-of-way currently used by freight:

- The cost of building the high-speed rail line is also very high due to the need to:
  - deal with grade separations at existing crossings: crossing rights - both public and private (including farm crossings) - are clearly established along existing rights-of-way, and it is difficult to minimize grade separations through rationalization (elimination and/or regrouping);
  - customize grade separations (overpasses or underpasses) to fit the existing municipal grid;
  - acquire existing railroadbeds, including compensation for displaced main lines, yards, industrial spurs and industrial sidings.

When new rights-of-way are used:

- The cost of building the high-speed rail line is not as high, partly because of the following:

- grade separations can be rationalized by following current standards for highways;

- grade separation costs can also be reduced by the adoption of standardized designs.

Major conclusions of VIA's routing studies

- Contrary to what one might expect, modifying existing rights-of-way for joint use by freight trains and high-speed passenger trains entails more capital expenditures, more operational constraints and - in certain circumstances - more environmental issues that building new, exclusive rights-of-way for the passenger operation (e.g. going through built-up areas).

- The new, exclusive rights-of-way would be along the shortest practical routes, designed to accommodate today's best rail technologies and speeds of 300 km/hr or higher, and capable of handling future rail alignment and geometry.

- In those areas where abandoned or soon to be abandoned tracks exist in convenient locations, high-speed-rail would make use of them.

- The exception to the use of exclusive rights-of-way would be in major city centers, where the most economical route is on existing, shared rights-of-way, or even on existing track, operating at conventional speeds.

- Sharing track with freight trains is not a viable option for high-speed rail.

THE FOUR PHASES OF HIGH-SPEED RAIL IMPLEMENTATION

A 12-year lead time is normally required to implement high-speed rail, divided into four phases. Some of the work is already done, therefore 10 more years would be required to implement high-speed rail in the corridor. The earliest date for commissioning a high-speed rail system through a request for proposals process would be around 2001.

Phase I : Planning

Phase II : Assessment

Phase III : Preliminary design and public consultation

Phase IV : Final design and construction

I. Planning Phase

This phase generally is defined as the work required, prior to preliminary design, to decide whether the project is technically feasible and sufficiently attractive financially to warrant a more detailed assessment. A number of canadian studies have reached this conclusion.

II. Assessment Phase

The high-speed rail project in Canada is moving toward Phase II, the assessment phase. This phase is generally defined as the work required to define the project's basic parameters, address other key issues and define a general framework for high-speed rail development, assess the socio-economic benefits of the project and determine the criteria if government support is made available, and establish the most appropriate form of project development.

This work, which needs to be performed before costly preliminary design and public consultation procedures are undertaken, would cost approximately $5 to $7 million and would require two years to do.

III. Preliminary design and public consultation

Assuming that the option chosen for the development of the project involves the issuance of a request for proposals to private bidders, this phase would include the bidding process, the evaluation of proposals and the award of an exclusive franchise to the successful bidder. In the case of a directed contract, this phase would include the negotiation with the single source consortium.

In either case, the process would be followed by surveys, site investigations and preliminary design studies by the selected developer. It would also involve securing permits, organizing public inquiries and coordinating expropriation procedures. This would require about 4.5 years to complete.

IV. Final design and construction

A 5.5 year final design and construction phase would be required. Final design would include the development of working drawings and manufacturing specifications. This would be followed by actual construction, service testing and commissioning.

VIA'S ROLE

VIA's long-term interest is to become the operator of high-speed rail in Canada.

A high-speed line should be part of the existing passenger rail network in order to maximize overall cost reduction and provide the greatest synergy. This is vital to the health of the rest of the services. Cost savings and operating efficiencies are possible with integration, as the total network would share overhead and other fixed costs with the other services.

Since VIA already operates a national passenger rail network, it has important advantages when compared to other potential operators. No other potential operator has the overall expertise, particularly in the areas of passenger railway operations, customer services and the passenger rail market.

Since high-speed is envisaged as a replacement to conventional corridor services, which represent the core of VIA's business, the impact of VIA not being the operator would be to make the passenger network it operates much less viable than it is today.

In the immediate term, VIA wishes to participate in the assessment phase, if it occurs, for two main reasons. As a potential operator, VIA's involvement would be important; also, the work carried out during the assessment phase would benefit from VIA's expertise garnered in the process of conducting its high-speed rail studies.

High Speed Rail and the Real World

by
Richard M. Soberman
University of Toronto

Introduction

Following the latest round of cyclical reversals in Canadian rail passenger policy, the question of need and opportunities for improved rail passenger service is now being reviewed, at the national level, by the *Royal Commission on National Passenger Transportation* and, at the local level, by the *Ontario-Quebec Rapid Train Task Force*.

As part of this reappraisal, the potential for high speed rail services in the Quebec-Windsor corridor, similar in performance to the Japanese Shinkansen (Bullet Train), or the even faster TGV now operating in France, is currently receiving more attention. These Japanese and French successes have created a degree of envy on the part of some Canadians who would like to see similar services operating in Canada, certainly in the Quebec-Windsor corridor, and possibly in the Edmonton-Calgary corridor as well.[1]

Clearly, there are serious questions about whether population densities within potential Canadian corridors can support the investment required to introduce high speed services. Nevertheless, studies by Via Rail, the Canadian Institute for Guided Ground Transport at Queen's University, various consultants, and manufacturers claim that there are, in fact, financially viable markets for such services in Canada.

Recently, there has been considerable publicity regarding two specific proposals, one from Bombardier based on *TGV* technology, the other by ASEA Brown-Boveri, based on the successful application of their *Sprintor* train in Europe. Both claim varying degrees of financial self-sufficiency, or even profitability.

Unfortunately, there are no *real* data in the public domain that support either the various assumptions and claims made with respect to potential ridership and revenues or the actual capital investment that would be required to implement each firm's independent definition of "high speed". Certainly, considering international

[1] In some respects, this envy might be better directed at Amtrak in the U.S. Operating in a demographic and competitive market that more closely resembles the Canadian scene, Amtrak has achieved considerable success. From 1981 to 1988, for example, Amtrak increased its cost recovery from 48% to 69%, compared to VIA's overall system cost recovery of 28% in 1988.

experience, Canadian institutional constraints on the delivery of rail service, current labour practices, requirements for environmental assessments, and the difficulty of land acquisition, there is some reason to believe that revenue forecasts may be overstated, and that costs may be understated.

How seriously proposals for high speed rail will be treated by governments and other potential financial backers remains to be seen. At this stage, there are more questions than answers because, to date, no serious and *objective* feasibility studies have yet appeared.[2] The purpose of this paper, therefore, is to establish a framework for a proper feasibility study, within which the reasonableness of various high speed rail proposals can be examined, and which would serve to reduce some of the current uncertainties.

General Approach

The financial viability of high speed rail services can best be assessed by examining the effects of *higher* speed on both revenues and costs. For purposes of illustration, rail passenger service between Toronto and Montreal is considered, but the approach can be extended to consider other segments of the Corridor, or other routings such as Toronto-Ottawa-Montreal.

The objective of high speed service, of course, is to reduce travel time by rail sufficiently to attract large volumes of passengers from other modes and, in addition, to generate new demand for intercity travel. In simple terms, therefore, any feasibility study requires, as a minimum, estimates of how costs and revenues are likely to be affected by *average speed*, before other community benefits are taken into account.

High speed can only be achieved by spending money - for infrastructure improvements to eliminate some of the current causes of speed restrictions, for the acquisition of new rolling stock that is capable of high speed, and for operation and maintenance. Modest increases in average speed should involve modest capital investment, and large increases in average speed, larger capital investment.

As shown in Figure 1, the *cost function* should increase more rapidly at higher speed. Naturally, there is a limit to the average speed that can be achieved which depends upon technology and the frequency of station stops. The Bombardier and ASEA proposals represent two points on this cost function which, as yet, are not very precise.

In the case of revenues, passengers volumes can be used as a proxy. In other words, even though there would be a variety of fares, there will be an average "yield" per passenger carried. If the average speed between Toronto and Montreal (currently about 110 kmh for the fastest trains) is somehow increased, then it is reasonable to expect an increase in ridership, average yield, and total revenue.

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[2] According to recent press articles, financial backers of the TGV proposal are now prepared to spend from $30 - 60 million on such a feasibility study, about half of which they hope will be funded by government.

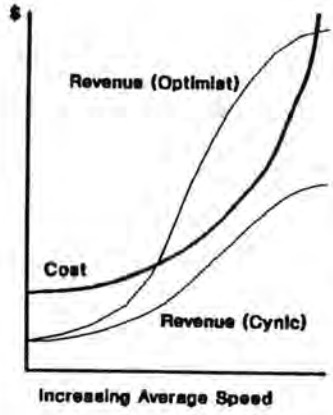


Figure 1

Depending upon the magnitude of the speed increase, and the corresponding fares, these new rail passengers will come from competing bus and airline services, as well as from private automobiles (by far, the largest unknown potential market). Assuming any significant increase in average speed is accompanied by a substantial increase in fares, high speed rail service may lose some of the more price sensitive rail passengers to buses, automobiles, or even the airlines.

On balance, modest increases in average speed should have little effect on ridership. (Here, improvements in reliability and scheduling are probably more important.) However, for larger increases in speed, the impacts should be more dramatic, up to the point where most of the potential market for *all intercity trips* is captured. In fact, proponents of high speed rail argue that this total potential, itself, will increase because the existence of such service will induce, or generate, new trips that would not otherwise be made. The upper limit and precise shape of this *revenue function* are both uncertainties that fall within the domain of the demand analyst.

Since Via Rail does not recover costs on the current Montreal-Toronto service, in relative terms, the starting point of the revenue function is lower than the starting point for the cost function. Beyond that point, there are two possibilities for the general shape of the revenue function.

The *cynic* assumes a revenue function for which *no combination* of speed and price generates revenues in excess of costs. In other words, the revenue and cost functions never intersect. By contrast, the *optimist* believes that there is *at least one combination* of speed and price for which revenues and costs are equal. Optimists also believe that beyond the breakeven point, it is even possible to make a profit.

For the cynics, no further analysis is required. For the optimists, at a bare minimum, some estimate of the *maximum potential revenue* and the *shape of the investment function* would provide a higher comfort level for any assessment of financial viability.

The Cost Function

As suggested in Figure 1, there is a range of costs associated with the average speed that can be achieved on the Toronto-Montreal route. The Bombardier and ASEA proposals, to the extent they include any *numbers*, represent discrete points on the cost function. Their estimates reflect particular assumptions about the type of rolling stock used and the nature of the infrastructure improvements required.

For example, the Bombardier claim, based on the use of TGV technology, assumes train operation on completely dedicated track, without grade crossings and without interference from other railway freight trains. On dedicated track, there would be no limits on train frequency, capacity, or performance that are dictated by other traffic. Figures cited recently in the press, suggest a capital investment of about $5.3 billion (including a $1.6 billion government contribution), but it is not clear whether this figure is for the entire Quebec-Windsor Corridor or for just the Toronto-Ottawa-Montreal route. For Toronto-Montreal alone, $2.5 to $3.0 billion has also been loosely referenced.

The ASEA proposal, at about $1.8 billion, does provide greater cost detail. It estimates a lower investment in infrastructure improvements because the service is designed to operate on existing, improved track. In this case, however, there would be limits on train frequency, capacity, and performance imposed by other traffic. Both proposals assume full electrification.

What is less clear, is the impact that intermediate average speeds between existing service and those proposed by either ASEA or Bombardier would have on costs. It could be argued, for example, that moderate increases in average speed (and corresponding improvements in reliability) might provide higher returns. For example, both proposals allow about $250 million for electrification. The reasons are obvious: both the *TGV* and the *Sprintor* are electric trains.

Diesel-Electric trains, of course, are capable of maximum speeds in the range of 200 kmh, and turbo powered locomotives, perhaps 250 kmh. There may be good environmental and economic reasons for dismissing these alternatives, but, as yet, even for electrified service, intermediate average speeds have not been considered in any serious way. In this regard, note that the highly successful (electrified) *Metroliner* between New York and Washington reaches a maximum speed (officially) of only 200 kmh on one section of the entire route. Much earlier feasibility studies by the Canadian Transport Commission also concluded that intermediate improvements in speed and reliability would probably produce larger payoffs than "quantum leaps" in speed.[3]

Via's fastest trains now make the Montreal - Toronto trip in a little under five hours for an average speed of about 110 kmh. Local services obviously achieve lower average speeds due to the frequency of intermediate stops. In fact, the following data for local service do show a considerable variation in average speed over various segments of the existing route:

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[3] *Intercity Passenger Travel Study*, Ottawa: Canadian Transport Commission, 1970.

Segment	Length (km)	Average Speed (kmh)
Montreal-Dorval	19	54
Dorval-Coteau	44	102
Coteau-Cornwall	48	111
Cornwall-Prescott	74	123
Prescott-Brockville	19	88
Brockville-Kingston	81	128
Kingston-Belleville	72	100
Belleville-Trenton	20	92
Trenton-Coburg	49	105
Coburg-Oshawa	62	101
Oshawa-Guildwood	30	95
Guildwood-Toronto	21	63

The short distances between some stations obviously contribute to lower speed. However, in addition to delays due to station stops, there are speed restrictions that result from frequent grade crossings, sections of excessive curvature and/or grade, or poor track condition. There are, for example, several hundred highway grade crossings that restrict speed on the present route.[4] By eliminating some of the more serious speed restrictions *through selective improvements*, it would be possible to achieve average speeds somewhere between existing service and the overall service improvements suggested by either ASEA or Bombardier, as shown in Figure 2.

The real question, therefore, is, if an investment of $1.8 billion produces an average speed capability of 200 kmh (according to ASEA), what increase in average speed could be achieved by an investment of perhaps of one-third of that amount on a more selective basis? Furthermore, what impact would such improvements have on revenue?

The Revenue Function

The potential market for high speed rail between Montreal and Toronto involves three basic components, namely, those who are now travelling by *all* modes, increases in the total number of intercity passengers resulting from population growth, and new, or induced trips. A major reduction in travel time between Kingston and Toronto, for example, could well generate additional recreational, shopping or business trips that would otherwise not be made.

Unfortunately, there are few data available to estimate the magnitude of this potential. Those data and forecasts that do exist present a rather confusing picture. For example, as shown in Table 1, according to the *only* data in the public domain, Via Rail carried

[4] Proponents of the TGV proposal argue that the costs of construction on a new, completely dedicated right of way would be lower than the costs of eliminating all grade crossings on the existing track.

about 914,000 passengers on the Toronto-Kingston-Montreal service in 1984.[5] In subsequent years, total system ridership remained about the same, so it is not unreasonable to assume about the same number of passengers today, even though the service frequencies have declined since the last round of Via Rail cuts. Note, however, that the 1984 data include passengers carried to and from intermediate points that are unlikely to be served by high speed trains.

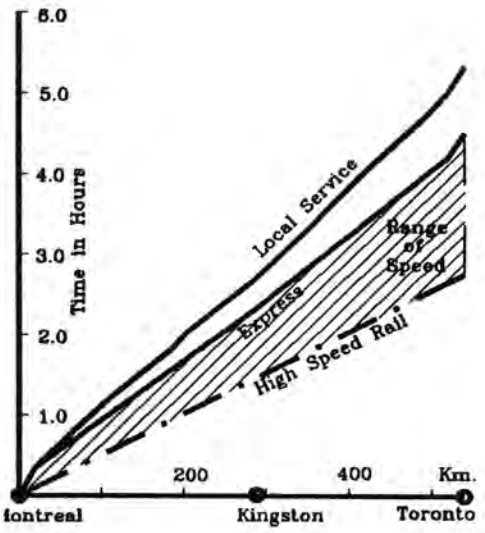


Figure 2

In its 1989 study, however, VIA places the total market for intercity trips in the Montreal-Ottawa-Toronto triangle at about 11.5 million trips, *by all modes*, of which two million are made by rail.[6] More recent data (1990) from confidential surveys, estimate a total market for the same triangle of about 13 million trips, of which 914,000 are by rail. However, the same source places the Toronto-Montreal airline market at slightly more than one million trips when, in fact, all airlines combined, now offer about 57 daily trips in each direction, equivalent to a total of about 3.4 million seats.[7] About the only point of agreement among these various estimates of the market is that automobile travellers represent the largest single element of the existing market.

Table 1 compares these various estimates of the scale of the existing commercial market (air, bus, and rail). In the case of seats offered by airlines and bus companies, obviously, not all of the seats are filled, but for reasonable assumptions about load

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[5] Nielsen Task Force, *Transportation*, A Study Team Report on the Task Force on Program Review, (Ottawa: 1985), p. 228.

[6] VIA Rail Canada Inc., *Review of Passenger Rail Transportation in Canada*, (Montreal, 1989), p.33.

[7] This results in an airline load factor of 29%, well below the 60% considered as a minimum in the industry. Some of the difference can be attributed to through passengers (e.g. Winnipeg to Montreal with a stopover in Toronto) but it is unreasonable to expect that these through passengers are equivalent to the total number of originating passengers.

factors, the total commercial market, today, appears to be a *maximum* of about three million passengers per year.

Table 1
"Random" Data on Corridor Travel Demand

Item	Estimate (in 1000s)	Source
VIA Ridership		
1984 *System*	6,770	Transport Canada
1988 *System*	6,415	1988 VIA Rail Annual Report
1984 Toronto-Montreal	1,552	Transport Canada
1989 Toronto-Ottawa-Montreal	2,000 914	VIA Rail Review confidential
1989 Toronto-Ottawa-Montreal *All Modes*	11,500 12,900	VIA Rail Review confidential
% by Automobile	68% 63%	Via Rail Review confidential
1989 Toronto-Kingston-Montreal		confidential
Air	1,016	
Rail	591	
Bus	218	
Total Commercial	1,826	
Auto	3,136	
Total	4,962	
1990 Service Levels (Toronto-Montreal)		
Average Daily Frequency (each way)		based on January schedules
Airlines	57	
VIA Rail	7	
Bus	8	
Equivalent Annual Seats (both ways)		
Airlines	3,386	January x 12
Bus	146	estimated

With the introduction of high speed rail services, some airline and bus passengers would transfer to the rail service, depending upon the price structure. At higher prices, very few diversions from lower cost bus services would be expected. In fact,

pricing based on full cost recovery would undoubtedly divert some of the existing rail passengers, either to bus or to private automobiles.

The VIA *Review*, for example, estimates lower rail passenger volumes in 2010 for its "competitive role" model, at an average speed of 127 kmh, than for the current level of service at 108 kmh. Presumably, the difference is due to higher fares and the elimination of certain intermediate stops.[8] The largest unknown, of course, is the extent to which high speed rail services could penetrate the automobile market, particularly for groups of two or more travelling together and/or in cases where an automobile is required at the destination end of the trip.

Dealing with Uncertainty

Since there are really no reliable data either on the actual investment needed to increase rail speeds or forecasts of the passenger volumes that would be attracted to such services, the approach in this section is to establish the range of volume and investment combinations required to achieve financial self sufficiency. From the limited data available, the reader can then decide how realistic these combinations may be.

To proceed in this manner, some estimates of operating costs at different levels of service are needed. The scarcity of actual cost data related to rail passenger services parallels the scarcity of real data related to investment and ridership, already noted above. However, there are at least some estimates that can serve as a starting point.

According to a Canadian Transport Commission study, operating costs for the Corridor services in 1984 were about $25.00 per train-km.[9] The CTC study shows how, under improved operating and institutional conditions, it should be possible to reduce these unit costs by half. Inflating those figures, and allowing for some reclassification of costs to reflect changes in operating responsibility between the operator (VIA) and the railway, results in the following operating cost estimates for 1990:

Direct Costs of Operation	$11.00 per train-km
Payments to the Railways	5.75
Total	$16.75 per train-km

These figures involve some fairly optimistic assumptions about improved efficiency, revised labour work rules, etc. which, clearly, would have to be achieved for any of the high speed concepts that have been proposed.

In addition, for speed improvements involving the use of existing railway facilities, there must be some incentive for the railways, over and above payments for such

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[8] VIA Rail, *op. cit.*, pp. 33-37.

[9] Adil Cubukgil and Richard M. Soberman, *The Need for Rail Passenger Service and Opportunities for Modal Substitution*, (Ottawa: Canadian Transport Commission, 1986), pp.36ff.

indirect costs as switching, signalling, and track maintenance. For purposes of illustration, an amount of $50,000 per month for every daily train departure is assumed to be reasonable. In other words, for giving priority to 10 trains per day in each direction, the Railway would receive $1 million per month, or $12 million per year as an incentive for on-time reliability.

Exclusive of investment in infrastructure and rolling stock, these estimates and assumptions result in the following operating cost estimates for 5 car trains of 300 seats:[10]

Daily Trains (Each Way)	Annual Seats (both ways in 1000s)	Operating Costs ($1000 per Year)
10	2,190	77,906
12	2,628	82,890
14	3,066	109,068
16	3,504	124,650

In order to determine the passenger volumes needed to achieve cost recovery at different levels of investment, assumptions also have to be made about fare levels (and, of course, the likelihood of attracting the required passengers at each fare level). Currently, VIA fares range from $40 to $50 for the one-way trip between Toronto and Montreal. For increased speed, certainly some increase in fare over current fares would be realistic. A range of one-way fares from $60 to $130 is considered here.

For this range of fares, Figure 3 shows the annual volume of passengers required to achieve cost recovery, for different investment levels. These investments (for both infrastructure and rolling stock) have been amortized at 11 percent over 30 years in order to obtain equivalent annual costs.[11] The discontinuous nature of the curves shown result from the use of point estimates for specific fares. Obviously, the curves could be "smoothed" by interpolating for other fare levels between these points.

In Figure 3, the investment level is taken as a proxy for average speed. Presumably, for higher investments, better, and thus more attractive, service can be delivered. For example, for a fare of $100, Figure 3 suggests that about 1.4 million passengers would be required annually to justify an investment of $500 million in new facilities and equipment. The question, then, is whether such an investment would *increase average*

[10] At higher levels of investment, of course, unit operating costs per train-km should decline. These reductions, however, would be small in relation to the increasing debt service costs. Given the crude nature of the operating cost estimates in the first place, the calculations in this paper assume constant values for unit operating costs.

[11] These calculations can obviously be shown for other interest rates, as well. In a more detailed analysis, of course, present discounted values of both costs and revenues should be compared over a reasonable time period. However, for purposes of illustration only, the annual cost basis can be used as a representation of breakeven volumes in a "typical" year.

speed sufficiently to attract 1.4 million passengers, at that fare. For an investment of $1 billion, at the same fare, the increase in speed would have to be sufficient to attract about 1.9 million passengers.

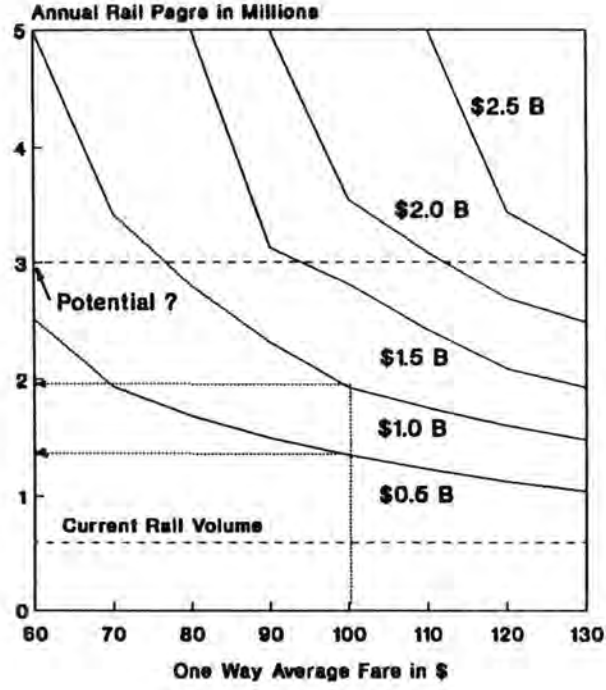


Figure 3

This display allows some flexibility in dealing with both uncertainty and reasonableness. The ASEA Brown-Boveri proposal, for example, probably involves an investment in the range of $1.5 to $2.0 billion to produce an average speed of about 200 kmh. For a journey time of 2 hours and 45 minutes, is it reasonable to expect to be able to attract 2.6 million passengers paying $120? Probably, the answer is: perhaps!

For the TGV proposal, even at an investment of $2.5 billion, it would be necessary to attract almost 3.5 million passengers at the same average fare, or 50 percent more. On its dedicated track, of course, the TGV system *would* be able to carry 3.5 million passengers. The Sprintor would not, thus ruling out any investment of that magnitude unless, of course, government subsidies were to be provided.

In all cases, no allowance has been made for government contributions, using "public interest" arguments, that might be generated in lieu of passenger revenues. Such contributions would obviously alter the breakeven analysis considerably, an argument that is not lost on the proponents of these high speed systems. For example, federal government subsidies for the Toronto-Kingston-Montreal VIA services in 1984 were about $61 million, or about $82 million in 1990 dollars. If, in lieu of continued subsidies, the federal government were to make a one time contribution of, say, $500 million, the financial feasibility of *investing* in high speed services would be enhanced; either breakeven fares or ridership could be lowered.

The possible justification for such continued government subsidy of Corridor rail services is another matter. It has been argued elsewhere, and even by the current government, that Corridor services should achieve full cost recovery.[12]

What is important, however, is to establish some reasonable range of investment in improved rail services that can be justified on the basis of realistic fares and market share with, and without, government subsidies. If there is insufficient information to determine that reasonable range, then the approach suggested here can be used to, at least, establish the unreasonable range. In other words, it may be easier to conclude that 3.5 million passengers is an unrealistic target than to estimate what a realistic target might be.

Conclusions

Interest in high speed ground transportation for Canadian "corridors" has surfaced and waned periodically, over the last twenty years, in response to potential developments and promises such as tracked air cushion and magnetic levitation vehicle technology. Recently, however, cutbacks in VIA Rail service in the face of the astounding success of the TGV in France (482.4 kmh!), has generated renewed interest in the potential application of high speed rail technology in Canada. This interest has been coupled with claims of economic feasibility and private sector financing.

The two most serious proposals by Bombardier and ASEA Brown-Boveri are, at this stage, largely descriptive in terms of technology and performance. Both promise to provide frequent service between Montreal and Toronto in well under three hours. Both say very little about costs, ridership, and revenues. It goes without saying, that both proposals would require a complete overhaul of the current institutional, decision making, and work rule structure under which existing rail passenger services are now provided.

Obviously, much more information and data are required by the proponents themselves, as to actual costs and potential markets under Canadian conditions. Such information should be developed in the course of detailed feasibility studies which consider the full range of improvements, between existing average speeds and the full potential of the TGV technology.

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[12] See Cubukgil, *op. cit.*, and Neilsen, *op. cit.* In this regard, draft rail passenger legislation prepared by the current government in 1984, but never tabled, proposed full cost recovery for Corridor services.

For example, saving 10 minutes between Montreal and Dorval may require a much larger investment than saving 30 minutes between Dorval and Kingston. Such intermediate average speeds do not preclude the use of *TGV* or *Sprinter* technology at their fullest potential over selected segments of the Montreal-Toronto route. If the cumulative effect of selective improvements reduces trip times by one hour, that option may well turn out to be more cost effective, relative to realistic assessments of the potential market, than attempting to reduce trip times by two hours.

For the very limited data available, and for very optimistic estimates of operating costs, the analysis of the Montreal-Kingston-Toronto service shows that an investment of around $1.5 billion (net of government contributions) would require a fourfold increase in rail ridership - roughly equivalent to the total market for all commercial services now offered, and a doubling of current fares.

That is probably the limit for any service that comes even close to being viable. That is also the capacity limit (for any realistic load factor) of any service that could be provided on existing track. As a result, even though a Montreal-Toronto route via Ottawa would increase the market potential, the capacity to handle more passengers than the required breakeven volume is not really increased.

On balance, this analysis suggests that technologies which make use of existing infrastructure, upgrading on a selective basis, show more promise for Canadian corridor conditions. If the institutional, decision making, and labour practices noted above can, in fact, really be streamlined, as would be essential for any truly high speed service, then the required feasibility studies should concentrate on establishing the true shape of the investment function associated with a range of average speed improvements. Then the brigades of demand analysts will be able to put their talents to work on equilibrium models that determine optimum fares to achieve cost recovery.

A REVIEW OF THE REGULATORY, COMPETITIVE AND INSTITUTIONAL SITUATION FACING TRANSPORTATION IN THE GREAT LAKES AND ST. LAWRENCE SEAWAY

Andrew Kibedi, Ontario Ministry of Transportation; **David Hackston** and **Richard Lake**, the Research and Traffic Group

Introduction

We discuss some of Canada's transport history and recent transport policy to understand specific problems that have arisen regarding marine carriage on the Great Lakes-Seaway System. Our argument is that the current plight of operators has been exacerbated by the unintended effect of previous policy decisions. We end the paper discussing some opportunities that lie ahead. Of course, the opinions expressed by the authors are theirs alone, and do not necessarily reflect policy of the Ministry of Transportation or of the Government of Ontario.

Possible Demise of Lakes-Seaway Transport System

Recession, and changing circumstances over the last ten years have influenced the transportation modes with varying degrees of severity. Transportation in Canada has not become integrated to any significant extent. The modes concentrate on competition rather than cooperation, and governments deal with single modal issues as they arise.

In this environment, the decline of a mode, which may be irreversible, can have consequences that are more dramatic than the simple bankruptcy of one or more operators. And, because transportation affects virtually every aspect of Canadian life, the impact can be much greater than the survival of one or two carriers.

The mode that has suffered most during the past few years has been the bulk carrier industry on the Great Lakes with its related shore based components.

The History:

Canada as a country has always been heavily dependant upon and influenced by transportation. The indigenous people are believed to have walked across a land bridge from Asia many thousands of years ago but soon they turned to the water for their principal transport infrastructure. The first white settlers arrived and adapted to using the transportation technology developed by their predecessors here. They chose the canoe and relied on Indian guides to show them the way across the continent. Eventually, rough roads were built, followed by canals to get around rapids and other barriers until the common effort was mustered to build railways, paved roads and a sophisticated air transport system.

The St. Lawrence Seaway, locks and canals completed in 1959, together with the Welland Canal, represents one of the great engineering projects of all time.

Previously, marine transport was divided between upper lakers and canallers.[1] Since railways were labour intensive and fettered by regulation and road transport was but in its early stages, the marine mode played a major role in the movement of cargo.

The Seaway as a project, was sold, particularly in the United States, as a system that would open the North American "heartland" to the world. Concurrent with the building of the Seaway, U.S. and Canadian authorities built huge hydro-electric power dams to harness the potential of the modified waterway.

For Canada the project involved not only five locks on the Montreal-Lake Ontario Section but also the eventual upgrading and deepening of the Welland Canal to "Seaway" standards. Development of the iron ore deposits in Quebec and Labrador combined with the seemingly inexhaustible demand for grain in a hungry world created an unbeatable potential for future traffic. The Seaway was also expected to create deep water ports inland and a new era of general cargo exports directly from centres in the Great Lakes.

However, ocean going vessels became too big for trading into the system. We have all seen the steady erosion of liner companies calling at lake ports. For instance, the U.S. used the Seaway for the export of close to half of its manufactured exports in 1959[2]. By 1989, this had dwindled to under 7%, and today the Seaway's general cargo tonnage is almost exclusively steel. Laker cargoes became more specialized year by year, and the concentration of vessel owners on the iron ore-grain and iron ore-grain and coal shuttles became more and more pronounced.

Looking back on the developments one has to recognize the extraordinary importance the Seaway had in the development of the steel-making capacity of Ontario and some of the mid-western steel centres, also on the golden age of Canadian grain exports to the rest of the world, but one also has to question at this juncture whether or not we are at an historical turning point in transport developments as our principal productive activities begin to shift gears.

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1 Vessels that could transit the smaller locks and carry the traffic to export position or to destinations below Lake Ontario.

2 Frankl, Ernest, *General Cargo Movements; Impacts of Competing Networks and Developing Technology*, Presented at a Symposium in Quebec City, June 6 - 9, 1982 and quoted in *The St. Lawrence River, Its Economy and Environment for the Great Lakes*, Toronto, 1989, p. 27.

Policy:

Early transport policy dealt with canals and railways, in fact it wasn't until well into this century that the Minister of Transport replaced the Minister of Railways and Canals. At that time, a first attempt was made to establish a national transportation policy. This attempt was largely thwarted by objections from the provinces and other interest groups. That is why truck regulation was excluded from the *Transport Act*, originally passed in 1938. Even so, a Board of Transport Commissioners for Canada was established. This Board was given regulatory powers over rail and marine transport and at one point even air (later transferred to the Air Transport Board).

It is easy to understand why transport policy and regulation are so fragmented; the modes are different and the country is vast with varying concerns and issues throughout. We have hardly had the time to collectively sit back and examine the totality, the urgent problems have always gained the upper hand.

In 1967, a further attempt was made to establish a transportation policy for all modes under federal jurisdiction when the *National Transportation Act* was passed. The multimodal Canadian Transport Commission was set up as the regulator, all the former boards were eliminated and their respective staffs and appointees brought under its umbrella. Some progress was made but, in reality, the former boards continued to exist as the Modal Committees in the CTC, each jealously guarding its turf against all threats, real or perceived. The CTC organization frustrated the intent of the Act.

Despite the provision of the NTA (1967) for the regulation of trucks and buses, the part of the Act that applied to these carriers never became operative except for the CN Roadcruiser Service in Newfoundland.

Each of the Acts mentioned above contained a statement of *National Transportation Policy* which, while well-intentioned and even referred to in decisions, never attained true national implementation. Similarly, the *National Transportation Act (1987)* contains, in Section 3, a broad statement of National Transportation Policy which intends that all modes are to be treated fairly and equitably but with due regard to their different nature and operating characteristics.

However, this statement only applies to those aspects of transportation falling within federal jurisdiction. The provinces and municipalities have other regulatory principles that apply to the various modes. these sometimes conflict, not only with the federal scheme, but also with each other. At the same time, policies that should not be considered transportation instruments (they use transportation to achieve other goals) are profoundly changing the face of transportation.

A considerable proportion of all transport networks in Canada are provided for, maintained and improved with public funds. Whether operators survive, and the extent to which private business is capable of undertaking the transport of people and goods, will continue to be

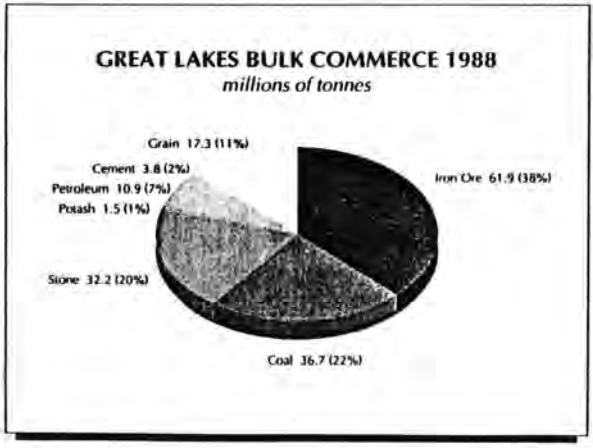
influenced not only by their own investment decisions but also by the host of other elements that determine the costs, competitive cushioning and socially underwritten side effects of their operation.

Thus, regulatory and investment decisions of government can have profound impacts on the continued operation of a carrier or the viability of a mode.

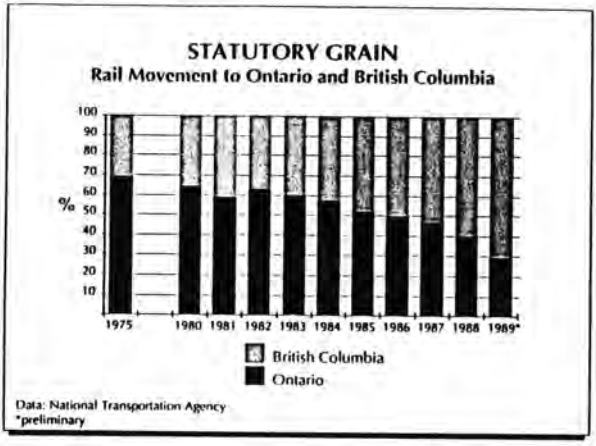
Decline of Efficiency Comparisons

In the late seventies, analysts looked at the various modes comparatively and government departments attempted to measure the relative efficiency of each system in as far as they served comparable markets, thus trying to attain through policy and fiscal tools a balanced system that made economic sense. Much of the literature and research of the times was devoted to questions of comparability, measures of efficiency, private versus social costs, etc. There were problems with many of the arguments developed, and strict comparability could never be achieved. While analysts and academics discussed, economic and international conditions changed and pressures to change the legislation governing transport became the stronger impetus.

The 1970's were good times for the Great Lakes-Seaway System. Carriers handled record volumes of cargo in the 1970's, which peaked around 1979 when 213 million tonnes were handled on the lakes and 55 million and 66 million tonnes on the Montreal-Lake Ontario Section and Welland Canal respectively. At that time, arguments were advanced for a twinning of the Welland Canal and studies were undertaken. Traffic subsequently declined, partly due to the recession of the early 1980's, but also due to the use of alternative routings. Operators' concerns largely went unanswered. Volume on the lakes in 1988 was 165 million tonnes.

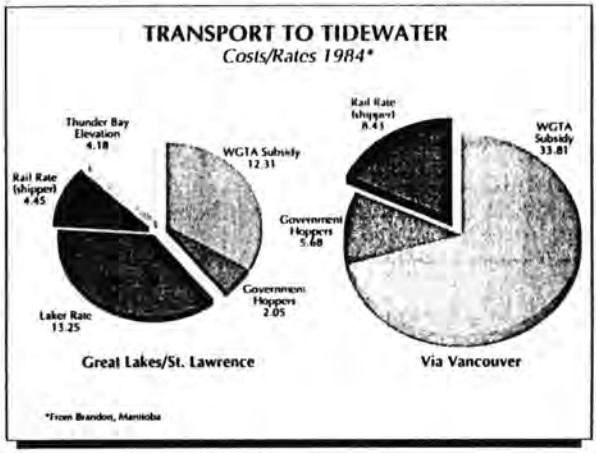


To add to the woes of the Canadian shipping industry, grain markets shifted and the *Western Grain Transportation Act* with its continuance of a rail rate system that favoured movement to west coast ports was implemented, as were massive port and terminal investments in the West. The result of these changes has been a major shift of grain exports to West Coast ports as shown below.



Two obvious associated examples of non-transport instruments defining Seaway transport developments are the *Western Grain Transportation Act (WGTA)* and the *Atlantic Region Freight Assistance Program*. The latter is a regional assistance program that is paid through the carriers--probably because it is administratively easier--and is, therefore, incorrectly perceived by many as a carrier subsidy. Undoubtedly, the lower net rates paid by shippers in the Atlantic Region benefit carriers because of the incentive to sell more in Central Canada. Marine carriers however, are excluded from the "westbound" part of the program which subsidizes movement from the Atlantic Region to Central Canada.

The *WGTA* is assistance to the western grain producing industry (farmers) but, once again, it is paid through the railway rate mechanism. The existence of this mechanism, as so often happens when the market place is tampered with, has resulted in distortions in the market place. For example, to benefit from the subsidy, grain must move by rail to one of the destinations named in the Act and the subsidy is paid directly to the railway. This eliminates any possibility of truck competition between the prairies and the Thunder Bay terminal elevators. Further distortion is created by the westward bias in the rate structure and because the grain market does not bear the entire cost of rail transportation.



Pressures away from Traditional Cargoes and for North-South Movement.

Many of the changes that occurred in Canada during the 1980's had their genesis in the United States in the late 1970's and the early 1980's. Significant changes to transportation regulation can be included in this category.

While much of the marine industry remained unchanged from a policy perspective, its competitors, particularly rail, went through major regulatory restructuring starting with the passage of the *Staggers Rail Act of 1980* in the United States. This ultimately led to the regulatory changes brought about by the *National Transportation Act, 1987*.

Many marine concerns of the day were not resolved, they were just avoided or forgotten. Underlying the new attitude was the belief that the new style of regulation, often mis-named "deregulation", would take care of market distortions. The new *NTA* would, in curtailing the powers of the central agency and freeing up the market (albeit the Canadian way --a little bit here, but not enough there) guarantee optimal allocation of resources and provide us with an efficient and economic transportation system.

The only direct regulatory change in Great Lakes transport was the repeal of the *Transport Act* and the elimination of the regulation of the rates charged by small operators such as Woodlands Marine (now defunct).

Meanwhile, changes in areas external to transportation again changed matters fundamentally; the Canada-United States Free Trade Agreement, for example, will impact on modes and route of movement, and even if "de jure" protective regulation exists, "de facto" all markets are shifting, as are the strategies of carriers.

Changes in Technology and Pricing Relationships.

In the meantime, technology has also changed fundamentally, creating transportation systems with their own special requirements and with linkages to the production system that are too new for traditional regulatory models; i.e. containerization, computer controlled optimization of vehicle loading, satellite communications, bar coded traceable containers, paperless transactions, hub and spoke concept, modularization of carrying units and the change of optimal port location depending on hub proximity.

Will Environmental Considerations and Energy Considerations Make a Difference?

Environmental factors are becoming increasingly important and marine transport is generally seen as being one of the less harmful modes. Recent comparisons have been made between moving large amounts of aggregate by truck and by water from quarries in the Manitoulin area to Southern Ontario, and it has been estimated that use of marine would save the use and later disposal of thousands of tires each year. This is particularly significant when considering the impact of recent tire fires such as the one at Hagersville.

However, as all transport experts know, it is the considerations that are reflected in transport rates (and service) that decide the choice of transport mode. It might be interesting to complete analyses of the sensitivity of transport choice to energy costs and to possible environmental measures designed to make undertakings self-sustaining.

Traffic in the System:

Even until recently, the St. Lawrence Seaway and Great Lakes transportation system was the main route for transport, import and export of most of the commodities to the principal producing and trading regions in both Canada and the U.S.

Lake vessel owners specialized in their own turfs, bulk cargoes. Package cargo carried on for a while but eventually ceased. In time, overseas general cargo shifted to containers and the small number of ports that now handle container vessels. These containers offer a capital intensive, modular way of shipping, a way to avoid pilferage and to maximize cargo integrity. In Canada, labour strife, extensive pilotage requirements and charges, tolls, season limitations, insurance

regulations and special equipment requirements all added complications, expense and time to transits so that only the less expensive and less time sensitive commodities could stay in the system, those commodities which Canadian operators were good at.

Even today, many port operators on the Great Lakes remember yesterday's lucrative general cargo, carried to a great extent in salties, and dream about regaining a share of it.

Competition, Captive Cargoes:

A recap of the well known competitive situation of the Seaway shows that the network is unusually closely linked with some of the main users who rely on the facility. The specialization into bulk has generated a transport rate situation where having revenue cargoes on both the front and back-haul permits pricing flexibility and low rates. If one of the two cargoes is eliminated (and this is happening), the rate for the remaining cargo can double.

The precarious situation of many of the shipper industries and their dependence on water transportation makes them captive to the Seaway, but also makes them vulnerable to competitors not thus constrained. The Ontario based steel industry is in this situation. It is estimated that the cost of transporting iron ore from the north shore of the St. Lawrence to Hamilton could double from about $6.50 per tonne to about $13.30 per tonne if grain traffic were not available from Thunder Bay to lower St. Lawrence river ports.[3] The impact of this on the Ontario-based steel industry would be in the tens of millions of dollars annually, costs which probably could not be recovered by increasing the price of steel. When the importance of this industry to Ontario is considered, the impact could be manyfold.

Grain is a highly regulated business, and is affected much more by institutional and international considerations than by the lowest transport cost. Grain at this moment could move competitively on rail direct from the West to Eastern Canadian tidewater, unthinkable even five years ago. To do so would require either the elimination of cleaning or the relocation of cleaning either to the Prairies or to the lower St. Lawrence ports. It should be noted that there is already limited cleaning capacity on the Prairies; some traffic could move directly now. Based on 1987 costs, rail could be competitive with the marine movement at laker rates of $19-20 per tonne.[4]

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3 Lake, Richard, Hackston, David and others, *The Great Lakes and St Lawrence Seaway System -Commercial Attractiveness and Priorities for Policy Development*, Marine Office, Ontario Ministry of Transportation, March 1990, p. 96.

4 ibid, p. 93.

New Bulk Markets:

Having discussed a number of problems associated with the Great Lakes - Seaway System, we would like to now turn to some brighter prospects for this system.

Canadian Business recently carried an article on the birth of a small cement company which located its main loading and distribution facility at the port of Oshawa.[5]

In Canada, cement is controlled by four large companies which apparently keep prices so high that it is now an attractive market for overseas competitors. Among the attractions for the new venture is the lack of inbound Great Lakes cargo for ocean going vessels loading steel or grain on their outbound voyages. Thus, the Oshawa transfer facility unloads vessels bringing in cement powder from Europe for distribution in the Southern Ontario market. At rates from $15 to $20 a tonne, and with material cost of $32 a tonne, the delivered price of imported cement is considerably lower than the price of the domestic product.

Canada and the U.S. have long been resource rich and bulk exporters, but as with the cement example, there is no reason to suppose that bulk commodities cannot be imported as well as exported. The above story also echoes the findings of a Marketing Study prepared for the Michigan-Ontario Maritime Advisory Committee[6] which recommended that the future of cargo revival on the system was to be found in the Lakes' hinterland, not in expensive overseas marketing.

Cross Lake Services:

A few years ago, an operation was set up with the assistance of the Government of Ontario to transport trailers from Oshawa to Oswego, New York. It was unsuccessful because of low demand. Since then, transborder traffic volumes have increased and there is renewed interest in such a service, although not to Oswego. Interest centres on Oshawa and the Toronto area to the western end of Lake Ontario around Olcott, New York (about 20 miles east of the Niagara River). The distance would be much shorter than the earlier service facilitating a regularly scheduled service using either a Ro-Ro ferry or tug and barge.

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5 Canadian Business, March, 1991 pp. 64 and ff.

6 Savage, Robert W., *Marketing the St. Lawrence and Great Lakes System*, Michigan-Ontario Maritime Advisory Committee, April 1990.

A very preliminary estimate was prepared by the Research and Traffic Group in a recent study[7] for the Ontario Ministry of Transportation. These estimates were based on recently published studies and on estimates, for movement between Oshawa and Olcott, made during the course of the study.

Despite the greater speed of a Ro-Ro operation, a tug and barge service could provide more convenient and hence more attractive operations for a trailer drop-off operation. This would come about because a tug and barge operation could operate with one barge under tow and one at each terminal available for unloading or loading, thereby reducing down-time for the capital equipment. A Ro-Ro, on the other hand, would have to dock, unload and reload before making another crossing.

Based on carrying forty-foot trailers, very preliminary per trailer space (capacity) costs of $60 and $65 would apply to barge and Ro-Ro respectively. To become viable, such a service would need to attract sufficient trailers to reach an average load factor of 60%. Assuming year around operation, a toll of $98 to $106 would be required to achieve economic break-even.[8]

Governments might find it interesting to promote this type of venture as a means of delaying land based investments and providing other avenues to shippers. Part of the success of these ventures could hinge on cabotage regulations, integrating facilities with other modes and in promoting equitable user-pay regulations across modes as well as sufficient Coast Guard ice control service on the lakes.

Passenger Possibilities:

Technology in the field of passenger transportation is also changing. The world over, operators are looking at and implementing high speed ferry services that avoid highway congestion and compete almost head-on with air transport in directness of routes and comfort. High speed passenger marine transport must be reliable, especially given the extreme weather conditions on the Lakes during storms and in the winter.

Several technologies have surfaced and are being evaluated by potential operators for introduction into Great Lakes Service. The requirements of speed indicate new technologies like hovercraft, catamarans, surface effect vehicles, swath, and modifications or hybrid applications of these that suit the Great Lakes environment.

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7 Lake, Richard, Hackston, David and others, *The Great Lakes and St Lawrence Seaway System -Commercial Attractiveness and Priorities for Policy Development*, Marine Office, Ontario Ministry of Transportation, March 1990, pp. 139-150.

8 ibid.

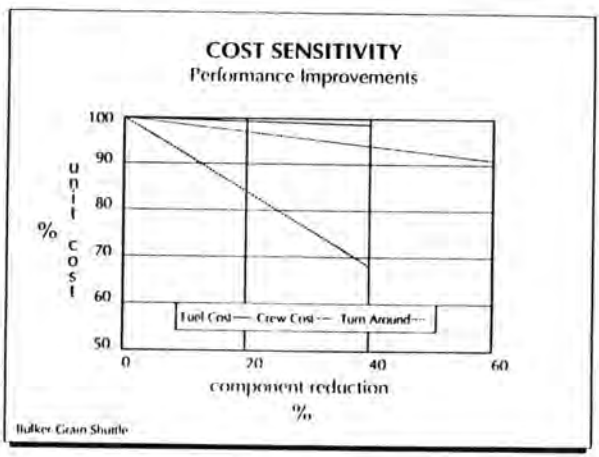
Cruising:

Studies have recently been completed on the potential for a Great Lakes cruising market. The common wisdom is that this is a growing opportunity, and that the Lakes will come into their own in this field. While start-up costs could be serious, it is possible that either foreign operators could explore the market as an extension to overseas trips, or that used foreign vessels could be adapted to a Lakes package.

Technology:

For the shipment of bulk commodities on the Great Lakes, it was recently demonstrated to the Ontario Government that, for a bulker grain shuttle, cost savings from improved turn around times would far exceed savings from either lower fuel prices or reduced crew cost as shown in the following graph. Aiding such an improvement would be ". . . automated satellite and radar navigation systems that would allow safe operation in poor visibility without speed reduction and centralized vessel traffic control."[9]

In a shipping world where rates are insufficient to amortize the capital costs of vessels in the fleet, it is unlikely that technological improvements will be made by current operators. The current fleet was built during and at the tail end of the shipbuilding assistance programs in Canada. Our fleet captured the binational movements of bulk cargo and established supremacy in inter- and intra-lake commercial shipping commencing in the late sixties and extending to the present time.



9 Lake, Richard and Hackston, David, *The Great Lakes/Seaway Enters the Nineties*, Marine Office, Ontario Ministry of Transportation, July 1990, p. 30.

The future, with free trade, could actually be an opportunity for Canadian operators to make gains in a total North American Lakes market. Of course, protection of national domestic carriers would have to end. If free trade survives, its implementation period and is extended to Mexico, the possibility of cabotage among Canada, the United States and Mexico could arise.

The last recession not only rationalized shipyards, it all but eliminated them on the Lakes. We are, thus, in a position where there is almost a clean slate. Most new opportunities will probably be greeted cautiously by operators. Innovations will likely be specialized conversions, add-ons to old equipment or special manufactures for niche markets.

The Lakes have not been a hot bed of diversification. Small vessels were discouraged by toll treatment. Increased urbanization and the demand for water-based recreation have created pressure for the conversion of small commercial ports into marinas with the former cargoes now carried by the overland modes. A brisk business involving cross-lake truck transport might revive some ancillary possibilities, but that is very speculative.

Where Do We Go From Here?

Looking towards the next century, much thought needs to be given to transportation policy in Canada. However, consideration from the perspective of an individual mode (or its users), issue or jurisdiction will be insufficient. With increasing continent-wide trade, Canadian jurisdictions should develop an umbrella framework for transportation policy to ensure continued economic and efficient transport by all modes, each doing what they do best, and without damaging market distortions.

We have seen what happened to the freight business on the Great Lakes as a result of economic conditions and the indirect effects of non-transportation market place distortions (caused by selective subsidies). It is time to more thoroughly evaluate all new programs and their potential impacts prior to implementation. Perhaps a good place to start is with a good hard look at the multiplicity of bodies, Canadian and American, that service (and collect tolls, fees, etc.) the industry on the Great Lakes, with a view to streamlining the product.

Lest we be accused of taking aim at government, industry too has to look long and hard at how it operates, why it operates the way it does, and what it must do to attract more traffic. The railways lured pulp and paper traffic away from the Lakes, and much aggregate now moves by truck. As stated earlier and in the Savage report, future traffic is here in Canada and the United States; go get it.

Optimism abounded when the Great Lakes Seaway entered the eighties. It was not borne out. Pessimism abounds as the System enters the nineties. It need not be borne out.

THE ST. LAWRENCE SEAWAY: CAUSES OF ITS DECLINE AND FUTURE PERSPECTIVE

By

Hazem Ghonima[1]

INTRODUCTION

The opening in 1959 of the North American hinterland to world shipping, following the construction of the St. Lawrence Seaway, has been of major importance to the economy of Canada and the U.S., particularly to the Great Lakes - St. Lawrence Seaway region. During the last decade traffic through the St. Lawrence Seaway has substantially declined from the records achieved in the late seventies. Grain, iron ore and coal movements, the major cargoes using the waterway, have all shrunk. This phenomena was accentuated in the second half of the eighties when the traffic was almost equivalent to that of the early sixties. As a result, the viability of the system has come under scrutiny, and uncertainty as to whether Seaway traffic can return to the record level of 1979 might be justified. A pessimistic scenario goes so far as to question the waterway's ability to maintain present traffic levels.

This paper will examine the major factors that influence the fluctuations of Seaway traffic in order to determine the causes of its decline and perspective for the future. Markets for major commodities using the Seaway will be described and alternative routes identified. Two scenarios of events likely to affect future traffic on the St. Lawrence Seaway will also be discussed.

BACKGROUND

The St. Lawrence Seaway is a system of fifteen locks and connecting canals and channels that are an essential part of the Great Lakes - Seaway Transportation System. It extends from Montreal to lake Erie and includes two sections: The Montreal - Lake Ontario Section (MLO), consisting of five Canadian and two U.S. locks, and the all Canadian Welland Canal with its eight locks. The waterway is administered by the Canadian St. Lawrence Seaway Authority (SLSA) and its U.S. counter - part, the Saint Lawrence Seaway Development Corporation (SLSDC).

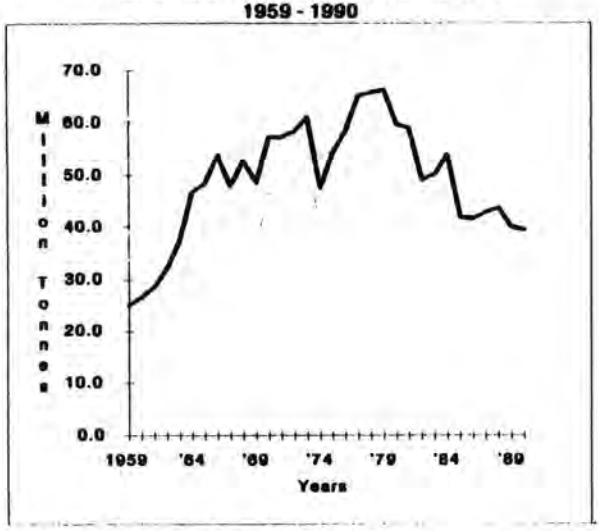
The Seaway is used for the overseas and domestic shipments of bulk commodities as well as general cargo that is composed mainly of iron and steel products. This cargo traffic can be grouped under five major categories: grains (including wheat, coarse grains and oilseeds), iron ore, coal, other bulk (including coke, stone, salt, petroleum products, and all other bulk cargo) and general cargo (including iron and steel products).

In the first navigation season of the St. Lawrence Seaway, cargo traffic was about 19 Mt on the MLO section and 25 Mt on the Welland Canal. With periodic fluctuations, cargo movements grew steadily until they reached the all time record of 57.5 Mt on the MLO in 1977 and 66 Mt on the Welland canal in 1979. Since then, the Seaway has experienced a steady

[1] President, TAF Consultants

decline in its traffic. Iron ore movements were the first to show a substantial decline, followed by U.S.grain and then Canadian grain. By 1982, cargo shipments on the Welland canal and the MLO section had fallen to 49 Mt and 43 Mt respectively. The economic recovery that started in mid-1983 contributed to a slight rebound of the traffic in 1984, but this short recovery was followed, again, by a drastic decrease in the 1985 traffic. Despite a slight recovery during the three years that followed, the traffic dropped in 1990 to the lowest level since the early sixties, recording 39.4 Mt and 36.7 Mt on the Welland Canal and MLO section respectively. This is almost 5% lower than the average of the last five years on both sections of the Seaway and 25% and 20% less than the average for the last 20 years on the Welland and MLO respectively (Please see Chart 1).

Chart 1
CARGO TRAFFIC THROUGH THE SEAWAY
1959 - 1990



Heavy line = Welland traffic, light line = MLO traffic

CAUSES OF THE DECLINE OF SEAWAY TRAFFIC

The economic problem the Seaway is facing stems from the dynamic environment in which the waterway competes. As an integral part of the North American transportation system, the Seaway is competing with several alternative routes and modes for the movements of various commodities that flow between various North American and overseas supply and demand centres. The amount and direction of commodities flowing through this network is influenced by a multitude of economic, political and institutional factors, at domestic and global levels. Hence, the Seaway competes for its share of commodity flows within this global transportation marketplace and consequently fluctuation in its traffic reflects the dynamic of this environment. It is therefore imprudent to assess the behavior of the Seaway traffic on one factor or based on traffic fluctuations at a specific period. Consequently, the causes of the decline of Seaway traffic should be examined within the context of the global commercial transportation network over a wide period of time.

To determine the causes of the decline, cargo movements that contributed to the shrinkage of Seaway traffic will be first identified and their markets described. Analysis of Seaway cargo traffic from 1959 to 1990 indicates that iron ore, U.S. grain and Canadian grain were the major components of Seaway traffic that contributed to the decline of Seaway traffic. For example, the decreases of U.S. grain on the MLO section from an average of 8.1 Mt, during the last twenty years, to an average 4.9 Mt during the last five years, contributed 42.4% of the total decline in MLO traffic. Similarly, the decreases of iron ore on the Welland canal from an average of 11.6 Mt during the last twenty years to an average of 6.8 Mt, during the last five years, contributed 26.5% of the total decline in Welland traffic. Table 1 shows the contribution, in percentage terms and by order of importance, of major cargo in the decline of traffic on both sections of the Seaway during the last two decades (Please see Table 1). In the pages that follows we will examine the reasons behind the decline of those major cargo movements.

Table 1
MAJOR CARGO MOVEMENTS THAT CONTRIBUTED TO SEAWAY TRAFFIC DECLINE

Cargo	MLO	Welland
U.S. Grain	-42.4%	-29.9%
Iron Ore	-26.5%	-42.5%
Canadian Grain	-24.8%	-18.2%
General Cargo	-03.2%	-04.0%
Other	-04.3%	-03.1%
Coal	+00.4%	-04.8%
Other Bulk Cargo	+00.8%	+02.5%

Note: negative (-) sign indicates declining impacts

Iron Ore Traffic

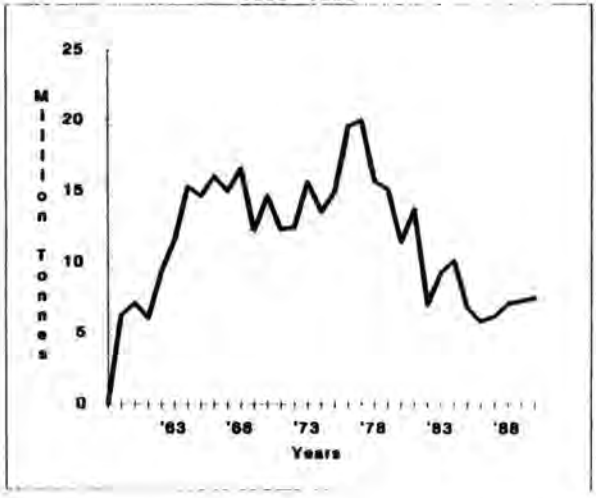
As shown on Table 1, iron ore movements were responsible for 26.5% of the MLO traffic decline and 42.5% of the Welland traffic decline during the last twenty years. Shipments of iron ore on the Seaway originate primarily from the Quebec-Labrador region. The ore is then brought south by rail to lower St. Lawrence ports and then moved by vessels to Canadian steel mills on Lake Ontario and to U.S. steel mills on Lake Erie. Part of the ore continues by rail to the Pittsburgh - Johnstown - Youngstown region. Substantial tonnage is also carried down through the Welland to the Hamilton area from U.S. mines in the Lake Superior region. Ore from Picton and Lake Ontario that once moved through the Welland Canal to the Buffalo area has disappeared in recent years.

Iron ore flows through the Seaway to the U.S. face direct competition from three major alternative systems: Quebec-Labrador ore transported by ocean vessel to U.S. Atlantic ports and then by rail to Johnstown-Youngstown-Pittsburgh region; U.S. Mesabi ore moved by vessel from Duluth-Superior to U.S. Lake Erie, and South American ore shipped by ocean vessel to U.S. Gulf and Atlantic ports. Similarly the flow of iron ore to Canadian steel mills competes with at least two alternative routes: shipments from Canadian Great Lakes and shipments from U.S. Mesabi range.

The size of the iron ore movements through the Seaway has been second only to grain traffic in importance. It increased from 5.6 Mt in 1959 to a record peak in 1977 when 20.2 Mt passed through the MLO section. In the following years, the traffic gradually declined and by 1982 it was only 7.4 Mt on the MLO. This, the lowest level since 1963, was caused by the prolonged economic recession that severely depressed the automotive and steel industries in North America that year. Despite a modest recovery in 1984, when the traffic reached 11.4 Mt, it was evident that a new situation - post 1977 - had developed. In 1986, the iron ore traffic on the MLO was 8 Mt; on the Welland, it dropped to the lowest level ever at 5.8 Mt. However, during the last three years, this traffic has slightly recovered and by 1990 it reached 11.5 Mt and 7.5 Mt on MLO and Welland canal sections respectively (Please see Chart 2).

Several factors determine the size of the iron ore traffic through the Seaway. Most important is the demand for finished iron and steel products in the U.S. and Canada. This, in turn, depends upon the general economic conditions and the steel usage factor in end markets. Other major factors include the share of domestic and imported steel in the total North American steel supply; steel-making technology; material uses as well as the performance of steel mills located within the Seaway region. For example, in 1978 when U.S.steel consumption was almost 99 Mt, the MLO iron traffic reached the record 20 Mt. But when the U.S. steel consumption dropped to only 69 Mt in 1982, iron ore traffic shrank to 7.4 Mt. Beside these demand factors, the size of the iron ore movements via the waterway depends on supply conditions as well as the ability of the Seaway to compete with alternative routes and modes. The latter factor will depend upon the efficiency of the waterway and is reflected in the total transportation charges. For example the 1977 Labour disputes in U.S. mines of Lake Superior reinforced the competitive position of the Seaway in that year. Nevertheless, the impact of this transportation cost is usually diluted by the vertical integration in the production, distribution and consumption of iron ore, which is a characteristic of this industry.

Chart 2
IRON ORE TRAFFIC THROUGH THE SEAWAY
1959 - 1990



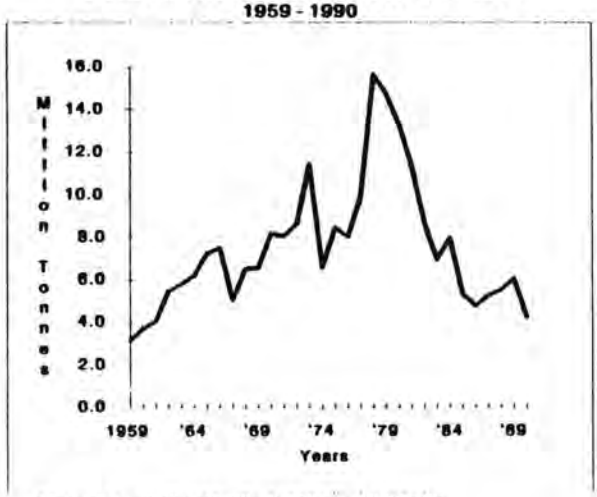
Grains

Grain traffic through the St. Lawrence Seaway is composed mainly of Canadian and U.S. export movements that originate at the Great Lakes terminals and are destined to overseas markets. The greater part of this traffic is carried by Canadian lakers to lower St. Lawrence ports, such as, Quebec City, Baie Comeau, Port Cartier for transshipment to ocean vessels, while a smaller portion is dropped off for domestic use at Hamilton, Prescott, Toronto, Montreal and other river ports. An important portion of the U.S. grain flow is exported directly to overseas destinations in ocean vessels.

U.S. Grain Traffic

In terms of impact on the decline of Seaway traffic, U.S. movements were responsible for 42.4% of the MLO traffic decline and 29.9% of the Welland traffic decline over the last twenty years (Please see Table 1). U.S. grain exports move to overseas destinations from four major U.S. coastal areas: the Great Lakes - St. Lawrence Seaway, the U.S. Atlantic, the Gulf and the U.S. Pacific. Exports through the Seaway system originates at the U.S. Great Lakes terminals and are destined to overseas markets. When the Seaway opened in 1959, U.S grain traffic, on the Welland canal, amounted to 3.1 Mt. This movement reached the record level of 14.5 Mt in 1978. During this period, two major cycles occurred in which the traffic fluctuated sharply. A third major cycle started after 1979 and reached bottom in 1986 when U.S. grain traffic through the Welland canal dropped to 4.8 Mt. A short recovery brought this traffic to 6.0 Mt in 1989 before it declined once again to 4.2 Mt in 1990 (Please see Chart 3).

Chart 3
U.S.GRAIN TRAFFIC TROUGH THE SEAWAY
1959 - 1990



Heavy line = Welland traffic, light line = MLO traffic

The level of U.S. grain traffic through the Seaway depends mainly on the amount of U.S. grain exported during the months of April to December of a specific year and on the demand from

traditional Seaway grain markets in Western Europe and, to a lesser degree, in North Africa and the Middle East. The causes of the decline of this traffic can therefore be explained by examining the patterns of total U.S. grain exports. For example it is a fact that the decline in demand from the European market in the last few years has had a drastic impact on the amount of U.S. grain exported via the Seaway. During the 1983-87 period, Western Europe was the biggest market for U.S. grain exported via the Seaway, representing an average of 43% of total U.S. grain exports through this outlet. North Africa - Middle East were second in importance, accounting for 29%, followed by the Soviet Union (7%), Eastern Europe (4.4%), Latin America and Asia with each (4%). Because of the diminishing share of Western Europe of the total U.S. grain exports in recent years, the Seaway share for moving U.S. grain gradually declined to only 4.5 percent in 1988. Meanwhile, the U.S. Gulf and the U.S. Pacific outlets both increased their share to 66% and 24 % respectively as their traditional markets, particularly in Asia, gained in importance.

The capacity of the U.S. grain transportation system also has an important impact on the level of U.S. grain exported through the Seaway. For example, in years when world grain demand was high and the U.S. economic situation was robust, the flow of various commodities through the U.S. transportation system flourished and the U.S. transportation system tended to experience capacity limitations. Therefore, the Great Lakes - Seaway system, which acted as a safety valve, by handling the grain overflow, experienced a sharp increase in its U.S. grain traffic. But with depressed economic situation in the U.S., commodity movements through the overall U.S. transportation system declined. Therefore, the available capacity of this system artificially increased and transportation rates, particularly that of the Mississippi barge, somewhat fell and consequently the competitive advantage of the Seaway diminished.

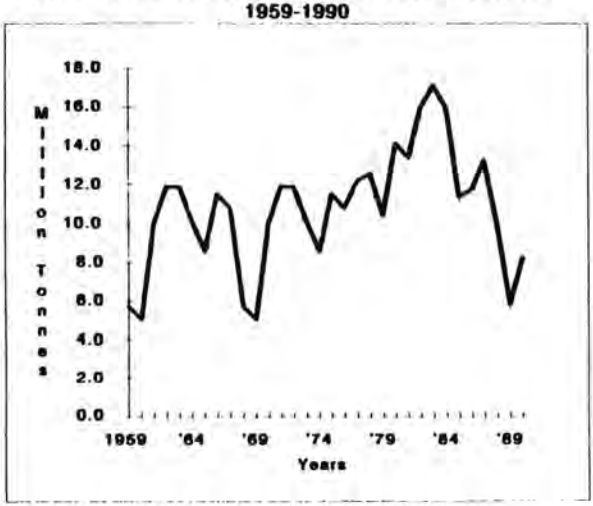
The U.S. Staggers Act, which became law in October, 1980, brought several changes in rail rate regulation that contributed to reducing the cost of moving U.S. grain by rail. Nevertheless, this factor by itself did not influence significantly the decline of U.S. grain exports via the Seaway. In fact, grain exported through the Atlantic has been higher in absolute terms and in percentage share than U.S. grain shipped through the Seaway since 1974, six years before the Staggers Act. Also, since 1986, the Seaway share of total U.S. grain exports has surpassed that of the Atlantic outlet. An important factor regarding the higher grain exports via this eastern terminal is the timing of grain shipments. When shipments are strong during the first three months of the calendar year, the U.S. Atlantic outlet seems to gain the upper hand in cumulative grain exports for the year. But in a year when U.S. grain exports are soft during the first three months, the cumulative traffic advantage tends to shift to the Seaway since the waterway usually moves more U.S. grain exports than the U.S. Atlantic outlet during the remainder of the season.

Canadian Grain Traffic

In terms of impact on the decline of Seaway traffic, Canadian grain movements were responsible for 24.8% of the MLO traffic decline and 18.2% of the Welland traffic decline over the last two decades (Please see Table 1). Canadian grain is transported to markets via four Canadian alternative routes: the Great Lakes - St. Lawrence Seaway system, including Thunder Bay direct and transshipment in the lower St. Lawrence, the all-rail route to the Canadian Pacific seaboard, the Atlantic seaboard and Churchill. While all grain shipped to the Pacific is for export, grain moving eastward by water is for export and domestic use, both of which contribute to the Seaway traffic.

Since the opening of the Seaway in 1959, Canadian grain traffic through the waterway increased steadily from about 4 Mt to the record level of 17 Mt in 1983, representing 35% of the total Seaway traffic on the Welland Canal. In the following years, the softening of the world grain trade market coupled with depressed ocean rates brought about a significant reduction in this traffic. By 1989 this traffic on the Welland dropped to a record low of 5.8 Mt before it resurged back to a modest 8.2 Mt in 1990 (Please see Chart 4). The causes of decline of this traffic can be determined by examining the role the waterway plays in the Canadian grain export industry.

Chart 4
CANADIAN GRAIN TRAFFIC THROUGH THE SEAWAY
1959-1990



Heavy line = Welland traffic, light line = MLO traffic

Canadian grain shipped through the Seaway depends on world grain demand and to a larger degree, on grain demand from traditional markets in Europe, the Soviet Union and North Africa - Middle East as well as on the available capacity of the Canadian Pacific outlet. During the 1983-87 period, on the average, 36% of the total Canadian grain exports went to Asia, 23% to the Soviet Union, 14% to North Africa - Middle East, 9% to each Western European and Latin American markets, 4% to each Eastern European and U.S. markets and 1.5% to Other Africa.

During the same period, the U.S.S.R market accounted for 40% of all Canadian grain exported through the St. Lawrence Seaway, followed by Western Europe (17%), North Africa - Middle East (16%), Latin America (13%), U.S.A. (5%), Eastern Europe (4%) and Other Africa and Asia with each 2%. In contrast, the market for Canadian grain exported through the Canadian Pacific seaboard outlet is concentrated in Asia, which during the 1983-87 period averaged 69% of total grain exported from this outlet.

In 1989, the shares of Western Europe and the Soviet Union of the total Canadian grain

exports diminished to 7 % and 11.5% respectively. In contrast the Asian market - a traditional Pacific market - increased its share to a dominant 37% of the Canadian grain exports. Therefore, with increasing demand from Asia relative to the demand from Western Europe and the Soviet Union, the Seaway share of total Canadian grain exports that averaged 47% during the 1983-87 period dropped to 27% in 1989.

In addition, serious supply problems in Canada, caused by two consecutive years of drought, worsened the already weakened Canadian grain position. As a result, Canadian grain shipments via the Seaway in 1985 dropped by 30% Mt from the 16 Mt level of 1984 to 11.3 Mt. Moreover, since 1985, and for the first time in more than a decade, the waterway's share of total Canadian grain exports dropped below that of the Pacific outlet. This situation coincided with the implementation of the Western Grain Transportation Act (WGTA). The latter has added, in recent years, a new factor in the shaping of Canadian grain distribution pattern that may have contributed to the distortion of the true economics of Canadian grain transportation system. As a result, it appears that the competitive position of the Seaway vis-a-vis the Pacific outlet has deteriorated, particularly when world grain trade is soft and ocean rates are depressed. Reinforcing this finding is the fact that the sharp drop in the 1985 traffic was expected to be corrected once Canadian grain exports rebounded. This did not materialize. On the contrary, despite a noticeable rise in total Canadian grain exports in 1986, the Seaway share continued to drop while the Pacific share increased.

General Cargo

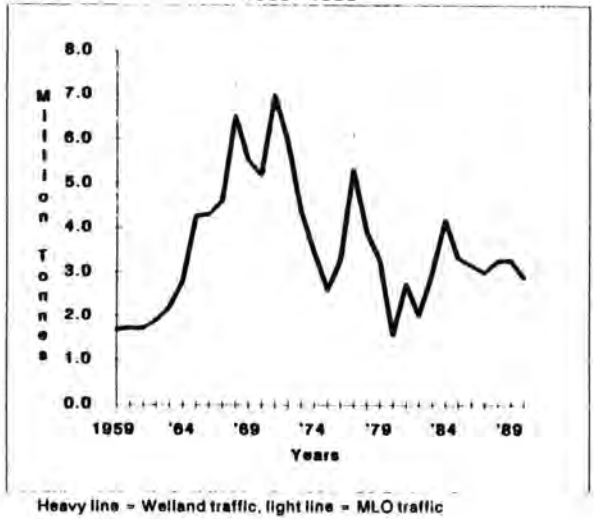
In terms of impact on the level of Seaway traffic, general cargo movements were responsible for 3.2% of the MLO traffic decline and 4.0% of the Welland traffic decline over the last two decades (Please see Table 1). Iron and steel products are classified, in terms of Seaway toll classification, as general cargo. Over the years these semi-finished steel products have increased consistently in importance within the general cargo category as other general cargo traffic declined, to the point where the iron and steel products currently represent 94 percent of the total general cargo traffic on the Montreal - Lake Ontario section and 93 percent on the Welland Canal.

General cargo traffic through the Montreal to Lake Ontario section grew from an estimated 1.8 Mt in 1959, to the record high of 7.8 Mt in 1971. During the following year, this movement experienced several sharp fluctuations and in 1990 was at 3.8 Mt level. On the Welland Canal, general cargo traffic, always somewhat lower than on the MLO section, was 1.7 Mt in 1959. This traffic peaked in 1971 to 7.0 Mt and similarly, after several sharp fluctuations, it settled at 2.9 Mt level in 1990 (Please see Chart 5).

The levels of the iron ore and steel shipments through the Seaway are the function of highly complex forces, including world iron and steel supply and demand, the U.S. steel industry situation, the trade policy concerning steel imports to the U.S and the technological development of the U.S. and Canadian steel industry. Almost 90% of the iron and steel products are imports from Western Europe destined for upper U.S. Great Lakes' ports. The principal countries of origin are: Belgium, the Netherlands, the United Kingdom, West Germany and Japan. To a much lesser degree, U.S. exports abroad and Canadian imports from overseas (transiting only the Montreal to Lake Ontario section) have utilized Seaway facilities. Only very small amounts of the U.S. - Canada trade, Canadian and U.S. domestic shipments, or Canadian steel exports abroad, travel via the Seaway.

The principal U.S. ports of destination on the Great Lakes - St. Lawrence Seaway are: Chicago, Cleveland, and Detroit. These flows are reflected in the MLO and Welland tonnages. Almost all U.S. steel imports moving via the Seaway transit both sections en route to the U.S. Great Lakes ports west of Lake Ontario. Most of the Canadian Seaway steel imports, on the other hand uses only the MLO section as these cargoes are destined to Hamilton and Toronto. Steel imports via the Seaway to U.S. destinations peaked in 1971 at 5.0 Mt, but since then, tonnage has declined substantially reflecting the deteriorating situation of the U.S. steel industry, the protectionist policy adopted by the U.S. Government and the competition of several alternative routes. In 1988, the level of this iron and steel flow was reduced to 2.5 Mt. In contrast, imports to Canada grew slowly but steadily since the opening of the waterway to reach the record level of 1.5 Mt in 1988.

Chart 5
GENERAL CARGO TRAFFIC THROUGH THE SEAWAY
1959 - 1990



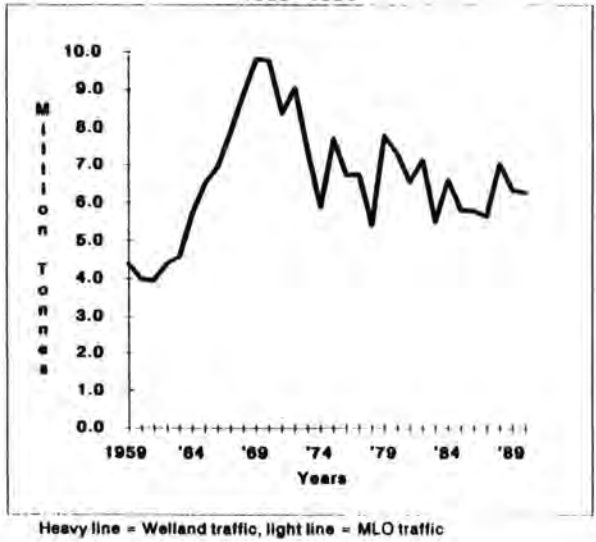
Heavy line = Welland traffic, light line = MLO traffic

Coal Traffic

In terms of impact on total Seaway traffic, coal movements were responsible for 0.4% of the rise in the MLO traffic but contributed 4.8% of total decline in the Welland traffic over the last twenty years (Please see Table 1). Coal transported through the Welland section represents the third largest commodity movement on the waterway. It originates primarily from mines in the U.S. Mid-West and is shipped by rail to Lake Erie ports where it is transferred to lake vessels for shipments through the Welland Canal to Ontario Hydro's thermal coal-fired stations and the steel-making plants located on Lake Ontario. Ontario Hydro operates one coal-fired station and one dual coal/gas-fired station. Of the three major steel-making industries in Ontario, only Stelco and Dofasco have metallurgical coal-consuming plants within the Seaway region. Cement plants and other users on Lake Ontario and below also generate a small amount of thermal coal traffic on the waterway.

Coal traffic on the Welland peaked from only 4.4 Mt in 1959 to the record level of 9.8 Mt during 1969 and 1970. In the years that followed, it gradually declined until it reached the bottom level of 5.5 Mt in 1983. With the strengthening of the economy, as well as for stock-piling purposes, this traffic fluctuated between 5.6 Mt and 7 Mt during the1984 - 1990 period (Please see Chart 6). During the 1981 navigation season, about 1.6 Mt of U.S. thermal coal were exported to Europe via the Seaway, contributing to a sudden surge in coal traffic through the MLO section of the Seaway. Originating from the American Mid-West, this coal was taken to the lower St. Lawrence by lakers and then transshipped to ocean-going vessels bound for the European market. The primary reason for this development was the sudden increase in coal demand as a result of the escalating price of petroleum coupled with the unstable political situation in Poland, a major coal exporter to Europe. Given the labour problems that temporarily limited the potential of the South African and Australian suppliers at that time, the U.S. coal exports were the only alternative to meet the sudden demand. This contributed to congestion problems in the U.S. coal transportation system, resulting in increased demurrage costs and, consequently, justifying exports of a portion of this U.S. coal through the Seaway. With the elimination of most of these factors in recent years, and particularly with falling oil prices, this traffic gradually diminished.

Chart 6
COAL TRAFFIC THROUGH THE SEAWAY
1959 - 1990



Heavy line = Welland traffic, light line = MLO traffic

OTHER FACTORS

Despite the substantial increases in Seaway toll levels since 1977, this component of the transportation costs still represent a small portion of the total costs of moving cargo through the Great Lakes - St. Lawrence Seaway system. Therefore, their impact on the decline of Seaway traffic is still insignificant particularly when assessed in isolation from other components of the total transportation costs. Nevertheless, continued escalation of lockage

fees on the Welland canal along with other costs could, in the future, have a negative impact on some components of Seaway traffic.

The U.S. Water Resources Development Act of 1986 contains revenue provisions under a separate act entitled the Harbour Maintenance Revenue Act; this was imposed on U.S. ports on April 1, 1987. The amount of the tax is 0.04% of the value of the commercial cargo involved. It is paid by the importer when cargo enters the U.S. and by the exporter when cargo is exported from the U.S. and by the shipper in any other case. Under this Act Seaway tolls are rebated to persons who paid the tolls to the extent of the American portion of the tolls (25%) levied on the MLO section of the Seaway. This toll rebate applies to both American and Canadian traffic irrespective of whether or not there has been a call at a U.S. port. Although the combined impact of the U.S port use tax and the SLSDC toll rebate may appear to benefit certain components of the Seaway traffic, particularly iron ore, in practical terms, the net effect should be insignificant. This is mainly due to the fact that major cargoes using the Seaway are more sensitive to market demand than to slight fluctuations in the differential rates existing between alternative modes and routes. Moreover, despite the modest revenue which may accrue to Seaway carriers as a result of the SLSDC toll rebate, the magnitude of this differential gain, relative to the value and total transportation cost of major cargoes, should not alter the actual traffic situation.

While it may sometimes be difficult to identify the damage a strike or accident may cause in terms of traffic lost to alternative routes or modes, it is evident that such incidents suggest instability within a system and may instill doubt and/or non-confidence in the minds of shippers. Nevertheless, no substantial evidence was found to suggest permanent damage to Seaway traffic as a result of strike or accidents.

FUTURE PERSPECTIVE

A serious challenge to the waterway's economic viability is the shape of world trade pattern in the future. Global trends indicate that the future will bring much tougher competition among trading nations resulting in a significant change in world trade patterns. Developments in demographic, political, economical, energy, technological and ecological fields will certainly contribute to strong fluctuations in world demand and supply of major commodities during the next two decades. Among the major economic and political factors contributing to this situation are: the removal, after 1992, of the remaining trade barriers among the 12 members of the European Community; Canada and U.S. freer trade and the potential Mexican trade connection; the faith of "Perestroika" i.e the restructuring of the Soviet economy; the rapid political and socio-economic changes evolving in the Soviet Union and Eastern Europe; development in other emerging trade blocs in East Asia and in the South Pacific and finally the economic and political uncertainty in the Middle East as a result of the Gulf war.

North American transportation policy is expected to evolve to cope with the new political and economic world order and consequently cargo movements through the Great Lakes - St. Lawrence Seaway will be affected. The level of traffic that will use the waterway will depend on the scenario of events prevailing at that time. Two perspective scenarios from which we can derive future lower and higher cargo levels through the Seaway are described below.

The terms optimistic and pessimistic scenarios used in this report are relative and refer to future conditions of the major factors which should contribute to a higher and lower levels of

cargo traffic through the St. Lawrence Seaway respectively. The following are assumptions for the two scenarios.

OPTIMISTIC SCENARIO

In this scenario, a steady growth in the world economy, which will be accompanied by a relative increase in energy consumption and healthier oil prices, is anticipated. Globalization will be the norm for business to respond to a world market already made smaller by telecommunications and larger by a more balanced share of wealth between the U.S., Western Europe and East Asia. As a result more trans-border joint ventures and mergers should evolve as corporations seek global linkages. World trade liberalization and business internationalization are expected to substantially increase world trade particularly in an eventual new economic and political order. Consequently, North American trade will benefit and traffic through the Seaway should grow.

Removal of internal barriers in the E.E.C. should be beneficial to the trade between two major western blocs as long as the process opens the market to international trade. Increasing trade among the two major Western economies should prompt Western Europe to soften its position on agriculture subsidies. Subsequently, a solution will be found to end agriculture trade war with the U.S.. As a result, seaborne trade, particularly that of grains, between the two western markets through the Atlantic ocean, will grow .

With healthier oil prices developing countries would be able to reduce their financial debt and increase their cash trade with the North American and Western European trade blocs. Thus, U.S. and Canadian exports, particularly grain to these markets should grow.

This scenario also assumes that the restructuring of the Soviet economy will achieve some progress. As a result, rapprochement with the Western world should materialize and with it the end of the cold war. Consequently, substantial increase in trade between the two previous enemies is expected. Moreover, the rapid political and socio-economic changes in Eastern Europe will most probably make the economy of Eastern Europe less dependent on the Soviet economy and therefore its trade relationship with Western Europe and North America should substantially increase in the longer term.

The negative impact of the WGTA on Canadian grain exports through the seaway will be diluted as a result of stronger world grain markets, relatively higher ocean rates and domestic efforts to remove the distorting effect of this Act. Consequently, the Seaway share of total Canadian grain exports will improve.

Moderate success of the U.S. Bonus Incentive Commodities Export Program (BICEP) and the cessation of the agriculture trade war thereafter will allow the U.S. to regain its market share in world grain trade. Therefore, U.S. grain exports will be higher than in the 1980's and the Seaway's share of the total U.S. grain exports will rise to a healthier level.

With a freer world trade and growing economy, North American steel demand should relatively grow. This will be accompanied by a gradual increase in iron and steel imports in the U.S.. Moreover, the modernization of steel mills within the Great Lakes - Seaway Region should slightly improve their share of total U.S. steel production. As a result, iron ore shipments through the waterway will be maintained above the levels during the 1980's. Meanwhile, other bulk cargo will continue its gradual growth in the future.

PESSIMISTIC SCENARIO

In a pessimistic scenario, a slowdown in the world economy and the extension of agriculture trade war on subsidies are anticipated. Emerging world trade blocs would reduce internal barriers while raising external ones that might prompt a western hemisphere trade war and weaken international trade. World grain trade would soften as a result of partial implementation of self - sufficiency grain policy in several importing regions, continued trade war between the E.E.C. and the U.S., and the mounting debt of developing countries. Consequently, North American trade will suffer and traffic through the Seaway should further decline.

The Canadian grain industry will continue to face a competitive market as a result of the unresolved agricultural trade war, and increasing dependence of developing countries on food aid programs. Meanwhile, the Canadian Wheat Board's choice to export grain through the Pacific terminals will continue due to advantageous domestic transportation rates - a result of the WGTA. Consequently, the Seaway share of total Canadian grain exports will remain below 30% percent particularly since market in Asia should grow relatively faster than traditional Seaway markets in Europe.

In this scenario, the share of U.S. grain exports of world grain trade is expected to decline due to fierce competition in world markets. Consequently, the Seaway share of total U.S. grain exports will remain below 5%, particularly since barge rate, along the Mississippi - Gulf route, will soften as a result of slow economic conditions.

With an economic slowdown steel demand will decline prompting a reduction in U.S. raw steel production in steel mills located within the Great Lakes-Seaway region. Consequently, iron ore movements through the Seaway should diminish. The decline in the demand for steel will also reduce its imports from overseas, particularly since protectionist policy should be anticipated. As a result, iron and steel imports to the U.S. via the Seaway should decline.

CONCLUSION

As described in this paper the causes for the decline of Seaway traffic are numerous and complex. Nevertheless, two factors that occurred during the last two decades could be considered as the major causes for the decline of Seaway traffic. These are: 1) the restructuring of the U.S. steel industry that necessitated a substantial reduction in the capacity of U.S. steel mills serving the Seaway and, 2) the decreases in demand for U.S. and Canadian grains from West Europe. Almost all the other factors that caused the decline of the traffic can be downwardly or upwardly related to those two factors. Finally, future perspective for Seaway traffic will depend on the scenario created by events prevailing at the time. An optimistic scenario will necessitate a world trade liberalization in addition to a steady growth in the world economy. Consequently, North American trade will strengthen and traffic through the Seaway could grow. In a pessimistic scenario, a slowdown in the world economy, and emerging trade blocs that reduce internal barriers while raising external ones will prevail. That might prompt a western hemisphere trade war and weaken international trade. Consequently, U.S. and Canadian overseas trade will soften and Seaway traffic decline (Please see Table 2).

Table 2
THE SEAWAY TRAFFIC: CAUSES OF ITS DECLINE AND FUTURE PERSPECTIVE

Cargo	Major Flows	Traffic Situation	Causes	Perspect. Mt
Can. Grain	**Welland** Canada to Canada (Tras.) Canada to Over.	Strong fluctuation/ Recently sharp decline below trend RY 83/ 17.1 Mt - LY 89/5.8 Mt	Supply - Demand Market pattern WGTA	Ps 8.0 Op 11.6
U.S. Grain	**Welland** U.S. to Over. U.S. to Canada	Strong fluctuation/ Recently sharp decline below trend RY 78/ 15.6 Mt - LY 90/ 4.2 Mt	Supply - Demand Market pattern Mississippi capacity	PS 4.4 Op 6.9
Iron Ore	**MLO** Canada to Canada /Up Canada to U.S./Up **Welland** Canada to Canada /Up Canada to Canada /Down U.S. to Canada/Down	Strong fluctuation/ Recently slight increase below trend RY 77/ 20.2 Mt- LY 82/ 7.4 Mt Strong fluctuation/ Recently slight increase below trend RY 77/ 19.9 Mt- LY 86/ 5.8 Mt	Economic situation Supply - Demand Trade Policy Technology	Ps 10.3 Op 11.8 PS 6.2 Op 7.8
Coal	**Welland** U.S. to Canada/Down U.S. to Over./Down **MLO** Canada to Canada/Up U.S. to Canada/Down U.S. to Over./Down	Strong fluctuation/ Recently slight increase below trend RY 69/9.8 Mt- LY 83/ 5.5 Mt Strong fluctuation Recently slight increase above trend RY 81/1.7 Mt- LY 74/0 .18 Mt	Supply/Demand Ontario Hydro Steel Mills Alternative source	PS 6.2 Op 7.1 PS 0.4 Op 0.7
Other Bulk	**Welland** All directions **MLO** All directions	Strong fluctuation Upward trend since 1984 RY 79/13.4 Mt- LY 82/7.6 Mt Strong fluctuation Upward trend since 1984 RY 79/11.4 Mt- LY 82/6.7 Mt	Economic situation Supply/Demand Trade Policy Oil Pice	PS 10.0 Op 11.2 PS 8.5 Op 10.0
General Cargo	**MLO** Over. to U.S./Up Over. to Canada/Up Canada to Overs./Down U.S. to Over./Down **Welland** Over. to U.S./Up U.S. to Over./Down	Strong cyclical fluctuation Declining trend RY71/7.8 Mt - LY 80/2.5 Mt Strong fluctuation Declining Trend RY71/7.0 Mt - LY 80/1.6 Mt	Economic situation Supply/Demand Trade Policy Technology	PS 3.6 Op 4.7 PS 2.8 Op 3.8

NOTE: RY = Record Year LY = Last Year
Over. = Overseas

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GREAT LAKES SHIPPING: A FLOUNDERING INDUSTRY

1.0 INTRODUCTION

The Great Lakes Marine Transportation community is in serious peril. What was once a very healthy, vibrant business has deteriorated into an industry whose future viability is in grave jeopardy. The movement of Canadian export grain through the system, the lifeline for most Canadian shipowners and the straight deck bulker, has dropped dramatically in recent years. From a record level of 14.4 million tonnes in 1983/84, grain shipments through the Port of Thunder Bay dropped to 9.7 million tonnes in 1985/86 and for the 1989 shipping season the situation is even more precarious. As of September 1989 lake vessels have carried a total of 2.3 million tonnes as compared to 6.9 million tonnes in 1988, a 60% decrease for an industry already reeling from losses of previous years. Shifting grain export markets, combined with a biased federal grain transportation policy, recent drought and crop failures and the increasing costs of marine transport on the Seaway, have created a situation where the major portion of Canada's export grain crop is now shipped off West Coast ports rather than through the Great Lakes system.

1.1 THE GREAT LAKES MARINE INDUSTRY

The 1960's and 70's were an exciting period for the Great Lakes shipping industry. The opening of the St. Lawrence Seaway in 1959 had allowed for an expansion in the size of vessels able to transit the system from Thunder Bay to the St. Lawrence. Additionally, in 1954, substantial iron ore deposits were discovered along the north shore of the St. Lawrence and the new deepwater ports of Sept-Iles, Port Cartier and Baie Comeau were soon to become household names for the industry. Maximum seaway size vessels could now carry 25,000 tons of iron ore up to the steel mills of Ontario and the United States and then proceed to Thunder Bay and other ports such as Duluth, Chicago, Milwaukee and Toledo to load grain for the huge transfer elevators built in the St. Lawrence. Generous shipbuilding subsidies by the Canadian Government allowed the major Laker owners to rebuild their aging fleets to suit the new lock configurations.

At the same time, the Laker owners enlarged their fleet flexibility by expanding into the operation of self-unloading vessels. Starting with some older, less efficient U.S. lakes tonnage, the Canadian fleet was significantly expanded to handle the growing trend to carry bulk cargoes such as coal, iron ore, gypsum, stone, potash, salt, cement clinker, coke breeze and bentonite clay in self-unloaders. These vessels eliminated the requirement for shore based installations to unload vessels. Self-unloaders could unload at any time of the day or night and most importantly, they could unload at a speed of 5,000 tons per hour as compared to the conventional shore rigs which could at best unload at 1,000 tons per hour. Because of its design and capabilities, the self-unloader was ideally suited for the high volume, short distance trades typical of the Great Lakes market.

During the 1980's the industry was decimated by a number of events brought about by the severe worldwide recession. In 1980 there were 12 Canadian shipping companies operating 125 vessels in the dry bulk trades. On the U.S. side, 15 companies also operated 125 vessels. Combined, these vessels carried approximately 200 million tons of cargo on the GL/SLSS. By the end of 1989, the Canadian dry bulk fleet was reduced to 6 major companies operating 81 Canadian flag vessels and the U.S. fleet was downsized to 62 U.S. flag vessels operated by 11 companies. On the St. Lawrence Seaway, traffic for the Montreal-Lake Ontario section declined to 26.4 million tonnes by 1988 from a 1977 peak of 57.5 million tonnes. On the Welland Canal section, from a peak in 1979 of 66.2 million tonnes, tonnage dropped to 30.4 million tonnes by 1988.

A number of factors have led to the downsizing of the industry. The recession of the early 1980's shook the foundations of the U.S. and Canadian steel industry which saw its production reduced by 50%. This severely affected the backhaul iron ore trade from the St. Lawrence to the mills. In one example, a Canadian shipowner went from transporting 1.7 million tons of ore in one year to 50,000 tons the following season.

In the grain trades the devastation was almost as great. President Carter's grain embargo against the Soviet Union in 1981 basically cut off all U.S. export grain shipments and killed what was once a flourishing trade for some of the Canadian shipowners who had freight contracts with the major U.S. grain trading houses. The Staggers Act of 1980 was another blow to the industry as this deregulation of the U.S. rail industry allowed the railways to carry grain in unit

trains to the U.S. East Coast at rates more competitive than the Lakers.

In addition, the European continent was once seen as a major customer of Canadian and U.S grain with the result that the Laker owners had built up their fleets to handle this tonnage. Today the EC 12 countries form a common alliance and heavily subsidize their crops in order to stay competitive with the U.S. and Canada. Thus the U.S. and Canada must turn to new markets in order to sell their grain.

1.2 CURRENT SITUATION

The Lakes market can be divided into two distinct trades; the **self-unloader** which can unload itself, and the **bulker** or gearless vessel which requires shore based equipment to unload its cargo. Over the years, the **bulker movement** has evolved into a two commodity trade. In the eastbound direction (headhaul) moves Canadian and U.S. grain loaded at Lake ports for the transfer elevators located in the St. Lawrence River. On the return voyage to the lakes (backhaul) iron ore is carried to feed the furnaces of major Canadian and U.S. steel mills. Table 1 outlines the tonnage involved in this trade for the years 1984 through 1988. Bulkers are also utilized:

1) To move iron ore from the north shore ports of Havre St. Pierre and Port Cartier to Sorel and Contrecoeur.

2) To move iron ore from Superior, Wisconsin to Hamilton, Ont.

3) For other miscellaneous cargoes moving among Great Lakes ports.

Fighting for control of this market are 6 Canadian flag companies. Group Desgagnes Inc. with a small coasting fleet of 7 vessels is not included in this analysis as they no longer consider themselves a participant in the grain trade. These include Canada Steamship Lines (CSL) with a market capacity share of 23.6%; followed by ULS Corporation with 21.4%; Misener Shipping with 19.4%; N.M. Paterson & Sons with 16.3%; Algoma Central Railway (ACR) with 13.5%; and P & H Shipping with 5.8% In 1990 ACR and ULS formed a pooling arrangement for their bulker fleets which provided them with an overall market capacity of almost 35%.

TABLE 1

CANADIAN GREAT LAKES BULKER FLEET
HEADHAUL/BACKHAUL TONNAGES

(MILLION TONNES)

	1984	1985	1986	1987	1988
HEADHAUL					
Canadian Export Grain	12.3	9.3	10.1	10.8	8.0
U.S. Export Grain	2.2	1.9	1.0	1.1	1.9
Canadian Domestic Grain	1.9	2.6	1.5	2.7	2.5
Total	16.4	13.8	12.6	14.6	12.4
BACKHAUL					
Ore for Lake Ontario Destinations	3.8	3.0	2.8	3.2	4.9
Ore for Lake Erie & Other Destinations	4.0	2.3	1.6	2.5	3.4
Total	7.8	5.3	4.4	5.7	8.3
GRAND TOTAL	24.2	19.1	17.0	20.3	20.7

Currently there are forty nine available bulkers, of which thirty seven are considered the most economically efficient to participate in the grain trade. The average age of this fleet is 21.4 years, which is still fairly young for a freshwater fleet. Twenty four of the newer units are propelled by diesel engines. However, the thirteen older vessels are run by steam turbines which in periods of high fuel costs become very expensive (50% higher) to operate as compared to today's modern fuel efficient engines. With regular maintenance on the hulls, there is no doubt that these vessels will be able to last another 15 - 20 years. However, given continuing oil price increases it will become essential to replace the turbines and boilers with a more efficient power plant, provided the

business is there to warrant the $6 million dollar replacement cost required (1989 dollars). The other remaining older units will most likely be scrapped in the next 3-5 years.

This rationalization of the fleet will continue due to the fact that the business available for bulkers has continued to decline in the past 5 years. The trend to move iron ore in self-unloaders has reduced the number of ore cargoes available for these vessels and Canadian grain volumes have also been reduced due mainly to market repositioning by the CWB. In 1989, U.S. grain moved in significant quantities for the first time in many years. However, due to competitive forces from the Mississippi/Gulf waterway system and the abundance of available bulkers to transport this grain (due to the reduced movement of Canadian grain), these cargoes were carried at freight rate levels equivalent to 1975 levels for the majority of the season.

The other market in the Great Lakes dry bulk business is the **Self-unloader** trades. The vessels in these trades are considerably more capital intensive and incur higher operating (additional crew and insurance) and repair costs due to the increased wear and tear on the vessel. This market consists of three Canadian carriers; CSL with 45.2%; ACR with 34.7%; and ULS with 20.1%. There are also 55 American owned self-unloaders operating on the Lakes. The U.S. vessels are traditionally employed in their own domestic business and thus are rarely available to compete with the Canadian fleets. In addition, the majority of their vessels are either too small or large to compete effectively. Their operating costs are also considerably higher than Canadian self-unloader vessels.

Table 2 outlines the Canadian self-unloading fleet capacity. The majority of the vessels are used in the non-grain trades such as coal, iron ore, sand, stone, salt, gypsum, potash, coke breeze and bentonite clay. However, about 500,000 tonnes of domestic grains do move around the lakes by this type of vessel. In the past, self-unloaders were also employed in the export grain trade, but due to the recent irregularities of this movement, other business such as coal top-offs have been found in order to provide more consistent employment for these higher cost vessels.

TABLE 2

CANADIAN FLAG GREAT LAKES SELF-UNLOADERS

	CSL	ULS	ACR
# Of Maximum Seaway Size Vessels	12	5	6
Average Capacity at Midsummer Marks	31,254	33,980	30,133
Average Age of Hull	18.5	16.2	15.2
Average Age of Unloading Equipment	15.6	16.2	9.2
# of Less Than Seaway Size Vessels	2	1	5
Average Capacity at Midsummer Marks	17,638	18,600	25,510
Average Age of Hull	39.5	38.0	18.2
Average Age of Unloading Equipment	24.0	9.0	17.0
Total Vessels	14	6	11

1.3 INDUSTRY TRENDS

Although self-unloader technology is not new to Lakes shipping, the trend in recent years for their utilization has accelerated in a bid to control costs in bulk transportation. As traditional shore based discharging systems age and the cost to replace them becomes prohibitive, the customers, particularly steel mills, are turning to the self-unloader for the handling of their total raw material requirements. On the U.S. side of the Lakes, only 3 steel mills are left using conventional grab systems and one of these companies, Inland Steel is seriously considering converting to total self-unloader movement in the near future.

STELCO, one of Canada's major steel manufacturers, is serviced totally by self-unloaders at their Nanticoke plant and it is almost a certainty that its Hamilton plant will convert within the next 3-5 years. When this happens a minimum of 6 more self-unloaders will be required to service this customer.

QIT, a major steel producer in Sorel, Quebec will in 1990 utilize self-unloaders for the first time to handle part of its requirements. Vessel congestion at their dock is at an all time high and by using self-unloaders it is estimated that dock capacity will increase by 30% as a result of faster vessel turn around time.

Another area where more self-unloaders will be required is the Algoma Steel Mill located at Sault Ste. Marie, Ontario. Although their raw materials are currently being shipped by self-unloaders, another 1 million tonnes of iron ore is railed to the plant from their mine located at Wawa, Ont. It is expected that this mine will be closed within a few years and when this happens another million tonnes of self-unloader capacity will be required to deliver the cargo from its new point of supply.

DOFASCO, the other steel producer located in Hamilton, Ontario also announced changes for the 1990 season. The Adams and Sherman mine in Northern Ontario were closed and approximately 2 million tonnes of iron ore is now sourced from the north shore of the St. Lawrence making the total ore moved in excess of 5 million tonnes. ULS employs their bulkers for this work and at this point in time Dofasco has shown no interest in conversion to self-unloaders. As the 1989-90 season ends this seems to be the only bright light as far as bulkers are concerned.

The self-unloader market has only recently turned around. Subsequent to the recession, freight rates remained stagnant due to an over supply of vessels. To offset this problem, ULS, CSL and ACR deployed 5 ships to participate in their international trades. Additionally, CSL was able to position 2 other Ocean/Lakers outside for their international trades subject to market conditions.

With these vessels now removed from the Lakes trade, the future for self-unloaders on the Lakes is encouraging, with the industry now into a second season of a supply/demand balance. However the possible cloud on the horizon will be the conversion of bulkers to self-unloaders which may jeopardize this delicate supply/demand balance. Both CSL and ACR have recently converted vessels to meet growing cargo requirements of existing customers. This practice will not continue given the fact that present freight rates are not high enough to justify the cost of converting more vessels. The area of concern remains the threat of the other Laker companies who are involved in the bulker trades only. As the trend towards self-unloaders continues,

the pressure will intensify for these companies to convert their vessels. At $18 million plus for a conversion (1989 dollars), it will remain difficult for these companies to justify funds of this magnitude for vessel conversions.

1.4 SUMMARY

If one was to summarize the Great Lakes marine industry today and for that matter world shipping in general, the Editorial page of AGRIWEEK, (OCT. 16, 1989) sums it up clearly;

"Economic conditions in seaway transportation do not presently favour expansion, and on the contrary the system is contracting as vessels are scrapped or diverted to other services. The lake fleet is aging and literally no new ship construction is presently planned. World wide, bulk shipping capacity is being scrapped much more quickly than new construction adds it. The global bulk shipping industry is also shrinking and faces among other things a worsening shortage of capital. Unless substantial improvements occur in grain-shipping economics, shipping capacity may at times restrain world grain trade in the years ahead at least as surely, and perhaps more surely, than the strict limitations of supply and demand."

2.0 THE ALTERNATIVES "A SHIPOWNER'S PERSPECTIVE"

From the shipowner's point of view, those carriers who operate bulkers must realize that the future for this segment of the industry does not bode well. The industry has 2 choices; the first one is that they can remain in the bulker business, but retire the less efficient vessels to the scrap pile. At the same time the owners must approach the CWB for long term contracts in order to guarantee the fleet's viability. The other alternative would be for those owners who already have self-unloaders to convert those bulkers which are efficient and scrap the remaining vessels which are more expensive to run and maintain and leave the bulker business altogether.

An examination of the bulker fleet, shows that there are 37 maximum seaway size vessels (25,000 tonnes) available for bulker tonnage. The average age of this segment of the fleet is 21.4 years and apart from possible re-engining of the turbines (13 vessels) and the conversion of some self-unloaders, the remainder of this fleet should continue to operate for another 15 - 20 years. Of all the 11 smaller ships remaining in the trade, 2 are of a specialized nature (7,000 tonnes) and do not participate in the export grain trade. Misener's

and ULS's medium size bulkers (2) should be scrapped due to their age and lower efficiency. Paterson's 3 intermediate vessels are 25 years old and although they are still required for some of the small ports which cannot handle the maximum size ships, the revenue earned in this part of the business, does not keep them competitive. From Paterson's viewpoint, the best alternative will be to scrap these vessels and use the proceeds to maintain their larger vessels.

The last 4 vessels belong to P & H Shipping which utilize 2 small intermediates (13,250 tonnes) for their own grain business and 2 intermediates (20,250 tonnes) for the CWB's business. The average age of this fleet is 46 years old and unless this company can do something to improve the efficiency of their vessels, it may be best for them to leave the business. From the CWB's point of view, why should they promote higher freight rates required to keep these smaller, less efficient vessels alive when lower rates (within reason) will suffice to maintain the maximum size vessels. The Eastern route is already expensive enough without trying to support these smaller vessels.

The bottom line is that 37 vessels remain that can most efficiently handle Canada's export grain requirements through the GL/SLSS. However, not all of these vessels are available to handle grain due to other bulker cargo commitments on the Lakes.

By the year 2000, it is expect that Canada will be exporting approximately 35 million tonnes of grain products. Presently the West Coast facilities can handle 19 - 22 million tonnes. Up to the 1987/88 crop year, the most ever shipped out has been 17 million. Furthermore, the St. Lawrence route at best will handle 8 to 8.5 million tonnes of export grain per year. This number may be increased by up to .5 million tonnes if some of the smaller less efficient tonnage is kept to carry domestic cargoes. This leaves a balance of 6 million tonnes that will have to be handled by a combination of rail, Churchill and direct ocean vessel from Thunder Bay.

2.1 CWB LONG TERM AGREEMENTS

The problem remains that even with the retirement of the older bulkers and the use of the remaining smaller vessels in the domestic grain trade, long term contracts are still required to secure this tonnage for the CWB or else this base fleet will continue to deteriorate as the Laker owners require the consistent revenue in order to maintain and upgrade their vessels.

This puts the onus on the vessel owners and the CWB to reach some agreement on long term tonnage. At this point we might question just what is the role of the CWB?

The Canadian Wheat Board (CWB) is an agency of the Federal Government which drives the entire grain marketing and delivery system for wheat and barley. The CWB operates a quota system for producer deliveries to primary elevators, allocates rail cars to move the grain from primary (prairie) elevators to transfer elevators in the St. Lawrence where the grain is transferred to ocean vessels. The agency owns 2,000 railway cars and uses the grain companies, brokers, and other commercial facilities to carryout the actual handling and transportation of grain.

From the CWB's perspective they will require this vessel tonnage especially if they wish to maintain exporting grain in volumes greater than 28 million tonnes. The vessel owner obviously wants to continue to handle this tonnage but he needs the security of a long term commitment.

The next step is to look at the financial numbers required (Table 3) to maintain the existing fleet and also to see what is required for a new bulker at $30 million and a new self-unloader at $55 million.

TABLE 3

TOTAL DAILY REQUIRED REVENUES

Bulker	New Bulker	S/U	S/U Conversion	New S/U
$20,700	$33,400	$22,900	$32,900	$43,100

Table 4 shows the freight rates required for the various type of vessels under the following assumptions:

1) The ore rate for bulkers will continue to be quoted on a Backhaul basis, or approximately $4.00 per tonne.

2) The ore rate for self-unloaders will continue to be quoted on a Backhaul basis, or approximately $7.00 per tonne.

3) Total trip time is a weighted average of all the grain ore trip combinations which is 19.5 days for bulkers and 19 days for self-unloaders.

4) Average cargo capacity is 25,262 tonnes for both types of vessel.

5) The required rate will also cover the revenue need on a grain shuttle basis.

TABLE 4

REQUIRED FREIGHT RATES

	Bulker	New Bulker	S/U(1)	S/U Conversion	New S/U
Freight Rate Req	$14.00	$21.75	$12.50	$17.75	$25.40

(1) Presently no self-unloaders are available for this trade.

From the CWB's perspective it is reluctant to once more enter into Long Term Agreements (LTA). From 1983 through 1988 they were involved in a number of LTA's for which 6 new vessels were built. The total tonnage allotted for these contracts was 12 million tonnes with the freight rates raising yearly based on a COLA and fuel surcharge formula. At the same time, U.S. grain tonnage deteriorated significantly in the early 1980's with the result that excess capacity existed for the bulker fleet. Thus, although some of the CWB's grain rates were protected by the LTA's the balance of the Board's tonnage was transported at spot freight rates which were considerably lower than the LTA rates. Table 5 shows how the two different rate structures fared during the period.

TABLE 5

CONTRACT VERSUS SPOT FREIGHT RATES

Frt. Rate	'80	'81	'82	'83	'84
(Incl. Fuel)					
Spot	$8.71	$9.50	$11.81	$12.65	$13.55
LTA	-	-	-	$14.78	$16.02
Frt. Rate	**'85**	**'86**	**'87**	**'88**	**'89**
(Incl. Fuel)					
Spot	$14.06	$13.65	$13.05	$13.65	$11.00
LTA	$17.86	$18.14	$16.67	$17.17	-

Needless to say, the CWB felt that the laker owners had overly benefited from the LTA's. Additionally the CWB has a difficult time signing long term contracts with higher rates to maintain the Canadian fleet and then watch many of the Canadian shipowners go out and book U.S. grain at significantly lower rates in order to fill out their vessel requirements. From the CWB's viewpoint, the shipowners were subsidizing the sale of U.S grain to their competitors, much to the detriment of the Canadian farmer and the Canadian Lakes Shipping industry in the long run. Thus, they are very reluctant to enter into any long term contracts, despite the fact that they will need this tonnage in the years to come. In many eyes it is a short-sighted approach, however given the events that have occurred in the last ten years of the industry, it is an understandable one.

2.2 BULKER CROWN CORPORATION

Another alternative to long term contract arrangements would be to suggest that the Canadian Government set up a crown corporation to purchase and subsequently operate a fleet of bulkers. Operating a fleet of 20 - 30 vessels would guarantee a minimum tonnage of grain shipped through the Seaway to help protect Canada's grain industry. Additionally, these vessels could then be chartered back to shipowners in order to complete their backhaul ore and other requirements. The timecharter rates would reflect the actual costs to operate the vessels in these ore trades, rather than the present rates which basically pay only for the incremental time used on the trip to reposition for grain cargoes.

It remains a question as to whether the Government or the CWB would be agreeable to such an arrangement. Presently their ownership of transportation assets is limited to 2,000 railcars and it is doubtful that they would want to be involved in operating a number of aging vessels which will require heavy expenditures to maintain in the coming years. However, the idea does have some merit, if Canada wishes to ensure that they will be able to meet their export grain requirements in the years to come.

2.3 DOWNSIZING OF THE FLEET

The other alternative remaining is for those three companies operating self-unloaders to scrap their older less efficient bulkers and gradually convert the more efficient ones into self-unloaders as the market requires them. As we saw in Table 3, the daily revenue required to cover the cost of this conversion is in the

range of $35,000 per day. In order to reach revenue levels of this range the shipowners will be required to scrap their older less efficient self-unloading tonnage and control their rate of conversion so as to not alter the demand/supply ratio for these vessels which would cause freight rates to decrease.

For the three remaining companies who only operate bulkers, downsizing remains a critical issue. Their less than maximum seaway size vessels should be scrapped as only the large vessels will maintain the efficiency required to keep them competitive with the alternative transportation modes. One of these, P & H Shipping, does not own any of these size of vessels. Their main market remains the domestic grain movement in the lakes and it is best that they strengthen their niche in this market by scrapping their very old tonnage and hopefully purchasing 1 - 2 of Paterson's newer intermediate size vessels. This assumes that Paterson should leave this segment of the business and concentrate on the maximum size vessels. Misener is another company which must sell off it's one smaller vessel to become more efficient.

For this segment of the industry, failure to do this will result in continuing decline and eventual bankruptcy for the owners. Unless considerable export grain levels (8 - 9 million tonnes) return to the Lakes soon, it is quite conceivable that the damage will have already been done and these companies will not survive.

What does downsizing mean to an industry such as this one? How does the management of these companies feel about finally facing the facts about some of their older tonnage? These are questions that are difficult to answer due to the very competitiveness remaining in this industry. As a result, I can only address these issues from CSL's point of view.

From CSL's viewpoint downsizing remains a critical issue. The company currently operates both on the Great Lakes and International markets. Traditionally a Lakes oriented company with 100% of its business tied to this market, the company has evolved in the last 7 years and now generates 20% of its revenues from international customers. Its present 5 year plan has this figure increasing to a 40% share of revenue. Although this expansion into international markets has enable the company to better survive the recent stagnant years on the Lakes, this further expansion of the fleet has resulted in an in-house battle as to which markets are best served.

Thus, the issue remains a divided one within CSL's management. For some, the idea of downsizing and demarketing Lakes customers to better serve the International markets has been one that would be well received. On the other hand, there are others who believe that although there are older units which should be scrapped, the Lakes does have a significant future and the fleet should be maintained and updated to meet these requirements.

Ultimately, the key is to retain profitability in all areas of operation. This means for CSL's management a realization that some of the older units must go. One smaller self-unloader should be scrapped and possibly 4 bulkers should be tied up unless the company is successful in negotiating a long term contract with the CWB. No company can afford to continue to refit these vessels so that they run only 5 months a year under the circumstances that the industry has witnessed in the last 5 - 8 years. The future is with self-unloaders and it is this area where efforts should be made to expand the fleet.

The idea of downsizing is not new to the company. In 1965 the Lakes passenger business was disposed of due to an aging fleet and the trend towards personal car and airplane travel. The package freight division, which at one time generated more revenue than the grain trade, was shut down in 1982. Despite a modernization of the fleet during the 1960's, the losses continued to increase due to deregulation in the trucking industry, competitive rail rates and finally the mounting stevedore costs involved in handling these vessels. Two grain elevators and a stone quarry were also disposed of in the last few years. Thus, CSL's management is quite capable of making the decisions required to maintain its viability in this industry. The question remains should it continue to operate in its present condition or should it consider the analysis of this report and be prepared to make a decision on downsizing.

CONCLUSION

It remains to be seen what the Great Lake shipping industry will do in the next few years. Certainly, if it carriers on the way it has since the last 8 years, there will continue to be bankruptcies and rationalization of the bulker fleets. From an industry viewpoint, I believe that the older and smaller less efficient tonnage should be scrapped immediately and unless the CWB can guarantee some firm grain commitments through the GL/SLSS, then maximum size turbine units should also be put to the wall in order to protect the

remaining bulker business. For those companies operating bulkers only, the choice of conversion remains not only an expensive one but also a questionable solution as possession of 1 or 2 of these vessels will not necessarily improve one's chances for survival. Customers are extremely leery of signing up long term contract tonnage (which is required in order to line up the funds for conversion) when they believe that the company is still not financially sound or that the company does not have sufficient vessel tonnage available to guarantee fulfillment of cargo requirements.

Thus, I believe the only option remaining for these operators is to downsize their fleet and find a niche in the bulker market either in the domestic grain or the limited export grain market or fact complete shutdown. With the CWB at this time not ready to commit to long term contracts, it remains the shipowner's decision and his decision only to decide what his future will be.

From CSL's and ACR's viewpoint, the continuing conversion of their more efficient bulkers to self-unloaders will help to reduce the need to rely on grain tonnage to meet revenue targets. For ULS, as long as DOFASCO requires 5 million tonnes of ore in bulkers then they will be forced to operate these vessels. To maintain profitability they will have to insist on higher freight rates to cover the revenues required due to the inconsistent flow of Canadian grain and low freight rates available for U.S. grain.

For the sake of the entire grain industry in Canada, a financially healthy Canadian shipping industry is required if Canada expects to meet its future world grain commitments. It is time both the marine industry and the rest of Canada particularly the Government and all grain shippers, particularly the CWB, woke up to this fact. There is still time for this industry to be saved but the recommendations of this report must be put into action both from the shipowner's perspective and from the grain shippers.

AVAILABILITY OF LESS-THAN-TRUCKLOAD SERVICE SINCE DEREGULATION IN THE TEN STATES BORDERING CANADA

by Folger Athearn Jr.*

ABSTRACT

Prior to deregulation, the restrictive entry policies of the Interstate Commerce Commission were blamed for poor service and high rates. It was predicted that, by allowing unrestricted entry into the transportation industry, competition in a free market would result in more efficient carriers providing better service at lower rates and that it would obviate the need for government regulation. After twelve years of de facto deregulation in the United States, the average number of less-than-truckload general commodity carriers providing regular service at the 467 county seats in the ten states that border Canada has decreased by 28 percent from the pre-deregulation (1976) level. Although major carrier operating expenses such as fuel and labor have not increased as rapidly as has the producer-price index, both the less-than-truckload rate index as well as the revenue per ton mile index have increased more rapidly than has the producer price index. The Interstate Commerce Commission's laissez-faire policies have allowed unjust rate discrimination to flourish. Other research has found that the trucking industry is now less productive and less efficient that it was when the Motor Carrier Act of 1980 was signed. Although there have been many carrier bankruptcies since deregulation, the trucking industry (especially regular less-than-truckload common carriers) remains in a financial crisis.

INTRODUCTION

Canada's Motor Vehicle Transportation Act of 1987 (MVTA) was enacted nearly a decade after administrative interpretations by the Interstate Commerce Commission began the process of de facto deregulation of interstate trucking in the United States. The MVTA provides for an overall review of regulations in 1992. Because of many similarities in the economies of those ten states that share a common border with Canada and the seven provinces bordering the United States, an analysis of changes in the availability of regular less-than-truckload (LTL) common carrier service in the ten border states during more than a decade of deregulation should help predict long-term changes in the availability of comparable Canadian service near to the international border.

To insure that all economic regions were included and that representative information about all counties was sampled, this paper measures changes in the availability of regular LTL service at every one of the 467 county seats in the states of Idaho, Maine, Michigan, Minnesota, Montana, New Hampshire, New York, North Dakota, Vermont, and Washington; the northern tier of ten states bordering Canada. For each county seat, the carriers that indicated that they provided that kind of trucking service in their points lists or service guides were counted. The county seats studied ranged in population from one which is a part of New York City to one with a population of only 30 people. While 11 cities had populations in excess of 200,000, over half of the county seats were small towns with populations of 5,000 or less. The combined population of all 467 county seats is equal to 39 percent of the total population of the ten state area. Figure 1 contains a chart showing population distribution by size of county seat. Table 1 contains detailed population information for each state. This table also tabulates for each state, the net gains and losses between 1982 and 1990 in the number of truckers providing regular LTL service at these county seats.

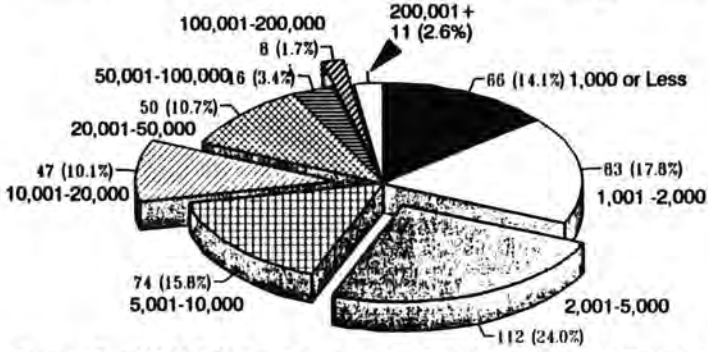
Table 1 **Population of 467 County in Ten States Bordering Canada included in this Study**
Populations in 1980 Census LTL Service Gains & Losses by County 1982-1990

Ten States Bordering Canada	County Seats	State Totals	Percent	Loss	Same	Gain	Total
Five Eastern States:							
Maine	191,806	1,125,027	17%	15	1	0	16
Michigan	2,502,285	9,262,708	27%	23	4	56	83
New Hampshire	265,566	920,610	29%	11	0	0	11
New York	8,737,091	17,556,272	50%	62	0	0	62
Vermont	98,538	481,456	20%	15	0	0	15
Eastern States Sub-Total	11,795,286	29,346,073	40%	126	5	56	187
Five Western States:							
Idaho	415,739	944,038	44%	21	6	17	44
Minnesota	1,386,937	4,069,970	34%	33	18	36	87
Montana	385,911	786,690	49%	10	15	32	57
North Dakota	326,589	652,444	50%	16	11	26	53
Washington	1,226,587	4,131,910	30%	33	0	6	39
Western States Sub-Total	3,741,763	10,585,052	35%	113	50	117	280
Total: Ten Border States	15,537,049	39,931,125	39%	239	55	173	467

Sources: Rand McNally Yellw Guide of United States Counties (1980 Census Data)
Individual Carrier Points Lists, Service Guides, & Rate Bureau Points Lists

Figure 1

Population Distribution of 467 County Seats in 10 States Bordering Canada



Source: Rand McNally Yellow Guide of United States Counties (1980 Census Data)

U.S. FEDERAL POLICY HAS FAVORED DEREGULATION SINCE THE LATE 1970's

Since the late 1970's, the United States federal government has pursued a policy of relaxing its economic regulation over banking, savings and loan associations, telecommunications, and transportation because it was anticipated that less government intervention and greater freedom to compete in the markets for these services would lead to lower prices and improved service. It was predicted that a free market would cause competitors to offer consumers more price and service options. Advocates of deregulation argued that unnecessary costs and alleged inefficiencies created by government economic regulation could be eliminated by relying on competition.

The 1989 Annual Report of the Interstate Commerce Commission (ICC) indicates that as of 31 December 1989 there were 41,602 motor carriers of property (ICC 1990, 130). "(B)y eliminating unnecessary barriers to entry, carefully monitoring carriers' safety records, and encouraging new and expanded motor carrier operations, the Commission's operating rights activity enhanced the quantity and quality of trucking service in the public interest." (ICC 1990, 63) "In the area of common carriage, the Commission will grant authority if it finds that the proposed service will serve a useful purpose, responsive to a public demand or need, unless it finds that the proposed service will be inconsistent with the public interest and the national transportation policy." (ICC 1990, 64)

In Ex Parte MC-77 (Sub 3), *Elimination of Certificates as a Measure of "Holding Out,"* the ICC administratively determined that it would no longer enforce the requirement that motor common carriers serve all points and provide all services authorized by their certificates of public convenience and necessity. Many carriers, including the "big three" (Consolidated Freightways, Roadway Express, and Yellow Freight System), have taken advantage of this policy to terminate their service in sparsely populated rural area and on short-haul traffic.

While the National Industrial Transportation League (NITL) and other organizations representing major shippers in the United States have endorsed the policies of the ICC and continue to call for complete economic deregulation of the trucking industry, there are indications that some shippers are becoming concerned that the "deregulated discounting frenzy" of the past decade may have caused the pendulum to begin swinging back to the carrier's side. (Muller 1991, 25)

Major shippers in the United States have benefited from the increased availability of truckload carrier service and deep discounts on their LTL traffic, but small businesses do not normally ship in full truckload lots and many (if not most) do not get significant (if any) discounts on their LTL shipments. Most small businesses must depend entirely upon regular LTL common carrier service because they do not have the volume of freight to justify a proprietary or contract trucking operation. This paper reports on changes in the availability of regular LTL common carriers transporting general commodities because that is the type of trucking service which is essential to the economic welfare of small businesses.

SOURCES OF INFORMATION ABOUT CARRIERS PROVIDING REGULAR LTL SERVICE

Field surveys, such as those described by Borlaug (1979 and 1981) and Kidder (1980, 1982, 1983, 1984, and 1985), which were funded in the late 1970's and early 1980's by the U.S. Department of Transportation, are one way to develop information about the availability of regular LTL common carrier service, but the cost is high and the reported results are based on the answers of many individuals who may not have sufficient experience and information to provide valid answers. Kidder (1985) reported that 63 percent of the interviewees were not familiar with rate increases because their firm's traffic decisions were being made at locations different from their rural location. Small businesses tend to be knowledgeable

about the specific carriers that are serving them. But they have neither the time nor inclination to concern themselves about the availability of other carrier options if they consider existing service and rates to be adequate.

A better measurement of the availability of regular LTL service can be obtained by consulting reliable carrier points lists, service guides, and commercial directories. There are a number of commercially produced directories that list those general commodity carriers that have advised the publishers that they provide regular LTL service at specific locations. The most complete of these directories is the *American Motor Carrier Directory* (MCD), formerly published by a company with the same name, then by International Thompson Transport Press, Inc. and now by K-III Press, Inc. While it is one of the sources that has been employed to verify data obtained from other sources about the availability of regular LTL service which is reported in this paper, it is not the primary source because it contains so much obsolete and inaccurate data that it must be used with great caution.

The publishers of the MCD (and also other points lists publishers) have been faced with the formidable task of keeping their guides up-to-date in an era of rampant carrier expansion, abandonment, and bankruptcy. For example, both the Fall 1990 edition of the directory published by National Highway Carriers Directory (NHCD) and the Spring 1991 edition of the MCD show P*I*E providing service, but this major nationwide carrier ceased operations due to bankruptcy on 26 December 1990. The Spring 1991 edition of the MCD shows Lifschultz Fast Freight, founded in 1899, serving many locations, but it suddenly ceased operations on 13 February 1991 leaving freight frozen in its Chicago and New York terminals after the trustee-in-bankruptcy rejected an offer from an employee group to purchase the company. (Schultz 1991, 20) It has been practical to exclude from the tally of carriers some of the more obvious abandonments of service due to bankruptcy; such as excluding from the 1988 tally the former service of American Freight System (a major carrier that ceased operations in 1988) and from the 1990 tally the former service of P*I*E. It has not been practical to exclude from the tally hundreds of small carriers that suddenly abandoned service or ceased operations without any notice or record.

One small carrier that prides itself in providing "regular" LTL service within its limited service area makes the observation that many of its competitors claim that they provide "direct" service at these same points when in fact they serve them only infrequently. "Direct" LTL service should not be confused with "regular" LTL service. (Many airline passengers have been dismayed to discover in this era of hub and spoke operations that there is a big difference between a "non-stop" and a "direct" airline flight.) Numerous conversations and letters from small short haul "niche" carriers indicate that they are the ones actually providing the service shown as "direct" by some of the major carriers. Only a few major carriers employing "niche" carriers candidly admit that they do not regularly perform all LTL service with their own personnel and equipment at some of their "direct" points. It is refreshing (and perplexing) to read that: "To preserve the excellence of service, Century Motor Freight, in some instances, may use the services of a short haul carrier to perform final delivery." Sometimes there is no practical way to avoid counting a carrier's "direct" points that are not actually served by that carrier. All points shown as being served "direct" by Century Motor Freight have been counted; as have all "direct" points "served" by other carriers that are less candid. Before the ICC started granting unlimited 48-state authority, this overstating of regular LTL service was not the problem that it is today. In evaluating the availability of regular LTL service, it is important to note that there is a greater overstatement of "direct" service by carriers today than was the case in 1982 or in prior years. A one truck, "ma and pa" truck operation can provide excellent "direct" regular LTL service in a limited area, but a trucker with only a dozen units of equipment and one terminal is entirely incapable of providing regular LTL service at all points within every state of a multi-state area. Short line railroads employ the

slogan "Not as long, but just as wide." Unfortunately, truckers do not have such a slogan. There are many small truckers with ambitions and advertisements that greatly exceed their capacity to perform. The publishers of the MCD (and to a lesser extent the publishers of other points lists) have not been successful in excluding a number of carriers that advertise their phantom "service" to points where they do not now, never have, and probably never will provide regular LTL service. This study has been able exclude from the tally for all years the phantom "service" of some carriers that are shown as regularly providing LTL service at all points in a multi-state area when the *National Motor Carrier Directory* (NMCD), now published by Transportation Technical Services, indicates that they operate less than ten pieces of equipment.

INDIVIDUAL CARRIER AND RATE BUREAU POINTS OF SERVICE LISTS ARE BEST

The most reliable sources for determining whether or not carriers provide regular LTL service are carriers' official (some also have very reliable "unofficial") points of service lists (these are sometimes called service guides, routing guides, etc.). These publications have been employed extensively to supplement and verify data contained in the next best source of service information; general commodity motor carrier rate bureau points lists. The Rocky Mountain Motor Tariff Bureau publishes the only nationwide points of service directory (RMB 118). While it is very complete for the western states, in other areas it must be extensively supplemented by cross-checking the carriers' service shown in RMB 118 against the list of carriers shown serving the same point the points of service tariffs issued by the Central and Southern Motor Freight Tariff Association (CSA 118), Eastern Central Motor Carriers Association (ECA 152), Middle Atlantic Conference (MAC 112), Middlewest Motor Freight Bureau (MWB 101), Pacific Inland Tariff Bureau (PIN 104), Niagara Frontier Tariff Bureau (NFB 169), Southern Motor Carriers Conference Rate (SMC 115), etc. One advantage of using these references is that rate bureaus do not "carry" carriers with delinquent bills for long. Carriers that fail to pay their tariff publishing fees (often because they are broke and going bankrupt) are involuntarily cancelled as participating carriers and their listings are soon deleted from the bureau points lists. In recent years, a number of carriers have stopped participating in rate bureau tariffs, but are still providing regular LTL service. The service of each of theses carriers must be obtained from their individual points of service tariffs, or unofficial points list, and added to the list of carriers serving each point which has been compiled from rate bureau points lists.

While the carrier service information contained in the directory published by NHCD is more accurate than information in the MCD, it is limited to those carriers that advertise in it. The carriers in NHCD's directory tend to be the major national and regional carriers. During the years 1982 - 1990, the number of carriers shown to be serving at points in the NHCD directory ranged between 58 and 69 percent of the carriers found to be providing regular LTL service at the same points by gathering data from rate bureau points lists and supplementing it with additional information to be found in individual carrier publications. The carriers found in bureau tariffs, but not listed in NHCD's directory and in the major commercial directories, tend to be the very small niche carriers (often they are the ones actually providing regular LTL service in remote areas). Although not all carriers are listed by NHCD in its directory, an analysis of changes in it gives a good indication of the relative change in the availability of regular LTL service provided by major carriers.

METHODOLOGY AND EXPLANATION OF TABLES AND CHARTS OF FINDINGS

A very crude way to measure changes in the availability of regular LTL service is to compare the number of carriers participating in ICC RMB 170, the participating carrier tariff of the only general commodity motor carrier rate bureau with nationwide coverage, before and after deregulation. On 2 May 1980 there were 1,160 carrier participants in ICC RMB 170-D. On 22 February 1991, there were only 444 participants in ICC RMB 170-H (and three of those are known to be bankrupt and out-of-business now). While this 62 percent drop in the number of

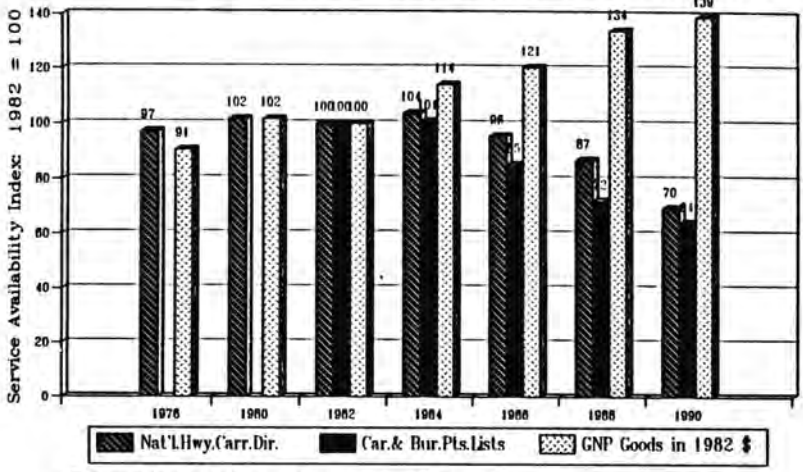
participants over a period of eleven years includes both large and small carriers and does not equate to a specific loss in the number of carriers serving any specific point, it is indicative of an industry that is significantly smaller now that it was prior to the Motor Carrier Act of 1980. Because many carriers have expanded their scope of operations to provide service to communities where other carriers abandoned service, a count of carriers known to be providing service at specific points is necessary to construct a more meaningful index of changes in the availability of regular LTL service.

Because it was used as the basis of the Pustay (1985) study on the impact of state and federal regulation on small rural communities, data from Fall issues for the years 1976 through 1990 of the NHCD guide have been used as the basis for creating one of the two parallel indicators of regular LTL service availability in this paper. Although it does not list available service provided by many of the smaller local carriers, it is one of the only available sources containing data that predates by two years the beginning of administrative deregulation of the trucking industry in the United States. Because this paper only is concerned with service provided by general commodities carriers, those carriers listed in NHCD's directory that only provide specialized service, such as FFE (a refrigerated carrier), and carriers known to be bankrupt and out-of-business were not included in the count. Table 2 summarizes by state, the availability of regular LTL carriers at each of the 467 county seats. The graphs in Figures 4 and 5 illustrate changes in the availability of service index for each state over the 14 year period and compares these changes to an index of GNP (Goods only; adjusted to 1982 dollars). Table 3 and Figures 6 and 7 provide similar information based on data compiled from individual carrier points lists and the general commodity carriers' rate bureaus. Although this data is more complete, it only covers the period 1982 - 1990. Figure 2 compares changes in both LTL service indexes with changes in an index based on the gross national product (Goods) in 1982 dollars.

An analysis of carrier survival and replacement for each of the 467 county seats has been performed by comparing the lists of carriers that served in 1982 with the lists of those still serving the same point in 1990. Figure 3 - Carrier Survival and Replacement presents the results of this comparison. Only 27.3 percent of regular LTL service provided in 1982 was still being provided by the same carriers in 1990. Only a portion of the 72.7 percent of the service that was abandoned or lost due to carrier bankruptcy during this eight year period was replaced by other carriers. By comparing the 1982 lists with the 1990 lists to determine the carriers serving in 1990 that did not serve a point in 1982 it was possible to calculate that other carriers expanding into abandoned markets replaced 36.8 percent of the 1982 service that had been lost. The remaining 35.9 percent of 1982 service was not replaced and represents a net loss in the availability of LTL service for the ten state area during an eight year period of economic expansion which saw a 39 percent increase in the volume of goods produced in the United States. This analysis of carrier survival does not account for service provided by many carriers that entered and exited markets between 1982 and 1990. A comparison was made of the carriers shown to be serving all 307 Montana points listed in the Fall 1976 edition of the NHCD directory and those listed in the Fall 1990 edition. At 300 of the 307 points there were no carriers still serving in 1990 that had been serving in 1976. At only 7 points did any regular LTL common carrier service survive the entire 14 year period.

Figure 8 - Truck Scale LTL Rate and Cost Index, Long Haul Transcontinental 1974 - 1990 compares changes in the index of the LTL scale of rates (This rate scale was used because it is applicable on the typical regular LTL carrier shipment which weighs under 500 pounds.) with an index of revenue per ton mile earned by Class I, Instruction 27, general freight common carriers, the producer price index, the consumer price index for transportation motor fuel, and an index of truck drivers hourly wages.

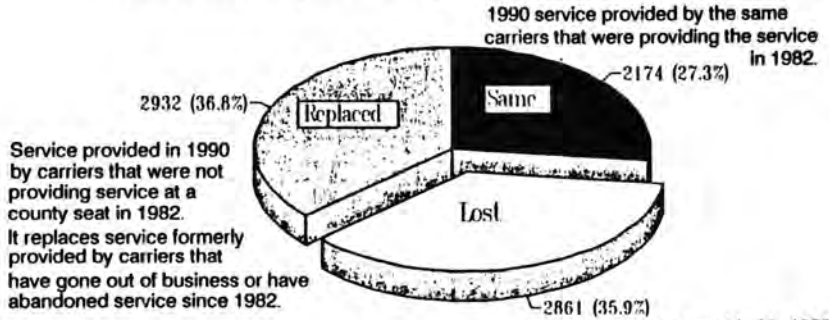
Figure 2 Changes in Availability of LTL Service in Ten States Bordering Canada 1976–90



Sources: National Highway Carriers Directory, Inc.
Individual Carrier & Rate Bureau Points Lists
GNP Goods in 1982 dollars. Department of Commerce, Bureau of Economic Analysis

Figure 3 Carrier Survival & Replacement in Ten States Bordering Canada 1982–90

Service measured by the sum of Regular LTL Service at 467 County Seats



Sources: Rate Bureau and Individual Carrier Points Lists

Table 2 Availability of Regular LTL Service in Ten States Bordering Canada
Sum of Regular LTL Service at 467 County Seats 1976 - 1990

Ten States Bordering Canada	1976	1980	1982	1984	1986	1988	1990
Five Eastern States:							
Maine	163	189	144	149	123	96	91
Michigan	771	832	1,006	1,178	1,149	1,269	994
New Hampshire	138	153	155	153	114	99	79
New York	2,288	2,204	1,790	1,549	1,382	1,126	766
Vermont	60	61	73	68	78	75	58
Eastern States Sub-Total	3,420	3,439	3,168	3,097	2,846	2,665	1,988
Five Western States:							
Idaho	118	133	166	212	193	135	143
Minnesota	444	611	711	801	763	661	590
Montana	112	113	133	128	94	136	113
North Dakota	101	109	124	196	193	152	161
Washington	251	249	279	325	294	227	199
Western States Sub-Total	1,026	1,215	1,413	1,662	1,537	1,311	1,206
Total: Ten Border States	4,446	4,654	4,581	4,759	4,383	3,976	3,194

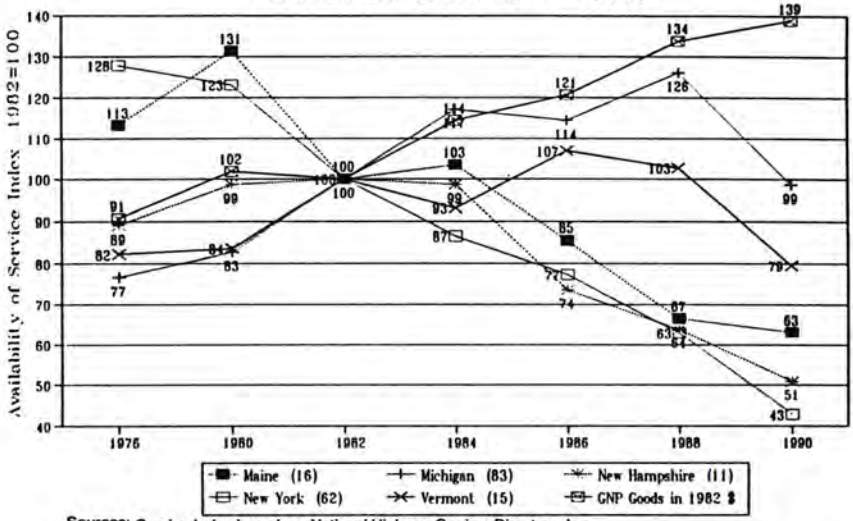
Source: National Highway Carriers Directory, Inc.

Table 3 Availability of Regular LTL Service in Ten States Bordering Canada
Sum of Regular LTL Service at 467 County Seats 1982 - 1990

Ten States Bordering Canada:	1982	1984	1986	1988	1990
Five Eastern States:					
Maine	269	196	187	165	127
Michigan	1,346	1,853	1,575	1,422	1,349
New Hampshire	244	225	192	170	114
New York	3,352	2,750	1,895	1,542	1,096
Vermont	173	152	138	141	91
Eastern States Sub-Total	5,384	5,176	3,987	3,440	2,777
Five Western States:					
Idaho	401	490	401	350	378
Minnesota	1,030	1,075	1,209	1,018	956
Montana	220	391	384	289	303
North Dakota	236	278	290	186	250
Washington	686	620	491	458	438
Western States Sub-Total	2,573	2,854	2,775	2,301	2,325
Total: Ten States Bordering Canada	7,957	8,030	6,762	5,741	5,102

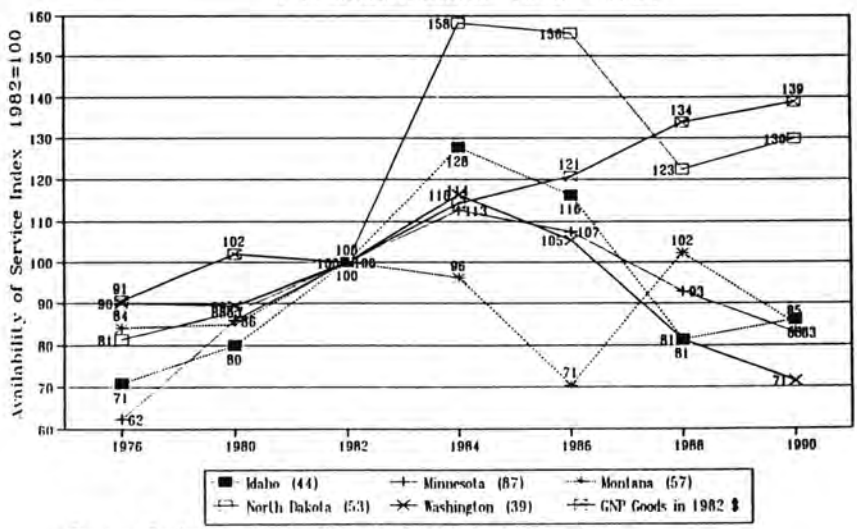
Source: Individual Carrier Points Lists, Service Guides, & Rate Bureau Points Lists

Figure 4 Availability of LTL Service Index for Five Eastern States 1976 - 1990



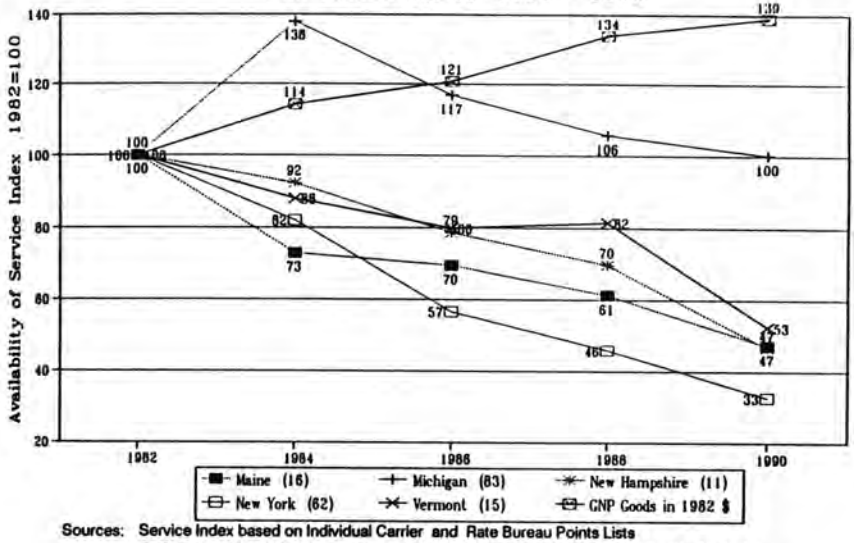
Sources: Service Index based on National Highway Carriers Directory, Inc.
GNP (Goods) Department of Commerce, Bureau of Economic Analysis

Figure 5 Availability of LTL Service Index for Five Western States 1976 - 1990



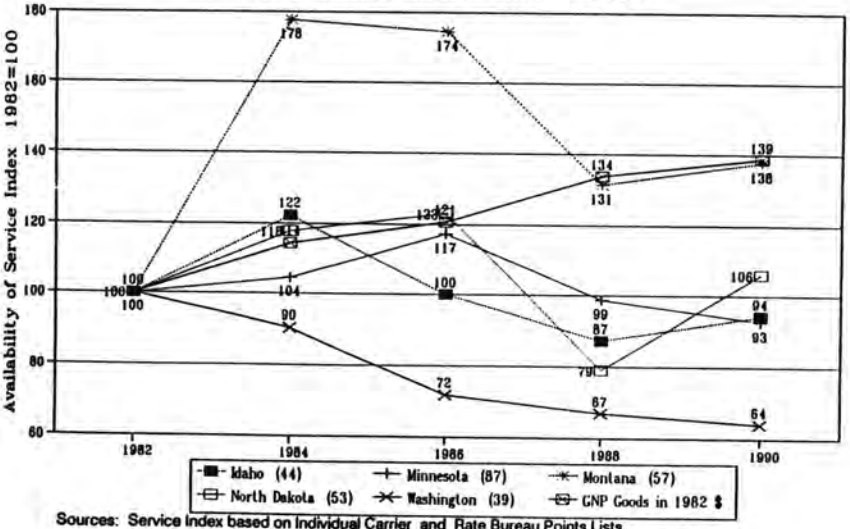
Sources: Service Index based on National Highway Carriers Directory, Inc.
GNP (Goods) Department of Commerce, Bureau of Economic Analysis

Figure 6 Availability of LTL Service Index for Five Eastern States 1982 - 1990



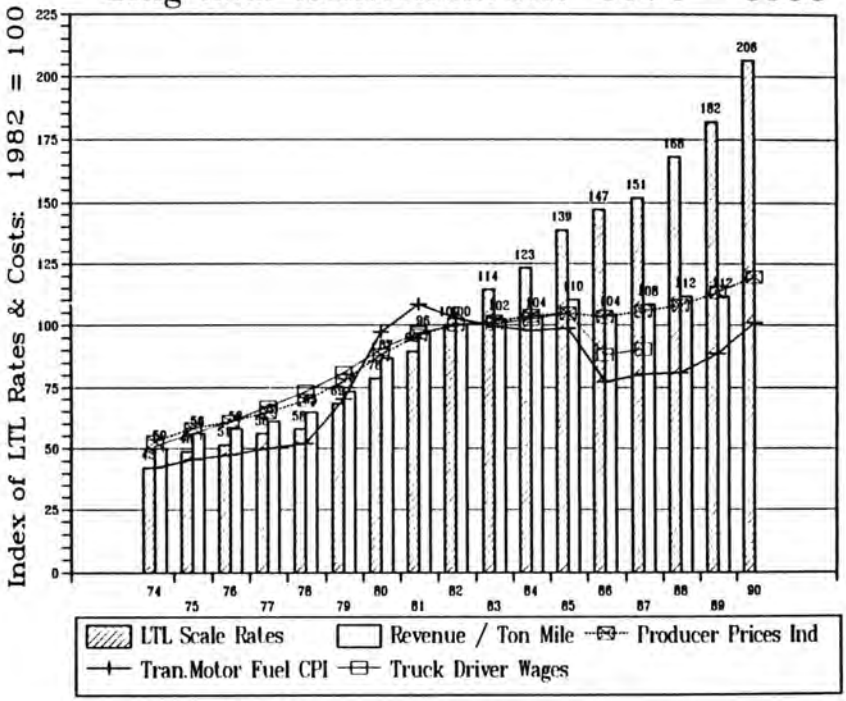
Sources: Service Index based on Individual Carrier and Rate Bureau Points Lists
GNP (Goods) in 1982 dollars. Department of Commerce, Bureau of Economic Analysis.

Figure 7 Availability of LTL Service Index for Five Western States 1982 - 1990



Sources: Service Index based on Individual Carrier and Rate Bureau Points Lists
GNP (Goods) in 1982 dollars. Department of Commerce, Bureau of Economic Analysis.

Figure 8 Truck Scale LTL Rate & Cost Index
Long Haul Transcontinental 1974 - 1990



Sources: ICC RMB 521 and 583 series; Transportation in America;
Department of Labor, Bureau of Labor Statistics

1982 - 1990, THE LONGEST PEACETIME EXPANSION IN U.S. HISTORY

According to President Bush's Council of Economic Advisors, after almost eight years of expansion, the economy entered a recession during the latter part of 1990. This has been the longest peacetime expansion in United States history. (Bush 1991, 21 and 37) Because the demand for transportation is a derived demand, changes in the economy need to be considered when evaluating changes in the availability of carrier service; including regular LTL common carrier service. Other things being the same, an increase in economic activity should result in an increase in the demand for transportation and vice versa. Increases in demand also should result in an increase in the availability of carriers providing service.

CONCLUSIONS

Prior to deregulation, the restrictive entry policies of the Interstate Commerce Commission were blamed for poor service and high rates. It was predicted that, by allowing unrestricted entry into the trucking industry, competition in a free market would result in more efficient carriers providing better service at lower rates and that it would obviate the need for government regulation. That the ICC has granted nearly all applications for operating authority during the past twelve years and that there are now 41,602 motor carriers of property is irrelevant to a majority of United States shippers that are so small they are only able to use the services of regular LTL carriers. Small businesses do not benefit from a multitude of newly certificated, small, irregular route and contract truckload carriers that are domiciled thousands of miles from where they need regular LTL service. After twelve years of de facto deregulation in the United States, the average number of less-than-truckload general commodity carriers providing regular service at the 467 county seats in the ten states that border Canada has decreased by 28 percent from the 1976 level. Since 1984, there has been a continuing decline in the average number of regular LTL carriers providing service at the 467 county seats included in this study. This six year decline has significantly reduced the potential for price and service options available to small businesses that must depend entirely on regular LTL general commodity carriers for their transportation service. Those responsible passage of the Motor Carrier Act of 1980 attributed the rash of carrier bankruptcies in the subsequent two years to decreases in demand associated with the 1980 - 1982 economic recession rather than deregulation. This six year decline has happened during an eight year expansion in the economy. It cannot be attributed to the 1980-1982 recession which ended eight years ago. Neither can the loss of 72.7 percent of regular LTL service due to abandonment or bankruptcy of the carriers that provided it in 1982 be attributed to a weak economy.

Have small businesses benefited in other ways which have helped to offset the decline in availability of regular LTL service? Although major carrier operating expenses such as fuel and labor have not increased as rapidly as has the producer price index (PPI), both the less-than-truckload rate index and the revenue per ton mile have increased more rapidly than the producer price index. What is significant is the difference between the increase in the per ton mile revenue index and the LTL rate index. While the index of per ton mile revenue has increased only slightly faster than has the PPI, the LTL rate index increased from 51 to 206 between 1976 and 1990 while the PPI increased from 58 to 123. What has happened is that discounts of up to 60 and 70 percent are given to preferenced shippers (usually very large shippers) while over 15 percent of all shipments (over half of all small businesses do not get any discounts) move on undiscounted class rates. (Michalson 1991) Nearly all of the non-discriminatory commodity rates (which were available to all shippers) have been cancelled. Although small businesses cannot compete effectively if they cannot obtain regular LTL service or must pay high, unreasonable, discriminatory rates, the Interstate Commerce Commission's policies have allowed unjust rate discrimination to flourish. Other research has found that the trucking industry is now less productive and less efficient that it was when the Motor Carrier Act of 1980 was signed. (Ozmet 1990) Even after so many carrier bankruptcies since deregulation, the trucking industry remains in a financial crisis. (Rakowski 1988)

The four westernmost states in this study were included in the Athearn (1989) study of regular LTL service in eleven western states. In that study, only data for the years 1976, 1982, and 1988 was collected. Although the same pattern of short-term increases in availability of regular LTL service followed by long-term losses is to be found in both studies, the peak year shifts when the data for seven years is studied. When only the three years were considered, 1982 was the peak year, but when all seven years are considered, 1984 is the peak year for the availability of regular LTL carriers. Using either index to measure the availability of regular LTL service the number of full-service carriers ready, willing, and able to transport the goods of most small businesses has been declining since reaching a peak about three to six years after the start of federal trucking deregulation in the United States. If this pattern holds true in Canada, by 1992, surviving truckers providing regular LTL common carrier service will begin to exit markets more rapidly than they are replaced by carriers expanding into new areas. There is a high probability that the replacement carriers expanding into areas of abandoned service along the border will not be Canadian controlled. (Dempsey 1990, 179) Laissez-faire transportation policies have not prevented unjust discrimination. A combination of continued Canadian deregulation and the opportunities provided by the Canada-United States Free Trade Agreement may result in the Canadian trucking industry, Canadian small businesses, and small rural communities having a difficult time competing during the 1990's.

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ENDNOTE

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IMPACTS DE LA DÉRÉGLEMENTATION DU CAMIONNAGE DANS UNE RÉGION DU QUÉBEC

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INTRODUCTION

Depuis le début de 1988, l'industrie du transport routier des marchandises au Québec et au Canada évolue dans un nouveau cadre réglementaire. Suite à la libéralisation des normes d'émission des permis ce sont maintenant les forces du marché, plutôt que l'État, qui déterminent le niveau de concurrence dans cette industrie. C'est dans cette optique que le ministère des Transports du Québec nous a confié le mandat de réaliser une étude dont l'objectif est de dresser un premier bilan des effets de la réforme du cadre réglementaire du camionnage dans la région Mauricie/Bois-Francs/Drummond (région administrative 04). L'enquête portait sur le transport de marchandises générales au niveau intraprovincial et extraprovincial. Pour ce faire nous avons réalisé deux sondages: l'un auprès des usagers de services de camionnage et l'autre auprès des transporteurs routiers opérant dans la région. Nous vous présentons ici quelques résultats de ces deux enquêtes.

Rappelons que ce nouveau cadre réglementaire vient changer de façon importante les règles du jeu régissant cette industrie. Ces nouvelles règles ont de multiples effets sur l'offre et la demande de services de camionnage. Étant donné des besoins en transport qui varient beaucoup d'une région à l'autre, il est alors impossible de saisir tous les effets de cette nouvelle politique si l'analyse ne porte qu'au niveau national. De plus, cette réforme soulève la question de la disponibilité des services aux régions périphériques. Il apparaît donc important de mesurer les impacts de la réforme du cadre réglementaire du camionnage dans une perspective régionale. C'est l'approche que nous avons proposée en l'appliquant d'abord à une région du Québec. Évidemment, on ne peut conclure sur l'état de la situation dans les autres régions du Québec. Mais, il s'agit d'un premier portrait régional qui est susceptible de nous indiquer si la situation en région semble radicalement différente de la situation générale d'ensemble, telle que décrite dans l'examen annuel 1989 de l'Office nationale des transports (1990), par exemple.

L'ENQUETE AUPRES DES UTILISATEURS

Au total 700 entreprises ont été sélectionnées au hasard dans la région 04. Ces entreprises couvraient la plupart des secteurs manufacturiers et du commerce de gros et de détail. Parmi ces entreprises, 133 nous ont retournées un questionnaire dûment rempli. Cela représente un taux de réponse de 19,0%. Plus de la moitié de

Tableau 1: Au courant des changements dans la réglementation

	Nombre	Pourcentage
oui	56	46,7
non	64	53,3
	120	100,0

Tableau 2: Changement observé dans le nombre de transporteurs en concurrence pour le trafic de l'entreprise (%)

	Intraprovincial		Interprovincial		International	
	TL	LTL	TL	LTL	TL	LTL
Hausse	41,7	29,1	33,3	40,7	21,4	30,8
Baisse	2,0	0,0	3,7	0,0	0,0	0,0
Stabilité	33,3	52,7	33,3	40,7	42,9	38,5
Ne sait pas	22,9	18,2	29,6	18,5	35,7	30,8

Tableau 3: Changement dans le nombre de transporteurs américains offrant leur service pour le trafic international

Augmentation	15,1
Diminution	1,9
Pas de changement	13,2
Ne peut répondre	69,8

Tableau 4: Satisfaction par rapport aux services offerts depuis le début de 1988

	Nombre	Pourcentage
Pas d'opinion	59	52,2
Satisfaits	52	46,0
Insatisfaits	2	1,8
	113	100,0

Tableau 5: Évaluation des changements dans les services (%)

	Charge complète	Charge partielle
Amélioration sensible	11,8	13,9
Amélioration mineure	10,3	12,5
Aucun changement	41,2	41,7
Détérioration mineure	5,9	6,9
Détérioration significative	1,5	0,0
Ne peut répondre	29,4	25,0

ces répondants étaient dans le secteur de la fabrication. Le questionnaire portait sur les caractéristiques des activités dedistribution et de transport des entreprises, sur leur perception des changements dans la réglementation et sur leurs attentes et perceptions quant à la qualité des services. Nous nous limiterons dans cette présentation aux deux derniers points, en faisant ressortir les points qui nous apparaissent les plus importants.

On peut d'abord noter (voir tableau 1) qu'une minorité, soit 46,7%, des répondants se sont dits au courant des changements dans la réglementation. Cette situation était particulièrement marquée chez les commerces de détail, où plus de 75% ignoraient les modifications survenues. Nous avons cependant contourné cette difficulté en ne faisant pas, de façon générale, spécifiquement référence à la déréglementation dans l'évaluation des changements survenus. Nous leur demandions tout simplement d'évaluer ce qui s'est passé depuis le 1er janvier 1988. C'est donc à nous d'essayer de voir dans quelle mesure la situation telle que décrite par les usagers découle de la nouvelle réglementation ou d'autres facteurs.

Une série de questions ont d'abord été posées par rapport au niveau de concurrence sur divers segments de marché du transport routier. On a alors demandé aux entreprises d'indiquer si elles considéraient qu'il y avait eu une hausse, une baisse ou pas de changement dans le nombre de firmes de camionnage pour compte d'autrui entrant en concurrence pour leur trafic (voir tableau 2). De façon générale sur tous les marchés on a observé soit une hausse ou une stabilité du nombre de transporteurs offrant leur service, et cela tant pour les expéditions en charge complète qu'en charge partielle. On peut cependant noter que c'est sur le marché intraprovincial des charges complètes, que le plus grand nombre d'entreprises ont noté une hausse de la concurrence, soit 41,7%. Sur le marché interprovincial des charges complètes et partielles, un nombre égal d'entreprises ont observé une hausse ou une stabilité de la concurrence. Dans les trois autres cas (intraprovincial en charge partielle, international en charge complète et partielle), il y a une majorité d'entreprises ayant observé la stabilité plutôt qu'une hausse de la concurrence.

De façon plus spécifique on a interrogé les entreprises sur la présence accrue des transporteurs américains. On leur a d'abord demandé si elles avaient noté des changements dans le nombre de transporteurs américains offrant leur service pour le trafic international (voir tableau 3). Or, la grande majorité des répondants se sont dits incapables de répondre à cette question, soit 69,8%. De plus, 13,2% n'ont noté aucun changement et 1,9% ont noté une diminution. Il n'y a en définitive que huit entreprises (soit 15,1%) qui ont pu affirmer que le nombre de transporteurs américains offrant leur service avait augmenté. De façon plus spécifique on a demandé aux entreprises qui avaient utilisé les services de transporteurs américains depuis le 1er janvier 1988, si elles avaient recours à des transporteurs américains auparavant. Sur les 13 entreprises ayant recours à ces transporteurs, 11 ont affirmé qu'elles avaient déjà recours à des transporteurs américains auparavant et seulement deux se sont avérées de nouveaux utilisateurs de ces services. Ces chiffres montrent que l'arrivée de transporteurs américains comme concurrents, en particulier sur le marché des charges complètes de longue distance, bien qu'elle puisse être très significative en termes de volume transporté, n'en demeure pas mois concentrée chez un nombre très restreint de gros expéditeurs dans le secteur manufacturier.

De façon générale, que pensent maintenant les entreprises de la situation qui découle de la nouvelle réglementation. C'est ce que

nous indique le tableau 4. La question qui était alors posée était la suivante: "Globalement, êtes-vous satisfait des services offerts par les compagnies de transport public depuis les modifications à la réglementation en janvier 1988?". Ce qui est évidemment frappant c'est le peu de réponses négatives à cette question. En effet, seulement deux des 113 entreprises ayant répondu à cette question se sont dites insatisfaites, ce qui représente 1,8%. Il y a par contre 52 entreprises qui ont exprimées leur satisfaction, soit 46,0%. Une majorité de 52,2% s'est finalement dite sans opinion. Une analyse selon le secteur d'activité arrive sensiblement aux mêmes résultats, si ce n'est une satisfaction un peu plus grande dans le secteur du commerce de gros.

On a interrogé un peu plus en détail la perception des utilisateurs de services de transport routier en ce qui concerne l'amélioration ou la détérioration de la qualité des services depuis le début de 1988 (voir tableau 5). Pour le transport des expéditions en charge complète très peu d'entreprises considèrent qu'il y a eu détérioration, soit 7,4%. Par contre 22,1% notent une amélioration sensible ou mineure. La grande majorité considèrent donc qu'il n'y a pas eu de changement (41,2%), ou elles se disent incapables de se prononcer (29,4%). La situation pour les expéditions en charge partielle est très comparable à ce que l'on observe pour les charges complètes. Peu d'entreprises (6,9%) y notent une détérioration de la qualité des services, un nombre appréciable (26,4%) considère qu'il y a eu amélioration, la majorité (41,7%) pense qu'il n'y a pas eu de changement, et 25,0% ne peuvent se prononcer.

On a ensuite regardé l'évolution des coûts unitaires moyens de fret depuis le 1er janvier 1988, donc sur une période d'un peu plus de deux ans (voir tableau 6). Dans les charges complètes, on doit certes parler de hausses modérées, voire de baisses de tarifs. Quelle que soit la destination des expéditions, environ 75% des entreprises ont connu des hausses de coûts de transport inférieures à 5% sur un période d'environ 28 mois. De ce nombre il y a même 27,8% des entreprises sur le marché interprovincial et 25,0% sur le marché international qui ont connu des baisses de leur coût unitaire de transport. La situation est presqu'aussi favorable aux usagers pour les charges partielles. Il y a en effet une proportion variant sur les différents marchés de 56,6% à 61,6% des entreprises qui ont connu des hausses de coûts inférieures à 5% depuis le début de 1988. Et encore là, 21,8% des répondants ont connu des baisses de coûts pour leur trafic interprovincial, et 30,8% pour leur trafic international.

Nous avons par ailleurs proposé aux répondants une série de caractéristiques possibles des services de transport, en leur demandant d'identifier les aspects du service qui seront importants pour eux au cours des cinq prochaines années (voir tableau 7). Or il en ressort que ce qu'espèrent encore le plus grand nombre d'usagers c'est de profiter de réduction des tarifs (39,8%). En deuxième lieu viennent deux aspects qui sont très liés: soins apportés à la marchandise (32,3%) et contrôle des dommages (25,6%). Puis on s'attend à une augmentation de la fréquence du service, à l'implantation de système d'échanges de données et à des mesures de sécurité accrues. L'aspect le moins cité est le service intermodal qui ne préoccupe que 3,8% des entreprises.

Terminons avec un mot sur la répartition modale et le transport privé. Dans les deux cas il faut parler d'une grande stabilité. En effet, dans le sondage, une seule entreprise sur 125 affirme avoir modifié ses choix modaux au niveau des approvisionnements depuis le début de 1988. Au niveau des expéditions la situation est à peine

Tableau 6: Variations des coûts de transport selon les usagers (en pourcentage)

	Charge complète	Charge partielle
Intraprovincial		
+ 10% et plus	10,0	17,9
+ 5% à 9,9%	14,0	23,2
+ 0,1% à 4,9%	32,0	21,4
pas de changement	36,0	26,8
- 0,1% à 4,9%	2,0	5,4
- 5% à 9,9%	4,0	3,6
- 10% et moins	2,0	1,8
Interprovincial		
+ 10% et plus	5,6	17,4
+ 5% à 9,9%	16,7	26,1
+ 0,1% à 4,9%	27,8	17,4
pas de changement	22,2	17,4
- 0,1% à 4,9%	11,1	13,0
- 5% à 9,9%	5,6	4,4
- 10% et moins	11,1	4,4
International		
+ 10% et plus	8,3	23,1
+ 5% à 9,9%	16,7	15,4
+ 0,1% à 4,9%	25,0	30,8
pas de changement	25,0	0,0
- 0,1% à 4,9%	8,3	7,7
- 5% à 9,9%	16,7	23,1
- 10% et moins	0,0	0,0

Tableau 7: Aspects importants du service au cours des cinq prochaines années (% d'entreprises ayant cité cet aspect)

Meilleur équipement	20,3	Augmentation fréquence	23,3
Réduction de tarifs	39,8	Meilleure logistique	7,5
"Just-in-Time"	21,1	Facilités d'entreposage	9,8
Service de groupage	7,5	Service intermodal	3,8
Soins à la marchandise	32,3	Contrôle des dommages	25,6
Mesures de sécurité	21,1	Repérage des expéditions	18,8
Échange électr. données	11,3		

différente, puisque quatre entreprises sur 122 affirment avoir modifié leurs choix de modes de transport. Les quelques changements apportés vont à une exception près dans le sens d'une utilisation accrue du transport routier. Il faut donc constater que la nouvelle réglementation dans le transport n'a pas eu d'effets sur les choix modaux dans la région.

Rappelons par ailleurs que l'une des interrogations soulevées par la nouvelle réglementation était la possibilité que celle-ci stimule le développement du transport privé. Sur la base des informations qui ont été recueillies dans notre échantillon, cette tendance ne semble pas se confirmer. En effet, parmi les 42 entreprises qui déclarent exploiter une flotte privée, 32 déclarent ne pas avoir changé leurs

pratiques à cet égard, trois déclarent y avoir moins recours et sept déclarent y avoir plus recours depuis le début de 1988. Si on considère par ailleurs que 73 entreprises déclarent ne pas avoir de flotte privée de camions, cela rend très marginale le gain net de 4 entreprises donnant une importance plus grande au transport privé. Le sondage nous a également permis de savoir que seulement cinq entreprises déclaraient avoir un permis leur permettant de faire du camionnage pour compte d'autrui, et que ce nombre n'avait pas changé depuis le 1er janvier 1988.

L'ENQUETE AUPRES DES TRANSPORTEURS

On s'intéressait pour cette partie de l'enquête, à la vingtaine de transporteurs routiers généraux opérant sur une base régulière dans la région 04. De ce nombre 14 ont participé au sondage, dont 12 par le biais d'une entrevue. Les deux autres transporteurs, que nous n'avons pu rencontrer, nous ont retourné leur questionnaire par la poste. Ces entrevues ont été réalisées en mai et juin 1990. De ces 14 transporteurs, neuf sont des transporteurs régionaux originaires de la région, et cinq sont des transporteurs nationaux. Dans ces derniers cas les entrevues ont été faites avec les gérants de succursale à Trois-Rivières. On entend par transporteurs régionaux ceux dont les activités reposent d'abord sur la région 04, et par transporteurs nationaux ceux dont les activités sont réparties de façon plus uniforme sur l'ensemble du territoire québécois et canadien. Les premiers ont leur siège social dans la région 04, et les seconds à l'extérieur de la région. Le questionnaire d'entrevue portait sur le profil de l'entreprise, leurs coûts et les services offerts, la nouvelle réglementation, le niveau de concurrence et les perspectives d'évolution de leur entreprise et de l'industrie.

Soulignons d'abord que la plupart de ces transporteurs offrent des services de transport des marchandises générales tant pour les charges complètes que partielles. Les proportions de TL et de LTL peuvent cependant varier beaucoup d'un transporteur à l'autre et une certaine spécialisation se retrouve tant chez les transporteurs régionaux que nationaux. On retrouve également une certaine spécialisation dans les marchés desservis par les transporteurs. Le trafic intraprovincial constitue le marché principal pour la grande majorité des transporteurs, même pour les transporteurs nationaux. Par contre, ces derniers sont proportionnellement un peu plus nombreux à consacrer une part plus grande de leurs efforts au transport extraprovincial. Il y a cependant quelques transporteurs régionaux qui sont fortement orientés vers le transport extraprovincial.

La première question portait (tableau 8) sur l'évolution depuis le début de 1988 du volume transporté par l'entreprise. Les transporteurs régionaux semblent avoir connu une situation plus favorable que les transporteurs nationaux à ce titre. Six d'entre eux ont connu une croissance, forte dans quatre cas et faible dans deux. A l'inverse, quatre des cinq transporteurs nationaux ont connu une faible diminution du volume transporté. Cette situation n'est cependant pas nécessairement négative, puisqu'il peut s'agir là des conséquences d'une rationalisation de la structure tarifaire pour tenir compte des coûts liés à chaque expéditeur. Mais elle s'explique également par l'expansion des transporteurs régionaux qui ont ouverts de nouveaux marchés intraprovinciaux et interprovinciaux. Cela découle évidemment de l'opportunité que leur offrait la nouvelle

Tableau 8: Indication par le transporteur des changements dans le volume transporté depuis janvier 1988

	Transporteurs Régionaux	Nationaux	Total
Une forte croissance	4	0	4
Une faible croissance	2	1	3
Aucun changement	0	0	0
Une faible diminution	3	4	7
Une forte diminution	0	0	0

Tableau 9: Changements dans le revenu unitaire janvier 1988

	Charges complètes	Charges partielle
Grande diminution	2	0
Légère diminution	4	3
Aucun changement	4	1
Légère augmentation	3	7
Grande augmentation	0	1
Ne s'applique pas/ne peut répondre	1	2

Tableau 10: Évaluation par le transporteur de sa situation financière actuelle par rapport à celle de 1987

	Transporteurs Régionaux	Nationaux	Total
Amélioration importante	1	1	2
Amélioration légère	2	1	3
Pas de changement	0	0	0
Détérioration légère	5	2	7
Détérioration importante	0	0	0
Incapacité ou refus de répondre	1	1	2

réglementation d'obtenir les permis qui leur faisaient défaut. Comme nous l'indiquait une autre question, il s'agit là, d'ailleurs, du principal changement que les transporteurs ont apporté aux services offerts.

Nous nous sommes ensuite penchés sur une très grande préoccupation dans l'industrie, soit le niveau des tarifs. Qu'en est-il de l'évolution du revenu unitaire moyen dans chacun des marchés des charges complètes et partielles? La majorité des transporteurs nous indiquent (tableau 9) que depuis le début de 1988, les tarifs ont diminué ou sont demeurés stables pour le transport des charges complètes. Sur le marché des charges partielles, une majorité affirme que les tarifs ont légèrement augmenté. En termes réels, compte tenu de l'inflation durant cette période, cela représente donc tout de même une baisse du revenu unitaire réel. On nous indiquait cependant que la guerre des prix sur le marché des charges partielles était terminée. A l'inverse, personne ne voit la fin de la guerre de tarifs qui touche le transport de charge complète.

Cette évolution des tarifs a évidemment un effet sur la situation financière des transporteurs. Comment a-t-elle évolué depuis le début de 1988? Une majorité de sept transporteurs pensent que leur situation financière s'est légèrement détériorée (tableau 10). Il y en a par contre cinq qui considèrent qu'elle s'est améliorée, dont deux qui pensent qu'elle s'est améliorée de façon importante.

Ce qui explique en grande partie l'évolution des tarifs, c'est le niveau de concurrence entre transporteurs qui a augmenté, bien que ce soit à des niveaux qui peuvent varier d'un segment de marché à un autre (voir tableau 11). Cette concurrence accrue provient d'abord des transporteurs québécois qui étaient déjà établis dans la région (voir tableau 12). Viennent ensuite les nouveaux transporteurs québécois dans la région et les transporteurs américains. Ces nouveaux transporteurs québécois ne sont cependant pas nécessairement de nouvelles entreprises de camionnage. Dans la majorité des cas il s'agit de transporteurs régionaux déjà existants originaires d'autres régions et qui ont élargi leurs activités dans la région 04. Huit transporteurs considèrent que la concurrence est plus vive de la part des transporteurs d'autres provinces. En ce qui concerne le transport privé, les avis sont partagés entre une concurrence plus grande de leur part et aucun changement. De façon globale, cette concurrence plus grande d'autres transporteurs routiers amène une majorité de transporteurs à conclure que l'offre de transport dans la région est excédentaire et qu'il y a trop de transporteurs y oeuvrant.

Tableau 11: Niveau de la concurrence sur les différents marchés

	Plus grande	Pas de changement	Plus faible	Ne sait pas
Charge complète				
Région 04	11	0	0	3
Intraprovincial	11	2	0	1
Interprovincial	10	1	0	3
International	9	1	0	4
Charge partielle				
Région 04	8	2	0	4
Intraprovincial	8	3	0	3
Interprovincial	6	3	0	5
International	6	3	0	5

Tableau 12: Niveau concurrence de la part de différents agents et transporteurs

	Plus grande	Pas de changement	Plus faible	Ne sait pas
Transporteurs québécois				
- déjà établis	12	1	0	1
- nouveaux arrivants	10	1	0	3
Transporteurs d'autres provinces	8	3	0	3
Transporteurs américains	10	3	0	1
Transporteurs privés	5	6	0	3
Courtiers en transport	4	7	1	2
Compagnies de location	4	7	1	2
Transporteurs ferroviaires	0	5	6	3

Quel est finalement leur point de vue sur la nouvelle réglementation? Deux questions portaient sur l'évaluation globale qu'ils en faisaient d'abord du point de vue de l'industrie du camionnage en général, puis pour leur entreprise en particulier (voir tableau 13). Les opinions sont pour le moins partagées, puisque sept transporteurs jugent les changements profitables tant pour l'industrie que pour leurs propres entreprises, alors qu'un nombre égal jugent négativement ces changements. Ces chiffres ressemblent à ceux sur l'évolution de la situation financière des entreprises. Il y a cependant trois transporteurs qui, même si leur situation financière s'est détériorée suite aux changements de réglementation, jugent que cela a été positif pour leur entreprise et pour l'industrie en général. De plus, il faut ajouter que, même parmi ceux qui jugent l'impact négatif, à peu près personne ne semble souhaiter revenir à la situation qui prévalait avant 1988.

Quelles stratégies ont été adoptées par les transporteurs face à cette nouvelle réglementation? Cela fait l'objet du tableau 14. Les deux actions stratégiques qui ont été privilégiées sont l'expansion du territoire couvert et la plus grande sélectivité au niveau de la clientèle, qui ont été citées par 10 transporteurs. On retrouve ensuite les efforts de vente accrus, cités par sept d'entre eux. Aucune des autres actions stratégiques n'a été citée par plus de quatre transporteurs. Notons que l'utilisation accrue des voituriers-remorqueurs n'a été citée que par deux transporteurs nationaux. Soulignons qu'une autre question a fait ressortir la nécessité de plus en plus grande des transporteurs de négocier avec leur clientèle. Les tarifs, en premier lieu, et le temps de transit furent quasiment les deux seuls enjeux de ces négociations. Par contre la situation de concurrence accrue n'a pas amené un grand nombre de transporteurs à conclure des accords ou arrangements avec d'autres transporteurs ou courtiers. En effet, seul quatre d'entre eux ont choisi cette voie, et il s'agit dans tous les cas de transporteurs régionaux.

Nous avons ensuite demandé aux transporteurs sur quels éléments ils devaient miser pour demeurer concurrentiels. Ceux-ci devaient choisir un maximum de cinq éléments parmi une liste de 10. Ils devaient ensuite les classer par ordre d'importance. On a alors accordé 5 points au premier élément cité, 4 points au second, 3 au troisième et ainsi de suite. Ces résultats se retrouvent au tableau 15. Plus le pointage est élevé, plus cet élément est considéré important par les transporteurs. L'élément qui vient en tête pour les deux types de transporteurs ce sont les tarifs. Il totalise 38 points au total. En deuxième place on retrouve la ponctualité lors des livraisons avec 25 points, mais qui apparaît particulièrement importante pour les transporteurs régionaux. La gamme de services offerts arrive en troisième position. A l'autre extrémité, la présence sur tous les marchés et la desserte des régions éloignées ne récoltent qu'un seul point. La rationalisation des opérations (15 points) et le contrôle des coûts (19 points) ne reçoivent par ailleurs pas toute l'attention que l'on aurait attendu.

Lorsqu'on demande aux transporteurs ce qu'il faut prévoir dans l'industrie au cours des années à venir, l'élément qui a été cité le plus souvent est l'augmentation du nombre de faillites (voir tableau 16). Parmi les neuf possibilités suggérées, les faillites ont été invoquées par 11 transporteurs. Le resserrement des contrôles et l'assainissement des systèmes de gestion ont ensuite été cités par six transporteurs. L'augmentation de la concentration et la formation de personnel l'ont été par cinq transporteurs.

Tableau 13: Évaluation par les transporteurs de l'impact de la réforme réglementaire

	Sur l'industrie	Sur leur entreprise
Positif	7	7
Négatif	6	7
Aucun impact	0	0
Incapable de répondre	1	0

Tableau 14: Stratégies adoptées face à la nouvelle réglementation

	Transporteurs Régionaux	Nationaux	Total
Expansion du territoire couvert	7	3	10
Réduction du territoire couvert	0	0	0
Ententes avec autres transporteurs	4	0	4
Arrangements avec des courtiers	1	0	1
Guerre de tarifs	1	0	1
Efforts de vente accrus	4	3	7
Introduction de nouveaux services	4	0	4
Spécialisation accrue	2	2	4
Plus grande sélectivité au niveau de la clientèle	6	4	10
Utilisation accrue des voituriers	0	2	2

Tableau 15: Éléments jugés importants pour demeurer concurrentiels dans le contexte actuel (pointage accumulé selon un classement de 5 à 0)

	Transporteurs Régionaux	Nationaux	Total
Gamme de services offerts	15	9	24
Tarifs	21	17	38
Rationalisation des opérations	7	8	15
Esprit innovateur	0	7	7
Contrôle des coûts	14	5	19
Présence sur tous les marchés	0	1	1
Fréquence des cueillettes	2	2	4
Ponctualité lors des livraisons	21	4	25
Desserte des régions éloignées	1	0	1
Type d'équipements	3	3	6

Pour faire face à cette situation on a ensuite demandé ce que l'entreprise entend faire dans les années à venir, en suggérant une liste de 12 types d'actions (voir tableau 17). Ce qui est d'abord privilégié ce sont les efforts de vente accrus et la plus grande sélectivité de la clientèle. On retrouve ensuite la spécialisation accrue et l'introduction de nouveaux services. Les autres actions sont suggérées par deux transporteurs ou moins. On peut remarquer que les expansions territoriales semblent être terminées, alors que cela a constitué une action privilégiée lors des deux premières années de déréglementation.

Tableau 16: Que peut-on prévoir dans l'industrie pour les années à venir?

	Transporteurs Régionaux	Nationaux	Total
Augmentation de la concentration	3	2	5
Augmentation du nombre de faillites	7	4	11
Implantation de nouvelles technologies	2	1	3
Assainissement des systèmes de gestion	5	1	6
Resserrement des contrôles	5	1	6
Formation du personnel	5	0	5
Plus grande coopération intermodale	2	0	2
Besoin de capitaux	1	0	1
Mises à pied	2	2	4

Tableau 17: Actions qu'entend prendre le transporteur au cours des prochaines années

	Transporteurs Régionaux	Nationaux	Total
Expansion du territoire au Canada	1	0	1
Expansion vers le marché américain	1	0	1
Réduction du territoire couvert	0	1	1
Ententes avec transporteurs canadiens	2	0	2
Ententes avec transporteurs américains	1	0	1
Ententes avec des courtiers	0	0	0
Guerre de tarifs	0	0	0
Efforts de vente accrus	5	3	8
Introduction de nouveaux services	4	0	4
Spécialisation accrue	4	2	6
Plus grande sélectivité de la clientèle	5	2	7
Utilisation accrue des voituriers	0	1	1

CONCLUSION

Si on veut maintenant résumer les résultats obtenus auprès des utilisateurs des services de camionnage, il faut d'abord souligner leur relative satisfaction par rapport à ce qui se passe dans cette industrie. Le nouveau contexte n'a pas généré d'insatisfaction quant à la qualité des services. Cette situation s'expliquerait en bonne partie par la situation favorable qu'ils ont connue quant aux tarifs de transport. Mais personne ne semble penser que cette situation favorable quant aux taux s'est faite au détriment de la qualité des services. Des questions nous ont permis d'interroger leur satisfaction quant à la qualité des services. Elles ont quand même fait ressortir une certaine insatisfaction par rapport à certains aspects des services de camionnage. La fiabilité des transporteurs quant aux délais de livraison qu'ils ont souvent eux-mêmes fixés, quant aux horaires qu'ils ont établis, ne semble pas suffisante selon les usagers. De même, les employés des transporteurs en contact avec la clientèle ne semblent pas toujours suffisamment informés ou supportés par leurs supérieurs. Par ailleurs les usagers espèrent que les tarifs vont continuer à baisser ou demeurer stables. Ils ont

également beaucoup d'attentes quant aux soins à apporter à la marchandise et au contrôle des dommages. Mais le nouveau cadre réglementaire semble avoir bien peu à voir avec ces attentes.

La toile de fond à cette évolution des tarifs de transport c'est évidemment le niveau de concurrence qui a augmenté sur tous les segments de marché. Les usagers l'ont constaté et ils ont évidemment profité de cette situation pour faire des pressions à la baisse sur les tarifs de transport. L'accroissement de la concurrence des transporteurs américains sur le marché du transport transfrontalier par contre, même si elle est de toute évidence réelle, touche un nombre très restreint d'entreprises de la région.

On peut par ailleurs souligner que le nouveau contexte n'a pas bouleversé le marché du transport et la répartition modale. En effet, il n'y a pas eu de mouvements en faveur ou en défaveur du transport routier. Le transport ferroviaire a un rôle à jouer auprès d'un nombre limité d'expéditeurs, et l'intermodalité ne semble pas une préoccupation dans la région. Il n'y a pas eu non plus de mouvement perceptible en faveur du transport privé, contrairement à ce que certains craignaient.

Si on regarde maintenant du côté des transporteurs, la première constatation est que les transporteurs régionaux ne sont certainement pas déclassés par leurs concurrents nationaux. Ils ont plus ou moins réussi à se tailler une niche de marché en concentrant leurs efforts sur une région donnée, a partir de laquelle ils ont pu étendre leurs services dans un souci de complémentarité avec leurs opérations existantes. La position plus ou moins confortable des transporteurs, tant régionaux que nationaux, semble plutôt liée à l'évolution fort différente qui caractérise les différents segments de marché. En effet, si le marché intraprovincial, et même interprovincial sur des moyennes distances, des lots brisés demeure relativement rentable, il en est tout autrement pour le marché des charges complètes. Sur le marché du LTL, malgré une concurrence accrue entre transporteurs québécois, la situation des tarifs semblent relativement sous contrôle. Comme le prédisait Boucher (1986), les grands transporteurs américains n'ont aucun avantage sur le marché des lots brisés de courte et moyenne distance. Quant au marché des lots brisés de longue distance vers les États-unis, il leur est acquis et cela n'a jamais été contesté par les transporteurs québécois. La concurrence est donc plus vive, mais il y a place pour les transporteurs régionaux qui auront bien ciblé un marché, et pour des transporteurs nationaux qui auront su rationaliser leurs opérations.

La difficulté vient du côté du marché des charges complètes et des tarifs très bas qui y sont pratiqués. La situation la plus dramatique se remarque sur le marché transfrontalier où la concurrence de quelques grands transporteurs américains est très vive. Mais la situation n'est guère mieux sur le marché interprovincial et même sur le marché intraprovincial des charges complètes. Comme les transporteurs sont pour la plupart des généralistes qui font à la fois du TL et LTL, tous sont frappés. Mais, plus leurs activités sont orientées vers le TL, plus leur situation est précaire. Cette situation suscite une certaine frustration chez plusieurs transporteurs qui pensent que les règles du jeu devraient être appliquées plus équitablement pour tous. On cite en particulier les problèmes des taxes sur le carburant, des contrôles routiers, du cabotage illégal.

Il en découle que la situation financière d'une majorité de transporteurs, sept sur les 12 qui se sont prononcés, s'est détériorée depuis 1988. Ils sont également partagés quant à

l'évaluation de l'impact sur l'industrie et sur leur entreprise du nouveau cadre réglementaire. Malgré cela à peu près personne ne semble vouloir revenir à une situation de contrôle économique sur les permis et les tarifs. La réalité de la concurrence accrue semble inévitable à tous et il s'agit de composer avec cette réalité. Par contre, bon nombre sont relativement pessimistes en prédisant une augmentation du nombre de faillites.

Qu'entendent faire les transporteurs pour consolider la position de leur entreprise? Les guerres de tarifs ne font certainement pas partie des stratégies privilégiées par les transporteurs que nous avons rencontrés. L'utilisation des voituriers-remorqueurs semble avoir plafonné. Les marchés où le transporteur devait prendre de l'expansion ont déjà été ouverts depuis deux ans et il s'agit maintenant de consolider cette expansion. Les transporteurs se tourneront donc désormais vers des efforts de vente accrus et vers une plus grande sélectivité de la clientèle.

Ces résultats ne sont pas tellement différents des résultats obtenus par l'Office nationale des transports du Canada dans son examen annuel de 1989. En effet, au niveau des conclusions générales de ces deux enquêtes, les résultats sont plutôt concordants. C'est par exemple le cas pour les observations suivantes:

- la percée des transporteurs américains sur le marché transfrontalier;
- la stabilité dans le niveau de concurrence de la part des camionneurs privés;
- l'évolution différente des tarifs de charges complètes et partielles;
- la saturation dans l'utilisation des voituriers-remorqueurs;
- la possibilité pour les expéditeurs de profiter de la forte concurrence sur le marché;
- le fait que la concurrence accrue vient plutôt de transporteurs déjà établis que de nouveaux arrivants.

La situation engendrée par la nouvelle réglementation semble donc avoir été globalement favorable aux utilisateurs de services de camionnage dans la région Mauricie/Bois-Francs/Drummond. Même si la qualité des services ne s'est pas vraiment améliorée, la plus grande concurrence entre les transporteurs leur a permis d'avoir accès à une gamme de services plus étendue que jamais. Cette concurrence accrue leur a également permis de profiter de pressions à la baisse sur les tarifs.

Les transporteurs sont de leur côté dans une position plus délicate, en particulier ceux qui sont très actifs sur le marché des charges complètes. La nouvelle réglementation a donné aux transporteurs régionaux une plus grande souplesse dans la recherche de trafic complémentaire à leurs opérations de base. La déréglementation économique a suscité beaucoup d'initiatives individuelles positives de la part des transporteurs et le secteur a sans doute atteint un niveau d'efficacité plus grand qu'auparavant. Mais la situation précaire de certains transporteurs risquent par ailleurs de souffrir grandement d'une récession économique qui serait trop sévère. Il est par ailleurs surprenant que les transporteurs n'aient pas eu plus recours aux ententes entre transporteurs pour améliorer leurs services. Quant au gouvernement, on peut s'attendre à ce qu'il augmente le contrôle routier afin d'assurer une application équitable des règles de sécurité routière. C'est dans l'intérêt de tous: transporteurs, utilisateurs des services de camionnage et usagers du réseau routier.

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Issues in the Evaluation of Socio-Economic Impacts of Transportation Investments: Québec-Windsor High Speed Rail as an Example

by

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Abstract

When evaluating the socio-economic impacts of a major transportation investment in a given mode on the transportation sector at large, the following impacts must be evaluated: impacts upon the users attracted to the proposed new service; impacts on other carriers and their suppliers; impacts on the infrastructure of competing modes.

An objective and thorough evaluation of these impacts raises a number of substantive and methodological issues, several of which are discussed in this paper, in the context of the analysis of proposed High Speed Rail services in the Québec-Windsor Corridor and the evaluation of their impacts.

Introduction

The subject matter of this paper is High Speed Rail in Canada; more specifically, the impacts that would be associated with the implementation and operation of high speed rail services in the Québec-Windsor Corridor. The objective of the paper is to explore a number of substantive and methodological issues associated with the analysis and evaluation of some of these impacts.

The first section of the paper outlines the context of this discussion and mentions a few recent key events. The second section identifies the impacts to be considered when evaluating High Speed Rail services. The next three sections explore the impact evaluation issues which this paper focuses on: this is done for user impacts, carrier impacts, and infrastructure-related impacts, respectively.

The Context

Over the last several years, High Speed Rail has become and, perhaps surprisingly, remained a hot news item on the Canadian transportation scene. This most recent wave of interested probably started in the last quarter of 1988, when it became known that plans were being drafted to again and further reduce VIA Rail's operational subsidies, this time for all four sectors of its services: Transcontinental, Regional, Remote, and even Corridor. As a significant reduction in subsidies was naturally expected to result in serious service cuts, mayors of the most important cities in the Québec-Windsor Corridor started making representations, individually and jointly, to the higher levels of government, for VIA Rail passenger services to be maintained at their current levels.

The Coalition of Corridor Mayors

In June 1989, partly as a response to these representations, Premiers Petersen of Ontario and Bourassa of Québec announced the formation of the *Ontario-Québec Rapid Train Task Force*, mandated to evaluate the feasibility and impacts of High Speed Rail in the Ontario-Québec Corridor. In July 1989, the concerned mayors formed the ad hoc *Coalition of Corridor Mayors*, which focused, pursued, and intensified representations and actions in favour of maintaining railway services and adopting High Speed Rail in the Québec-Windsor corridor. In July 1989, VIA Rail released its study of passenger transport (1), a significant proportion of which is devoted to High Speed Rail in the Québec-Windsor Corridor.

The Ontario-Québec Rapid Train Task Force

In January 1990, the Ontario-Québec Rapid Train Task Force initiated a series of studies on High Speed Rail in the Québec-Windsor corridor, covering the following subjects:

two studies to summarize the numerous previous studies;

a market study including a detailed ridership forecast;

an environmental impact study;

a study to define operating practices and evaluate costs;

a study to evaluate the socio-economic impacts of High Speed Rail on the transportation sector;

a study to evaluate the socio-economic impacts of High Speed Rail on the economy at large.

High Speed Rail Scenarios for the Corridor

In these studies, the first three or all four of the following levels of improved railway services in the Québec-Windsor Corridor:

a *No Investment Scenario*, under which there are no expenditures on passenger rail improvement: the level of service of every inter-urban mode is as in the Base Year (1987);

a *200 km/h Scenario*, under which there is some investment in enhanced rail services using conventional equipment on upgraded existing CN or CP Rail track and right-of-way and, with a maximum operating speed of 200 km/h;

a *300 km/h Scenario*, under which there is some substantial investment in new railway technology, with the High Speed Rail services operated entirely or primarily on new exclusive track and on new, dedicated rights-of-way, with a maximum operating speed of 300 km/h;

a *400 km/h Scenario*, under which there is even more substantial investment in new guided ground (but non-railway) technology, such as Maglev for instance, with the so-called High Speed Rail services operated entirely on a new, technology-specific, guideway, this guideway being primarily implemented on a new dedicated right-of-way, with a maximum operating speed of 400 km/h.

The authors of the present paper were involved in one of the above-mentioned studies (2), which, like the other studies by the Task Force, has not yet been made public at the time of writing this paper. As a result, the paper does not report on the findings of that study, but on some issues that were raised and discussed while performing it. These issues are not peculiar to the Québec-Windsor Corridor: they would have been raised in any other study of the impacts of high speed rail.

Identifying the Impacts

Socio-economic impacts resulting from a transportation investment can be analyzed from the most direct to the most indirect: starting with impacts on users of the proposed services, then with impacts on the carriers offering the transportation services analyzed, and their suppliers , then with impacts on the transportation infrastructure used to offer these services.

User Impacts

User impacts are associated with the economic value, directly to the users themselves and/or to society in general, of time savings resulting from shifts by new users from modes they used previously, in this case to the new High Speed Rail services. The accuracy of the evaluation of user impacts is directly related to that of the demand forecasts.

Carrier Impacts

Upon implementation of new High Speed Rail services in the Québec-Windsor Corridor, other carriers (air and bus, essentially) are likely to be impacted, and possibly even their suppliers: impacts include decreased traffic, changes in operational patterns, changes in operating results, etc. Although private transport by automobile is not a carrier per se, impacts upon suppliers to automobile

Infrastructure Impacts

New High Speed Rail services could also exert indirect impacts upon the infrastructure of other modes: decreased utilization, possibly resulting in reductions in infrastructure-related maintenance costs, and maybe even avoidance of or deferments of investments required to rehabilitate and/or upgrade the impacted infrastructure and/or to increase its capacity. In this case, such impacts would be exerted chiefly on airport facilities, expressways, and major highways.

Issues Related to the Evaluation of User Impacts

There are few substantial or methodological issues or problems related to the evaluation of user impacts per se. The consumer surplus approach, introduced as early 1888 by French Engineer Jules Dupuit, is widely accepted and documented today (3, 4, 5, 6, 7, 8). Decisions must be made, naturally, as to the appropriate value of time, income level and trip purpose segregation, and as to whether the personal or social value of the time saved (or convenience gained) should be used.

But considerably more important and difficult are the substantive and methodological issues raised by the very basis for evaluating the consumer surplus: attraction to the new mode (High Speed Rail in this case) and modal shifts (to High Speed Rail from competing intercity modes).

Limitations of Surveys of Potential Traveler

In transportation planning circles, it is generally agreed that a modeling approach to demand forecasting is preferable to a survey approach. Indeed, surveys and questionnaires present significant difficulties, few of which have been satisfactorily resolved. Some of these difficulties are experienced in all surveys: finding a truly representative sample, the high cost of a sample of sufficient size. Some of these difficulties are even more acute in the case of a new and radically different transportation mode, such as High Speed Rail.It is difficult to expect a person to predict his/her reaction to an improved transportation service that is essentially unknown. Furthermore, even if the person had a reasonably accurate perception of the good being offered (the person has used the TGV in a trip to France, for instance), that person's occupation and/or socio-economic status (and hence travel-making behavior) could be very different in time (the elapsed time between the survey and the service being available could be as long as ten years).

Demand forecasting models, the generally-preferred approach to predicting modal shifts, have limitations of their own, some of which are discussed for given models in another paper (9). The two main limitations of (most of) these models are their inability to represent threshold effects and the limited range of service attributes that they take into account.

Modeling Threshold Effects

Threshold effects are expected to be very important in the case of High Speed Rail in the Québec-Windsor Corridor. This can be illustrated by using travel between Montréal and Toronto as an example. As of today, a business traveler can make a return trip by air between these two cities in a long, but still acceptable day: as a result of this, the air mode's share of business trips between these two cities is (depending on the source) somewhere between 75 and 85%. With the conventional rail services available, by contrast, it is almost impossible to make the return trip in a day and expect to have some time left to do business: as a result, the rail mode's share of business trips between these two cities is estimated to be below 10%. A slight reduction in the rail travel time will change the modal shares only marginally, as was shown even by the (not insignificant) time savings made possible in the past by the Turbo Train. Should a new High Speed Train make it possible to complete the Montréal-Toronto return trip in a day, however, many business travelers would chose the train, as has been amply demonstrated by the intensive use of the Shinkansen and TGV by business travelers (10, 11, 12). Modeling such a threshold effect is indeed crucial to obtaining a realistic estimate of High Speed Rail's market share, yet most demand forecasting models can not model them. Threshold effects in the Québec-Windsor Corridor are not restricted to the Montréal-Toronto route: comparable threshold effects are to be expected with the possibility of half-day return trips between Québec and Montréal, between Montréal and Ottawa-Hull (as was demonstrated by the success of the experimental STOL service in the past), and between Toronto and London.

Non-Quantifiable Level-of-Service Attributes

Demand forecasting models include level-of-service attributes that can be quantified (typically: travel time, frequency, and fare) and exclude those that can not. But quantifiable service attributes are by no means the only determinants of mode choice and travel-making behavior. Surveys of business travelers in Canada (13) have shown that business travelers value schedule adherence, comfort, and safety (typical train attributes) highly. This can even be observed in the Corridor today: between Montréal and Québec, the train is the mode with the longest travel time and lowest frequency; its fare is relatively high; yet VIA's first class is often fully-booked and the train still captures (depending on the source) from 2 to 4% of all trips despite its poor performance: what, if not comfort, safety and schedule adherence would draw travelers to the train. If these inherent qualities could be coupled to the low travel time and high frequency of a modern High Speed Rail service, one can easily imagine the very significant market impact. But what demand forecasting model takes into account, explicitly, comfort, safety or schedule adherence ?

Transferability of Observed Travel Behavior Patterns

One last issue is related to beliefs on the transferability of observed travel behavior patterns, in particular the high use of the train in some countries. A frequently(privately, at least)-heard comment is that *The Japanese and French use the train so much simply because their car ownership levels are lower and their expressways are more congested and/or in greater state of disrepair than Canada's; Canadians would not take the train because they love their car so much.* Such an argument, of course, does not long resist the acid test of an objective analysis: most Japanese and French business train travelers own a luxurious sedan which they left at the train station and probably a second (or event third) car at home; few would argue that Canadian expressways provide such a smooth ride or are so pleasant to drive on in the middle of a snow storm; finally, if Canadians use their car so much, it is, in most instances, because their car provides by far the best transportation service available: their travel behavior is rational and, if offered an alternative, they would surely consider it and leave their car if the alternative offered superior service.

The transferability of observed travel behavior patterns comes into play particularly when trying to evaluate induced demand for a new mode. Despite their limitations cited earlier, conventional (but improved) demand forecasting models still probably represent the best available method to predict changes in modal shares resulting from the introduction of a new mode such as High Speed Rail. But these models, calibrated on travel behavior observed with existing modes in the Corridor, are not well suited to predict induced demand when the new mode offers significant level-of-service improvements, such as is the case with High Speed Rail. In the real world, induced demand (whether attributable to sedentary persons induced to make trip or by more frequent trip-making by travelers attracted from other modes) has been shown to be an important factor in the commercial success of the Shinkansen and TGV (11,12). Ignoring induced demand is neither realistic nor objective, and it results in a systematic underestimation of High Speed Rail ridership. But this is likely to happen when people simply believe (mostly in the absence of any rigorous demonstration) that observations on travel behavior can not at all be transferred between countries.

Issues Related to the Evaluation of Carrier Impacts

Impacts on carriers (air and bus carriers, in this instance) would result primarily from losses of traffic (and revenues) to High Speed Rail. To evaluate these impacts, as well as, if needed, impacts upon the carriers' suppliers, two approaches may be used: a direct approach based on carrier interviews, and an indirect approach based on economic principles and analyses.

In the direct approach, contact is made with selected carriers, and the prospects of a future possible change of business are discussed, the objective being to try and obtain an appreciation of what the competitive

response of the carrier would be likely to be under the circumstances. This approach is subjective and speculative:

> *subjective*, because the response that is obtained is the response of one carrier, and, as such, it is not necessarily representative of the industry; even more so, the response is that of an individual, not of the carrier as a corporate entity;
>
> *speculative*, because the respondent does not know what the competitive position and strategy of his firm will be at the point in the future when a decision needs to be made, neither what the general economic conditions will then be, which will dictate the firm's strategy.

An indirect approach may be used to achieve the same objective, namely to predict what the carrier response would be if they were threatened by a significant loss of market share; in this case, the approach used tends to base the answer on some purely economic principles, under the following assumption: whatever their individual competitive position, carriers as a group will be faced by new economic realities, which their reaction will have to take into account. This second approach complements the first one: it is less subjective and speculative, but also less specific and precise.

In the case of High Speed Rail, a thorough treatment of this complex problem would require an equilibrium econometric model for both the air and bus industries. As far as is known, such a model has not been developed yet; such a model would include modules of cost functions, travel demand, and network design. Some elements of this model could be based on work by Caves (14), Pollack(15), and Trapani and Olson (16).

When the scope of the study is limited, a more simple approach may be used. The approach consists of computing (only) the (new) air and bus fares and frequencies following the loss of market share consecutive to the introduction of High Speed Rail, the assumption being that the response of these carriers would be rational and based on sound economic behavior on the part of the impacted firms. The problem becomes analytically tractable if the following two fundamental assumptions of economic rationality are made:

> the new fares would be set so that the same conditions of profitability (as under the No Investment Scenario) would be met: in other words, what fares would be practised if airlines set them to maximize their profit in the same manner as they were doing before the introduction of High Speed Rail;
>
> the new frequencies would be such that the same load factor (as under the No Investment Scenario) would be maintained.

With the base (i.e. without High Speed Rail) data, it is possible to establish, for each travel market, the load factor and profitability conditions: not in actual numbers, but in terms of their relationship to traffic volume and level

of service. Once this is done, the new level of service and market shares with High Speed Rail are introduced, and the new frequency and fares may be calculated. The approach is explained mathematically in Appendix D of (2).

It should be stressed that the assumption on the constancy of the load factor may lead to an over-estimation in the predicted change in frequency: when faced with competition, and wanting to maintain their load factor, airlines and bus operators in fact have other strategies available than just reducing frequencies: changing the fleet mix to smaller aircraft or busses, for instance, modifying the structure of their network to reduce the number of direct services and replace them with transfers, etc. The implication is that this approach might result in what could be considered as an analytically-predicted extreme reaction on frequency of service on the part of the carriers.

Issues Related to the Evaluation of Infrastructure Impacts

The introduction of a High Speed Rail service in the Québec-Windsor Corridor will result in the diversion of traffic:

from the automobile, especially on shorter journeys, such as Québec-Montréal, Montréal-Ottawa-Hull, and Toronto-London, where, according to all sources, its present modal share is well in excess of 80%;

from air transport on longer journeys, such as Montréal-Toronto and Ottawa-Hull-Toronto.

This will result in a a corresponding reduction in the degree of utilization of the airports in these cities, and in the major highways and expressways linking them. The *indirect* impacts resulting from the reduced infrastructure utilization are expected to be:

reductions in operations and maintenance costs resulting from lower utilization levels of airport and highway facilities;

reductions, deferment, or avoidance of investments necessary for rehabilitating the impacted airports and highways;

reductions, deferment, or avoidance of investments necessary for construction for expanding the capacity of the impacted airports and highways.

The analysis and evaluation of such infrastructure-related indirect impacts presents slightly different methodological problems for highways and airports.

In the case of highways and expressways, the analysis must be done separately for each province, as each province is responsible for construction, operation, and maintenance of highways and expressways on its territory. The analysis may then proceed as follows:

first, it is necessary to identify the highways and expressways which would experience a change in automobile travel as a result of the introduction of High Speed Rail services, and also identify also the travel markets (city pairs) that would cause these changes;

second, the expected reduction (or, in a few instances, increases) in automobile traffic for each of the highways and expressways identified must be estimated;

each highway or expressway must be analyzed separately, in some cases (Highway 401 being a good example) segment by segment; this analysis measures the degree of utilization before and after the introduction of the High Speed Rail services, by comparing the (before and after) automobile traffic with the known (present or future) capacity of the highway: the expected reduction in automobile traffic is thus placed into the appropriate perspective;

then, conclusions of this analysis on the indirect impacts on operating costs, maintenance costs, and the level on investment on those highways and expressways, respectively, may be reached for each highway segment.

As a result of the method chosen, this analysis is highly dependent on two sets of numbers:

present traffic volume on the relevant highways and expressways;

present (and future, in the case of planned expansions) capacity of the said highways and expressways.

The above analysis approach thus requires that very detailed information be obtained, which can probably be obtained only from the respective provincial departments of Transport or Highways, on:

the present and future levels of total (i.e. all origins and destinations) traffic on the impacted highways and its growth, so as to assess the proportion of that traffic represented in the base year by reduction of the origin-destination automobile traffic on the relevant city pair;

the present and future operation and maintenance budgets and the possibility that they could be reduced as a result of reduced automobile traffic: in other words, to what extent are operating and maintenance costs fixed or can they vary with traffic volume;

capital budgets, to outline the proposed investments in rehabilitation or capacity expansion on the impacted highways, and to assess whether the proposed investments could be reduced, deferred, or avoided as a result of the automobile traffic reduction that would follow the introduction of High Speed Rail services.

In the case of air transport, the impacts of introduction of High Speed Rail service in the Québec-Windsor corridor on the aviation infrastructure will depend on the size (absolute and relative) of any reduction in the number of flights and the volume of air passenger traffic to and from the various airports used by corridor travelers. Terminal requirements would also be affected by reductions in the number of passengers using each airport.

To provide a basis for evaluating these impacts, one may consider the annual activity levels at the 19 airports in the corridor available for commercial air transportation. (the market demand study did not consider travel in private or corporate aircraft). Table 1 presents data on the level of activity at the 11 major Corridor airports and on the relative importance of corridor travel at these airports.

Table 1

Relative Importance of Corridor Flights at Corridor Airports

City	Airport	Weekly Flights	Proportion to/from Corridor	Weekly Seats	Proportion to/from Corridor
Québec	Québec	1156	63%	29,546	39%
Montréal	Dorval	4726	34%	532,164	29%
	Saint-Hubert	94	100%	7,876	100%
	Total	4820		540,040	
Ottawa	Uplands	5284	48%	175,080	45%
Kingston	Kingston	62	100%	1,178	100%
Toronto	Pearson	7108	25%	1,027,018	20%
	Island	580	64%	31,192	66%
	Buttonville	100	100%	5,600	100%
	Total	7788		1,063,810	
London	London	428	92%	15,146	96%
Windsor	Windsor	116	100%	7,174	100%
Sarnia	Sarnia	142	100%	4,622	100%

Note: Only non-stop scheduled airline flights are considered, in both directions. Appendix E provides the detail for each airport.
Source: Latest Issue of the Official Airline Guide

The demand forecasts (and reductions in air traffic) must be analyzed to estimate likely change in aircraft activities in the future years. To convert forecast air trips by mode to equivalent numbers of aircraft, estimations of service mix (obtained, for instance, from data published in the *Official Airline Guide*) must be analyzed and the average number of seats per aircraft computed for each city pair.

In computing equivalent numbers of aircraft, assumptions (or, even better, estimations) should be made made about aircraft load factors in each market. Otherwise, the numbers of equivalent aircraft represented by travelers diverted from air to rail could vary by as much as 100%. Fortunately, the load factor effect may be offset by the fact that the analysis used average seats per aircraft based on current fleets. As the airlines modernize their fleets in the next decade, the averages may increase. For example, current jet equipment used in the corridor has seating capacities in the 100 to 136 passenger range. Airbus equipment on order has configurations in the 137 to 180 passenger range. In any event, as will be discussed below, the findings of this analysis do not seem to be sensitive to these assumptions.

The detailed results of the analysis of changes in aircraft activity at the impacted airports will present the following information:

forecasts of annual volumes of passengers using each airport,

estimates of annual passenger volumes in the year before the introduction of High Speed Rail service,

the change in annual passenger volumes at each airport between the first year of service and the preceding year,

the change in annual passenger volumes at each airport over succeeding ten year periods,

each of the above items for equivalent annual aircraft movements at each airport and

each of the above items for equivalent average daily aircraft movements at each airport.

This evaluation must be performed for every study scenario and each significant year in the planning horizon.

It is often found in such an analysis that the indirect impacts on the air transport infrastructure are not significant to the point of allowing reductions in recurrent costs or investments at the impacted airports. Indeed, aircraft activities are so varied today at major airports, especially with the generalization of the hub-and-spoke operational practice, that reductions in air traffic in a corridor (as would result from the introduction of point-to-point High Speed Rail serving high-density markets), although important on that corridor, are much less important for the airports as a whole. For instance, flights to or from a Corridor city represent only 25% of all flights at the Lester B. Pearson Airport in Toronto, according to published data: consequently, an overall reduction of traffic of 10% on these Corridor flights would constitute only a 2.5% reduction in traveler traffic at Pearson, but not even necessarily a reduction of 2.5% in aircraft movement.

Disclaimer

This paper represents the personal views of the authors and does not necessarily reflect the official position of the universities or private consultancy which they are or were associated, neither those of the governmental agencies or private companies for which some of the work mentioned was performed.

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HIGHWAY USER CHARGES: ARE TRUCKERS PAYING THEIR WAY?

by

D.B. Toms

Peat Marwick Stevenson & Kellogg

A. Introduction

Road user charges are an important, complex, and controversial issue. Canada's railways and automobile associations claim that truckers are not paying their share of highway costs. If so, trucking companies are either being cross-subsidized by other users of the highway system, or subsidized from general government revenue. The user charge issue is particularly significant for railways, since they compete directly with trucking companies in some segments of their business.

Micro-economic theory suggests that road prices be based on marginal costs. Put another way, the user charges that truckers pay should just cover the additional costs associated with their use of the public highway system. It is generally accepted that this principle is valid for determining road user charges (1), but there is considerable disagreement over how it should be applied. Two basic questions must be resolved: how do we determine marginal costs, and which taxes and fees qualify as legitimate user charges.

This paper examines current highway costs and user charges for primary and secondary highways in the province of Ontario. Three traffic levels are considered for each road class. Cost recovery ratios are calculated for common truck configurations considering both incremental and total costs.

B. Current road user charges

There are two major components to highway user charges in Ontario: registration fees and fuel taxes. The first component, registration fees, is a fixed amount per year which varies with vehicle weight. As a result, the fee per kilometre for a given vehicle depends on the number of kilometres travelled during the year. For this analysis, the average annual utilization of tractor-trailer configurations is assumed to be 160,000 kilometres, while the average annual utilization of straight trucks is assumed to be 80,000 kilometres. These figures represent the midpoint of utilization ranges published in a Transport Canada report (2). Registration costs for the analysis were obtained from the current Ontario fee schedule for commercial vehicles.

Exhibit 1
The ideal lifecycle of a road

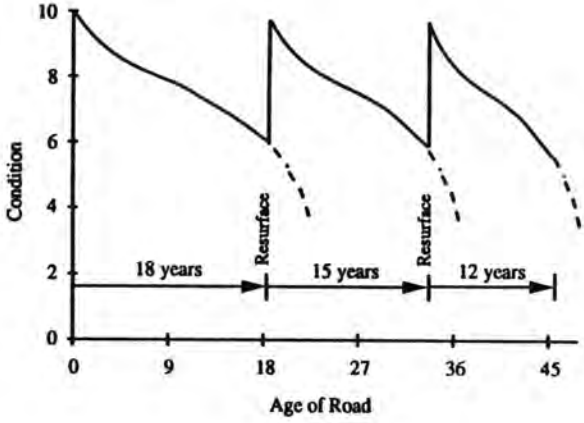
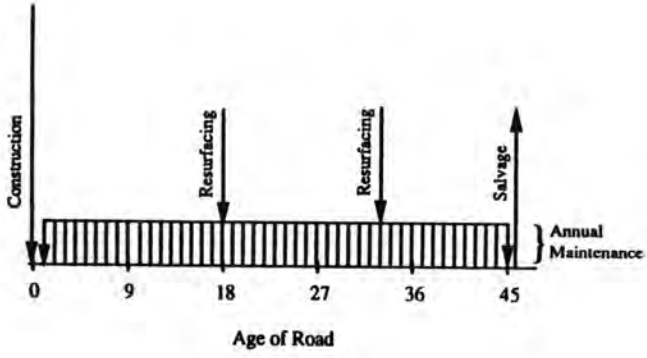


Exhibit 2
Road lifecycle costs



The second component of user charges, fuel taxes, is fully variable. The Ontario government applies a 10.9 cent per litre tax on diesel fuel, while the federal government applies a 4 cent per litre excise tax plus the new goods and services tax (GST). However, because GST paid by trucking companies can be recovered as an input tax credit it has been excluded from the analysis.

There is also some debate over whether the federal excise tax should be considered a legitimate user fee. Canadian railways must pay the same tax on diesel fuel for locomotives, and most road expenditures are made by provincial governments rather than the federal government. As a result, the railways have argued that the federal excise tax should be considered a "general revenue tax" rather than a road user fee. For comparative purposes highway cost recovery ratios have been calculated both with and without the federal excise tax.

Fuel taxes per kilometre depend on a vehicle's rate of fuel consumption. For this analysis, estimates were based on empirical relationships developed by Clayton et al. (3) relating fuel consumption to gross vehicle weight. However, an adjustment was made to reflect gains in fuel efficiency since the empirical relationships were developed. Vehicle weight data for the analysis were obtained from field surveys conducted by the Ministry of Transportation, Ontario (MTO) as part of its 1987 Commercial Vehicle Survey (4).

C. The highway life cycle

The concept of highway life cycles plays a critical role in the analysis. Exhibit 1 shows how a highway "wears out" over time, based on information collected by the Transportation Association of Canada (5).

A roadway begins to deteriorate soon after construction is completed. Initially, annual maintenance activities focus on snowplowing and cleaning, but by year 3 they include pavement sealing and patching as well. In this example, resurfacing (overlay) is required in year 18 and year 33 to avoid premature failure. With timely resurfacing and adequate annual maintenance the useful life of the road would be about 45 years, at which point total reconstruction would be required. Note that the rate of deterioration increases each time the road is resurfaced.

Exhibit 2 is a representation of the real cash flow required to keep the example road in service. Construction costs are incurred at the beginning of the analysis period, while cash outlays for annual maintenance are required throughout the roadway life cycle. In addition, resurfacing costs are incurred in year 18 and year 33. However, there is a "salvage value" associated with the road, since it can be rebuilt at the end of its useful life. For this analysis, road salvage values are assumed to equal the cost differential between building a new road and rebuilding the existing facility. Alternatively, the analysis could have been extended to the end of a second life cycle.

By **discounting the cash flows** depicted in Exhibit 2, we can determine the present value of the road's life cycle costs. The result represents the equivalent amount required at the outset of the project to cover all present and future costs over the next 45 years. From another perspective, it represents the total advance fee that road users

would be expected to pay if there were no annual user charges and no government subsidies. If we divide this total amount by **discounted traffic data** we can estimate required user charges for various vehicle configurations and compare the results with current user fees. Traffic levels must be discounted in the same way as highway costs since they are a surrogate for user charges paid over the life of the road.

An important question related to the above is the appropriate discount rate to use. It is clear that we should deal with a real discount rate because all cash flows are expressed in constant dollar form. Also, the discount rate should represent the province's cost of funds - in this case Ontario - since most roadway investment occurs at the provincial level. Bisson, Bullock and Trotter (6) reviewed several studies dealing with the discount rate issue, and concluded that analyses of public projects typically employ a real discount rate of four to six percent. The rate assumed for this analysis is 5.5% - slightly higher than the midpoint of the identified range. The rationale for the increase is that investors expect a higher yield on debt backed by provincial governments.

D. Cost classes

The preceding section described the analysis in conceptual terms. However, the existence of several cost classes added complexity to the calculations.

Rilett, Hutchinson and Haas (7) have identified three broad classes of highway costs:

1. Uniquely occasioned, or long-term separable costs, which may be clearly assigned to a particular vehicle class (e.g., truck climbing lanes).

2. Common costs, which cannot be assigned to a specific vehicle class (e.g., the annual costs of snow removal).

3. Joint costs, which are occasioned by all vehicle types but for which a specific responsibility measure can be identified.

The same classification system has been adopted for this analysis, although different terminology has been used. In this paper, Category 1 items are referred to as **truck specific costs**, Category 2 items are referred to as **common costs**, and Category 3 items are referred to as **load specific costs**. In addition, truck specific costs have been subdivided into *structure costs* and *other*. Since each class has its own "cost driver" (or allocation base) the discounting process was repeated four times.

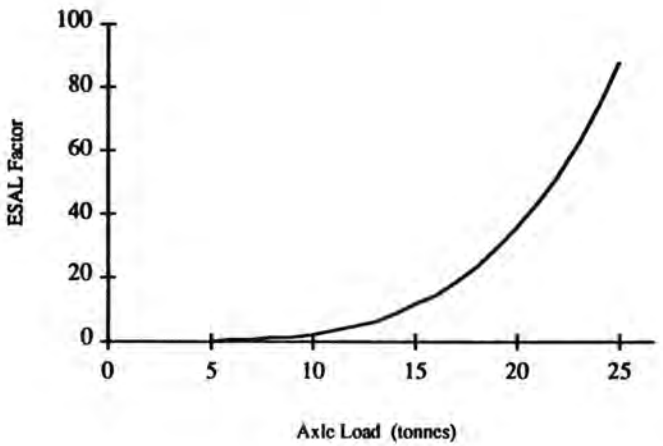
1. Truck Specific Costs

Construction costs for highway structures are not directly proportional to design load. As design load is reduced, factors such as snow loads and the dead weight of the bridge itself become more and more significant. Exhibit 3 summarizes the findings of a U.S. government study (8) that examined bridge costs on rural interstate highways in the northeast United States. Although these results may not be completely transferable, they should provide a reasonable indication of the situation in Ontario.

Exhibit 3
Bridge cost savings with lower design loads

Single unit design load	Combination vehicle design load	Bridge Cost Reduction
18.1 tonnes	24.5 tonnes	4.6%
13.6 tonnes	18.5 tonnes	7.4%
9.1 tonnes	12.2 tonnes	12.3%
4.5 tonnes	6.1 tonnes	17.5%
2.3 tonnes	3.1 tonnes	20.7%

Exhibit 4
Approximate ESAL factors for single axles



The allocation base for **truck specific structure costs** was the number of vehicles observed in the Exhibit 3 weight increments. Vehicle weight data for the analysis were obtained from the MTO commercial vehicle survey. After determining costs per vehicle for each weight increment, weight data were further analyzed to determine average structure costs by truck configuration.

The second group of truck specific costs, **truck specific - other,** consists of construction costs for truck climbing lanes and weight and inspection facilities. In this case, the allocation base was simply the number of trucks using the road.

2. Common Costs

The **common cost** category includes items that cannot be assigned to a specific vehicle class, and for which there is no clear "cost driver". The allocation base used for common costs was the total number of vehicles using the road.

The common costs category includes both construction and maintenance items. Maintenance examples include the annual costs of snow removal, sanding, and zone painting. Construction examples include grading and drainage costs, plus that portion of pavement deterioration that can be attributed to the environment. The latter item is very important, since the environment can account for more than half of total pavement and overlay degradation (7).

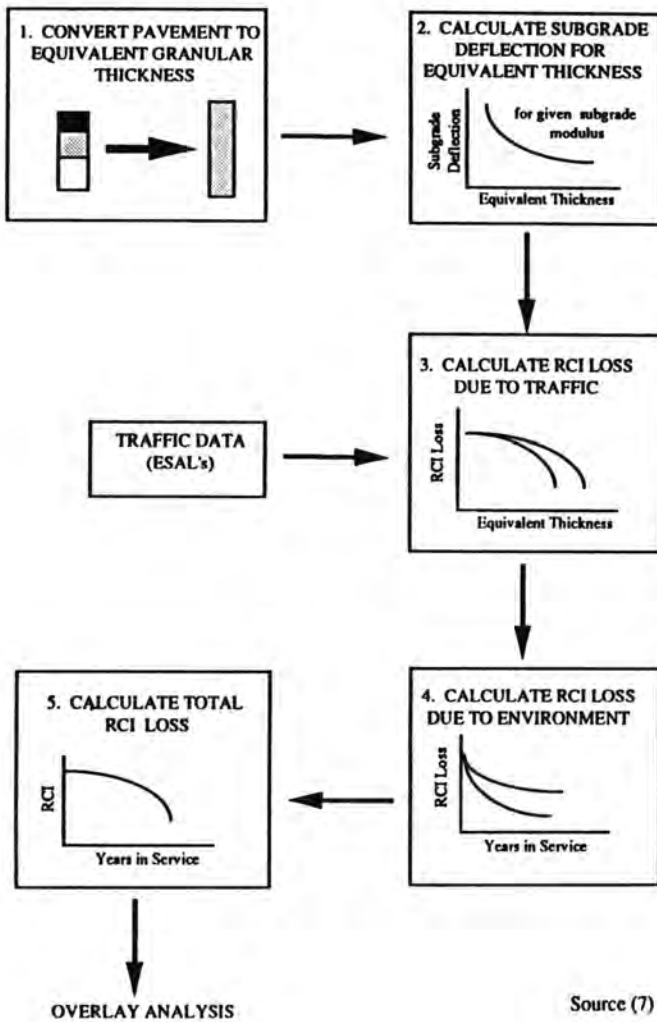
3. Load Specific Costs

The **load specific cost** category contains that portion of pavement deterioration that can be attributed to traffic loads. In this case, the "cost driver" used for the analysis was the number of equivalent single axle loads (ESAL's) carried by the pavement structure.

The ESAL concept is an important tool in the field of highway design. It was developed as a result of extensive research conducted during the 1950's by the American Association of State Highway Officials (AASHO). ESAL factors, which are available for a variety of axle configurations and loads, represent the number of repetitions of a standard load required to cause the same amount of pavement damage as one repetition of the actual load. ESAL factors are approximately equal to the fourth power of the actual load divided by the standard load, as shown in Exhibit 4. However, tabulated AASHO factors from Yoder and Witczak (9) were used for the analysis rather than the fourth power law. Also, AASHO tandem axle factors were used for both tandem and triple axles.

Data from the MTO commercial vehicle survey were analyzed to estimate the number of ESAL's carried during the road life cycles. This information served as input to a flexible pavement model used to estimate load specific costs per ESAL. Finally, unit costs were multiplied by the average number of ESAL's for each configuration to estimate load specific costs by vehicle type.

Exhibit 5
Structure of Ontario flexible pavement model



Source (7)

E. Ontario flexible pavement performance model

The Ontario pavement performance model is based on the AASHO research described above, longer term road tests conducted in Brampton, Ontario and some theoretical analysis (7).

The structure of the model is summarized in Exhibit 5. First, the pavement structure is converted to an equivalent granular thickness using equivalency factors for the construction materials used. Next, the theoretical subgrade deflection is determined based on equivalent granular thickness and local subgrade conditions. The subgrade deflection and expected traffic load (ESAL's) are used by the model to project roadway deterioration due to traffic loading. Finally, deterioration due to the environment is estimated and added to the traffic result to produce a profile of road comfort index (RCI) versus time.

The pavement is normally resurfaced (overlaid) when it reaches the minimum acceptable RCI. Performance of the overlaid pavement structure is predicted in a similar manner, although layer equivalency factors for the original structure are discounted substantially to reflect their condition at the time of the overlay .

Exhibit 6 lists major assumptions made to apply the pavement model. Assumptions are based on several data sources (7, 10, 11, 12).

F. Highway cost data

Cost data for the financial analyses are summarized in Exhibit 7. Construction costs and salvage values are based on an MTO report (13), maintenance costs are based on data published by TAC (14), and overlay costs are based on estimates by Rilett et al. (7). The construction and maintenance data were adjusted to include an allowance for highway structures, and a further adjustment was made to construction data to include purchase of the right of way. Also, the maintenance and overlay figures were indexed to 1990 levels using the highway construction price index published by Statistics Canada (15).

As discussed earlier, road salvage values were assumed to equal the cost differential between building a new road and rebuilding the existing facility. However, structure salvage values were based on remaining useful life. The total useful life of a highway structure is assumed to be 50 years, based on a TAC publication (5).

Unfortunately, neither the MTO nor the TAC data show costs to the required level of detail. Therefore, overall cost estimates were split into the required categories using other data sources. The construction cost breakdown is based on an analysis of highway construction/reconstruction in the state of Oregon (16). The maintenance cost breakdown is based on historic Ontario data, as reported by Haritos (17). The same information sources were used to make the cost adjustments described above.

Exhibit 6
Major assumptions for application of the pavement model

	Primary highway	Secondary highway
Number of lanes	4	2
Initial two way AADT - low traffic	10,000	2,000
Initial two way AADT - medium traffic	15,000	4,000
Initial two way AADT - high traffic	20,000	6,000
Annual traffic growth	2%	2%
Traffic in design lane	80%	100%
Percent trucks	20%	20%
Equivalent granular thickness of pavement structure (mm)	840	710
Subgrade modulus (kpa)	3,160	3,160
Initial ride comfort index	8.5	8.5
Post-overlay ride comfort index	7.5	7.5
Terminal ride comfort index	5.5	5.5
Maximum number of overlays	2	2

Exhibit 7
Cost data for financial analysis (dollars per kilometre)

	Primary highway	Secondary highway
Construction	4,392,000	1,104,000
Annual maintenance	26,400	8,900
Overlay (per mm)	2,240	1,120
Salvage value of road	2,350,000	650,000
Salvage value of structures	based on remaining useful life	

Exhibit 8
Construction cost breakdown

	Percent of total costs	Load related	Truck Specific		Common
			Structures	Other	
A. Primary Highway					
Pavements & shoulders	25.5	100%	-	-	-
Structures	23.0	-	21%	-	79%
Engineering	13.5	-	-	-	100%
Grading & drainage	13.5	-	-	-	100%
Roadside, safety & traffic service	12.5	-	-	-	100%
Truck lanes & weight/inspection facilities	7.0	-	-	100%	-
Right of way	3.0	-	-	-	100%
Other	2.1	-	-	-	100%
B. Secondary Highway					
Pavements & shoulders	34.5	100%	-	-	-
Structures	15.5	-	21%	-	79%
Engineering	13.5	-	-	-	100%
Grading & drainage	16.5	-	-	-	100%
Roadside, safety & traffic service	11.5	-	-	-	100%
Truck lanes & weight/inspection facilities	2.5	-	-	100%	-
Right of way	3.0				
Other	3.0	-	-	-	100%

Exhibit 9
Maintenance Cost Breakdown

	Percent of total costs	Load specific	Common
Snow plowing, sanding & salting	44.72	-	100%
Surface & shoulders	23.00	100%	-
Road patrol	7.38	-	100%
Signs, traffic lights & illumination	4.29	-	100%
Grass mowing & forestry	3.85	-	100%
Drainage & culverts	3.75	-	100%
Safety devices & disaster	3.35	-	100%
Bridges	2.77	-	100%
Zone painting	2.39	-	100%
Snow fences & hedges	1.70	-	100%
Cleaning right of way	1.62	-	100%
Other	1.17	-	100%

After breakdown of the base cost data, items were assigned to one or more of four cost classes. This process is summarized in Exhibit 8 for construction costs, and in Exhibit 9 for maintenance costs . Note that Exhibit 8 refers to **load related costs** rather than **load specific costs**. The new term was introduced because a portion of load related costs will later be attributed to the environment, and therefore reclassified as a **common cost**.

It is clear from Exhibits 8 and 9 that a major portion of construction and maintenance expenses fall into the common cost category. Since common costs are not directly related to traffic volume we can expect cost recovery ratios to vary dramatically depending on whether incremental or total (fully allocated) costs are considered.

G. Cost recovery results

Exhibit 10 shows estimated cost recovery ratios for rural four-lane primary highways, considering three traffic levels. Exhibit 11 presents similar information for rural two-lane secondary highways. In both cases, cost recovery ratios are shown with and without the federal excise tax. The configuration codes used in Exhibits 10 and 11 are explained below:

Code	Vehicle description
2	2 axle straight truck
3	3 axle straight truck
3-S2	5 axle tractor/semi-trailer
3-S3	6 axle tractor/semi-trailer
3-S3/1B	6 axle tractor/semi-trailer with liftable axle
3-S2-2	7 axle A-train or C-train
3-S2-S2	7 axle B-train
3-S3-S2	8 axle B-train

H. Conclusions

The following conclusions can be drawn from Exhibits 10 and 11:

1. The extent of cost recovery varies widely for different truck configurations. In general, cost recovery ratios are lowest for heavy straight trucks and multi-axle tractor/semi-trailers (e.g., 3-S3, 3-S3/1B). Cost recovery ratios are highest for 3-S2 vehicles (the most common truck configuration) and certain double trailer combinations.

2. Cost recovery ratios are quite sensitive to traffic volume. Within a given highway class ratios increase at higher traffic levels.

Exhibit 10
Estimated cost recovery ratios for rural primary highways

A. Low Traffic

Configuration	Cost recovery - including excise tax		Cost recovery - excluding excise tax	
	Incremental	Total	Incremental	Total
2	0.61	0.41	0.47	0.32
3	0.78	0.50	0.61	0.39
3-S2	1.02	0.61	0.79	0.47
3-S3	0.75	0.52	0.58	0.41
3-S3/1B	0.55	0.42	0.43	0.33
3-S2-2	0.88	0.59	0.68	0.46
3-S2-S2	0.87	0.59	0.68	0.46
3-S3-S2	0.72	0.53	0.56	0.41

B. Medium Traffic

Configuration	Cost recovery - including excise tax		Cost recovery - excluding excise tax	
	Incremental	Total	Incremental	Total
2	0.72	0.52	0.55	0.40
3	0.92	0.64	0.72	0.50
3-S2	1.25	0.80	0.97	0.62
3-S3	0.89	0.66	0.69	0.51
3-S3/1B	0.63	0.52	0.49	0.40
3-S2-2	1.04	0.75	0.81	0.58
3-S2-S2	1.03	0.75	0.80	0.58
3-S3-S2	0.84	0.65	0.65	0.51

C. High Traffic

Configuration	Cost recovery - including excise tax		Cost recovery - excluding excise tax	
	Incremental	Total	Incremental	Total
2	0.78	0.60	0.60	0.46
3	1.02	0.75	0.80	0.59
3-S2	1.42	0.96	1.09	0.74
3-S3	0.98	0.76	0.76	0.59
3-S3/1B	0.68	0.58	0.53	0.45
3-S2-2	1.16	0.87	0.90	0.68
3-S2-S2	1.14	0.87	0.88	0.68
3-S3-S2	0.92	0.75	0.71	0.58

Exhibit 11
Estimated cost recovery ratios for rural secondary highways

A. Low Traffic

Configuration	Cost recovery - including excise tax		Cost recovery - excluding excise tax	
	Incremental	Total	Incremental	Total
2	0.69	0.39	0.53	0.30
3	0.89	0.47	0.70	0.37
3-S2	1.23	0.57	0.95	0.44
3-S3	0.84	0.50	0.65	0.38
3-S3/1B	0.58	0.41	0.45	0.32
3-S2-2	0.99	0.56	0.77	0.43
3-S2-S2	0.98	0.56	0.76	0.44
3-S3-S2	0.79	0.50	0.61	0.39

B. Medium Traffic

Configuration	Cost recovery - including excise tax		Cost recovery - excluding excise tax	
	Incremental	Total	Incremental	Total
2	0.89	0.59	0.69	0.46
3	1.18	0.74	0.93	0.58
3-S2	1.72	0.95	1.32	0.73
3-S3	1.11	0.76	0.86	0.59
3-S3/1B	0.75	0.59	0.58	0.46
3-S2-2	1.33	0.87	1.03	0.68
3-S2-S2	1.30	0.87	1.01	0.68
3-S3-S2	1.03	0.75	0.80	0.58

C. High Traffic

Configuration	Cost recovery - including excise tax		Cost recovery - excluding excise tax	
	Incremental	Total	Incremental	Total
2	0.98	0.72	0.75	0.55
3	1.32	0.91	1.03	0.71
3-S2	1.96	1.20	1.51	0.93
3-S3	1.24	0.92	0.95	0.71
3-S3/1B	0.82	0.68	0.64	0.53
3-S2-2	1.48	1.06	1.15	0.83
3-S2-S2	1.45	1.06	1.13	0.82
3-S3-S2	1.13	0.89	0.88	0.69

3. Cost recovery ratios appear to be higher for secondary highways than for primary highways. There are several reasons for this difference. First, construction costs are much higher for primary highways. Second, traffic concentration in the right lane of four-lane roads results in uneven pavement wear. For this analysis it is assumed that both lanes are resurfaced at the same time. Finally, since traffic volumes are low for secondary highways a large proportion of pavement costs are attributed to the environment. Pavement degradation due to the environment is a common cost, so the associated expenses are allocated to all highway users.

4. In the case of medium volume primary highways, incremental costs are recovered for several configurations if excise taxes are considered to be a legitimate user fee. However, if excise taxes are excluded, incremental costs are not recovered for any truck configuration.

5. In the case of medium volume secondary highways, incremental costs are recovered for most configurations if excise taxes are included. In several cases, incremental costs are also recovered when excise taxes are excluded.

Cost recovery ratios are highly sensitive to the assumed discount rate. The reason for this sensitivity is that a large proportion of total highway costs are incurred "up front", while revenues are spread over the life of the road. The following table illustrates discount rate sensitivity for 3-S2 vehicles (including excise taxes) on a medium volume primary highway:

Discount Rate	Incremental Cost Recovery Ratio
3%	1.64
4%	1.47
5%	1.32
5.5% (base case)	1.25
6%	1.19
7%	1.08
8%	0.98

This research has shown that blanket statements cannot be made on whether truckers are paying their share of highway costs. The extent of cost recovery depends on several factors, including vehicle configuration and load, road class and traffic volume, and the discount rate assumed for the analysis. Perhaps most significant, it depends on the costs that truckers are expected to pay, and the fees and taxes considered to be legitimate user charges. It is important that the implications of these issues be fully understood before making any changes to highway cost recovery policy.

The methodology presented in this paper is valid for determining highway cost recovery ratios. However, the results cannot be considered completely authoritative until a more comprehensive study is undertaken. With further research the accuracy of the results could be improved, and the analysis could be extended to include other vehicle and roadway classes.

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PRODUCTIVITY IMPROVEMENTS IN THE TRUCKING INDUSTRY

by

J.M. Bowland and D.B. Toms

Peat Marwick Stevenson & Kellogg

A. Introduction

Canadian truckers have faced tremendous change during the past decade. Competition has increased within the industry, American carriers have recently secured a sizeable share of the transborder market, and truckers are facing increasing safety regulations. Profit margins are very thin and companies are forced to look for ways to become more productive.

This paper is based on research conducted on behalf of DriveSave/TruckSave, a branch of the Ministry of Transportation Ontario. The study objectives were to:

- Determine the nature and scope of existing productivity programs in the Ontario trucking industry.
- Examine the potential for further productivity improvements.
- Identify major barriers that restrict productivity gains.

The research program included a review of articles on trucking productivity and a survey of more than 40 Ontario carriers and suppliers. We reviewed government studies and industry cost data compiled by Statistics Canada to identify productivity measures already implemented in the industry. For the carrier survey, we targeted private and for-hire carriers with fleets of 25 or more vehicles. To get a good cross-section of industry issues, we included a variety of carrier sizes, industry segments (i.e. private vs. for hire), and types of operations (e.g. truckload vs. less than truckload, linehaul vs. pick up and delivery). In addition to the carrier survey, the Ministry sampled 22 drivers.

B. Literature Review

The following highlight the major productivity savings identified in our literature review.

1. Driver Costs

Drivers represent the single largest cost element for most trucking operations.

Hiring **low cost labour** (usually non-union) is perhaps the most obvious way to reduce driver expenses. However, in many ways such an approach can be short sighted and counter-productive. Low pay makes it hard to attract and keep quality drivers. As a result, recruiting, training, and insurance costs can increase substantially. Dissatisfied employees are also more likely to abuse company equipment, which can result in higher maintenance costs. Finally, rapid turnover can negatively impact the quality of customer service.

In many cases, **incentive compensation** systems can help to lower overall driver costs. Paying drivers a flat rate per mile is probably the simplest form of incentive pay. For more sophisticated systems, it may be necessary to develop standards and methods of work measurement. Care must be taken to ensure that the system is applied fairly, and that the behavior it encourages is consistent with overall company goals.

Minor **operational changes** can produce significant savings. For example, scheduled pick-ups can help a cartage company to minimize cross-town driving, and delivery appointments can cut wasted time at the loading dock. In the case of line haul operations, companies can arrange for a "relay" (e.g. companies with terminals in Montreal and Toronto can arrange for drivers to meet and switch vehicles in Kingston). This gets both drivers home at night, which makes for lower expenses and healthier driver lifestyles.

When properly implemented, **technology** can also help to lower driver costs. For example, in-cab cellular phones and satellite communication systems can save time that the driver would otherwise spend at a truck stop "checking in" with the dispatcher.

2. Fuel Costs

Fuel consumption and therefore fuel costs can be reduced through different productivity measures.

Modern diesel engines are more fuel efficient than their predecessors. Much of the improvement is due to the incorporation of electronic control systems (i.e. the so called "electronic engine"). These new engines typically include auto shut-offs, programmed speed limits and engine diagnostics to assist with trouble-shooting and maintenance. Many carriers claim that the new engines cut fuel consumption by at least 10%.

Well thought-out **specifications** in other areas can pay dividends as well. High-torque engines and turbochargers facilitate gearing to lower engine RPM's, which in turn results in better fuel economy. Thermostatic fans cut engine drag by working only when necessary. Radial tires reduce vehicle rolling resistance. Controlled tests have shown that devices to reduce aerodynamic drag can reduce fuel consumption by up to 11% for tractor/semitrailers, and even more for straight

trucks operating at highway speeds. The aerodynamic improvements incorporated into new tractor designs are said to reduce fuel consumption by as much as 20-30%.

The kinds of improvements outlined above can facilitate a major reduction in a carrier's overall fuel bill. However, some companies argue that these savings pale in comparison to the savings possible through **driver education and incentive programs**. Most education programs focus on reducing speed and idling time. A general rule of thumb is that a 1 mph reduction in speed results in a 0.1mpg improvement in fuel economy.

Changes to **fleet management and administrative practices** can also be used to minimize fuel bills. Fuel consumption should be monitored for each vehicle, to identify inefficient trucks and to lessen the likelihood of theft or fraud. Fuel consumption should also be considered in dispatching decisions, so that the right-sized truck is sent on the most efficient route possible. Finally, fuel consumption should be carefully considered when formulating maintenance schedules and evaluating equipment replacement options.

3. Maintenance Costs

Maintenance costs increase exponentially with vehicle age, so it is very important to have a modern fleet. This is particularly true for long haul operations, since a breakdown on the road can be very expensive to repair. Other opportunities to reduce maintenance costs include the following.

Preventative maintenance programs can play a key role in reducing overall maintenance costs. In most cases, companies start with the service intervals recommended by the vehicle manufacturer, and then make adjustments to tailor the program to their particular operations. Service schedules can be based on time, mileage, or some combination of the two. Often, a computer system is helpful to track service schedules and flag vehicles that should be brought in for servicing.

Training programs are required for vehicle technicians and drivers. Drivers can learn to make basic repairs on the road, and to recognize and report more serious problems so that they can be repaired promptly when the unit returns to base. Vehicle technicians need to regularly upgrade their skills to cope with changes such as the introduction of electronic control systems in modern tractors.

Vehicle standardization can also help to lower maintenance costs. Technicians become familiar with a particular engine, and are thus able to make repairs more efficiently. Standardization can reduce parts inventories and thus lower inventory carrying costs.

For some smaller fleets, **full service leasing** may be a cost effective alternative. The leasing company handles preventative maintenance and repairs, and can also provide better emergency coverage for breakdowns on the road.

4. Equipment Costs

High vehicle utilization is the key to keeping equipment costs low. Some companies are able to double or triple shift their equipment, so that it is on the road nearly 24 hours per day. Often, this requires changes to operating practices.

Reducing empty miles is a vital part of any productivity program. Computer systems can help carriers match loads with available equipment, and on-board communication systems make it easier to divert drivers to pick up a backhaul en route.

Some carriers try to save money by opting for **"plain vanilla" equipment**. However, this strategy does have drawbacks. For example cabover tractors are less expensive but are unpopular with most drivers. Driver input is often very helpful when trying to choose equipment.

The equipment that a carrier chooses to operate has a major impact on its other cost factors. For example, **high capacity equipment** such as B-train doubles spread driver costs over a larger payload. Similarly, **custom designs** such as drive through doubles can improve loading/unloading efficiency. Depending on the specifics of a carrier's operations, the extra costs associated with specialized equipment may well be justified.

5. Management & Administration

Well designed information systems can help a carrier reduce its management and administrative costs. Most companies are already use computer systems for basic functions such as accounting, but many are overlooking potential applications in other areas of the organization.

Computer reports can provide timely information to managers for their daily operating decisions. In most cases, managers can monitor their company's performance by closely tracking a few key indicators. Exception reports can identify problem areas.

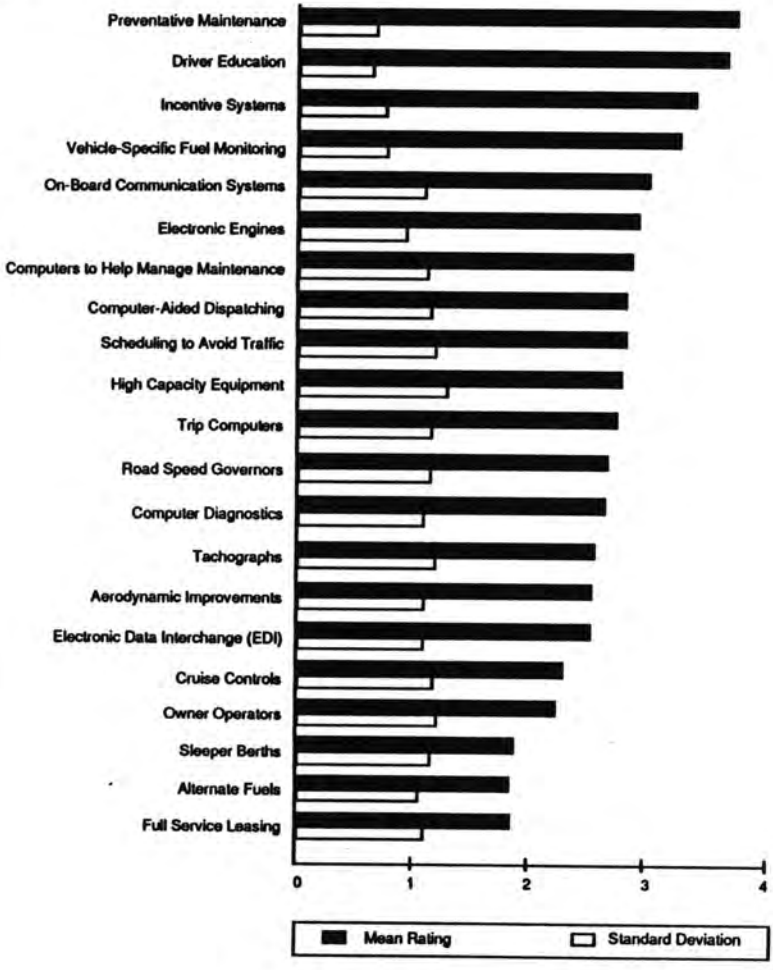
Costing systems are a useful tool for many management decisions. A careful cost analysis can reveal which kinds of business are the most profitable for the company, and the results can serve as a guide for future marketing efforts.

Electronic Data Interchange (EDI) has enormous potential for reducing administrative costs, and it can also be an important marketing tool. However, growth of EDI in the trucking industry has been relatively slow, partly because customers are not yet geared up to use the system.

6. Human Factors

Most of the literature concentrated on productivity improvements through tangible changes to equipment and operating practices. However, intangibles such as **employee motivation** also have a major impact on a carrier's profitability.

Exhibit 1
Ratings of Productivity Measures



Careful recruiting is the first step toward building an effective team. Applicants should be subjected to a written and practical driving test, and references should be carefully checked. Where possible, working conditions should be improved so that good drivers are more likely to stay with the company.

Drug and alcohol abuse results in poor workmanship and low productivity. Substance abuse causes higher worker compensation rates, higher unemployment insurance, low worker morale, high injury rates and high absenteeism. Pre-employment testing, rehabilitation training and careful monitoring of employees suspected of substance abuse can reduce problems with substance abuse.

It is vital to keep lines of **communication** open in both directions, and to recognize exceptional contributions (e.g., through an awards program). Responsibility should be pushed as far down in the organization as possible to encourage employees to "buy into" the results of company decisions.

C. Survey Results

The carrier survey done by PMS&K and the driver survey completed by the Ministry identified potential productivity improvements in the trucking industry. The main survey asked carriers to rate productivity measures, identify productivity measures already implemented by their company and to identify barriers to success. The survey of drivers asked respondents to rate productivity measures.

1. Ratings of Productivity Measures

Carriers were asked to rate various productivity measures on their potential to reduce operating costs. Note that ratings were based on potential savings for their particular operations, regardless of whether this potential had been realized or not. Ratings were indicated on a scale ranging from 1 (minimal potential) to 4 (high potential).

Exhibit 1, **opposite**, shows average ratings and standard deviations for the various measures that respondents were asked to consider. The standard deviations provide an indication of how much the ratings varied within the survey sample. For example, if ratings for a given productivity measure were relatively consistent, the associated standard deviation would be small. On the other hand, if ratings varied greatly from carrier to carrier, the standard deviation would be large.

From Exhibit 1, it is clear that there are some items which seem to offer high potential for productivity improvement with virtually all carriers - as evidenced by high mean ratings and relatively low standard deviations. This group would include items at the top of the list, such as preventative maintenance programs, driver training, incentive systems, and vehicle specific fuel monitoring. Other items received mixed reviews. This is not particularly surprising, since operations vary so much from one carrier to another. For example, high capacity equipment such as B-Train doubles can provide significant benefits for carriers that haul bulk commodities over long distances. However, the same equipment is of little or no

use to companies whose business is dominated by local deliveries in an urban area.

Carriers were also asked to indicate the extent to which they agreed or disagreed with a series of statements about productivity, using a scale that ranged from 1 (disagree strongly) to 4 (agree strongly). Several of these statements related to the effectiveness of various productivity measures, as shown in Exhibit 2, below.

Exhibit 2

Carrier Responses to Statements—About Productivity Improvements

Statement	Mean Response	Standard Deviation
It is important for a fleet to have an accurate costing system.	3.85	0.37
Trucking companies need to put more emphasis on training their employees.	3.39	0.72
A modern fleet helps to keep operating costs low.	3.33	0.84
Trucking companies can save money by working more closely with their suppliers.	3.28	0.69
It is important to get drivers involved in company operations (e.g., truck specifications)	3.21	0.80
Most productivity improvements result from technological innovations.	2.46	1.00
Allowing 16.2 meter (53') trailers in Ontario will allow us to significantly increase our productivity.	2.08	1.06

2. Improvements Previously Implemented

One of the objectives of our survey was to determine the kinds of improvements that carriers have already made, and, to the extent possible, the results that have been achieved.

Exhibit 3, **overleaf**, lists the most common productivity measures applied to fleets in the survey sample. While the percentages in Exhibit 3 are useful for comparison purposes, they probably underestimate the extent to which these measures are applied within the industry. One of the reasons for the discrepancy is that some carriers think of these devices as standard practice rather than a "productivity improvement".

Very few carriers were able to accurately quantify the savings resulting from productivity measures that they had implemented. Even when measurement was attempted, there were usually extraneous variables that influenced the results (i.e. the tests were not "controlled"). However it was clear that many carriers did achieved significant operational savings from relatively minor changes.

Exhibit 3
Improvements Implemented To Date

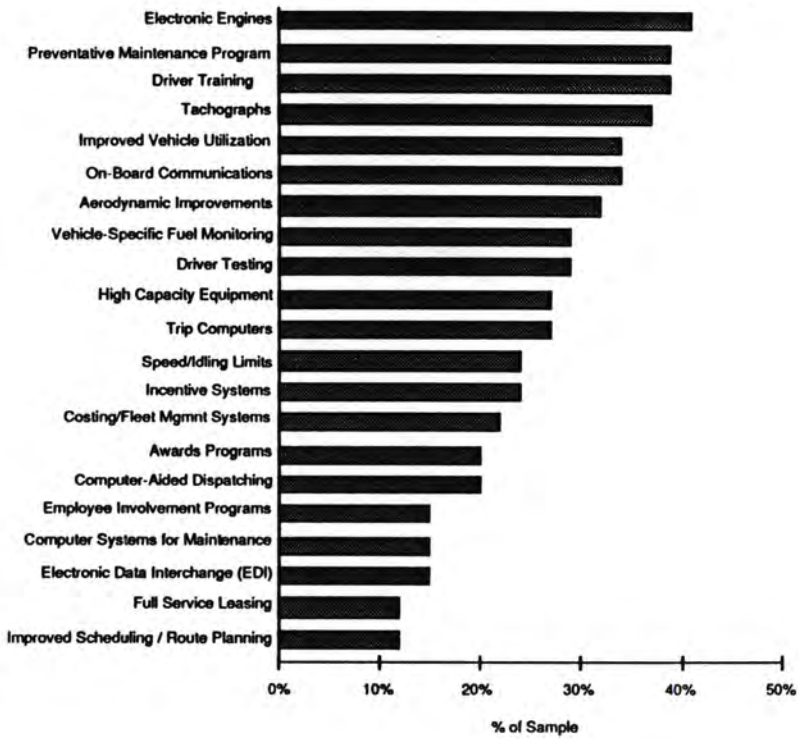
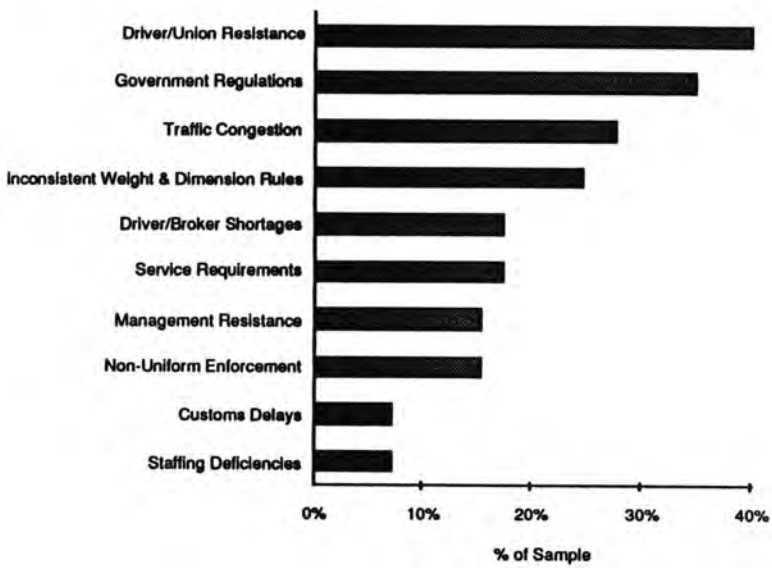


Exhibit 4
Barriers to Productivity Improvement



3. Barriers To Success

As part of the carrier survey, companies were asked to identify barriers to improving the productivity of their trucking operations. The most frequently cited barrier to productivity improvement is resistance from drivers and/or their unions. For example, several carriers mentioned that they would like to implement some sort of incentive pay system, but felt that this would cause problems because it runs counter to the "union philosophy" of treating everyone the same. To some extent, carriers were able to overcome driver resistance through efforts to improve communication and involve employees in company decisions.

Government regulations are also thought of as a major barrier to productivity gains. Most carriers agree with the National Safety Code in principle, but several were concerned about the resulting administrative burden. Ten carriers complained specifically about inconsistencies in weight and dimension regulations. Carriers were also concerned about a lack of uniform enforcement of trucking laws, particularly with respect to U.S. carriers operating in Canada.

Traffic congestion is a serious problem for truckers operating in Southern Ontario, especially for those with pick up and delivery operations in Toronto and surrounding area. Carriers are trying to get around this problem through changes to their operating practices, but in most cases they are constrained by customer service requirements. Many customers demand service during peak congestion times: early morning deliveries and late afternoon pickups.

Shortages of qualified drivers and/or owner operators were cited as a barrier by seven companies. In most cases, they emphasized that the problem was with driver quality, not quantity (i.e., they are still seeing lots of applicants but many do not meet minimum standards set by the company).

Interestingly, six companies mentioned resistance on the part of managers as a barrier to productivity improvement. Many of these cases involved private carriers that have problems getting the attention of senior executives who are more concerned with the company's "main business". However, management resistance can also be a problem with for-hire carriers, particularly when efforts to involve employees in company decisions threatens the power base of supervisors and mid-level managers.

Exhibit 4, **opposite**, summarizes the carriers responses on the barriers to success.

4. Driver Responses

Drivers were asked to rate the same productivity measures as the carriers and to identify specific means of improving productivity. The three main means of productivity improvements identified independently by the drivers were better and more efficient dispatching, incentive programs, and less paper work.

Exhibit 5, **below**, shows the carriers' and the drivers' ranking of the top five productivity measures. Although the measures are similar, the relative importance of the measures are viewed differently.

Exhibit 5

Ranking of Top Productivity Measures

Ranking	Carrier Management	Drivers
1.	Preventative maintenance	Driver education
2.	Driver education	Incentive systems
3.	Incentive Systems	On-board computers
4.	Vehicle specific fuel monitoring	Scheduling to avoid traffic
5.	On-board communications	Preventative maintenance

D. Conclusions

This following present the major conclusions derived from the study. They are based primarily on quantitative and qualitative data collected during the surveys.

- **Productivity gains** generally result from a well implemented combination of the basics rather than a single major change. Most carriers are aware of potential improvements to their operations, but many fail to act because of internal and/or external barriers.

- **Major barriers to success** include resistance to change within the organization, government regulations, traffic congestion, service requirements and shortages of quality drivers/brokers.

- **The extent of productivity programs varies** considerably within the industry. Some carriers have already made impressive gains, but there is room for further improvement in most organizations.

- **Productivity improvements** such as preventative maintenance programs, driver training, and incentive compensation systems offer high potential for productivity gains with virtually all carriers. However, the benefits from most productivity measures are highly dependent on the specifics of carrier operations. Thus, productivity programs must be custom-designed to fit the particular needs of each individual company.

- To date, most trucking companies have concentrated on improving **physical aspects** of their operations (e.g. careful vehicle specifications and better maintenance). Carriers generally recognize the importance of **human factors** and intangibles such as employee morale, but initiatives in these "softer" areas are relatively rare.

- **Information systems are a vital** management tool. Unfortunately, many trucking companies have limited computers to basic record-keeping functions such as accounting. Since accurate costing systems are rare, carriers can find themselves chasing after unprofitable business.

- Truckers should focus on **lowering barriers within their control.** Many of the barriers identified by the industry survey are beyond the immediate control of trucking companies. For example, there is not much that carriers can do about inconsistencies in weight and dimension rules other than lobbying governments for change. Truckers need to concentrate their efforts on lowering the barriers that they can do something about. Most of these internal barriers are dominated by human issues.

- Trucking companies can save money by working more closely with their **customers and suppliers.** More than 90% of the surveyed carriers agreed that trucking companies can save money through closer relationships with their suppliers. Most suppliers offer assistance with equipment specifications, and many are willing to take part in trials to prove their product. Unfortunately, many carriers do not take full advantage of these kinds of services. Carriers and customers can work together as well. For example, long-term contract with customers may justify the purchase of specialized equipment that is optimum for the customer's product.

- **Government** can play an active role in disseminating information about productivity improvements, but government programs are more effective when co-sponsored by trucking associations. A good example of this is the Ministry of Transportation, Ontario's current Award of Excellence Program to recognize improvements in productivity, fuel efficiency and safety.

A PRODUCTIVITY STUDY OF FOR-HIRE INTERCITY TRUCKING 1978-1988

For-hire trucking is of vital and increasing importance in providing freight transportation services to the Canadian economy. It is also under-going a period of rapid change as a result of de-regulation and free trade.

By 1987, for example, for-hire trucking moved 30 per cent more intercity freight tonnage than did railways. It also enjoyed a much higher rate of growth over the last decade than had railways. Between 1978 and 1987, for-hire trucking increased its movement of inter-city freight tonnage by 84.8 per cent while the domestic movement of freight by Canada's two main railways increased only 15.4 per cent. (Statistics Canada 1988 1, 175)

It was also in 1987 that the Federal government passed a Motor Vehicle Transport Act. This created a new national framework for the regulation of extra-provincial trucking. The legislation, which came into effect as of January 1 1988, called for the easing of entry regulations, the discontinuance of rate controls, increasing uniformity in the market entry conditions required by the various provincial licensing boards, and a federal system of safety regulation.

In view of trucking's increasing importance, and of the coming of trucking deregulation, it is desirable to obtain a clear picture of how the industry has been functioning. Such a picture will aid in understanding its competitiveness position and will provide a better baseline for future comparisons.

This study will begin by outlining the methodology chosen and the data available. It will then sketch the evolution of the industry during the periods, 1978-1980 and 1981-1988. It will continue with an examination of various measures of productivity during the decade. It will end with a brief summary and conclusion.

Methodology

Measures of productivity show the relationship between the outputs of an industry and the associated inputs. A measure of partial productivity shows the ratio between outputs and a particular input, for example between units of labour and units of output. Total factor productivity shows the ratio of output to a composite of inputs. An increase in total factor productivity means that the production function as a whole has shifted and that more output can be produced from the same level of inputs.

This paper is a direct result of my work at Statistics Canada, but the views expressed are my own and do not necessarily reflect those of Statistics Canada. Special thanks are due to the people in the Surface Transport Section of Statistics Canada, D. Dodds, R. Harris, F. Nix and A. Clayton.

TABLE I
INTERCITY TRUCKING ORIGIN AND DESTINATION TRAFFIC
1978-1988

YEAR	1978	1979	1980	1981	1982	1983
VALUE ('000,000s)	$2,324.0	$3,076.0	$3,328.0	$3,349.0	$3,351.0	$3,799.0
LIVE ANIMALS	$30.9	$34.5	$42.9	$36.2	$41.7	$44.9
FOOD, FEED, BEVERAGES, AND TOBACCO	$385.2	$484.7	$533.3	$543.6	$659.1	$651.8
INEDIBLE CRUDE MATERIALS	$170.9	$252.1	$217.1	$227.7	$228.0	$312.8
INEDIBLE FABRICATED MATERIALS	$867.7	$1,024.3	$1,154.0	$1,260.1	$1,181.8	$1,283.1
INEDIBLE END PRODUCTS	$802.4	$1,146.3	$1,195.1	$1,242.4	$1,304.3	$1,333.7
GENERAL FREIGHT	$186.0	$192.7	$182.6	$119.9	$148.9	$170.9
TONNE-KILOMETRES ('000,000s)	36,399.2	42,367.6	41,723.7	39,779.3	37,910.4	41,919.6
LIVE ANIMALS	499.2	602.5	599.5	460.2	492.1	560.6
FOOD, FEED, BEVERAGES, AND TOBACCO	6,563.4	7,351.6	7,530.1	7,119.6	8,135.0	8,024.9
INEDIBLE CRUDE MATERIALS	3,026.2	4,182.2	4,364.6	4,288.7	4,277.1	5,579.6
INEDIBLE FABRICATED MATERIALS	16,060.7	17,815.7	18,969.8	18,375.6	16,000.7	18,439.7
INEDIBLE END PRODUCTS	6,620.7	8,083.4	7,723.7	8,431.6	7,744.6	7,847.2
GENERAL FREIGHT	1,529.0	1,330.2	1,324.3	1,003.7	1,259.1	1,467.4

YEAR	1984	1985	1986	1987	1988	
VALUE ('000,000s)	$4,108.0	$4,497.2	$4,897.2	$4,867.0	$5,164.3	
LIVE ANIMALS	$30.3	$27.6	$45.2	$32.0	$33.	
FOOD, FEED, BEVERAGES, AND TOBACCO	$721.9	$761.0	$814.3	$795.8	$842.1	
INEDIBLE CRUDE MATERIALS	$302.5	$411.6	$473.0	$543.9	$493.9	
INEDIBLE FABRICATED MATERIALS	$1,365.0	$1,489.1	$1,900.9	$1,672.9	$1,745.9	
INEDIBLE END PRODUCTS	$1,445.4	$1,527.8	$1,537.3	$1,509.2	$1,763.1	
GENERAL FREIGHT	$144.3	$160.2	$126.1	$175.1	$218.9	
TONNE-KILOMETRES ('000,000s)	42,824.2	43,722.8	48,930.4	37,320.8	37,888.3	
LIVE ANIMALS	487.8	502.0	605.6	754.7	720.3	
FOOD, FEED, BEVERAGES, TOBACCO	8,627.7	8,613.5	9,349.6	9,894.4	10,371.5	
CRUDE MATERIALS	6,202.1	6,757.6	8,120.8	12,981.1	8,713.2	
FABRICATED MATERIALS	18,670.3	19,316.3	21,134.2	23,079.1	24,763.0	
END PRODUCTS	8,329.7	8,099.6	8,622.2	8,334.2	9,660.4	
GENERAL FREIGHT	1,188.4	1,193.8	1,095.0	1,436.3	2,640.9	

Source: Statistics Canada

Partial productivity measures can easily mislead An increase in the level of output associated with a unit of labour could occur, not because. a change in the efficiency of the labour, but because the labour is able to now work with more or improved units of capital. For this reason, an effort has been made to also use a measure of total productivity to follow changes in productivity in this industry.

The approach followed is that developed by Solow, Denison, and Jorgenson-Griliches in the 1950s and 60s. It is assumed a function exists and that it has certain characteristics. These are: first,

TABLE II
INTERCITY TRUCKING FIRMS' REVENUE
AND TOD TRAFFIC REVENUE
1978-1988

YEAR	1978	1979	1980	1981	1982	1983
DIVISIA INDEX OF INTERCITY TRUCKING ORIGIN AND DESTINATION TRAFFIC	100.0	110.9	114.1	111.6	106.3	114.9
RECORDED TOD TRAFFIC REVENUE/ TOTAL INTERCITY TRUCKING FIRM REVENUE	70.1%	72.3%	70.0%	75.7%	70.6%	70.0%
OUTPUT INDEX	100.0	115.2	114.2	107.6	94.8	113.0

YEAR	1984	1985	1986	1987	1988	
DIVISIA INDEX OF INTERCITY TRUCKING ORIGIN AND DESTINATION TRAFFIC	119.5	118.7	130.0	147.3	155.3	
RECORDED TOD TRAFFIC REVENUE/ TOTAL INTERCITY TRUCKING FIRM REVENUE	72.9%	70.3%	68.0%	65.6%	67.0%	
OUTPUT INDEX	114.9	118.5	124.8	137.4	142.6	

Source: Statistics Canada

substitution is possible between inputs; second, there are constant returns to scale; and third, all inputs are paid the value of their marginal product. These assumptions permit a total factor productivity index to be created by dividing a Divisia (Tornquist) composite output index by a Divisia (Tornquist) composite input index (Dhruvarajan and Harris, 1978, 223-228).

The required assumptions are reasonable in the case of trucking. A changing mix of inputs can be observed in use. There are a wide variety of firms present in the industry. The industry has a large number of suppliers, customers, firms, and employees. It also face competition from other modes of transportation.

Output

Output is measured in physical terms, revenue tonne-kilometres for the six basic types, or sections, of commodities measured by Statistics Canada. These commodity sections are: live animals; food, feed, beverages and tobacco; inedible crude materials; inedible fabricated materials; inedible end products; and unclassified or general freight. Table I presents the recorded movement of intercity tonne-kilometres of freight. The six types of output are combined into a Divisia index of Composite Revenue Output for for-hire trucking firms involved in the movement of intercity freight, shown in Table II.

Information on tonne-kilometres is only available on the portion of trucking output which is concerned with the movement of freight a distance in Canada of over 25 kilometres. It is collected through an origin-destination survey carried out by the Transportation Division of Statistics Canada.

Tonne-kilometres were preferred to tonnes and to revenue in constant dollars as a measure of output. Tonne-kilometres register changes in either the weight or distance freight is moved but are not affected by changes in relative prices which do not reflect changes in the physical characteristics of commodities.

Before 1981, Statistics Canada endeavoured to collect and report information on tonne-kilometres, tonnes, and revenue for intercity for-hire trucking firms reporting annual revenues on of $100,000 or more. After 1980, although information on tonnes and revenue contin-

TABLE III
CAPITAL INPUTS
1978-1988

YEAR	1978	1979	1980	1981	1982	1983
CAPITAL EXPENDITURES (MILLION $)	$424.0	$515.7	$606.3	$596.0	$557.1	$579.5
FIRM	$333.6	$399.2	$464.5	$425.1	$399.6	$381.7
OWNER-OPERATOR	$92.2	$116.5	$141.7	$168.9	$157.5	$197.8
KILOMETRES DRIVEN (MILLION)	3,121.0	3,402.0	3,619.0	3,330.7	3,017.3	3,737.6
FIRM DRIVERS	1,926.6	2,047.4	2,144.4	1,793.3	1,743.6	2,200.1
TRUCK DRIVERS	574.0	582.9	606.0	405.0	340.3	360.0
TRACTOR DRIVERS	1,351.9	1,464.5	1,533.6	1,387.5	1,403.3	1,840.1
OWNER-OPERATORS	1,195.2	1,356.4	1,475.3	1,537.4	1,271.6	1,537.5
CAPITAL FLOW UNITS	3,032	3,171	3,376	3,138	2,981	3,394

YEAR	1984	1985	1986	1987	1988	
CAPITAL EXPENDITURES (MILLION $)	$693.0	$760.3	$899.1	$1,065.2	$1,153.0	
FIRM	$423.2	$491.5	$581.2	$633.6	$677.2	
OWNER-OPERATOR	$259.6	$268.8	$338.0	$431.6	$474.8	
KILOMETRES DRIVEN (MILLION)	4,245.5	4,267.6	4,817.1	5,318.6	5,939.6	
FIRM DRIVERS	2,332.4	2,700.0	2,817.0	2,825.2	3,068.1	
TRUCK DRIVERS	264.7	299.7	353.0	308.0	308.0	
TRACTOR DRIVERS	2,167.7	2,200.4	2,464.0	2,517.2	2,760.2	
OWNER-OPERATORS	1,713.1	1,667.6	2,000.1	2,493.3	2,646.4	
CAPITAL FLOW UNITS	4,100	4,298	4,676	5,195	5,332	

Sources: Firm information from Statistics Canada, Broker information from G. Davies "Owner-Operators in Intercity Trucking 1978-1988".

ued to be collected and reported for the general population of intercity carriers, information on tonne-kilometres was only collected and reported for the larger firms, those reporting annual revenues of $500,000 or more. There is thus an apparent drop in output between 1980 and 1981 which is due instead to a reduction in the population being reported. Similarly any change in productivity occurring between 1980 and 1981 could be due to the change in population for which information is available.

Although the proportion of the firms involved in intercity freight being analyzed decreases following 1980, the firms available for study continue to provide the bulk of intercity movement of freight. In 1987, for example, over 80 per cent of intercity freight tonnage was moved by firms earning at least $500,000 and these firms earned over 90 per cent of the resulting revenue.

Ideally it would be desirable to also obtain a Divisia index of Composite Available Output since not all the available freight capacity of trucks moving intercity freight is used. Unfortunately, this is impossible on the basis of the available data.

The freight revenue reported in the TOD survey does not equal constant proportion of the revenue received by intercity trucking firms, but can vary between 65.6 and 78.0 per cent of the total. The reported revenue in the TOD survey was equal to between 70 and 73 per cent of the freight revenue received by intercity trucking firms in

TABLE IV
LABOUR INPUTS
1978-1988

YEAR	1978	1979	1980	1981	1982	1983
FIRM EMPLOYEES	87,873	91,890	91,447	75,958	68,962	68,154
TRANSPORT	39,274	83,443	82,302	41,287	38,229	38,317
DRIVERS	49,236	52,287	51,429	40,127	37,441	37,977
OTHER TRANSPORT	938	1,156	873	1,160	898	840
MAINTENANCE	7,717	8,117	7,772	6,830	6,218	6,047
TERMINAL	14,921	14,920	13,260	14,194	12,063	11,961
ADMINISTRATIVE AND OTHER	14,161	15,480	13,993	13,457	12,322	11,889
OWNER-OPERATOR YEARS (2,640 HOURS)	9,021	9,182	9,902	10,231	9,324	9,648
OWNER-OPERATOR EQUIVALENT EMPLOYEE YEARS (1,920 HOURS)	11,030	12,317	13,616	14,095	11,735	13,266
TOTAL EMPLOYEE EQUIVALENT YEARS	98,103	104,407	105,063	89,963	80,677	81,420
FIRM EMPLOYEE SALARIES ('000,000s)	$1,242.7	$1,430.1	$1,843.9	$1,829.6	$1,726.9	$1,799.4
TRANSPORT	$788.9	$971.2	$1,089.8	$1,079.7	$989.7	$1,038.7
DRIVERS	$777.3	$956.6	$1,077.7	$1,019.5	$976.8	$1,023.2
OTHER	$8.9	$12.6	$12.1	$16.2	$12.9	$12.4
MAINTENANCE	$121.7	$147.4	$158.8	$158.8	$153.8	$154.7
TERMINAL	$217.8	$262.3	$281.4	$212.1	$200.7	$208.3
ADMINISTRATIVE AND OTHER	$219.8	$274.1	$314.7	$314.1	$212.8	$316.7
BROKER NET INCOME	$144.5	$221.6	$227.6	$261.1	$174.8	$182.8
TOTAL PAYMENT FOR LABOUR	$1,488.2	$1,886.7	$2,071.5	$2,091.8	$1,911.5	$1,977.4

YEAR	1984	1985	1986	1987.	1988	
FIRM EMPLOYEES	70,783	73,423	72,463	76,378	75,093	
TRANSPORT	40,251	41,932	41,132	42,646	42,846	
DRIVERS	39,320	41,066	40,447	42,460	42,183	
OTHER TRANSPORT	941	866	695	786	663	
MAINTENANCE	6,041	6,121	6,088	3,965	3,844	
TERMINAL	12,670	12,780	12,466	13,592	13,028	
ADMINISTRATIVE AND OTHER	12,011	12,972	12,777	13,375	13,375	
OWNER-OPERATOR YEARS (2,640 HOURS)	11,697	11,122	12,423	16,724	17,761	
EQUIVALENT EMPLOYEE YEARS OF OWNER-OPERATORS (1,920 HOURS)	19,909	19,389	19,457	23,009	24,422	
TOTAL EMPLOYEE EQUIVALENT YEARS	86,592	88,824	91,920	99,387	99,515	
FIRM EMPLOYEE SALARIES ('000,000s)	$2,044.6	$2,188.7	$2,250.3	$2,282.1	$2,470.8	
TRANSPORT	$1,187.3	$1,267.3	$1,280.9	$1,260.2	$1,426.3	
DRIVERS	$1,173.3	$1,254.2	$1,272.1	$1,244.8	$1,410.3	
OTHER	$14.0	$13.1	$16.7	$15.4	$15.0	
MAINTENANCE	$189.6	$178.3	$184.0	$190.4	$191.2	
TERMINAL	$333.1	$348.4	$381.4	$387.2	$396.3	
ADMINISTRATIVE AND OTHER	$334.4	$394.7	$396.0	$451.3	$457.0	
BROKER NET INCOME	$209.9	$452.8	$424.9	$366.0	$453.7	
TOTAL PAYMENT FOR LABOUR	$2,252.8	$2,641.5	$2,675.2	$2,753.2	$2,924.5	

Sources: Firm information from Statistics Canada, Broker information from G. Davies "Owner-Operators in Intercity Trucking 1978-1988".

TABLE V
INTERCITY CARRIER FUEL INPUTS
1978-1988

YEAR	1978	1979	1980	1981	1982	1983
TOTAL FUEL ENERGY PURCHASED (TERA-JOULES)	67,549.8	84,802.8	89,814.3	78,768.1	68,862.9	78,835.2
BY FIRMS	43,766.5	44,027.0	49,357.2	38,898.1	45,366.4	48,148.2
BY OWNER- OPERATORS	24,782.9	20,766.8	24,357.2	23,870.8	23,497.5	24,719.0
TOTAL EXPENDITURE ON FUEL (MILLION $)	$315.4	$363.4	$365.3	$442.8	$378.7	$324.8
BY FIRMS	$225.4	$279.2	$211.6	$231.1	$256.8	$277.9
BY OWNER-OPERATORS	$89.8	$83.3	$154.3	$210.9	$121.8	$206.8
FUEL SUPPLIED FREE TO OWNER-OPERATORS	$26.6	$34.6	$40.9	$40.6	$43.2	$40.8
VALUE OF OWNER-OPERATORS' FUEL	$113.6	$124.0	$195.2	$251.5	$264.2	$264.8

YEAR	1984	1985	1986	1987	1988	
TOTAL FUEL ENERGY PURCHASED (TERA-JOULES)	80,489.7	78,857.2	89,781.3	95,884.2	102,242.4	
BY FIRMS	53,992.9	52,283.7	56,411.6	58,443.2	55,578.5	
BY OWNER-OPERATORS	26,493.8	26,573.3	33,375.7	42,339.0	43,763.8	
TOTAL EXPENDITURE ON FUEL (MILLION $)	$348.0	$303.2	$359.6	$1,027.0	$1,042.0	
BY FIRMS	$237.2	$300.2	$302.9	$367.4	$300.7	
BY OWNER-OPERATORS	$110.7	$202.8	$256.7	$659.6	$441.3	
FUEL SUPPLIED FREE TO OWNER-OPERATORS	$40.2	$74.5	$93.3	$95.2	$103.2	
VALUE OF OWNER-OPERATORS' FUEL	$271.0	$277.4	$440.0	$334.9	$345.3	

Sources: Firm information from Statistics Canada, Broker information from G. Davies "Owner-Operators in Intercity Trucking 1978-1988".

1978-1980 and in 1984-1985, between 75 and 79 per cent in 1981-1983, and between 65 and 69 per cent in 1986-1988. The divisia index, therefore, was adjusted to take into account the changes in coverage, as shown in Table II. It was assumed that the unreported revenue was generated by the carriage of a similar composition of commodities to that generating the reported revenue.

INPUTS

Four inputs are included in the analysis: capital, labour, fuel, and other intermediate inputs. From 1979 to 1980, information on the inputs purchased by for-hire intercity trucking firms reporting annual revenues of $100,000 are used in this study. After 1981, only data on the inputs purchased by for-hire intercity trucking firms reporting annual revenues of $500,000 or more are used. Firms which are household goods movers are included where appropriate. Information on the inputs purchased by for-hire intercity trucking firms is drawn from a different Statistics Canada survey than that analyzing the origin-destination movement of Canadian freight and covers all their operations, rather than just their Canadian intercity operations. This forced the use of the adjusted measure of output discussed in the preceding section.

Table III presents a measure of the flow of capital input services used by for-hire firms involved in the intercity movement of freight. This flow of capital services is measured by an index of the distance travelled by all the power units owned and leased by the companies or by their hired owner-operators, as called brokers.

TABLE VI
MATERIAL INPUTS OTHER THAN FUEL
1978-1988

YEAR	1978	1979	1980	1981	1982	1983
EXPENDITURE IN CURRENT DOLLARS (MILLION)	$1,268.6	$1,380.0	$1,526.0	$1,383.5	$1,422.5	$1,324.4
BY FIRMS	$1,111.7	$1,191.7	$1,309.7	$1,143.5	$1,219.8	$1,085.1
BY BROKERS	$156.9	$188.3	$216.3	$240.0	$202.7	$240.3
EXPENDITURE IN 1981 DOLLARS (MILLION)	$1,716.6	$1,710.0	$1,716.6	$1,383.5	$1,290.2	$1,092.2

YEAR	1984	1985	1986	1987	1988	
EXPENDITURE IN CURRENT DOLLARS (MILLION)	$1,737.7	$1,979.2	$2,191.2	$2,460.0	$2,694.3	
BY FIRMS	$1,426.2	$1,663.7	$1,807.6	$1,971.6	$1,960.0	
BY BROKERS	$311.6	$323.5	$383.6	$488.4	$534.2	
EXPENDITURE IN 1981 DOLLARS (MILLION)	$1,420.0	$1,338.0	$1,655.0	$1,780.0	$1,734.3	

Sources: Firm information from Statistics Canada, Broker information from G. Davies "Owner-Operators in Intercity Trucking 1978-1988".

The flow of capital services is measured by the distance covered by revenue equipment. This provides a reasonable proxy for both the hours of use of revenue equipment and the wear and tear on it resulting from use. There have been no major changes during the decade in the conditions governing the distance covered per hour by a revenue equipment. The optimum speed for fuel efficiency has remained about 55 mph and road conditions have not generally changed dramatically during the decade. In addition, revenue equipment completely dominates the capital structure of the industry. In 1987, for example, depreciation on revenue equipment was over ten times that for depreciation of administrative buildings and equipment, and this leaves out of consideration the cost of the rented equipment and the expenditures by brokers (Statistics Canada 3, 38).

The ability of a large motor freight vehicle to move cargo is approximately proportional to its maximum loaded tonnage. Different weights, therefore, are given to the mileage of trucks and of tractors. The maximum weight for a "straight 3-axle truck", such as might commonly be used in the intercity movement of freight, ranges between about 47,000 to 60,000 lbs in the ten provinces. The maximum weight for a "5-axle tandem tractor with a tandem semi-trailer" ranges between about 80 and 105,000 pounds (Ship by Truck 1988, 344-347). Thus a typical 3-axle truck has a permitted weight of about sixty per cent of a typical 5-axle eighteen wheeler. It can carry thus about sixty per cent of the load of an eighteen-wheeler. It is assumed, therefore, that a typical 3-axle truck provides sixty per cent of the capital services per kilometre driven, compared to a semi-trailer tractor. It is also assumed that intercity trucking firms normally employ owner-operators who operate tractors.

Labour input is measured by employee years. The labour employed by intercity for-hire trucking firms is shown in Table IV. The typical owner-operator works more hours, though fewer days, in a year than a typical employee, as discussed in G. R. Davies "The Owner-Operator in Intercity Trucking, 1978-1988". The latter works a forty hour week, with time off for a yearly vacation and various special holidays. The former normally drives whenever he can get the work. The number of estimated broker years of employment, therefore, is adjusted to account for the difference in hours.

TABLE VII
INTERCITY TRUCKING FIRMS AND THEIR INPUTS
1978-1988

YEAR	1978	1979	1980	1981	1982	1983
NUMBER OF FIRMS	3,720	3,545	3,250	1,216	1,250	1,270
FREIGHT RECEIPTS (MILLION)	$3,602.5	$4,253.0	$4,757.2	$4,689.7	$4,532.3	$4,871.9
CAPITAL SERVICES (MILLION)	$426.8	$515.7	$606.2	$594.0	$557.1	$579.5
LABOUR SERVICES (MILLION)	$1,498.2	$1,898.7	$2,071.5	$2,081.8	$1,911.5	$1,977.4
MATERIAL INPUTS OTHER THAN FUEL (MILLION)	$1,268.6	$1,388.8	$1,326.9	$1,383.3	$1,429.5	$1,334.4
FUEL (MILLION)	$314.4	$263.4	$366.3	$462.8	$479.7	$724.8
TOTAL OPERATING EXPENSES (MILLION)	$3,496.0	$4,147.8	$4,770.1	$4,701.2	$4,576.8	$4,825.3
OPERATING RATIO	0.970	0.975	1.003	1.002	1.010	0.990
INDEX OF CAPITAL SERVICES	109.8	109.8	116.8	109.2	99.6	126.3
DIVISIA INDEX FOR LABOUR	100.0	106.3	107.8	90.6	81.8	81.9
INDEX OF MATERIAL INPUTS OTHER THAN FUEL	100.0	99.6	100.8	80.6	73.2	76.3
INDEX OF TERAJOULES PURCHASED	100.0	96.9	102.6	90.8	78.4	88.9
DIVISIA INDEX FOR INPUTS	100.0	103.5	105.3	89.6	81.2	86.2

YEAR	1984	1985	1986	1987	1988	
NUMBER OF FIRMS	1,302	1,430	1,586	1,680	1,720	
FREIGHT RECEIPTS (MILLION)	$5,637.8	$6,385.4	$6,907.2	$7,424.5	$7,743.3	
CAPITAL SERVICES (MILLION)	$693.0	$760.2	$829.1	$1,063.2	$1,132.0	
LABOUR SERVICES (MILLION)	$2,253.5	$2,641.5	$2,675.2	$2,783.2	$2,926.5	
MATERIAL INPUTS OTHER THAN FUEL (MILLION)	$1,727.7	$1,979.2	$2,191.2	$2,460.0	$2,494.3	
FUEL (MILLION)	$848.0	$903.2	$939.6	$1,027.0	$1,062.0	
TOTAL OPERATING EXPENSES (MILLION)	$5,522.2	$6,284.1	$6,735.2	$7,307.3	$7,614.7	
OPERATING RATIO	0.991	0.984	0.974	0.984	0.982	
INDEX OF CAPITAL SERVICES	141.6	145.3	161.7	179.7	191.3	
DIVISIA INDEX FOR LABOUR	86.0	88.7	91.3	88.4	88.3	
INDEX OF MATERIAL INPUTS OTHER THAN FUEL	82.8	90.6	96.4	103.7	101.8	
INDEX OF TERAJOULES PURCHASED	91.9	89.8	102.6	112.7	118.8	
DIVISIA INDEX FOR INPUTS	91.4	93.2	101.9	110.1	110.8	

Sources: Firm information from Statistics Canada, Broker information from G. Davies "Owner-Operators in Intercity Trucking 1970-1988".

Owner-operators' earnings are referred to as their net income. This is because they normally do not earn a salary but rather keep what is left after paying their various costs of operation. Strictly speaking, their net earnings includes any profit earned, as well as their salary opportunity cost. Most years, however, many owner-operators fail to even cover their salary opportunity cost.

The work-force is divided into six groups: firm drivers, other firm transport personnel, firm terminal personnel, firm maintenance personnel, firm sales and administrative personnel, and owner-operators. These groups are combined into a single Divisia index for labour.

Fuel is examined as an independent input, as shown in Table V. This was done for three reasons. It comprises a similar proportion of total cost to that of capital. It has fluctuated sharply in price. The ... has been the possibility of considerable economies in

TABLE VIII
OUTPUT AND INPUT INDICES
1978-1988

YEAR	1978	1979	1980	1981	1982	1983
COMPOSITE OUTPUT	100.0	113.2	114.3	103.4	94.8	113.0
CANADIAN CONSTANT DOLLAR GDP	100.0	102.9	105.4	109.2	105.4	116.1
COMPOSITE INPUTS	100.0	103.5	105.3	89.4	81.2	84.2

YEAR	1984	1985	1986	1987	1988	
COMPOSITE OUTPUT	116.9	118.4	124.8	137.6	142.6	
CANADIAN CONSTANT DOLLAR GDP	116.1	121.7	123.4	131.9	137.6	
COMPOSITE INPUTS	91.4	93.2	101.5	110.1	110.8	

Note: The index of constant dollar Canadian GDP is based on OECD totals for Canadian GDP.

fuel consumption due to: more fuel efficient engines becoming available; improvements to other aspects of revenue vehicles, including tires and stream-lining; and a concern amongst company managers to encourage fuel efficient driving techniques.

Fuel consumption is measured in terajoules because three different fuels, gasoline, diesel oil, and propane, were used during the decade in varying proportions. It is assumed that these fuels were used in similar proportions amongst the vehicles driven by brokers as in those driven by firm drivers.

"Material inputs other than fuel" are examined as a single input category, as shown in Table VI. This is obtained by subtracting from total operating expenses those for capital, labour, and fuel, whether paid directly by the firms or paid by their owner-operators. The yearly total is then deflated by the Personal Expenditure component of the GNP Implicit Price index. This deflator was chosen because of the very wide variety of the items entering the production process as intermediate inputs other than fuel.

As noted above, the individual input indexes were combined into a Divisia index of inputs. This is presented in Table VII.

The Evolution of the Industry

The evolution of the firms involved in the for-hire intercity movement of freight must be examined in two periods, 1978-1980 and 1981-1988, because of the 1981 change in population available for examination. A number of similarities, nevertheless, exist in both periods.

During 1978-1980, the general population of firms involved in this traffic experienced an increase in their operating ratio. The large rise in their operating ratio in 1980 corresponded with a drop in the index of industry output, as can be seen by comparing Tables VII and VIII. Owner-operators during this period drove about 40 per cent of the kilometres driven moving freight, as can be seen from Table III. In 1979, industry output rose much more than GDP but, in 1980, output fell slightly despite the continued rise in GDP, albeit at a slower rate. As can be seen in Table IX, during 1978-1980, composite inputs rose overall less than half as fast as composite outputs. Capital services, however, rose only marginally less than output, while labour services rose at about half of output, and fuel and

TABLE IX
AVERAGE ANNUAL RATES OF GROWTH
1976-1988

PERIOD	1976-1988	1976-1980	1981-1988
COMPOSITE OUTPUT	5.0%	5.9%	6.7%
CAPITAL SERVICES	5.7%	3.7%	9.3%
LABOUR SERVICES	-0.2%	3.4%	1.2%
FUEL ENERGY	1.7%	1.2%	2.9%
MATERIAL INPUTS	5.1%	5.0%	3.2%
COMPOSITE INPUTS	1.0%	2.6%	3.1%

material output rose only marginally, if at all.

During 1981-1988, the population under examination was composed of the firms in the industry with an annual gross income of over $500,000. These firms experienced a sharp rise in their operating ratios in 1982, corresponding to the steep drop in their output that year, as shown in Table VII and VIII. This drop in output came with the recession of that year, shown by the GDP figures. The fall in output also corresponded with a drop in proportion of mileage driven by owner-operators. From driving 46 per cent of kilometres in 1981, their share fell to only 42 per cent in 1982, as can be calculated from Table III.

In 1983 the economy came out of recession and output increased sharply. Output changed by a larger per cent than did the level of GNP. Similarly, it had declined by a larger per cent in the recession year. Although output recovered, the role of owner-operators in driving freight declined further. It fell to only 38.6 per cent.

During 1984 and 1985, operating ratios were under 0.985. Output, however, hardly changed, despite the steady growth in the economy. Owner-operators also continued to only drive about 40 per cent of the kilometres driven by the industry.

In 1986, a period of rapid growth began for these firms. Their operating ratios fell 0.974. Output rose almost 14 per cent. GDP, however, only continued its moderate growth. Owner-operators continued to drive only about 40 per cent of kilometres driven. In 1987, output continued its rapid increase while GDP continued to grow only moderately. The firms' operating ratio, however, returned to about 0.985. Owner-operators saw their share in driving rise to almost 47 per cent. In 1988 there was a return to a slower growth in output while GDP continued a steady expansion. The firms operating revenues remained about 0.985 and owner-operators continued to enjoy driving almost 47 per cent of kilometres driven.

Overall during 1981-1988, as shown in Table IX, output, on average, rose by a little under 7 per cent annually. Composite inputs rose by under half this amount. The capital services required to move this freight increased by slightly more somewhat more than did output itself. The labour services required, however, rose barely at all. Fuel energy requirements and the level of material inputs other than fuel rose at about the same rate as that for composite inputs as a whole. Overall, the composite output of firms in intercity trucking rose faster than did the GDP. The operating ratio of firms, as low as 0.97 at the beginning of the period, rose at the start of 1980s but then declined somewhat again.

TABLE X
PARTIAL PRODUCTIVITY INDICES
1978-1988

YEAR	1978	1979	1980	1981	1982	1983
CAPITAL PRODUCTIVITY INDEX	100.0	103.1	97.9	96.8	93.1	93.6
LABOUR PRODUCTIVITY INDEX	100.0	108.3	106.9	114.1	118.9	140.4
FUEL PRODUCTIVITY INDEX	100.0	118.9	111.4	114.9	120.9	142.1
OTHER INTERMEDIATE INPUTS INDEX	100.0	115.8	114.2	128.2	125.1	130.8

YEAR	1984	1985	1986	1987	1988	
CAPITAL PRODUCTIVITY INDEX	91.8	91.4	92.4	97.6	93.8	
LABOUR PRODUCTIVITY INDEX	133.6	133.3	147.6	139.9	165.4	
FUEL PRODUCTIVITY INDEX	122.0	121.9	121.4	139.8	127.7	
OTHER INTERMEDIATE INPUTS INDEX	130.8	130.6	139.0	151.8	160.9	

During both 1978-1980 and 1981-1988, composite output grew at a little under 7 per cent. Composite inputs grew at less than half this rate, about 3 per cent. Despite this, capital services, in both periods, grew at a rate that was close to that of output, 6 per cent in the earlier period and 8 per cent in the later period. The need for labour services, for fuel energy, and for labour services was below 4 per cent in both periods. The rate of growth, however, in both fuel energy and in material inputs other than fuel was higher in the later period than the earlier, while the rate of growth in labour services was lower in the later period.

Productivity Measures

Because total productivity figures give the overall view of changes in productivity, they will be reviewed first. Partial productivities will then be examined to see what light they can add to the picture.

During 1978-1988, total factor productivity in the intercity movement of freight by for-hire trucking firms increased by 47 per cent. This gives a compound total productivity growth rate of 3.9 per cent a year. During the earlier period, 1978-1980, it was a compound 4.2 per cent and in the later period, 1981-1988, it was a compound 3.4 per cent. Since the populations studied during the two periods are not identical, it can not be stated whether or not productivity growth was clearly lower during the 1980s than it was at the end of the 1970. It is reasonable to say, however, that overall it was likely about the 4 per cent.

Productivity growth has not been consistent over time. There have been occasions of sharp increases, as in 1983 and during 1986-1987. There have also been occasions of decline, as in 1980, and 1984-1985. Productivity growth in the industry tends to occur during periods of output growth. In 1983, output rose 21 per cent and, in 1986 and 1987, it rose 14 per cent and 17 per cent respectively. Occasions of productivity decline in the industry tend to correspond to years of declining output, as in 1980, or of relatively constant output, as in 1984 and 1985. The important role of owner-operators in allowing firms to change their level of output without requiring a corresponding increase in firm capital and labour makes it impractical to compare changes in productivity and output to a measure of industry capacity. It does seem likely, however, that productivity improves

TABLE XI
TOTAL FACTOR PRODUCTIVITY
1978-1988

YEAR	1978	1979	1980	1981	1982	1983
INDEX	100.0	111.2	108.5	112.7	115.8	126.8
YEAR	1984	1985	1986	1987	1988	
INDEX	125.9	124.4	132.8	143.8	146.7	

overall as the industry approaches capacity.

Partial productivity increases of 65 and 61 per cent were achieved, respectively, in labour and in material inputs other than fuel. During 1978-1980 the compound increase was 3.4 per cent and 6.9 per cent respectively. In 1981-1988 it was 5.4 per cent and 3.2 per cent respectively. Improvements in the productivity of material inputs other than fuel tended to occur in steps, with occasionally declines. Improvements were most dramatic in the recession year of 1982 and in the period of rapid expansion after 1985.

In the area of labour productivity, the greatest economies have occurred in maintenance personnel. In 1978-1980 maintenance personnel alone showed virtually no increase in numbers. In 1981-1988 they decreased by the largest percentage of the four groups of firm employees, almost 15 per cent in absolute numbers. During 1978-1980, the least savings were in the area of administrative personnel. These increased 13 per cent in numbers, compared to a 14 per cent rise in composite output. In 1981-1988, the lowest increase in labour productivity came in the area of transport personnel. It is interesting to note, however, the distance driven annually by transport personnel nevertheless increased dramatically. It rose from 43,000 kilometres in 1981 to 60,000 in the year following the 1982 recession. By 1987, transport personnel were driving 70,000 kilometres a year.

The partial productivity of fuel rose only 38 per cent. In the earlier period the compound increase was 5.5 per cent and in the later it was period it was only 2.6 per cent. The slow increase in the partial productivity of fuel is surprising considering that it was during this period that various new technologies were being introduced, including improved tires, streamlining, and more fuel efficient engines. It is also clear that greater potentialities likely existed for improvements in fuel productivity that were not exploited. The highest level of fuel productivity in the entire decade was recorded in 1983 when, no doubt, the lesson of the importance of fuel economy taught by the 1982 recession was fresh in everyone's mind.

There was an actual decline in the partial productivity of capital. Between 1978 and 1980 it decreased by 2.1 per cent. Between 1981 and 1985 it fell by 14 per cent. After 1985 it began a slow improvement, though it fell again slightly in 1988. It is possible that the decrease in the productivity of capital indicates that it was being substituted for other inputs. It is also possible that much of the change in the partial productivity of capital lies in changes occurring in its age structure. The evolution of the age structure of equipment in the for-hire trucking was reviewed in the Statistics Canada publication, 1985 Trucking in Canada. During 1978-1980, between 47 and 49 per cent of the equipment fleet was over 5 years old, and between 1.5 and 2.5 per cent was under a year old.

From 1981 to 1984, the equipment fleet aged steadily. In 1981, 46 per cent of the fleet was over 5 years old. By 1984, 57 per cent was over 5 years old. During these years, no more than 3.1 per cent of the fleet was under a year old. In 1985, however, the age of the equipment fleet began to turn around. In that year over 10 per cent of equipment was then under a year old, and under 51 per cent was over 5 years old. (Statistics Canada 1986 4, 172-173)

In summary, total productivity rose about 4 per cent a year during the period 1978-1988. The heart of the improvement in productivity lay in improvements in the use of labour and in material inputs other than fuel. Fuel productivity improvements were less than perhaps might have been expected and were likely considerably less than what was possible. The partial productivity of capital has tended to decline during the period. While it is possible that this decline was due to a substitution of capital for other inputs, there is evidence that it may well have been due to the effects of aging on the equipment fleet.

Conclusions

During the period 1978-1988, the firms in the for-hire intercity trucking industry are suitable for examination using the Divisia/ Tornquist approach. During this decade, the composite output of these firms grew at about 7 per cent per year. Overall, intercity freight rose more than did the GDP in the decade. The firms operating ratio rose at the beginning of the 1980s, but then declined again, though not generally to the levels at the end of the 1970s. Capital services grew at close to the same rate as composite output, but economies were realized in the areas of labour, fuel, and material inputs other than fuel. Owner-operators played a large role in the industry and permitted firms to change output levels without changing their levels of capital and labour by a proportionate account. Total productivity grew at a rate of about 4 per cent per year. The largest increase in productivity lay in the area of labour services. Improvements in fuel productivity were slower than might have been expected and this may be due to frequent carelessness in attempting to realize the possible gains from using fuel efficiently. During the decade there was a decrease in capital productivity. This may have been due to a substitution of capital for labour, but there is also evidence that points towards the decline being due to changes in the age mix of the equipment fleet.

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DEREGULATION AND THE QUALITY OF AIRLINE SERVICE IN NORTHWESTERN ONTARIO

BY

W.B. JANKOWSKI*

INTRODUCTION

Since 1984 the Canadian airline industry has operated in a *de facto* deregulated environment. The industry received its current regulatory framework with the passage of the National Transportation Act (Bill C-18) of 1988. One of the concerns regarding deregulation has been its potentially negative impact on the quality of airline service in the smaller, remote communities. However, little empirical work has been done on this issue. The objective of this paper is to partly fill this gap by documenting changes in the airline service quality in seletcted communities[1] in Northwestern Ontario between 1983 and 1989. The city-pair markets analysed in this paper are:

Thunder Bay -Kenora; Thunder Bay-Dryden; Thunder Bay - Sioux Lookout; Thunder Bay - Terrace Bay; Thunder Bay - Geraldton; Thunder Bay - Fort Frances; Thunder Bay - Red Lake; Sioux Lookout - Kenora; Dryden - Fort Frances; Dryden - Red Lake; Tarrace Bay - Geraldton; Fort Frances - Red Lake (see Figure 1)

The analysis focuses on the following quality indicators: type of plane used; flight frequency; the availabilty of 'same day' return service; and flight directness.

The paper is divided into four sections.
Section 1 discusses changes in the types of planes used.
Section 2 presents a discussion on the availability of the same day return flights.
Section 3 discusses changes in the service frequency.
Section 4 discusses the issue of directness of the available flights .

1. AIRCRAFT TYPE ANALYSIS

The passengers typically view jet service as superior to non-jet service. This is because small planes are less comfortable due to increased engine noise and vibrations, lower speed, less comfortable seats, lack of washrooms and most often lack of in-flight service. In addition, passengers view the smaller plane as less safe. Aircraft types used in each city-pair market in 1983, 1986 and 1989 are shown in Table 1.

As shown in Table 1, there has been a remarkable stability in the type of equipment used by airlines in Northwestern Ontario. Thus, changes in the industry after airline deregulation have had little or no impact on the type of plans used.

FIGURE 1
AIRLINE ROUTE NETWORKS
NORTHWESTERN ONTARIO, 1989

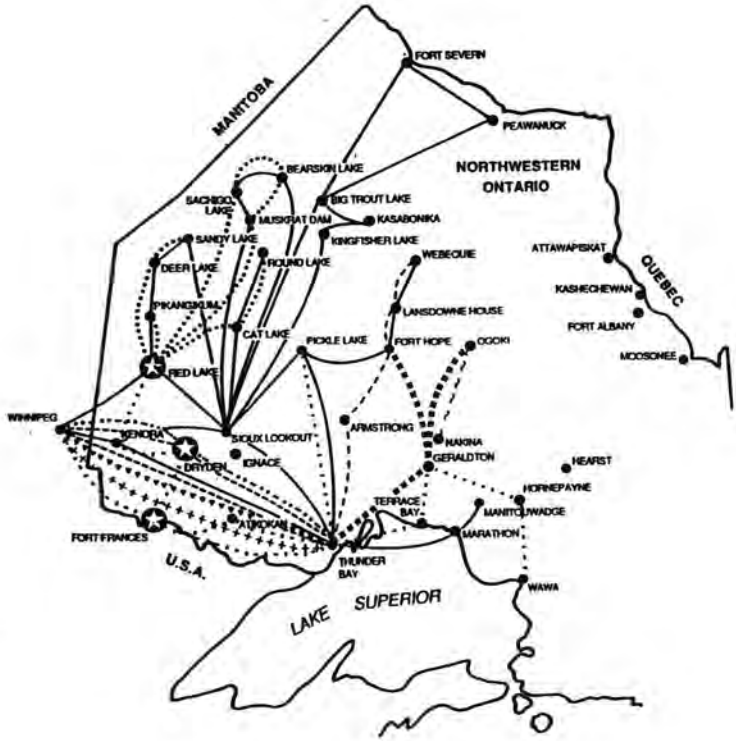


TABLE 1
AIRCRAFT TYPE USED[2], BY CITY-PAIRS

CITY PAIR	1983	1986	1989
Thunder Bay-Kenora	nonjet DHT-20	nonjet DHT-20 BE9-15	nonjet DHT-20 BE9-15
Thunder Bay-Dryden	jet/ nonjet DHT-20 B-737	jet/nonjet DHT-20 B-737	jet/nonjet DHT-20 B-737
Thunder Bay-Sioux Lookout	nonjet BE9-15 PA-6	nonjet BE9-15	nonjet BE9-15
Thunder Bay-Terrace Bay	nonjet DHT-20	nonjet DHT-20	nonjet DHT-20
Thunder Bay-Geraldton	nonjet DHT-20	nonjet DHT-20 BE-9 CNA-22	nonjet DHT-20 PA-6
Thunder Bay-Fort Frances	nonjet DHT-20	nonjet DHT-20	nonjet DHT-20 DH8-22
Thunder Bay-Red Lake	nonjet DHT-20	nonjet DHT-20	nonjet DHT-20 BE9-15
Sioux Lookout-Kenora	nonjet BE9-15	nonjet BE9-15	nonjet BE9-15
Dryden-Kenora	nonjet DHT-20	nonjet DHT-20	nonjet DHT-20
Dryden-Fort Frances	nonjet DHT-20	nonjet DHT-20	jonjet DHT-20
Dryden-Red Lake	nonjet DHT-20	nonjet DHT-20	nonjet DHT-20
Terrace Bay-Geraldton	nonjet DHT-20	nonjet DHT-20	nonjet DHT-20
Fort Frances-Red Lake	nonjet DHT-20	nonjet DHT-20	nonjet DHT-20

Source: *Official Airline Guide*, July 1983, 1986 and 1989 issues.

2. SAME DAY RETURN FLIGHT ANALYSIS

The availabilty of same day return flights is an important quality indicator for business travellers. The number of the same day return flights has been identified on the assumption that travellers require at least four working hours at their destination before returning home (Table 2).

TABLE 2
SAME DAY RETURN FLIGHTS BY CITY-PAIRS

CITY PAIR	NUMBER OF SAME DAY RETURN 1983	NUMBER OF SAME DAY RETURN 1989
Thunder Bay-Kenora	0	2
Thunder Bay-Dryden	1	2
Thunder Bay-Sioux Lookout	1	2
Thunder Bay-Terrace Bay	0	1
Thunder Bay-Geraldton	0	1
Thunder Bay-Fort Frances	1	1
Thunder Bay-Red Lake	0	1
Dryden-Kenora	1	1
Dryden-Fort Frances	0	1
Dryden-Red Lake	1	1
Sioux Lookout-Kenora	0	1
Terrace Bay-Geraldton	0	1
Fort Frances-Red Lake	0	0

Source: *Official Airline Guide*, July 1983 and 1989 issues.

In nine city-pair markets the availability of the same day return flights increased, while there was no change in the remaining four markets. None of the markets experienced a reduction in the available flights.

3. FLIGHT FREQUENCY AND SEAT AVAILABILITY ANALYSIS

Flight frequency and seat availability are important indicators of airline service quality. Data on frequency and seat availability are shown in Table 3.

TABLE 3
WEEKLY DEPARTING FREQUENCY AND SEATS AVAILABLE BY CITY-PAIRS

CITY-PAIR	WEEKLY DEP. FREQ.	WEEKLY DEP. SEATS
THUNDER BAY-KENORA		
1983	6	120
1986	30	485
1989	23	380
THUNDER BAY-DRYDEN		
1983	19	1615
1986	20	1725
1989	24	528
THUNDER BAY-S.LOOKOUT		
1983	8	102
1986	19	240
1989	22	330
THUNDER BAY-TERRACE BAY		
1983	6	120
1986	6	120
1989	6	120
THUNDER BAY-GERALDTON		
1983	6	120
1986	17	345
1989	11	150
THUNDER BAY-FT. FRANCES		
1983	12	240
1986	12	240
1989	17	412
THUNDER BAY-RED LAKE		
1983	6	120
1986	7	140
1989	18	305
SIOUX LOOKOUT-KENORA		
1983	6	90
1986	11	165
1989	7	105
DRYDEN-KENORA		
1983	12	240
1986	12	24
1989	14	280
DRYDEN-FT. FRANCES		
1983	6	120
1986	7	140
1989	2	40
DRYDEN-RED LAKE		
1983	12	240
1986	12	240
1989	11	220
TERRACE BAY-GERALDTON		
1983	6	120
1986	6	120
1989	6	120
FORT FRANCES-RED LAKE		
1983	6	120
1986	7	140
1989	1	20

Source: *Official Airline Guide* (July 1983, 1986 and 1989 issues).

As indicated in Table 3, in most markets frequency of service and available seats increased between 1983 and 1989. The only markets which experienced a reduction in frequency and seat availability are Dryden-Fort Frances, Dryden-Red Lake and Fort Frances-Red Lake.

4. FLIGHT DIRECTNESS

Airline passengers prefer direct versus indirect flights, *ceteris paribus*. This is because direct flights typically take less time and offer greater convenience: there is no need to switch planes and airlines, and the likelihood the the luggage loss is reduced. Data on direct and indirect flights are shown in Table 4.

TABLE 4
DIRECT AND INDIRECT FLIGHT AVAILABILITY

CITY PAIR	1983	1986	1989
Thunder Bay-Kenora	indirect	direct indirect(3)	direct indirect(3)
Thunder Bay-Dryden	direct indirect(2)	direct indirect(2)	direct indirect(2)
Thunder Bay-Sioux Lookout	direct	direct indirect(1)	direct
Thunder Bay-Terrace Bay	direct	direct indirect(1)	direct indirect(1)
Thunder Bay-Geraldton	indirect(1)	direct indirect(1)	direct indirect(1)
Thunder Bay-Fort Frances	indirect(1)	indirect(1)	direct indirect(1)
Thunder Bay-Red Lake	indirect(4)	indirect(4)	indirect(1)
Sioux Lookout-Kenora	direct	direct	direct
Dryden-Kenora	direct	direct	direct
Dryden-Fort Frances	direct	direct	direct
Dryden-Red Lake	direct	indirect(1)	indirect(1)
Terrace Bay-Geraldton	direct	direct	direct
Fort Frances-Red Lake	indirect(2)	indirect(2)	indirect(2)

Note: the numbers in the brackets represent the number of stops for the indirect flights.
Source: *Official Airline Guide*, July 1983, 1986 and 1989 issues.

Similarly as in the case of other quality indicators, service convenience measured by flight directness improved in most markets.

5. SUMMARY AND CONCLUSIONS

This paper examined the issue of airline service quality in Northwestern Ontario betwen 1984 and 1989. The analysis focused on the following quality indicators: the type of plane used; flight frequency and seat availability; the availabilty of 'same day' return service; and flight directness. With only few exceptions, most analysed city-pair markets experienced improvements in service quality. Thus, the concerns that deregulation would negatively affect quality of service in smaller, remote communities did not materialize in Northwestern Ontario.

NOTES

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1. Bill C-18 divided the country into two areas: the southern-deregulated and the northern-regulated zones. The communities which are discussed in this paper lie in the southern, deregulated zone. (The dividing line separating the southern and northern domestic sectors is defined by the 50th parallel from the Atlantic Ocean to the Ontario-Manitoba boundary to the 53rd parallel at the Manitoba-Saskatchewan boundary, the diagonal joining the 53rd parallel at the Manitoba-Saskatchewan boundary to the 55th parallel from the Saskatchewan-Alberta boundary to the Pacific Ocean (Statistics Canada, 1986, p.207)).

2. DHT-20 = Boeing Canada DASH-8[20 seats]; BE9-15 = Beechcraft C99 Airliner -[15 seats]; 737-115 = Boeing 737 [115 seats]; DH8-32 = Boeing Canada DASH-8 [32 seats]; J31-18 = British Aerospace Jetstream 31 [18 seats]; CNA-22 = Cessna [22 seats]; PA6-6 = Piper Aerostar [6 seats]

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An Update on the Impacts of Regulatory Reform on Scheduled Air Passenger Service in Atlantic Canada

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1.0 INTRODUCTION

This paper presents the results of on-going research being conducted into the impact of regulatory reform on scheduled commercial air services in Atlantic Canada (Bisson, Rogers: 1988). Specifically, the study focuses on intra-regional air passenger service to points within the four Atlantic Provinces, namely New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland. Included in the analysis were direct and one-stop inter-regional services to four external gateways (Montreal, Toronto, Ottawa, and Boston) which provide connections to the rest of Canada, the United States, and other international destinations.

The analysis provides a snapshot of the routes, frequency of flights, aircraft employed and direct operating costs encompassed by the scheduled air transportation system at the end of 1984, 1987 and 1990. The authors acknowledge that the use of this methodology has resulted in the omission of transient activity occurring during the interim periods, particularly with respect to service by independent carriers such as Intair. This airline is included in the 1987 figures at which time it served the region under the name Inter-Canadian and operated under the Canadian Airlines umbrella. Subsequently, Intair operated independently but withdrew from Atlantic Canada before the end of 1990 when the service statistics were gathered. However, this does not significantly detract from the purpose of this paper which is to present some general trends and performance statistics for the industry following the removal of various economic regulatory restrictions.

The new National Transportation Act (Bill C-18) which came into effect on January 1, 1988 has substantially removed previous economic regulatory restrictions on the air transportation industry. In anticipation of this reform, the industry has essentially been operating under the new rules since 1984. Hence, the actual 1984 air transportation system was selected to represent the pre-deregulation period for the Atlantic Region.

1.1 OBJECTIVES

One of the initial concerns surrounding the deregulation of the air passenger transportation industry was the possible loss or reduction of service by the major carriers to various low density markets. This is a vital concern to the Atlantic Provinces which are comprised of several relatively small population centres, but which depend heavily on air transportation to support a strong export trade with Central Canada and the Eastern Seaboard of the United States.

The primary objectives of this study were:

1. to highlight the evolution of air services from various centres in Atlantic Canada to various other points within the region as well as to critical external gateways;

2. to compare the current level of output generated by the air transportation system to that which existed in the pre-deregulated environment;

3. to quantify the carriers' total direct costs of operating the network;

4. to evaluate the efficiency of the network in terms of fuel consumption per unit of output.

2.0 Short Term Changes to Air Service in Atlantic Canada (1984-90)

There have been dramatic structural changes in the air transportation industry in Atlantic Canada since regulatory reform was initiated in 1984. The most dramatic of these changes was the acquisition of Eastern Provincial Airways by CP Air and the subsequent formation of a new national carrier, Canadian Airlines International (CAIL), following the merger of CP Air and Pacific Western Airlines. These events have firmly established Air Canada and CAIL as the two major trunk carriers.

Atlantic Canada has seen the rationalization of some services by the national carriers but this has generally been replaced by service offered by their regional affiliates, namely Air Nova, the Air Canada partner; and Air Atlantic, the Canadian Airlines partner. These two regional carriers have taken advantage of the less restrictive environment by establishing hub-and-spoke networks and employing smaller aircraft, namely the Dash 8 turbo-prop and BAe 146 regional jet aircraft, to match capacity to the many low density markets in the Atlantic Provinces.

The impact of this increased use of smaller aircraft on service levels to specific points was determined via a detailed analysis of direct flights, one-stop same-plane services, total frequencies and "same day" return services between various city-pairs. An analysis of the departing seats between various origin-destination pairs was also performed to determine whether seating capacity had suffered as a consequence of the substitution of aircraft.

2.1 Flight Frequency and Departing Seat Analysis (1984-1990)

One of the most obvious results of regulatory reform has been the tremendous increase in the number of flights offered by the airlines. Indeed, on a system-wide basis, weekly frequencies jumped from just over 1000 in 1984, to more than 1400 in 1987, and then to almost 2100 flights per week in 1990. Thus, during the six years since deregulation, flights have increased by more than 100 percent!

The system-wide figures are important in identifying overall trends but one must also consider the situation in specific markets, between particular city-pairs. Therefore, a comparison of the total number of arrivals and departures per week at each airport in the region was performed for each of the three study years. Halifax clearly dominated the results, with approximately 680 departures per week in 1990 or more than triple the activity of its nearest competitor, St. John's, which had approximately 190 departures per week. These findings were generally in line with results obtained three years ago indicating that Halifax was rapidly evolving as a "mini-hub" for intra-regional traffic (Bisson, Rogers : 1987).

Figures 1 and 2 provide a closer look at the intra-regional activity by illustrating the changes in the frequency of direct flights from five major centres within the region to Halifax. Figure 1 shows that the frequency of direct flights has increased significantly from each of the five centres with the number more than doubling between 1984 and 1990, for all centres except St. John's. Figure 2 provides a somewhat different picture by indicating a general stabilization in the number of departing seats between 1987 and 1990, except for Moncton which benefited from the introduction of BAe 146 jet service to Halifax. Nevertheless, all of the centres have experienced an increase in seating capacity to Halifax since 1984.

When analyzing service from Atlantic Canada to the four external gateways direct and one-stop, same-plane service were combined so as to take shared services such as those between Fredericton and Saint John into consideration. However, indirect services requiring passengers to change planes was not included as this type of routing generally provides a lower level of service. Figures 3 and 4 present the frequency of direct and one-stop flights as well as the number of departing seats from each of the major centres. Once again, Halifax clearly stands out both in the number of frequencies and in the number of departing seats. In terms of destinations, Toronto and Montreal are best represented with service to Ottawa and Boston varying dramatically depending on the city of origin.

DAILY DIRECT FLIGHTS
DESTINATION: HALIFAX

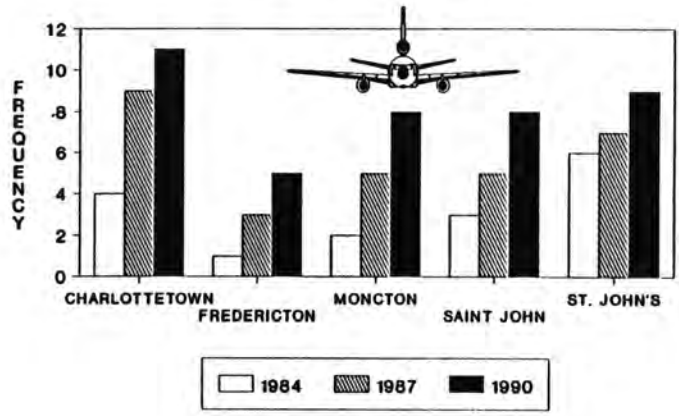
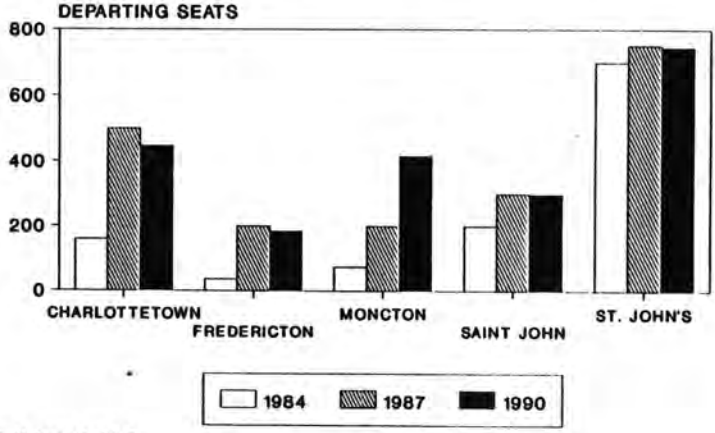


Figure 1

DIRECT FLIGHTS - DEPARTING SEATS
DESTINATION: HALIFAX



As at Dec.31, 1990

Figure 2

DAILY FLIGHTS TO EXTERNAL GATEWAYS
DIRECT & ONE-STOP/SAME PLANE SERVICE

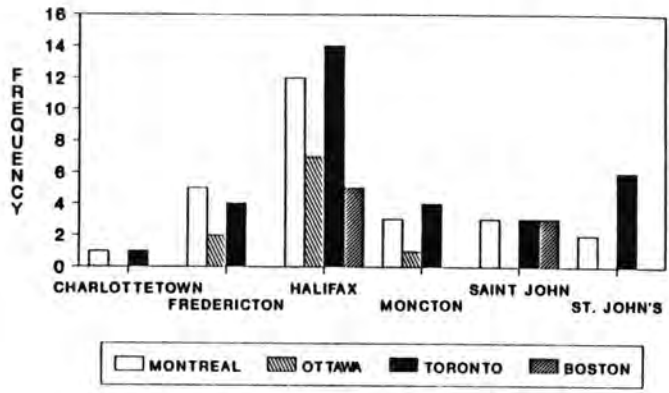
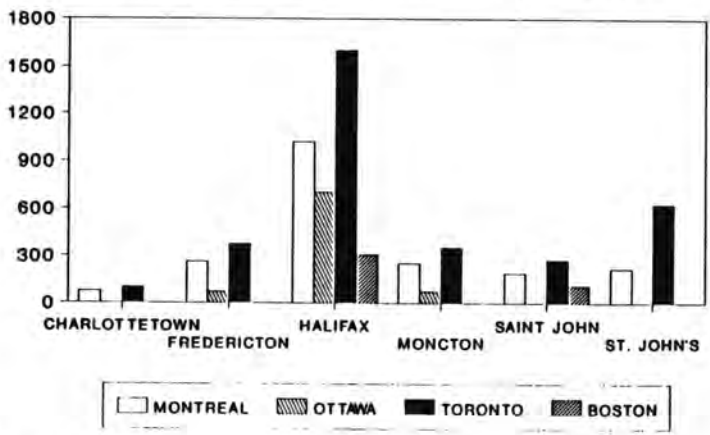


Figure 3

DEPARTING SEATS TO EXTERNAL GATEWAYS
DIRECT & ONE-STOP/SAME PLANE SERVICE



As at Dec.31, 1990

Figure 4

2.2 Same Day Return Flights

Same-day return flights are another indicator of the level of service offered in a particular market. This is of greatest concern to commuters or business travellers wanting to leave on a morning flight, complete their business dealings at the destination and return home the same night so that the next business day will not be disrupted.

The analysis which was carried out was similar to that carried out by Bisson and Rogers (1988), whereby it was assumed business travellers would require at least five hours to conduct business at the destination before returning home. This meant that a particular flight or connection would have to arrive at the destination before 12:30 PM local time.

The analysis was performed incorporating both direct and indirect flights leaving major centres in Atlantic Canada for various important destinations and returning later the same day. Table 1 shows that while Halifax is receiving the best return service, all centres except Saint John have experienced dramatic improvements since 1984. It is interesting to note that while there are three flights per day from Saint John to Boston only one allows for a satisfactory same-day return flight for the business traveller. In fact, there is at most one return connection offered per day to Boston from any city in New Brunswick or Newfoundland.

Table 1
Same-Day Return Flights

ORIGIN	DESTINATION	1984	1987	1990	Change
Charlottetown	Halifax	1	4	4	+3
	Montreal	1	2	4	+3
	Ottawa	0	2	2	+2
	Toronto	1	2	2	+1
	Boston			3	
Fredericton	Halifax	1	1	2	+1
	Montreal	1	1	2	+1
	Ottawa	1	1	2	+1
	Toronto	1	1	3	+2
	Boston			1	
Halifax	Montreal	2	3	4	+2
	Ottawa	2	2	3	+1
	Toronto	3	5	4	+1
	Boston			3	
Moncton	Halifax	1	2	3	+2
	Montreal	2	2	4	+2
	Ottawa	1	2	2	+1
	Toronto	2	2	3	+1
	Boston			1	

Table 1 (Cont'd)
Same-Day Return Flights

Saint John	Halifax	1	1	2	+1
	Montreal	2	2	2	-
	Ottawa	1	1	1	-
	Toronto	2	2	2	-
	Boston			1	
St. John's	Halifax	3	2	6	+3
	Montreal	2	2	3	+1
	Ottawa	1	2	2	+1
	Toronto	3	2	3	-
	Boston			1	

2.3 Analysis of Service To/From Small Airports

Already mentioned have been the concerns over the possible loss of service to low density markets. Table 2 addresses this concern by showing the changes in direct service offered to and from Halifax from various smaller population centres. Although the results are somewhat conflicting, they are generally positive. Looking first at the frequency of direct flights, it appears that service levels have seen vast improvements since 1984, particularly in Deer Lake, Stephenville and Yarmouth, all of which saw the introduction of direct service to Halifax. The number of departing seats has also seen fairly substantial improvements though not increasing at the same rate as direct flights. Sydney has seen mixed results with seat capacity actually declining since 1987.

These results are indicative of a trend towards the substitution of some or all of the national carriers' larger jets by turbo-prop and regional jet aircraft operated by the regional airlines. This provides better matching of capacity to the market and has yielded as many as three or four direct flights per day to and from Halifax where there was little or no direct service previously. This greatly improves the number of destinations which can be reached from these smaller centres by offering more frequent service and connections from the regional hub. It also increases the potential to schedule same-day return flights to other destinations which would not have been possible prior to deregulation when the national carriers only served most of these communities with one flight per day.

Table 2
Direct Service - To/From Halifax

		DAILY DIRECT FLIGHTS			DEPARTING SEATS		
ORIGIN	DESTINATION	1984	1987	1990	1984	1987	1990
Deer Lake	Halifax	0	3	4	0	194	188
Stephenville		0	1	2	0	37	114
Sydney		7	10	12	530	599	484
Yarmouth		0	1	4	0	37	148
Halifax	Deer Lake	1	3	7	110	194	299
	Stephenville	0	1	3	0	37	151
	Sydney	6	9	11	430	479	447
	Yarmouth	1	2	4	100	74	148

2.4 Service to New Destinations

The development of a regional hub-and-spoke network combined with the use of smaller aircraft within the region has not only allowed the regional carriers to offer greater frequencies to existing points within the system, but has also allowed the introduction of service to new communities. Table 3 provides a comparison of destinations served during the study period and indicates that five new destinations are directly accessible from points within Atlantic Canada. Meanwhile, service to another destination, St. Leonard NB, is slated for introduction by Air Nova in early 1991.

Table 3
Comparison of Destinations Served Directly From Points Within the Atlantic Provinces

DESTINATION	1984	1987	1990
Bathurst, NB			X
Boston, MA	X	X	X
Charlo, NB	X	X	X
Charlottetown, PEI	X	X	X
Chatham, NB	X	X	X
Churchill Falls, NFLD	X	X	X
Deer Lake, NFLD	X	X	X
Fredericton, NB	X	X	X
Gander, NFLD	X	X	X
Goose Bay, NFLD	X	X	X
Halifax, NS	X	X	X
Iles de la Madeleine, PQ			X
Moncton, NB	X	X	X
Montreal, PQ	X	X	X
Ottawa, ON	X	X	X
Portland, ME			X
Quebec City, PQ			X
Saint John, NB	X	X	X
Stephenville, NFLD	X	X	X
St. John's, NFLD	X	X	X
St. Pierre			X
Sydney, NS	X	X	X
Toronto, ON	X	X	X
Wabush, LAB	X	X	X
Yarmouth, NS	X	X	X
Total Points Served	20	20	25

3.0 System Cost and Efficiency

The previous section showed that frequencies have increased dramatically in the wake of regulatory reform, gaining approximately 40 percent between 1984 and 1987 and another 46 percent between 1987 and 1990. This compound growth resulted in a 105 percent increase in total frequencies on a systemwide basis.

Figure 5 shows the increase in total number of flights as well as the changes which have taken place in the composition of the aircraft fleet since deregulation. This clearly illustrates the dramatic shift towards the use of smaller aircraft, with the Dash 8 turbo-prop aircraft now providing just over one-half of all flights offered in the region. Indeed, it has been the use of these smaller aircraft by the regional carriers which has allowed the airlines to more than double the frequency of flights offered throughout the system, while maintaining reasonable load factors. Figure 5 also shows that the total frequencies produced by the regional carriers, comprised of those flights made by the Dash 8 and BAe 146 aircraft, represented 70 percent of the total flights offered in 1990.

Figure 6 presents a graphical comparison of the total available seat miles generated in 1990 relative to 1984 and illustrates the proportion contributed by each type of aircraft. This figures shows that the true system capacity, as measured by the available seat miles (ASMs) generated, increased at slower rate than total flights due to the proliferation of the smaller aircraft. Total annual ASM's in 1990 were just over 3.4 Billion, an increase of 12 percent from 1987, and up 49 percent from 1984. It is interesting to note that the regional carriers offered 70 percent of the flights in 1990 but only generated 30 percent of the total available seat miles.

This phenomenon can be explained by a couple of factors. The number of available seat miles is a function of both the seating capacity of the aircraft as well as the stage lengths flown. An analysis of the average stage lengths flown by each type of aircraft indicated that the smaller aircraft were being utilized for shorter flights. In fact, the average stage length for the Dash 8 turbo-prop aircraft was approximately 200 statute miles and less than 400 miles for the BAe 146 regional jets. Meanwhile, the major carriers were found to be using their larger jets, those with seating capacities for 100 or more passengers, for longer flights. The analysis showed that the average stage length for the DC9 and Boeing 737 aircraft had increased from approximately 400 to 500 miles, in 1984 and 1987, to over 600 miles by 1990 following the introduction of the mid-range BAe 146 jets. Even larger jet aircraft such as the Boeing 727 and 767, as well as the Lockheed L1011 are generally only used between Toronto and Halifax. This observation would seem to confirm that the major carriers are gradually withdrawing their larger aircraft to the higher density, long haul routes while the regional carriers are effectively filling the void by providing service on the shorter, lower density intra-regional routes using their smaller aircraft. However, it should be noted that the regionals are also fairly active in providing inter-regional flights particularly with the new BAe 146 jets.

COMPARISON OF ANNUAL FLIGHTS
BY AIRCRAFT TYPE
(1984 & 1990)

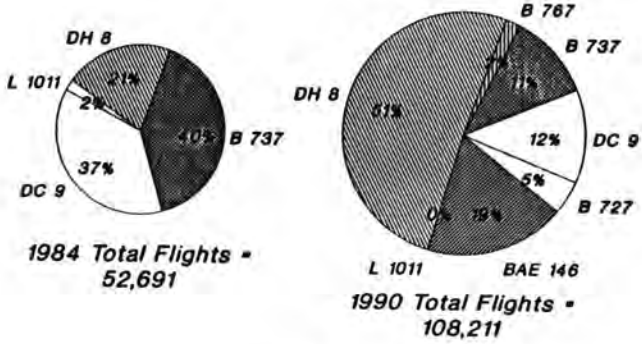


Figure 5

COMPARISON OF ANNUAL ASMS
BY AIRCRAFT TYPE
(1984 & 1990)

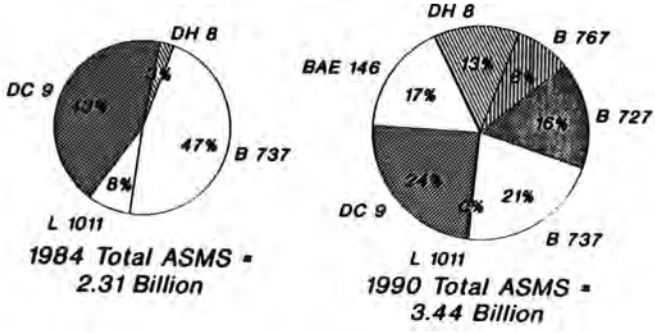


Figure 6

3.1 Comparison of Total and Unit Operating Costs (1984-1990)

Another objective of this study was to determine whether deregulation had resulted in an improvement in the efficiency of the network by allowing the airlines to have greater flexibility in matching particular types and sizes of aircraft to the specific markets being served. One performance measurement used was a comparison of the total annual direct operating costs of the system for 1984, 1987, and 1990.

The total direct operating costs were derived by reconstructing the actual network and schedule which existed for each of these years. Block times were estimated for each flight and multiplied by an hourly rate which included crew costs and direct maintenance costs. Landing fees, general terminal charges, and other cyclic maintenance costs were also calculated for each flight. Fuel costs were calculated separately, including both a cyclic and hourly portion, to approximate the fuel consumed while manoeuvring on the ground as well as during the flight. Aircraft ownership costs were not included in this comparison.

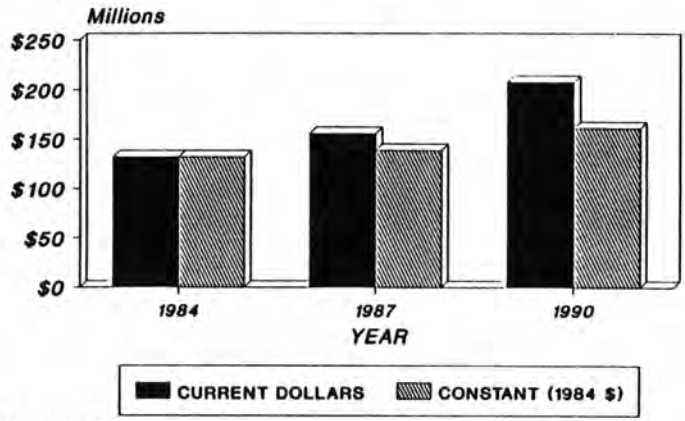
Figure 7 shows the results of the costing analysis, displaying the total annual operating costs in current dollars as well as in real terms (constant 1984 dollars). During this period the total direct operating costs of the system increased by 58 percent to approximately $ 208 million, in current dollars. This was somewhat greater than the 49 percent increase in total available seat miles. As a result, the average direct cost per available seat mile increased from 5.7 cents to 6.0 cents in current dollars, as shown in Figure 8.

However, in real terms, the total direct operating cost of the system increased by only 23 percent, or less than one-half the increase in ASM capacity. This was primarily due to the fact that the average fuel price declined by approximately 26 percent, in real terms, during the period. It should be noted that fuel prices did increase rapidly during the last quarter of 1990 but were diluted due to the fact that the average price for the whole year was used in this analysis. As a result, the average cost per ASM (in constant 1984 dollars) actually declined from 5.7 cents in 1984 to 4.5 cents in 1987, coincident with significantly lower fuel prices, but then increased slightly to 4.7 cents per ASM in 1990.

The lower costs per available seat mile, in real terms, would seem to indicate that the network was more efficient. This is somewhat misleading, however, as it is clear that the dramatic fluctuations in fuel prices were largely responsible for the reduction in the average cost per seat mile. One must also be careful not to assume that the airlines were more profitable as a result of the reduced operating costs, as this analysis does not take changing load factors into account nor does it address the changes which may have taken place in revenue yields due to changes in fares. The effects of deregulation on air fares in the region is currently also being investigated as a separate research project.

The average costs per available seat mile for 1990 are shown for particular aircraft types in Figure 9. The ratio of the direct operating cost to the fully allocated cost per seat mile may be misleading due to the omission of aircraft ownership costs from the direct operating costs. However, the figure provides a valid comparison of the unit costs among these aircraft. It is evident that the larger seating capacities and longer stage lengths flown by both the DC 9 and Boeing 737 aircraft provide economies of scale in reducing the average cost per seat mile of these aircraft relative to those employed by the regional airlines.

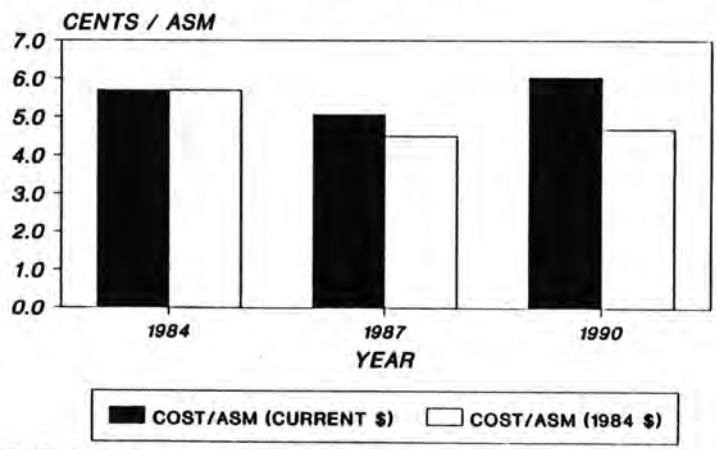
COMPARISON OF TOTAL DIRECT COSTS (1984 - 1990)



Note: Does not include aircraft ownership costs.

Figure 7

COMPARISON OF AVERAGE DIRECT COST / ASM (1984 - 1990)



Note: Does not include aircraft ownership costs.

Figure 8

3.2 Environmental Impacts

Commercial air transportation as a whole is becoming more "environmentally-friendly" particularly in the area of aircraft noise. Newer stage III aircraft are being used to replace the older and considerably louder stage II aircraft as part of many airlines' regular fleet replacement programs. Many regional airlines' use of turbo-prop aircraft has also tended to result in a reduction in aircraft noise emissions relative to the use of their turbo-fan (jet engine) cousins.

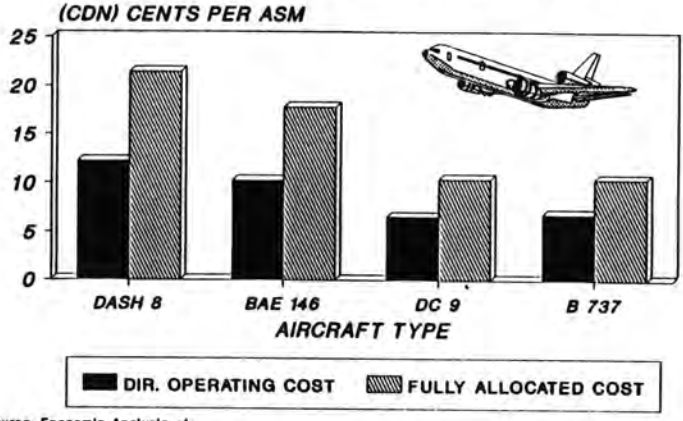
Fuel efficiency of vehicle or aircraft fleets is becoming an increasingly important issue as the transportation sector as a whole is a primary consumer of non-renewable fossil fuels and whose exhaust emissions are a major contributor to the "green-house effect". However, if for no other reason, transportation firms are very interested in improving the fuel efficiency of their fleets as fuel represents a large component of their total operating costs.

Figure 10 presents a comparison of the fuel efficiency of a few of the major aircraft types used in the air transportation system in Atlantic Canada. The lines on the graph represent the fuel efficiency of the aircraft over a range of stage lengths (in statute miles), while the bars show the estimated fuel efficiencies being achieved based on the average stage lengths for which these aircraft were employed in this region.

Both the Dash 8 and BAe 146 are state-of-the-art aircraft and represent the mainstay of the regional airlines current fleet. Meanwhile, the DC 9 has proven to be a very cost effective aircraft on various routes in the region and has long been a "workhorse" of the Air Canada fleet. The Dash 8 turbo-prop aircraft provides the largest number of flights in the region, and this graph shows that for any given stage length it offers the best fuel efficiency as measured by the ratio of available seat miles produced per litre of fuel. However, its lower speed and seating capacity make it impractical particularly on long haul or high density routes. The DC 9 fares relatively well in terms of fuel efficiency due to its 100 seat capacity and 2 engine configuration. In fact, it provides approximately the same fuel efficiency as the Dash 8 when one compares them based on the typical stage lengths at which they are employed; approximately 200 miles for the Dash 8 and 600 miles for the DC 9. The BAe 146 does not compare as well based on fuel efficiency, however its speed and seating capacity are used to fit particular niches whose stage lengths or market demands may be considered too large for turbo-prop aircraft yet too small to be served economically by larger jets.

In terms of the overall air transportation system in Atlantic Canada it was found that the fuel efficiency improved by more than 5 percent between 1984 and 1987 with the increased use of the turbo-prop aircraft. Between 1987 and 1990, the use of turbo-prop aircraft continued to expand by over 100 percent, but due in part to the introduction of the BAe 146 on the mid-range routes, the overall fuel efficiency of the network declined somewhat. Nevertheless, the average fuel efficiency currently stands at 11.8 ASM / Litre or a marginal 0.5 percent better in 1990 than in 1984.

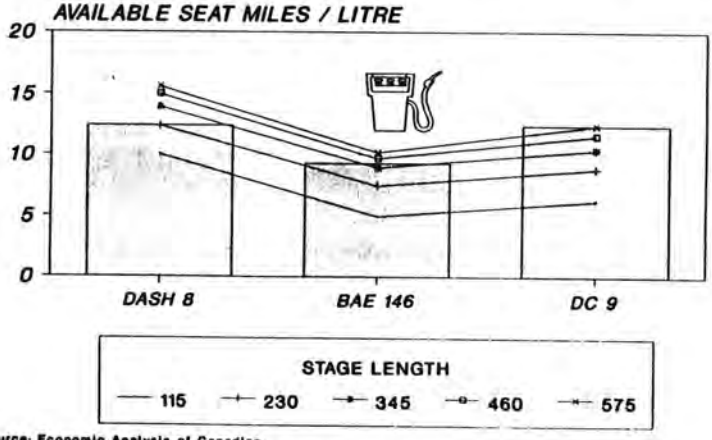
COSTS PER ASM (1990)
FOR SELECTED REGIONAL AIRCRAFT



Source: Economic Analysis of Canadian Regional Transport Aircraft

Figure 9

FUEL EFFICIENCY COMPARISON (1990)
FOR SELECTED REGIONAL AIRCRAFT



Source: Economic Analysis of Canadian Regional Transport Aircraft

Figure 10

4.0 Conclusions

Air transportation is continuing to evolve in Atlantic Canada following the introduction of a more market-oriented regulatory policy. Some centres in the region briefly saw competition by three regional airlines: Air Atlantic, Air Nova, and Intair, compared to one prior to deregulation. Following Intair's withdrawal from the region, two regional carriers both in partnership with the two major carriers: Air Canada and Canadian Airlines.

Atlantic Canada has generally witnessed a dramatic increase in the frequency of flights since deregulation due largely to the use turbo-prop aircraft. At the same time, Halifax has continued to evolve as a regional hub. Together, these factors have contributed to improvements for many communities in terms of the number of accessible destinations both within the region as well as to external gateways. In some cases, this has meant a substitution of a single jet service offered by a major carrier to more frequent turbo-prop flights by the regional carriers. This has also translated into an improvement in the number of same-day, return flights at many airports.

Volatile fuel prices have influenced the cost performance of the network with direct operating costs declining in response to fuel prices in 1987 but then increasing again by 1990. Also, it was found that while the average cost per seat mile have increased since 1984 when measured in current dollars, the cost actually dropped in real terms.

The fuel efficiency of the system as a whole has remained virtually unchanged compared to 1984. However, the airlines have tended to better balance the speed and fuel efficiency of their fleets to the stage lengths served.

It remains to be seen how the air transportation system in Atlantic Canada will continue to evolve in the face of an increasingly turbulent environment. Reduced consumer and business spending due to the recession, the GST, airport privatization, and the federal government's proposed cost recovery policy all pose concerns for domestic air carriers. With the future of international and transborder air travel in question it also remains to be seen how Canada's major carriers will seek to align themselves in order to compete in a more global or at least continental transportation market. This may also affect the future of air transportation in Atlantic Canada via the alliances which have been established between the regional and national carriers.

Indeed, the next update to this research may present far different results.

AIR TRANSPORTATION DEREGULATION : QUO VIVADIS?

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University of New Brunswick

The deregulation of the U.S. air transportation system has turned out somewhat differently than its strongest proponents predicted over a decade ago. They foresaw a period of turbulence during which the pre-existing national carriers would make those adjustments necessitated by the now unfettered competitive environment. The concensus (at least among economists) was that a competitive industry providing low cost, high quality air transportation would emerge following the restructuring.

At the outset, the policy appeared to be on track. New carriers emerged, price competition intensified, and traffic volumes increased. And when negative profits began to emerge, some analysts suggested that they were the combined result of the 1979 rise in fuel prices and the 1981 recession. They were thus viewed as a temporary set-back for the policy. However, the weak financial performance of the carriers continued through the 1980s. Bankruptcies and mergers resulted, giving rise to speculation as to the future of the policy.[1] The trend continues into the 1990s (Ott 1990). We look at the U.S. deregulation experience, first focusing on the issues of concentration and hubbing. Then we assess why the industry is less contestable than predicted and finally, we address policy alternatives.

1. INDUSTRY CONCENTRATION

By the mid-80s, concerns were being expressed about the direction in which the industry was evolving. A prime concern has been the trend toward industry concentration (some would say reconcentration), and the emergence of a variety of "anti-competitive" actions by some firms. Viewed from a different perspective, these actions would be considered as nothing more than the continuation of the non-price competition which characterized the regulatory period, albeit in a different form. In the regulatory period, such competition was accomplished largely through service scheduling and the quality of in-flight amenities. In the new environment, frequent flyer programs, computer reservation systems, and airport presence protected through

[1] For an overview of some of the debate concerning reregulation, see Thomas (1990).

the control of both landing slots and internal airport space have all become competitive tools.

The extent to which the proposition about reconcentration is true depends both on one's perspective and the basis of comparision. If one were to use the number of firms in the industry as the measure, reconcentration has occurred (Brenner 1988). Following deregulation, the number of firms in the industry increased. Through mergers and bankruptcies, the number has declined once again. A variety of authors have considered this question and documented the mergers which have occurred (Jordan 1988). Others have constructed Herfindal-Hirschman indices (HHI) by airport over time, and observed that the indices have tended to rise. Such authors as Flint (1988) have argued that this implies increased concentration in the industry. In reality, it appears to document only the increasing dominance of carriers at their various hubs.

However, when the issue is viewed from the perspective of the individual city-pair markets, the reconcentration of the industry may well be more illusion than fact. Taneja (1976) distinguishes between the total number of competitors in an individual city-pair market and the number of *effective* competitors. He defines an effective competitor as one which captures at least ten per cent of the revenue traffic on the specific link in question. Using this definition, and focusing on the twelve month period ending Sept. 30, 1974, he found that only 11 of the top 100 city-pair markets in the U.S. had four or more effective competitors. The most competitive market was Los Angeles to Honolulu which had 6 effectively competitive firms. In most markets 2 or 3 firms was the norm. It is perhaps this kind of analysis which has led Kahn (1988) to suggest that there may well have been an increase in competition at the specific link level. Because it is at the level of the individual link that fares and other dimensions of competition are determined, it is here that the HHI (or any other measure of concentration) should be calculated.

In the absence of up-to-date data on the traffic volumes of the various carriers on specific links, we decided to utilize capacity shares as a proxy. Sixteen links were selected from the 1974 Taneja data so that longitudinal comparisions could be made. The capacity figures were developed using the Official Airline Guide for the relevant periods together with aircraft seat capacities found in Aviation Week and Space Technology. One difference between the 1990 figures and those for 1984 must be noted. The 1990 data include the capacities of those smaller airlines engaged in code-sharing with larger carriers. It was not possible to adjust the 1984 data to reflect code-sharing. Thus the results for the earlier year may overstate the

amount of real competition.

The changing pattern of competition as measured by the total number of competitors on these 16 links is shown in Table 1. When the 1990 figures are compared with those for 1974, 7 markets reveal an increase in the number of firms while 8 show a decline. The other market reveals no change. The comparision between 1984 and 1990 suggests the number of firms increased in 4 markets, fell in 9 and remained unchanged in 3.

Data related to the number of effective competitors are shown in Table 2. Between 1974 and 1990, 5 links experienced a growth in the number of effective competitors, 2 experienced a decline and the balance remained unchanged. When the comparision is made between 1984 and 1990, the results are 6, 5 and 5 respectively. These 1990 data, of course, include Eastern Airlines which had a presence on four of the links in question. If Eastern is arbitrarily deleted from the analysis, the number of links where effective competition increased is reduced to 4, while the number on which it fell rises to 7. The number of links where there was no change remains as before.

Finally, Hirschman-Herfindal Indices were constructed for each of these links for 1984 and 1990 to permit further consideration of the changing levels of concentration.[2] The results are set out in Table 3. In the case of the ten largest markets (ranked by 1974) the index rose in only three during the period under review. The 16 markets split evenly with 8 rising and 8 falling. While the inclusion/exclusion of Eastern from the 1990 capacity estimates made some difference to the specific values of the Index, it made no difference in the direction of change for these markets.

One must conclude that there is no clear pattern concerning the allegation of increasing levels of concentration. However, before a definitive answer on the question is possible, additional research at the link-specific level must be carried out. It should focus on the changing patterns of competition in the medium and smaller sized markets.

2. AIRPORT HUBS

Firms have undertaken a variety of initiatives designed to maintain, or perhaps even to expand, their role in the industry. In this category, one would place the dramatic changes in their route structures into the hub and spoke

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[2] It was not possible to utilize the Taneja data to construct HHI's for 1974.

systems. Under this structure, passengers are routed through a central hub in the course of their journey from origin to destination. This allows the carrier to increase load factors and possibly frequencies at the expense of the passenger who must now spend more time in travel between the same end points. Benefits accrue to the carriers in the form of increased revenues due to the retention of more passengers on-line and in the form of cost reductions due to consolidation of operations.

It has been suggested that the hub-and-spoke operations have impacted negatively on the competitive structure of the industry through effects on concentration levels at hub airports. For example, Phillips (1985) documents concentration levels at large U.S. hubs and concludes that the level of concentration is high. In reaching that conclusion, however, that analysis assessed 2-firm and 4-firm concentration ratios for individual airports. We have found that concentration levels are not so great if airports are grouped by zone. Our results appear as Table 4.

Airlines landing at any one of the airports in a zone have access to that market. For example, JFK, LaGuardia, and Newark all serve the same market area but each of these airports is dominated by a different carrier. The Herfindahl-Hirschman Index calculated for each of these airports is significantly higher than that for the airports considered as a single group for both 1984 and 1988. Wealso found this to be true at the Chicago airports and those serving the Washington, D.C. area.

Some carriers solidified their hub dominance between 1984 and 1988 as demonstrated by Delta at Atlanta. On the other hand, the dominant carrier changed at some hub airports over this period. This turnover may be seen in Table 4 for both Los Angeles and Boston and reflects route restructuring. Overall, it is difficult to assess the impact of the hub-and-spoke system on industry concentration until an analysis is carried out for all airports in the system which serve a single market zone as well as for those which have experienced a turnover in carrier dominance. Our results suggest that the hub-and-spoke system may not have impeded competition to the extent suggested by others (e.g. Flint 1988; Phillips 1985).

3. DEREGULATION SURPRISES

The central objective of deregulation was the establishment of a highly competitive airline industry. That industry was to provide high quality air service at low fares. The phrase "highly competitive industry" 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, we implicitly think of the perfectly competitive model and the

equality between price and marginal cost. On the other hand, many are concerned about what might be called competitive (some would say anti-competitive) activities. While the central theme here is the evolution of the industry under deregulation, there is much more involved than a tour of recent industry history. It is necessary to begin by briefly considering the notion of a "competitive industry" in a broader sense.

McNulty (1968) 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" (monopolistic). It would seem more appropriate to consider them as competitive and rent-maximizing 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. What we fail to recognize is McNulty's point (page 641) 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. It is competitive activity which better characterizes the industry over the past decade. It is instructive to ask why the 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. Parallel examples could be found in other industries as well (eg. Steven Job with Apple/MacIntosh computers).

A more realistic interpretation of the events which have occurred in the deregulated industry is found in the property rights literature. 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 elsewhere that there can never be a complete specification of property rights where the service sector is concerned (Brander et al. 1989). 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 a rising market supply of effort curve, 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 the limited availability of passengers and firm activities 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 rivals costs, 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 (e.g. Kahn 1988), 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.

4. POLICY ALTERNATIVES

Whatever their origins, these developments in the deregulated environment have led to a renewed debate over the policy. In the extreme, there are calls for the reregulation of the industry. Even among supporters of deregulation, there have been calls for the disapproval of future merger proposals. Two other policy options exist. One of these would focus on improving the performance of the deregulated industry by generating additional competition. The other would enhance competition by adopting an open skies policy.

4.1 Reregulation of the Industry

There appears to be growing support for this policy option at least among certain members of the U.S. Senate. Among previous supporters of the policy, Dempsey (1987), for example, feels that the question is simply one of when the reregulation will occur. Brenner (1988) feels the policy has been a failure from the outset. While these voices are in the minority, they do attract an audience (e.g. Thomas, 1990). Thus the alternative has to be considered.

Reregulation of the airline industry offers no guarantees that we can do it better the second time around. The arguements concerning regulatory policy failures have been well rehearsed and will not be repeated here. Suffice it to say that such a policy alternative should be approached only as a last resort.

4.2 Enforced Competition

That there has been a spate of mergers in the airline industry in recent years is a matter of record. That there will be further mergers in the years immediately ahead is a matter of widespread agreement assuming, of course, that such proposals are not disapproved by the U.S. Department of Justice. Before one accepts the notion that such mergers are perforce "bad", one should ask why the mergers have taken place.

A variety of explanations exist. One possibility is that

they are aimed at getting access to airport facilities and thus making the expansion of an airline's geographic coverage possible. A second possibility is that airlines are using the merger as a tool to increase airport access within their existing network so as to obtain additional landing slots and/or internal airport space at congested hub airports. In this case, the objective might be to increase hub dominance and thereby strengthen one's competitive position. On the other hand, the action may be taken to weaken the position of a rival firm, in effect breaking down a rival's hub dominance. A third possibility is that the airline seeks efficiency gains through expansion. The last-mentioned appears unlikely except, perhaps with reference to the smaller carriers.

It is generally agreed that there are few, if any, economies of scale in the airline industry. This rules out at least one potential explanation for the spate of mergers. It should be noted in this regard, however, that there do appear to be economies of density. These might be used as an explanation of the acquisitions made by some of the smaller carriers operating outside the major hub network.

Airport access would seem to be a powerful motive for merger activity. Therefore, as a general rule, a policy of enforced competition should be ruled out. Still, there may be a role for anti-trust activities provided that they contribute to the long-run financial health of the industry. The point might best be made by focusing on two examples. The first of these involves a potential merger in which one of the two firms faces irreversible financial difficulties. In the long-run, such a firm would most likely collapse in any case. The dimunition of competition is not a realistic test for the approval of the merger in such a situation. Competition in the long-run would diminish in any case. Only in situations where both parties to a proposed merger are likely to survive in the long-run and where the merger would significantly reduce competition should consideration be given to its disallowance. The other area for potential anti-trust disallowance of industry activities is related to the question of airport dominance. When the assets of Eastern Airlines were auctioned as part of the bankruptcy proceedings, United Airlines submitted the highest bid ($35.5 million U.S.) for 67 slots and 5 gates at Washington's National Airport. The U.S. Department of Justice blocked that sale on anti-trust grounds, and the package went to Northwest Airlines when it matched the United bid.[3] As above, this may constitute an appropriate use of the anti-trust provisions. Beyond these two

[3] As reported in The Globe and Mail, Saturday, Feb. 16, 1991.

situations, the use of anti-trust law to promote competition constitutes a ploicy of enforced competition with all of its cost-escalating consequences. Such an approach is to be avoided.

4.3 Improving the effectiveness of current policy

An alternative to interference with the industry would be to improve the competitive environment, identifying and correcting specific problem areas. Current policy has resulted in increased concentration and a lack of contestability, raising concerns about the potential exploitation of monopoly profits. It appears, however, this ability to earn monopoly rents is more the consequence of certain *institutional* arrangements than a result deregulation per se. Primary among these arrangements would be the mechanism used in the allocation of landing slots at the busier airports and airline control over internal airport space by means of long term lease arrangements.

Deregulation was premised on the notion that airport facilities would be expanded by the relevant authorities as the need arose because of increasing traffic levels. In effect, the proponents of deregulation assumed that the supply of airport facilities was almost perfectly elastic. In fact such was not the case, and little airport expansion has taken place in the most congested areas since deregulation. Certainly, one reason for this is the power of the incumbent airlines who have effective veto power over the expansion of airport capacity through a set of airport use agreements. It is clear that such agreements were necessary during the construction of many of the airports in order to obtain lease commitments and through these, financing arangements. However, at the present time, they inhibit airport expansion and, in effect, are a competitive tool to be used by those carriers already in residence. Such agreements may involve prior airline approval for large capital projects, of additional bond sales, and in some instances, of a variety of fee changes (White 1991).

In addition, there have been allegations that the quality of air service has declined. Increased congestion has caused increased delays and reductions in on-time arrivals. Increased hubbing has led to increased circuitity and fewer non-stop flights and same-plane services. As well, concerns have been expressed about the competitive strategies which have been evolved by incumbents including frequent flyer programs (to promote brand loyalty), partnership arrangements with local service airlines, and computerized reservations systems. All these concerns, however, can be combined into one : fears for potential rises in airfares because of the combined impact of all these factors on the market power of rival firms and the contestability of the industry.

To the extent that these concerns are valid, they have not yet shown up in the form of higher airfares. In real terms, the average U. S. fare per mile was lower in 1988 than in 1978 (U.S. Department of Transportation 1990). The best means of ensuring that this trend continues is to take actions to ensure that potential competitors have full access to the airport facilities. In turn, we are of the opinion that the best means of making certain that this occurs is to hold periodic auctions of airport capacity (Brander et al. 1988). This would ensure all competitors, actual and potential, of a level playing field.

4.4 Open Skies Policy

There is one final policy option which must be addressed. This is the option of opening up the domestic airline market, presumably on a bilateral reciprocal basis, to foreign competition. This is, of course, the open skies policy, and is a policy which should be seriously considered in situations where the alternative is an overly concentrated domestic industry. It should be regarded as a policy of last resort.

Thus regarded, it would be implemented only in a situation where the attempts to improve the workings of the deregulated industry were a hopeless failure. In this scenario, it would be implemented as an alternative to the options of enforced competition and/or reregulation of the industry. In essence, it is similiar to the British policies adopted to deal with the question of industrial monopoly at the turn of the century - the threat of the removal of all tariff protection were this warrented by the unfettered exploitation of monopoly power.

5. A SUMMING UP

It appears that the fears concerning the reconcentration of the U.S. airline industry are exaggerated as are the likely near-term consequences. The scenario which has unfolded is one which should have been anticipated as firms strived to increase their market shares and the extent of product differentiation. Significant amounts of competition remain as evidenced by the continued decline in the real level of air fares. Rather than focus attention of the reregulation of the industry or on a policy of enforced competition, efforts should be devoted to improving the existing policy of deregulation. Of particular importance here is the objective of ensuring more open access to the infrastructural facilities required to operate in the industry.

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TABLE 1

LEVELS OF COMPETITION IN THE U.S. AIRLINE INDUSTRY

NUMBER OF CARRIERS SERVING SPECIFIC LINKS

LINK RANK 1974	LINK CITY PAIRS	NUMBER OF FIRMS SERVING LINK 1974	12/1984	11/1990
1	BOSTON/NEW YORK	8	9	9
2	NEW YORK/WASHINGTON	12	11	8
3	CHICAGO/NEW YORK	12	11	7
4	MIAMI/NEW YORK	8	8	9
5	LOS ANGELES/NEW YORK	8	12	9
6	FT. LAUDERDALE/N.YORK	6	5	7
7	L.ANGELES/S.FRANCISCO	10	13	10
8	N.YORK/SAN FRANCISCO	7	8	9
9	DETROIT/NEW YORK	9	8	5
10	CHICAGO/LOS ANGELES	8	8*	6
20	CHICAGO/WASHINGTON	10	7	5
30	BOSTON/CHICAGO	7	6*	5
40	L.ANGELES/WASHINGTON	7	9	9
50	HONOLULU/S.FRANCISCO	8	7	7
75	L.ANGELES/MINNEAPOLIS	4	4	3
100	MIAMI/ORLANDO	4	6	7

*Two additional carriers were awaiting government approval at this date.

Sources: **1974**: N. K. Taneja, The Commercial Airline Industry, Table 2-7; **12/1984**: Official Airline Guide, Dec. 15,1984; **01/1991**: Official Airline Guide, Jan. 15,1991.

TABLE 2

CHANGING LEVELS OF EFFECTIVE COMPETITION IN THE U.S. AIRLINE INDUSTRY

NUMBER OF CARRIERS SERVING SPECIFIC LINKS

LINK RANK 1974	LINK CITY PAIRS	EFFECTIVELY COMPETITIVE FIRMS 1974	12/1984	11/90
1	BOSTON/N.YORK	2	3	3
2	N.YORK/WASHINGTON	2	3	5
3	CHICAGO/N.YORK	3	4	3
4	MIAMI/N.YORK	3	3	4(3)
5	L.ANGELES/N.YORK	3	3	5
6	F.LAUDERDALE/N.YORK	3	3	3(2)
7	L.ANGELES/S.FRANCISCO	3	3	4
8	N.YORK/S.FRANCISCO	3	3	4
9	DETROIT/N.YORK	2	4	2
10	CHICAGO/L.ANGELES	4	4	2
20	CHICAGO/WASHINGTON	3	4	3
30	BOSTON/CHICAGO	3	3	3
40	L.ANGELES/WASHINGTON	3	4	4
50	HONOLULU/S.FRANCISCO	4	2	2
75	L.ANGELES/MINNEAPOLIS	2	3	1
100	MIAMI/ORLANDO	3	2	4

*The bracketed numbers for 1990 reflect the number of effective competitors if Eastern Airlines are excluded from the analysis.

Sources: 1974: N. Taneja, The Commercial Airline Industry, Table 2-7; 1984: Official Airline Guide, Dec 15, 1984; 1990: Official Airline Guide, Nov 1,1990.

TABLE 3

LINK SPECIFIC CONCENTRATION INDICIES
1984 AND 1990

1974 RANK	CITY-PAIR LINK	HIRSCHMAN-HERFINDAL INDEX 1984	1990	
1	BOSTON - N.YORK	2527	2051	
2	N.YORK - WASHINGTON	2271	1934	
3	CHICAGO - N.YORK	2084	3234	
4	MIAMI - N.YORK	3737	2020	(2528)*
5	L.ANGELES - N.YORK	1769	1532	(1590)*
6	F.LAUDERDALE - N.YORK	3556	2136	(2715)*
7	L.ANGELES - S.FRANCISCO	2565	1972	
8	N.YORK - S.FRANCISCO	2006	1428	
9	DETROIT - N.YORK	1802	5280	
10	CHICAGO - L.ANGELES	2393	3467	
20	CHICAGO - WASHINGTON	2386	3387	
30	BOSTON - CHICAGO	2534	3531	
40	L.ANGELES - WASHINGTON	1707	1712	
50	HONOLULU - S.FRANCISCO	2187	2202	
75	L.ANGELES - MINNEAPOLIS	3561	7452	
100	MIAMI - ORLANDO	3172	2119	(2233)*

* The bracketed figures are the HHI for 1990 when Eastern Airlines are excluded from the analysis.

TABLE 4

DOMINANT CARRIERS AND HERFINDAHL-HIRSCHMAN INDICES BASED ON DEPARTURES, SELECTED AIRPORTS, 1984 AND 1988*

	1984			1988	
Airport	Carrier	%	HHI	Carrier	%	HHI
Chicago (O'Hare)	United	39	2079	United	43	2834
Chicago (Midway)	Midway	85	7335	Midway	65	4774
Atlanta	Delta	45	3722	Delta	51	4096
L.Angeles	United	19	1092	Delta	14	922
Boston	Delta	20	1092	Eastern	16	1087
Washington (National)	Eastern	21	1068	Eastern	21	1140
Washington (Dulles)	United	18	977	United	42	2286
Baltimore (BWI)	Piedmont	35	1802	Piedmont	63	4103
N.York (JFK)	Transworld	20	1251	Transworld	27	1719
N.York (LaGuardia)	Eastern	24	1136	Eastern	21	1101
Newark	P. Express	46	2358	Continental	46	2533
(O'Hare+ Midway)	United	35	1828	United	36	2178
(W.Natl+ Dulles+BWI)	Piedmont	16	957	Piedmont	23	1134
(JFK+ LaGuardia+ Newark)	P.Express	17	879	Continental	21	1091

*Unadjusted for mergers and code-sharing agreements

Source: *Airport Activity Statistics*, 1984 and 1988 Editions

MOTOR CARRIER STRATEGIC PLANNING

INTRODUCTION

Transportation services are an essential factor in the economic and social development of any society. In Québec, the Minister of Transport and his Direction générale du transport des personnes et des marchandises play a major role in this respect. In fact, the Direction générale du transport des personnes et des marchandises has the mandate to promote the mobility of people and goods through access to integrated, reliable, efficient, effective and safe transportation systems, thus contributing to Québec's economic and social development.

Furthermore, transportation is developing rapidly and major factors, especially demographic and economic factors, will continue to have an impact on the context in which the Direction générale works: market globalization, the aging population, changes in the role of the government and the reduced availability of the resources allocated to government, to name but a few.

It was therefore time for the Direction générale to review its objectives and strategies. To this end, it pondered over its future, using strategic planning to conduct this exercise in management.

This paper will present the specific objectives sought and strategies used by the Direction du transport routier des marchandises.

1. TRANSPORTING GOODS IN QUÉBEC

Québec has a very open economy, exporting 40% of its gross domestic product (GDP). The globalization of trade, especially since the Canada-U.S. Free Trade Agreement and the creation of a single European market, is putting the emphasis on open markets. In this context, transportation, which gives Québec firms access to foreign markets, is a factor of prime importance in our economy. It goes without saying that efficient transportation systems are essential to Québec's export companies if these are to remain competitive.

Most goods are shipped by road, rail or water. Air transportation is mainly used to carry valuable goods and to supply isolated regions.

Since the post-war period, because of its flexibility and polyvalence, trucking has become the main means of carrying goods in Québec.

Activity in the maritime and railway sectors, meanwhile, has slowed down. Maritime transportation is burdened by overcapacity both on the St. Lawrence Seaway and on international routes as a whole; less tonnage to carry, in grain and ore, for instance, account for the situation on the Seaway. Activity on the railways has dropped off too, mainly as a result of competition from road transportation. Recent federal legislation on transportation will lead the railway companies to further streamline their operations and concentrate their activity on the more economically viable routes.

The internationalization of economies has thrown transportation services into a more competitive world where the intermodal system, containerization, the use of logistics, and centralized transfer points (e.g. the port of Montréal) are expanding rapidly.

Government policies have also evolved. Economic regulations have been relaxed, leaving more room in which market forces can work. At the same time, safety and environmental regulations are being tightened up.

2. TRUCKING

Given its flexibility and its polyvalence, road transportation is particularly well adapted to the needs of shippers. This activity sector has grown considerably over the years. It is increasingly competitive over long distances, and has been able to capture a part of the market once reserved for railway transportation.

Shippers use two kinds of operation to meet their road transportation needs: private trucking and for-hire trucking.

2.1 Private trucking

For a shipper, private trucking means carrying his goods on his own vehicles or vehicles he leases. As an activity, this complements other activities of the same firm. It usually involves short-distance transportation, with 50% of the movements made over less than 50 km. Private trucking is usually intraprovincial or local.

Operating expenses for private trucking, for fleets of five vehicles or more, are estimated at $3.5 billion for 1989, a clear indication of the importance of this activity.

Private trucking is exempt from economic regulations (a transportation permit is not required), which govern public transportation. However, the regulations do allow firms to add transportation for remuneration to their private trucking activities, especially for transportation between subsidiaries and for return trips. However, the Highway Code and its technical regulations, imposing weight and size restrictions on trucks, standards for transporting dangerous goods, standards for the securing of loads, restrictions on driving hours, etc., apply indiscriminately to both private trucking and for-hire trucking.

2.2 For-hire trucking.

For-hire trucking consists in offering transportation services for remuneration to anyone requesting them (a manufacturer or a wholesaler, for instance), and assuming responsibility for the movement of goods. Such an activity normally constitutes the reason for the firm's existence.

Since the economic reform of trucking came into force in 1988, the service provided by these transport companies is governed by two statutes, a federal one applicable to firms engaged in extraprovincial transportation and a Québec one governing local firms and intraprovincial movements by firms that also undertake extraprovincial transportation.

The type of goods carried also significantly influences the operation and organization of both bulk trucking and general trucking.

The Québec general trucking industry[1] comprises over 8000 firms with a turnover estimated at close to $2 billion in 1990 (almost 50% of these firms are owner-operators). This sector is more heavily involved in extraprovincial transportation, which accounts for 46% of the carriers' revenue. The 300 Québec public carriers engaged in international trucking pocketed 16% of the revenue received ($235 million) by Canadian carriers for across-the-border business.

The structure of the industry depends on whether truck loads or less-than-truck loads are carried. Because of the network structure, operations, management costs and infrastructures required, LTL transportation is dominated by a few large firms. Owner-operators and small firms generally carry full loads. Other firms concentrate on specialized sectors such as car carriers, tank trucks and parcel delivery service.

[1] General transportation deals with goods not covered by the Regulation respecting bulk trucking, which refers mainly to forest products and goods carried in dump trucks.

Québec experiences a good deal of competition from Ontario in interprovincial movements since, according to 1984 figures, 81% of the tonnage is carried and 65% of the revenue is earned by Ontario truckers.

On the other hand, more than 90% of the time, regional and local competition is between firms established in Québec. Two years after the new legislation came into force, 93% of the new permits were issued to Québec carriers. The new foreign competition in Québec comes mainly from Ontario, with 271 firms (4%). For the time being, American carriers deal almost exclusively in extraprovincial trucking. Only 34 of the 564 American firms that come into Québec are licensed for intraprovincial trucking.

The transportation of goods governed by the Regulation respecting bulk trucking, made under the Transport Act, is almost entirely a regional or local activity. The legislative amendments enforced in Québec in early 1989 are in keeping with the traditional line of thought of a sector in which the government must intervene in order to create a healthy balance between supply and demand. This policy was largely the result of the fact that a number of carriers were affected by the decrease, over the past 10 years at least, in public road works in Québec. Furthermore, extraprovincial transportation of these same goods is subject to federal legislation which has liberalized access to trucking.

Bulk trucking attracts a high percentage of independent truckers. In 1988, 10 200 permits were in the hands of 7400 Québec permit holders with a total turnover of some $430 million.

2.3 Brokers and leasing

In addition to the usual types of public trucking and private transportation, there is a wide range of formulas available for shipping goods by road. The shipper can entrust the logistics of his needs to an intermediary such as a broker, or use a variation of private trucking such as leasing a tractor (with or without the driver) or hiring an independent carrier to haul his trailers and semi-trailers.

It is to be expected that these leasing activities will continue, with a falling off of the leasing of tractors with drivers because of the recent relaxation of the rules for obtaining a trucking permit. The hiring of independent carriers for private trucking is a growing phenomenon, as is the use of brokers, which should continue to develop, following the trend observed in the United States.

2.4 Trends

At first glance, it appears that trucking, because of its flexibility, will benefit from the increased demand for north-south transportation more than the railways, which are designed to deal more specifically with east-west traffic. It is important to ensure the greatest number of benefits possible for Québec carriers in these new markets. Furthermore, in view of the high proportion of the total cost of exported goods that is due to transportation, the efficiency of the road transportation system is an important factor in the competitiveness of Québec's export companies in the context of free trade.

3. THE ISSUES AND THE CHALLENGES

The objectives and the strategies of the DTRM (Direction du transport routier des marchandises) must take into account the main issues to be dealt with in the coming years. The object of this chapter is to emphasize those issues.

3.1 Globalization of trade, and international competition

In recent years, a number of countries have intensified their efforts to reduce or even eliminate tariffs and other trade barriers. The Canada-U.S. Free Trade Agreement, the 1992 European Market and the importance given the present round of GATT negotiations are reflections of this trend.

International agreements of the sort will, among other things, intensify competition on the markets where Québec firms are already active, and open up new markets to them. Greater specialization of national economies and of businesses could also result, as well as international integration of the production process.

This new worldwide economic context will highlight the importance of transportation in establishing the competitive position of various sectors of our economy on the international market. Transportation companies and their customers should develop greater awareness of how international transportation functions today and how it will develop in the future, particularly with respect to intermodal transportation and the role of intermediaries, including international forwarding agents.
Transportation is expressly excluded from the Canada-U.S. Free Trade Agreement. Across-the-border trucking will nevertheless be affected by free trade since this mode of transportation is used for over 50% of the value of our trade with the United States, and trade barriers for American carriers coming into Québec were dropped at that time. At the end of 1989, there were 564 American carriers in Québec, 229 of them new that year. Even though this figure includes a

large number of independent carriers, it nevertheless shows that more and more American trucking companies will be found in Québec, mainly because of the growth in north-south trade.

As mentioned earlier, there is every reason to believe that trucking, because of its flexibility, will benefit more from the increased demand for north-south transportation than the railways, which are designed to serve east-west demand. It is important to ensure the greatest number of benefits possible for Québec carriers in these new markets. Furthermore, in view of the high proportion of the total cost of exported goods that is due to transportation, the efficiency of the road transportation system is an important factor in the competitiveness of Québec's export companies in the context of free trade.

Since road transportation is in growing demand for long-distance shipping, Québec firms are increasingly subject to the regulations--whether economic, social, fiscal or safety-oriented--of American states and Canadian provinces, as well as those of the federal government. These regulations differ in their nature and their implementation. It is therefore becoming more and more important to promote the interests of Québec firms with the governments in question in order to ensure that the firms are dealt with equitably.

The growth in Québec's trade explains why the ministère du Transport du Québec (MTQ) wants to make promotion of Québec's interests one of its main objectives. To reach this objective, the MTQ must provide leadership and work with the industry to develop greater coordination in its commercial relations and in its policies with neighbouring governments. Greater emphasis must be placed on gaining new markets for Québec firms.

3.2 Economic deregulation of trucking

Economic deregulation with respect to competition in transportation services has moved forward rapidly in Canada since 1988. Companies transporting goods must adapt to this increased competition within their own industry, particularly by streamlining operations, becoming more specialized, modernizing equipment and management methods, and offering services adapted to customer needs. This is the context in which the MTQ must intensify its efforts, working with the associations of road carriers.
The Québec trucking industry must be in a position to satisfy these new expectations efficiently. An on-going evaluation of deregulation and its effects should be based on:

- the structure of the industry;
- its competitiveness;
- its ability to adapt to new markets;

- the measures it takes with respect to prices and services, particularly in order to deal with foreign competition;
- its profitability and its productivity;
- the cost structure of the various carriers;
- the activities and dynamic nature of the industry;
- the markets served, particularly in outlying regions of Québec.

3.3 Local regulation of bulk trucking

There have been two diametrically opposed trends in this activity sector in recent years. On the one hand, customers, representing the demand for transportation services, would like to see an end to protected sectors so that free market forces can play in this sector, and even question the existence of brokerage agencies which they see as a monopolistic factor.

On the other hand, truckers, representing the supply side, would like a more rigid, more restrictive framework. They want more work for brokerage agencies: specifically, all government, paragovernmental and municipal contracts.

There is obviously a hiatus between supply and demand, the nature and extent of which are poorly understood. The MTQ, as a customer, does not play a major role in demand in this sector. Relations between truckers and customers must be improved--this is a priority.

3.4 Meeting the requirements of safety regulations

Highway safety is a priority for the MTQ, since liberalization of the economic regulations governing trucking must not have any adverse effects in this respect. Highway safety is one of the objectives of the follow-up in this area.

The MTQ has an important role to play in managing the highway network. Increases in traffic and in loads carried have a major impact on the condition of the roads and on highway safety. The MTQ must therefore acquire greater knowledge in order to prepare a better traffic policy for commercial vehicles.

Furthermore, the industry has requested that the government give it a greater consultative role in the preparation of policies. This would result in policies more easily integrated by the industry. The industry has also requested that new policies be tested before being enforced through regulations.

3.5 Enforcing road regulations

The MTQ draws up rules governing transportation and sees that they are adequately enforced; the industry has requested much stricter enforcement of regulations in this sector. If all enforcement activities were concentrated in the hands of the SAAQ, more coherent action could be taken.

The MTQ should see that enforcement priorities are established with a view to reaching its objectives.

3.6 Efficiency of transportation systems

One of the greatest challenges for anyone planning a transportation system is to increase the efficiency of the traditional system. While the "just in time" philosophy is increasingly popular among large manufacturers, there is an increase in pick-up and delivery jobs in urban areas and in the costs associated with heavy traffic. A revision of the road transportation system should go beyond the usual regulatory framework to analyse the cost to society of transporting goods by highway. In order to minimize the costs entailed by congested traffic, new performance indicators should be developed, based on pick-up and delivery time. It is in this context that the MTQ must increase its knowledge of goods movement in urban areas. This knowledge should be developed in a more systemic perspective that would take account of the competitive and complementary relations between modes of transportation.

More efficient transportation systems would facilitate the distribution of goods within urban centres as well as shipments to other regions. Greater efficiency in this area would increase the competitiveness of regional economies. The importance of the Montréal economy and the extent of traffic problems in that region heavily underscore the need to integrate road transportation systems. Origin/destination surveys of the transportation of goods by road will elucidate this problem.

3.7 Training manpower

The manpower problem faced by the trucking industry in Québec is the same as that in Canada and the United States. In order to be effective, efficient, productive and profitable, the industry must retrain all its manpower at every level of trucking.

The industry therefore needs an overall plan for coordinating training. A manpower adaptation committee is already at work. Even though vocational training is the responsibility of the ministère de la Main-d'oeuvre et de la Sécurité du revenu, the MTQ must see that the training process is set up and provide technical support.

3.8 Developing and investing in new technology

The trucking industry must give more thought to adapting new technologies in order to improve operations management. These technologies--data processing, software and electronic data interchange (EDI)--would help a firm keep tabs on costs and orient marketing strategies. This of course would depend on the expertise of the human resources in the firm, management's attitude to changes in technology and environment, and management's awareness of the strategic challenges posed by the industry today.

This is the context in which the MTQ shall promote measures enabling Québec trucking companies to increase their competitiveness, in particular by encouraging computerization and technological transfers.

The MTQ could play a major role in the development of these new technologies by providing financial support, thus fostering the use of these strategic tools.

3.9 Intermodal transportation

Extraprovincial land transportation services, by road or by rail, will increasingly have a dominant role to play in determining Québec's place in the intercontinental transportation of goods. The growing competition between both ports and airports will necessitate the development of more highly integrated and efficient intermodal services in which trucking plays an important part.

Multimodal transportation of goods has grown considerably world-wide, because of the globalization of trade and the discontinuation of rail service on branch lines. In this respect, the MTQ should foster the complementary nature of modes of transportation in order to encourage the development of more efficient multimodal services, which would benefit Québec shippers endeavouring to become more competitive on the international market.

4. OBJECTIVES AND STRATEGIES

Objectives and strategies are at the heart of any strategic plan. This section states the objectives of the Direction du transport routier des marchandises and describes the strategies adopted to reach them.

The objectives may be divided into two categories: those designed to provide better support for Québec's transportation systems and those of a more organizational nature, designed to make the work of the DTRM more effective.

4.1 Objectives and strategies for transportation systems

4.1.1 To promote efficiency in transportation systems

To reach this objective, the DTRM has adopted the following strategies:

- Increasing its knowledge of the industry--of customer needs, of shippers, of carriers and of supply;
- Improving the management of information resources;
- Seeing that Québec carriers are treated equitably;
- Promoting the productivity of transportation services and the penetration of new markets by coordinating action with all partners;
- Relaxing the regulatory framework of transportation services;
- Granting greater importance to interprovincial and intermodal transportation.

4.1.2 To promote integrated development of transportation sectors and systems

To reach this objective, the DTRM has adopted the following strategies:

- Increasing knowledge of goods traffic in urban centres;
- Adopting an intermodal approach and promoting the complementary nature of services, thus contributing to their integration into transportation networks.

4.1.3 To see that the regions have the transportation services required for their development

To reach this objective, the DTRM has adopted the following strategies:

- Keeping tabs on growth of the supply of transportation services in the regions;

- Preparing a profile of the basic services required to serve the regions.

4.1.4 To promote safety

To reach this objective, the following strategies have been developed:

- Following up on enforcements of regulations by creating tools to that effect and developing indicators;

- Sharing responsibility for safety between the Direction générale and its partners in that domain;

- Developing a policy for monitoring the transport of passengers and goods by road;

- Developing a traffic policy for road vehicles that exceed the standards for vehicle size and/or load size.

4.1.5 To emphasize the promotion of Québec's interests in transportation

To reach this objective, the following strategies have been developed:

- More closely following developments in federal measures and in actions taken by neighbouring governments;

- Giving priority to the creation and promotion of dossiers on the strategic and particularly fragile sectors of Québec's economy;

- Providing leadership and developing more coordinated action with other parties involved (federal and provincial departments, agencies, associations, etc.), in order to promote Québec's interests.

4.2 Objectives and strategies based on organization

4.2.1 To establish more ties and foster greater cooperation with the partners of the Direction générale

To reach this objective, the DTRM has developed the following strategies:

- Increasing its presence in the industry;

- Promoting greater integration of the measures taken with the various administrative units of the Department;

- Creating mechanisms for consulting partners outside the MTQ, such as the SAAQ, the CTQ, the ministère de la Sécurité publique and the federal and provincial governments.

4.2.2 To delegate activities to those partners able to carry them out

To reach this objective, the following strategies were developed:

- Helping certain agencies, associations and carriers acquire the expertise required in their sector;

- Delegating operational activities for monitoring and supervising road transportation to the SAAQ, the CTQ and the ministère de la Sécurité publique, in keeping with their respective missions and their present and future ability to assume this mandate.

4.2.3 To associate human resources with the new policies of the DTRM

To reach this objective, the DTRM has adopted the following strategies:

- Setting up an information program on the policies of the DTRM;

- Directing human resource skills development towards new issues;

- Encouraging cooperation and interaction between the various sectors of the DTRM and with other administrative units in the MTQ.

5. CONCLUSION

For any organization, strategic planning offers an ideal opportunity for reflection and a subsequent expression of the desire to work towards newly defined objectives.

This process was centered mainly on identifying the context within which transportation operates in Québec and forecasting future trends. The general socioeconomic context, government policies relating to various programs and the rapid development of the transportation sector have an impact on the policies and measures adopted by the MTQ as a whole.

The MTQ must deal with increased demand resulting from growing needs.

The current government context is characterized by a relative scarcity of resources. The MTQ is affected by this situation and must make do with resources that have decreased while demand has shot upwards.

It thus appears important to clearly define objectives and adopt strategies that will enable the MTQ to reach its objectives more effectively.

In this perspective, strategic planning is an excellent management tool for dealing with change. This process will serve not only to react to a changing world, by reevaluating objectives, but also to forecast developments in transportation and its socioeconomic environment.

The need to reevaluate an organization's policies goes hand in hand with the need to face new challenges. To do this, the DTRM worked with the Direction générale to initiate group deliberations, for the first time, in all its administrative units.

This first step resulted in clear policy objectives towards which the staff will work, and time, energy and resources will be directed on a priority basis.

This paper on strategic planning is a guide to be used to give direction and a structure to the steps and measures to be taken over the next few years.

THE FEASIBILITY OF AN INTERMODAL COST ALLOCATION SYSTEM

by Henry Hide and Susan Sherman
Cole, Sherman & Associates Ltd.

1. INTRODUCTION

Which mode of transportation is the most cost-effective for a particular origin/destination, and under what circumstances? The subject of intermodal competition between road and rail both within Canada and between Canada and the United States has a long and often acrimonious history, and is today still one of the most debated questions in Canadian transportation. Current energy supply considerations and the Canada-U.S. free trade agreement serve to highlight the need to be able to assess, to an acceptable degree of accuracy, the real cost implications of particular transportation strategies.

The inability to satisfactorily resolve the disagreements as to who is paying their true costs, who is receiving hidden subsidies, and who is being penalized by "unfair" taxation and licensing constraints, is a function of the lack of a comprehensive cost assessment system, rather than the lack of the basic information needed to compute the relevant costs.

Transport operators are, by the nature of their task, concerned primarily with the movement of goods to the timetable demanded by their customers. If they do not perform as required, they do not stay in business. Their costing systems have historically been limited to the provision of a level of information sufficient to determine whether they were making or losing money. Furthermore, this determination is highly dependent upon tax structures and accounting procedures which may mask the true costs of operation. The development of more detailed costing systems was outside their available resources. This was more a function of the lack of appropriate computing hardware and software than the absence of the desire to enhance their systems. It was left to the major transportation research organizations such as the UK government's Transport and Road Research Laboratory (TRRL) and the World Bank to develop the first comprehensive costing system covering both the vehicle and the infrastructure, with

their RTIM and HDM systems. But even these were single mode models which initially operated on mainframe computers only.

Not too many years ago, a computer system which could model the costs of even a single operator to any degree of disaggregation would have required mainframe computer power and highly structured software. This requirement was in fact the biggest constraint in the development of a better understanding of the modal and intermodal cost trade-offs. Such systems would have been too expensive compared to their benefits; their rigid programming would have meant that systems developed for a particular purpose were not easily adapted for non-standard applications such as comparison between different modes.

The recent rapid introduction of the microcomputer and its corresponding applications software has reduced the cost and time requirements of systems development to a level which is now within the reach of both private and public organizations. The recent development of costing models, in particular for highway and railway operation, provides evidence of this trend.

This paper presents the view that the technology is now in place that would support the development of a system capable of providing definitive answers to the question of intermodal cost comparisons. Such a system could be developed as either a single system/databank to be fed data from operators across the country. An alternative system architecture could involve a variety of user-level real-cost systems which would feed aggregated (and thus less sensitive) data to a central system. Under the second arrangement, each operator would operate a system appropriate to the operation and mode, and would derive the benefits of better understanding of maintenance and operation costs.

In addition to purely economic tradeoffs between modes, the intermodal system would be able to make comparisons on the basis of environmental considerations, such as total levels of emissions by type, or energy consumption. Any of these could be evaluated as totals, on a ton-mile or a passenger-mile basis, determined from disaggregated data on miles travelled by commodity and by engine/vehicle configuration.

A discussion of the operation of two recently developed systems, one for computing the economic life of buses and one for assessing the most cost-effective maintenance programmes for railroad track, is included in this paper. The data requirements for these systems are shown to be no more comprehensive than what is currently required for normal accounting and management use. The simplicity of the

systems' installation and operation are also highlighted. The ease with which these systems can be extended to other vehicle and infrastructure systems is explained. The potential benefits from their operation will be evaluated at both the individual operator and the strategic levels.

The two systems, BusLife and TM$, have been developed for and are currently operated by, two major North American transportation operators.

2. Overall Framework of the Intermodal System

The overall framework of a system for use in comparing costs between different modes must satisfy a series of basic requirements which include:

- **All basic inputs should be readily available** and generally required to be input by owners/operators for other purposes such as accounting and management.

- **Evaluation trade-offs should be capable of comparing different modes on a common basis.** A fully developed system to compare costs between modes should be able, for example, to realistically allocate the costs of highway construction and maintenance activities to the different vehicle types using that highway, through pavement deterioration rates relating to the actual vehicle mix. The true costs of operating highway vehicles can be established independently of the taxation regime.

- **The system should operate efficiently.** A basic requirement is that it operate on a microcomputer with no customized hardware.

- **The system should avoid a "black box" approach** by openly disclosing its assumptions and algorithms.

- **The system should be user friendly.** System operation should not be restricted to those who are computer-educated. The most effective use of this type of system comes with the ability of those who understand the costs and processes to be able to interact with the computer directly.

- **All system outputs should be simple to understand,** suitable for all the system users, and tailored to the users' requirements rather than being logical to the programmer.

The two major requirements which to date have rarely, if ever, been met are the abilities to compare costs of different modes on a common basis, and to present these comparisons in a simple, easy-to-understand format. It is now possible to achieve these requirements with today's desk-top computer hardware and software, which allow a large amount of information to be manipulated quickly and easily by a user with only a very rudimentary understanding of computers.

3. SYSTEMS DEVELOPED AND CURRENTLY IN OPERATION

Two components of an overall system meeting the above requirements have been developed and are currently in operation. These are the TM$ track management system, a railway infrastructure maintenance package, and BusLife, a fleet-based life cycle costing system.

3.1 The TM$ Track Management System

TM$ is a system designed to increase effective access to track performance data, to forecast the effects of deterioration and maintenance activity, and to formulate cost-effective maintenance programmes. In its primary function of assisting railroad operators in planning their track maintenance operations, TM$ is used to schedule the application of funds to each maintenance activity and section of track. Data interfaces and manipulation programs allow electronic transfer of condition data from track geometry recording cars and other data from corporate data bases.

However, once implemented on a railroad, TM$ provides a source of data and modelling experience that can serve as a basis to actually determine the real costs of each type of traffic, and how each type impacts the railroad's infrastructure maintenance needs. The "true cost of maintenance" could thus be allocated to each commodity type as a portion of its costs, rather than the more usual apportionment of costs based on revenue percentages.

For use in track maintenance, TM$ displays track condition indices in colour graphic form to enable quick understanding and assimilation of data from large sections of track, or to permit detailed analysis of track problems on a mile-by-mile basis. Forecasts are based on statistical models of track deterioration and maintenance effectiveness, and are used by the cost and economic evaluation models to develop coordinated surface, rail and tie maintenance programmes for periods of up to five years. The Surface Maintenance System portion of TM$ is currently in operation on the Burlington Northern Railroad (BN), while further detailed development of rail and tie maintenance systems is continuing.

The TM$ graphic display, although in itself not a requirement for the intermodal cost allocation model, provides evidence that a graphic display can be highly significant in improving the ability of users to understand quantities of sophisticated and complex data. The example of TM$ graphics shown in Figure 1 represents the quality of a ten-mile long section of track as measured by a track recording car, along with TM$ forecasts of track quality over the same section in twelve months' time. The example shown in Figure 2 shows a more detailed look at a one-mile section of the same track, including the corresponding portion of the condensed track profile.

Figure 1: TM$ TRACK QUALITY OUTPUT

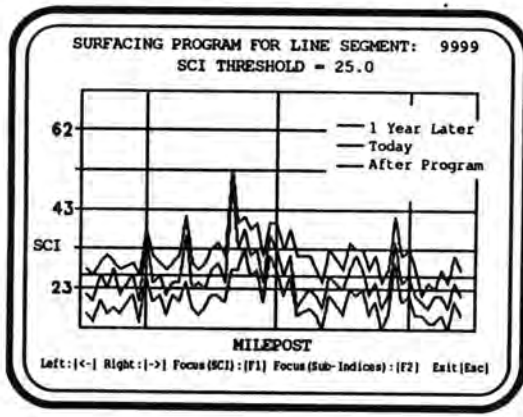
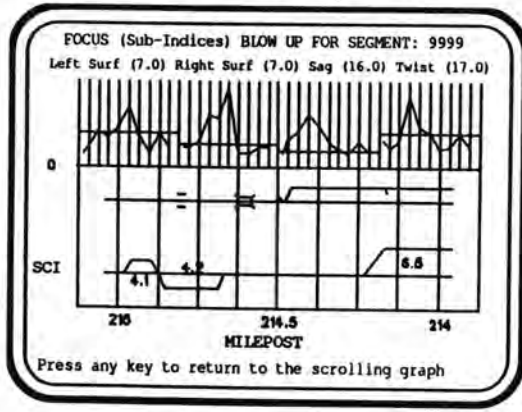


Figure 2: TM$ DETAILED TRACK QUALITY OUTPUT



The judicious use of sampling techniques, the reduction of data volumes through statistical combination, and the appropriate use of colour and symbols, can dramatically enhance the usefulness of any computer system. In the case of a complex database, the addition of graphics is a near-necessity to all but the most intimately acquainted individual, whose detailed knowledge of one area generally precludes a clear view of the broader picture. The intermodal cost system will depend on these techniques to a large degree, in presenting complex data summaries and comparisons. The recent ability of microcomputers to provide fast, colourful, detailed graphics at low cost is clearly a serious consideration in developing the intermodal system.

The TM$ system can be adapted to operation as a highway maintenance model, by transferring the highly modular structure of the system to a database of pavement records rather than track geometry car outputs. The system operates using a state-of-the-art relational database which can interface with any computer capable of communication with the IBM DOS environment (which includes virtually all computers in operation in the 1990's).

Substantial additional work in this area is currently being carried out by British Rail, in the development of their Maintenance and Renewal Planning Aid System (MARPAS). MARPAS is being developed in part to provide British Rail with the means of allocating the true costs of maintenance between the different "businesses" sharing track. Detailed mechanistic models are expected to enable the finished system to allocate portions of each maintenance activity to the traffic which caused the maintenance to be required. Although MARPAS is not a microcomputer-based system, it is expected to make substantial use of graphical output in its presentation material.

A further system to monitor and plan railway track maintenance is under development by Canadian Pacific Railway (CP Rail) with their TMAS (Track Maintenance Advisory System) which also makes use of empirically derived statistical track deterioration and improvement relationships.

The Union Pacific Railroad (UP) is yet another railway which has commenced development of a system for quantifying current track condition and assessing future maintenance requirements.

BN, CP Rail and UP are making extensive use of the microcomputer for the actual maintenance system and linking the system to a mainframe database for updating and refreshing the systems own database.

3.2 BusLife

BusLife is a life cycle costing system designed to work with the data present in a typical vehicle information system. It determines the life cycle costs attributable to a fleet of buses, on an individual bus or bus group basis. BusLife was developed, in part, to enable bus operators to compare different types of vehicles and different types of service, so as to provide a common basis for comparison. All aspects of bus operation costs are included, so that BusLife provides a framework for trading off the costs and benefits of various retirement/refurbishment/purchasing decisions using a common platform. The system is currently being implemented at GO Transit in the Greater Toronto Area.

In addition to providing a summary of past details on buses, BusLife provides statistical forecasting of future bus operation costs.

Although BusLife was developed to assist bus operators in fleet purchasing and major maintenance decision-making, a by-product of its implementation is a firm understanding of the cost structures involved in bus operations, including a very realistic understanding of the actual overheads involved in the maintenance and purchasing operations. It is the determining of the true costs of bus operation, rather than the application of mandated accounting-related costing procedures, that provide the basis for a comparison across different modes.

Figure 3 shows an example of BusLife output in which two potential bus operation strategies are compared. In one, the bus is run harder and refurbished more thoroughly than in the other. Such manipulations can be easily carried out by the individual interested in making the decision, using only a handful of computer keys, rather than requiring a computer operator who is unfamiliar with the end use of the data.

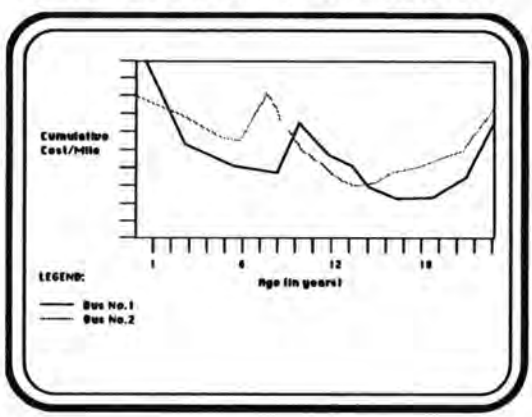
The BusLife system can be easily adapted to the operations of trucks, railway equipment, ships, and any other vehicle used for the transportation of goods or passengers. Although the existing implementation involves a time-based vehicle life cycle, it also operates on mileage-based life cycle, or a combination of the two.

An example of the application of vehicle life cycle costing being expanded beyond the economic sphere can be found in the Hamilton Street Railway (HSR) Alternative Vehicle Technology Investigation. In this study, the BusLife system is being applied to a detailed analysis of existing and future costs associated with three technologies under

consideration: the emission-reduced diesel, compressed natural gas, and the modern trolleybus. The study is considering each alternative using a wide range of criteria, which include life cycle costs, air quality, noise and visual pollution, safety, and community acceptance. The study is using the Planning Balance Sheet approach to present all the alternatives.

The HSR methodology could be applied across the broader picture to compare all the transportation alternatives on the basis of their costs to society as a whole. The intermodal system would present these summaries by aggregating detailed figures from each operation, rather than by making generalizations based on total industry figures. As in the cost exercise, the best choice will depend upon a combination of circumstances, rather than determining a single best for all situations.

Figure 3: BUSLIFE CUMULATIVE COST GRAPH



4. USE OF THE EXISTING AND PROPOSED SYSTEMS

4.1 System Environment

The systems described above operate on IBM DOS-based microcomputer equipment, although they can interface with mainframe or minicomputer systems for the purpose of obtaining data if this is a more efficient way of importing the information needed to operate the system.

4.2 Data Requirements

Data required for the systems described above include only that which is already available and collected for other purposes within the organization.

Infrastructure-related information such as track condition indices, traffic volumes and tonnages, soil condition, condensed profile data, climate data and track materials are made available to TM$ through the primary datasets used for storing these items. Actual maintenance performed, defined by track segment, actual labour and material cost, and type of work, are also made available to the system for analysis purposes.

The BusLife system uses bus capital cost and resale values, as well as actual labour and materials costs directly from a vehicle maintenance costing system. It tracks vehicle mileage and availability, fuel consumption, and other related factors, some of which are also available through the vehicle maintenance system. Any additional data, such as financial information, is keyed in directly to BusLife. All data is either already available in electronic form, or is easily obtainable in hard copy for input to the system.

In the case of an operator with no vehicle maintenance system, all input can be directly keyed into BusLife. Under these circumstances, BusLife will double as a vehicle maintenance system in its own right.

4.3 System Outputs

Outputs of both TM$ and BusLife are strong user-friendliness and graphics. In most cases, the graphics are an essential part of the output, not just window-dressing to make reports look more aesthetically pleasing. They use colour and graphical techniques to enable the user to assimilate much more information, in a more meaningful manner, than would be possible using tables of numbers alone. Tabular reports are also provided to allow exact information to be presented, for such items as detailed cost breakdowns, cash flows and what-if scenarios.

5. Expansion of the Existing Systems to the Intermodal System

It has been shown above that the systems already developed by Cole, Sherman are easily adaptable to other modes and operator types. The two existing systems, TM$ and BusLife, represent cost allocation systems for both infrastructure and vehicles. The expansion of these two into other modes (TM$ into highway and facilities management, and BusLife into locomotive, rail car, and truck systems, as discussed

earlier in this paper) essentially covers the range of system types and qualifications required to build and implement the intermodal system.

The final requirement would be an integration module, which would combine the results of the various operators' systems. The integration module would allocate all costs on a common ground, across all modes and uses. Algorithms for determining the basis upon which to combine the different sources of information would be accessible to the user. The sensitivity of the model to these algorithms would be tested at the initial stages of model development.

One of the most important aspects of the integration module will be establishing the means of comparing modes which are significantly different in nature. Table 1 presents a brief outline of a possible common ground upon which to begin.

6. BENEFITS OF THE INTERMODAL SYSTEM

6.1 Benefits to the Individual operator

The benefits to the individual operator are in the effective management of the costs of infrastructure and equipment in providing a transportation service. These benefits are tangible and demonstrable in that operators have already implemented life cycle costing systems in both spheres.

It is clear that, on the highway side, the cost of maintenance is borne by the Department of Transportation (or equivalent). As such the allocation of costs for infrastructure usage is a significantly more detailed undertaking, given that the highway "operator" has little control over the extent to which each type of vehicle uses the infrastructure. However, highway sampling data (e.g., traffic counts by vehicle type) is highly refined in all areas which would potentially be interested in this type of system. Automatic measurement of pavement deterioration is also well established in North America, thus providing electronically the key input necessary for a highway maintenance system. Allocation of costs would relate to types of vehicles by class and size, and could be done accurately by applying well-established statistical techniques to the deterioration indicators.

6.2 Benefits at the Strategic Level

At the strategic level, transport authorities are finally within the grasp of the means to decide the "true" costs of each mode, and thus the potential to base transportation policy decisions upon realistic cost information derived from disaggregated data, not summarized and

over-simplified data constantly subject to suspicion and public criticism.

Not all transportation operators would be required to participate in the intermodal cost allocation analysis. An adequate statistical sample of operators, based on size and type of operation, would be sufficient to ensure accuracy of comparison, provided that overall cost and usage figures for each mode are available.

Table 1: OUTLINE OF ROAD AND RAIL EQUIVALENCY TABLE

Road Equivalent	Rail Equivalent
Costs:	**Costs:**
Fuel & Oil Consumption	Fuel & Oil Consumption
Vehicle Maintenance Costs	Train Maintenance Costs
Driver Time	Crew Time
Highway Maintenance (portion allocated to individual vehicle based on contribution to deterioration)	Truck Maintenance (portion allocated to individual train based on contribution to deterioration)
Capital Cost of Vehicle	Capital Cost of Equipment
Overheads (facilities, support and supervisory staff)	Overheads (facilities, support and supervisory staff)
Environmental Costs (noise, air)	Environmental Costs (noise, air)
Land Costs (portion allocated to vehicle based on miles)	Land Costs (portion allocated based on ton-miles)
Social Costs (police, health services, safety)	Social Costs (safety)
Benefits:	**Benefits:**
Payload (disaggregated by commodity type)	Payload (disaggregated by commodity type)
Distance Travelled	Distance Travelled

7. SUMMARY

In the light of current economic and international issues, the question of intermodal competition is as relevant in the 1990's as it has ever been. Operators of each freight and passenger transportation service are convinced that theirs is the best and least-cost solution, if only the world would understand that they were unfairly burdened through taxation and/or unjust subsidies to the competition.

As long as the figures involved on all potential sides of the argument are suitably muddy, there will never be any means of satisfactorily resolving this argument.

This paper puts forward the idea that the issue could be resolved, or at least made clearer, through the application of existing computer systems technology to the understanding of cost allocation between the modes. A system could be developed that would be based on readily-available data, would be efficient, user-friendly, easy to understand, and based on algorithms available for scrutiny and sensitivity analysis. Partial systems are already in operation at a number of transportation operators in North America and around the world, and are under development in more still. An integration module would be required, which would pull together the output of all these systems with the addition of global cost-allocation algorithms.

A fully-implemented intermodal system would benefit both operators and the transportation-using public by reducing overall costs, energy use and environmental damage through promotion of the most cost-effective mode on a case-by-case basis.

The system would not require the participation of all operators in all modes to ensure success.

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U.S. and Canadian Statistical Sources for Transborder Trucking Information

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I. INTRODUCTION

The United States and Canada were significant trading partners prior to the Free Trade Agreement (FTA) between the two countries, with trade exceeding $187 billion (Cdn.) in 1988[1]. The goal of the FTA is to increase economic efficiency and North American competitiveness through the removal of barriers to trade in goods and services between the two countries. Virtually every expert predicts that the FTA will result in rationalization of manufacturing and distribution patterns and create new commodity flow patterns across North America[2]. Trucking will play a large role in this commodity movement. In 1989, over $122 billion (Cdn.) of trade between the U.S. and Canada was transported by truck. Assuming that trucking costs were 4 percent of the value of these commodities, the transborder trucking industry is a $4.88 billion industry.

The transborder trucking industry is evolving with transborder growth and with these changes, many public and private issues arise because of the different regulatory, safety and infrastructure environments in each country. When the maximum Heavy Vehicle Use Tax (HVUT) was increased from $240 (U.S.) to $1,900 in 1982 and later reduced to $550 in 1984, Canadian carriers and authorities voiced concerns over the equity of levying the tax on certain Canadian vehicles but not on others. Section 932 of the Deficit Reduction Act of 1984 directed the U.S. Department of Transportation to conduct a study to determine the significance and equity of the HVUT on transborder trucking operations. Another study was conducted by the U.S. Government Accounting Office (1987) at the behest of Senator Danforth of Missouri to further investigate the disparate policies on either side of the border on trucking issues.

Both countries have differing size and weight regulations that lead to inefficiencies in load planning for carriers operating on both sides of the border. Cabotage and the geographic dispersion of traffic affects the relative efficiency of carriers competing in the transborder market. Transport Canada recently sponsored a series of studies examining the economic, financial and operating environments of the Canadian transborder trucking industry. How these issues will or can be resolved depends in part on the availability of a reliable, timely and accessible database on transborder trucking. In addition, the carriers themselves need data for market and operational planning.

The goal of this paper is to examine and appraise the major sources of information upon which policymakers, researchers and carriers can make decisions. An improved information environment will lead to better decisions and facilitate the economic coordination

and integration sought in the market through free trade. Our focus will be on two major information areas: traffic flow and financial/operating statistics.

II. U.S. AND CANADIAN STATISTICAL SOURCES OF FINANCIAL AND OPERATING INFORMATION

Annual Reports to the Interstate Commerce Commission (ICC)

Motor carriers under the jurisdiction of the ICC (e.g. all interstate carriers) are required to file annual and in some cases quarterly reports to the Commission. The annual report contains a wide variety of financial, operating, expense, employment and equipment statistics and is available for public viewing at the ICC. These reports are generally available within a year after the filing year. The statistics from these reports are made widely accessible through commercial publications such as the American Trucking Associations' (ATA) Financial and Operating Statistics (F&OS) series of four Motor Carrier Quarterly Reports and one Motor Carrier Annual Report per year. The most recent Motor Carrier Annual Report (1989) displays 156 data elements per carrier. The databases upon which the publications are based contain over 170 and over 240 elements for the quarterly and annual reports respectively and are available on computer tape.

Detailed reports are only required of Class I and II carriers (over $1,000,000 in annual revenues). There are over 45,000 ICC regulated for-hire carriers in the U.S. and less than 2000 are Class I or II carriers. In addition, private carriers and exclusively intrastate carriers are not required to file reports with the ICC. Obviously, there are many carriers not in the ICC reporting population and after accounting for incomplete or non reporting carriers, the 1989 ATA database contains data for 1567 carriers. Another commercial compilation of the ICC annual reports is the TTS Blue Book of Trucking Companies. This publication expands the coverage to major intrastate carriers which do not report to the ICC. As a consequence, over 2000 annual reports are summarized in the 1989 edition of this source. While both publications only capture a small number of the total number of for-hire carriers, both capture the largest portion of the revenue-generating capacity of the trucking industry. No carriers below $1,000,000 in annual revenues (Class III) were required to report to the ICC after 1980, so financial/operating data on the 43,000+ smaller carriers are not available. It is very likely that the larger reporting carriers are indeed the ones which participate or potentially will participate in U.S.-Canada transportation.

Motor Carriers of Freight and Household Goods Movers Survey (MCF)

Statistics Canada conducts this survey annually to provide information about the size, structure and economic performance of Canada's for-hire trucking industry. The survey consists of a relatively complete balance sheet, an operating statement including detailed expense categories, an income account, equipment and employee classification and compensation, selected firm demographics, and miscellaneous information. Noteworthy is a categorization of revenues between intraprovincial, interprovincial (domestic) and international (transborder). The MCF is a complete census of the larger carriers (revenues exceeding $250,000 in 1987 for the 1988 survey) and a sample of carriers with revenues between $100,000 and $250,000. Excluded from the survey are private, parcel and courier carriers, and motor carriers domiciled in the U.S. that cannot provide separate statistics for their

Canadian operations.

In the U.S., interstate carriers are required to file annual reports with the ICC (and intrastate carriers to some intrastate regulatory agencies and public utility commissions) as part of their regulatory obligations. These reports are available for public review. In Canada however, a non transportation agency conducts the MCF survey under prescribed guidelines for maintaining confidentiality. Since the Canadian data are collected confidentially, the information is only available in aggregated form. The publication Trucking in Canada summarizes and aggregates the MCF in what is perceived to be useful categories for a wide variety of users. In addition, tabulations of data can be made by Statistics Canada on a cost basis so long as carrier confidentiality is maintained.

The latest MCF survey results are contained in the Trucking in Canada 1988. Available in November 1990, this suggests a lag of approximately one and one half to two years before the data are available in print form. However the Motor Carriers Freight Quarterly Survey (MCFQS) provides vital income and expense information eight weeks after collection for the top 40 Canadian carriers and 14 to 16 weeks for all other carriers earning $250,000 or more.

Annual reports of publicly held carriers

Publicly held carriers in both the U.S. and Canada are required to file financial statements with the appropriate securities agency in each country and issue annual reports to stockholders. These reports typically contain management narrative that elaborates on the financial and operating statistics of the report. Twenty-nine publicly held carriers in the U.S. were recently listed in Transport Topics. Only a handful of carriers in Canada are publicly held and the most significant are part of conglomerates and the trucking portion of the annual report varies from very little to great detail.

Trucking Activity Survey - Industry Structure Survey (TAS/ISS)

The private trucking industry is a significant part of transportation. The primary objectives of the annual TAS are: 1. to obtain information about the size, structure and economic performance of the private trucking sector in Canada, and 2. to provide estimates of the origin and destination of intercity commodity movement. The TAS is thus both an industry structure survey (ISS) and an industry activity survey (IAS). The TAS/IAS is discussed below in section III. The survey population is limited to commercial operators of vehicles carrying freight and operating 15 or more vehicles.

The TAS/ISS is an abbreviated version of the MCF for private carriers, lacking for the most part selected financial information and certain expense details. The primary indicator of transborder activity is the number of kilometres traveled by the reporting units in the U.S. In 1988, 198 of the 2487 reporting carriers traveled 46.5 million kilometres in the U.S., less than 1.5 percent of the total distance traveled by Canadian domiciled private carriers. It is thus possible to obtain financial and operating statistics on Canadian private carriers involved in transborder service on an aggregate basis.

Census of Transportation

The Census of Transportation is carried out every five years and provides financial

and employment data on for-hire trucking in the U.S. The 1987 Census data were released in late 1990. For the country as a whole and for each state, data are provided for Standard Industrial Classification (SIC) 42 (motor freight traffic and warehousing) on revenue, establishments, payroll, and number of employees. Number of establishments refers to carrier operating locations for which a single carrier may have many. While such information is only available on an aggregate basis, it would be especially useful for pinpointing where motor carrier activity and resources are located. Based on the 1987 Census of Transportation, over one third of the country's long haul, general freight trucking capacity is located in the gateway states along the Canadian border, primarily in seven East North Central and Middle Atlantic states (29 percent in IL, MI, NY, OH, PA and WI).

Census also publishes data for the trucking industry in its annual Motor Freight Transportation and Warehousing Survey (WATS) that can provide valuable information for updating every-five-year statistics in the Census of Transportation when assembling data to compare the U.S. and Canadian trucking industries in aggregate. WATS provides operating revenues, operating expenses, and annual payroll data for SIC 42 at the national level but not at the state level.

Evaluation

In order for available statistical data to be useful for the analysis of the transborder economic environment, one has to identify the carriers or the portion of the information that is relevant to the transborder market. Nothing in any ICC derived database identifies which carriers participate in the transborder market or to what degree. A number of sources could be used to identify carriers in the transborder market. The Niagara Frontier Tariff Bureau's Tariff 172 lists all carriers participating in its international tariffs. A number of routing guides and directories may be searched to identify carriers competing in international markets. These include the American Motor Carrier Directory, National Motor Carrier Directory, National Highway and Airway Carriers and Routes, Canadian Transportation Guide and the trucking directories published by provincial trucking associations such as the Ontario Ship by Truck. Once identified, the financial and operating information for those carriers can be isolated for analysis. In contrast the "Canadian based" information is generally not available on a "firm specific" basis and must be aggregated before being made available. However since there is identification of the degree to which the carrier depends on transborder revenues, this results in a more precise utilization of the data.

The financial and operating statistics are generally comparable although there is no specific set of accounting conventions required of the Canadian carriers as there is of the U.S. carriers. At the same time there are significant omissions in each data source. For example, the U.S. database contains demographic data that can be used to estimate the average shipment size, average load and average length of haul of the carrier. Such information is especially useful in classifying carriers into different market segments. This information is not recorded for the MCF[3] and can only be estimated for a small subset of the MCF population contained in the Truck Origin-Destination study described below.

On the other hand, the MCF identifies how major commodity groups or types of service account for revenue while the ICC reports only what broad commodity category into which the carrier falls. Further the ICC reporting requirements were revised in 1987 when the reporting form was shortened. Expense data by function were omitted (line haul versus terminal expense) while Canadian carriers continue to report this information. These and other

differences are expected given the divergent objectives of the government institutions responsible for administering the basic data collection.

Finally, there is a major discrepancy between the coverage of private carriage involved in transborder traffic. Canada has produced a consistent survey for several years while the U.S. lacks any detailed data on private trucking whatsoever.

It may be concluded that financial and operating statistics are generally available for the largest, most important for-hire carriers competing in the transborder market. The sources of such information are summarized in Table 1. Identifying transborder carriers is more ad hoc and difficult for U.S. domiciled carriers than for Canadian carriers but Canadian carrier information is generally not available on a firm specific basis. While some data elements are not consistently available on both Canadian and U.S. carriers, this should not prevent meaningful analysis of for-hire competition in the transborder market.

TABLE 1
Financial/Operating Data Sources

	Census of Transportation	ICC-based ATA's F&OS Reports; TTS' Blue Bk.	Truck Inventory & Use Survey	MCF and TAS/ISS	Annual Reports
Type of Data	Economic activity	Financial & operating	Truck/equipment operating data	Financial & operating	Financial & operating
Latest Available/ Frequency	1987/every 5 years	1989/Annual & quarterly	1987/every 5 years	1988/Annual & quarterly	Annual
Industry Coverage	All establishments in SIC 42	Interstate, For-hire, > $1Mil	44,000 trucks	All For-hire >$250,000 Private > 15 vehicles	Publicly held carriers < 50
Unit of Observation	Carrier operating locations	Carrier	Trucks, tractors, trailers	Carrier[1]	Carrier
Agency/ Source	U.S. Bureau of Census	Interstate Commerce Commission	U.S. Bureau of Census & FHWA	Statistics Canada	Carrier, SEC
Computer Output Available	None	Yes	Yes	Yes[1]	N/A
Printed Report Title	1987 Census of Transportation; Geog. Area Series Sel. Trans. Industries; Summary (TC87-A-1)	ATA's Motor Carrier Annual Report; ATA's Motor Carrier Quarterly Report; TTS' Blue Book (annual data)	1987 Census of Transportation: Truck Inventory & Use Survey; United States (TC87-T-52)	Trucking In Canada-1988	N/A

[1] Data only available in aggregations

III. U.S. AND CANADIAN STATISTICAL SOURCES OF TRAFFIC AND COMMODITY FLOW INFORMATION.

1993 Commodity Flow Survey

The last reliable commodity transportation survey (CTS) was conducted in 1977 by the U.S. Bureau of Census. That survey was a shipment sample collected at shipping points (from shippers and receivers) that identified freight flow by commodity type, mode of transportation, origin and destination, and weight of commodity. The information was tabulated and typically available in published form three years later. The raw data was also made available on magnetic tape. The 1983 CTS did not produce statistically useful traffic flows and hence was not released as an official product of the Census. Currently a Commodity Flow Survey (CFS) is being planned for 1993 which will basically duplicate and improve upon the old CTS. The CFS will measure tons, mileage, value, and possibly transport cost and shipment size (Aanestad, 1991). The 1993 CFS will be a manufacturing establishment based (shipper based) rather than carrier based survey. Out of a universe of 850,000 establishments, it plans to sample 150,000 (the 1977 CTS only sampled 20,000 establishments). The CFS will have 18 to 20 million observations versus 1.2 million observations in the 1977 CTS. Unlike the previous CTS, the CFS plans to include data collection on U.S.-Canada commodity flows. While it can obtain responses on shipments originating in the U.S. and destined to leave the U.S., it has no authority to survey shippers in Canada with freight destined for the U.S. The CFS is in the planning stages at this writing and attempts are being made to incorporate international flows to as great a degree as possible.

For-Hire Trucking Survey (Truck-Origin Destination Survey or TOD) and Annual Statistics Canada Survey on International Movements of For-Hire Canadian Domiciled Carriers.

The TOD is a waybill sampling survey in existence since 1976 while the International Survey is an add-on to the TOD since 1987. The objective of the TOD is to measure the output of intercity for-hire trucking industry in order to produce reliable estimates of output on a spatial basis. The sample is based on the MCF carrier universe of carriers with revenues exceeding $500,000. The population is stratified according to type of operation and area of operation to develop a survey frame. A sample of carriers is taken from each frame and a systematic sample of shipping documents from each sample carrier is carried out. The following information is collected for each shipment: the origin and destination, commodity description, weight and revenue and whether the shipment was interlined or not.

Traffic flows measured by tonne-kilometres, revenues and tonnes can be derived from this basic database. The most recent TOD, "1988", is contained in Chapter 5 in Trucking in Canada 1988. Both provincial and major city to city flows are exhibited as well as movement by commodity.

The major limitation of the TOD is its treatment of transborder truck flows. Its coverage does not include U.S. carriers whose freight records are domiciled in the U.S. Thus freight that is handled by Canadian domiciled carriers, whether direct or interline, is covered, but direct line shipments of U.S. domiciled carriers are not.

Since these flows are derived from sample data, the data are subject to various degrees of statistical reliability as measured by the coefficient of variation. The survey is originally intended to provide estimates for region to region truck flows but previous research studies

have used the TOD to measure market concentration (McRae and Prescott, 1983), compare prices under different regulatory environments (McRae and Prescott, 1982), measure output for econometric modeling of costs (Kim, 1984) and firm revenues (Chow, 1982). This is done by aggregating sample data to the carrier level. Indeed this is a necessity since the MCF does not contain physical output data or firm characteristics critical to economic modeling of a trucking cost functions.

Trucking Activity Survey - Industry Activity Survey (TAS/IAS)

The TAS/IAS uses a subset of the carriers reporting in the TAS/ISS, private carriers with expenses exceeding $500,000. The survey produces estimates of tonne and tonne-kilometre activity by major origin - destination and commodity detail. However like the TOD it is limited to Canadian domiciled private carriers and excludes U.S. carriers which cannot provide separate statistics for their Canadian trucking operations.

Statistics Canada Customs Database

All commodities transported across Canada's international boundaries are documented with Revenue Canada's customs division. Information from export and import documents is extracted by Statistics Canada into a database that is aggregated and published in Export-Merchandise Trade (Catalogue 65-202) and Imports-Merchandise Trade (Catalogue 65-203). Tabulations include various levels of detail by geography, commodity type and mode of transportation. Canadian origins or destinations are defined by province of entry into or exit from the country. U.S. origins or exits are defined as one of the 18 subregions. Commodity codes follow normal conventions and modes carrying the commodities are distinguished (rail, highway, air, and ship). Finally, the measure of flow is dollar value of freight transported. The data are available on computer tape aggregated to province-to-U.S.-region flows by commodity.

U.S. Customs Transborder Trucking Data

A "feasibility study" is being done through offices of the U.S. Department of Transportation, U.S. Customs, and the Foreign Trade Division of the Bureau of Census. Forms are now coded into a database with millions of records. Two CD-ROMs are available, one for imports and one for exports. The database shows commodities moving into the U.S. across the Canadian and Mexican borders by vessel, air and "all other modes." There is no differentiation of truck traffic from other surface-mode movements in the coded data. However, truck movement detail is on the original U.S. Customs forms. The feasibility project now underway involves Census and Customs working together to code differentiated surface traffic for a sample of the millions of forms collected by U.S. Customs. A reports will be issued in 1991 upon completion of the feasibility study to assess whether the ultimate goal is cost-effective: to build modally differentiated transborder surface data into the regular Customs data coding efforts of the Foreign Trade Division of Census.

Commercial Traffic Flow Databases

Freight traffic flows are commercially produced by several firms which utilize and enhance publicly available data. Reebie's Transearch is based on the 1977 CTS and provides estimates of freight flow by market area, traffic lane, commodity and mode of transport. For trucking, it produces less than truckload (LTL) versus truckload (TL) and for-hire versus

private carrier disaggregation. Recently it has also developed a transborder freight flow database based on the Statistics Canada customs data described above. Its basic enhancement is the transformation of dollar value flows into tonnage flows and the disaggregation of that flow into state rather than subregional level of geographic detail. The tonnage transformation was achieved by using value to weight ratios known for specific commodities. A similar procedure was used by Chow (1988) to estimate transborder tonnage by shipment type (LTL versus TL) and carrier type (ICC, private, non ICC). The Reebie transborder database has 1988 data, 1990 estimates and 1991 forecasts for tonnage by mode (major modes only) to a 4 digit STCC commodity code level.

Evaluation

Several sources of traffic flow information are available for estimating transborder traffic flows and these are summarized in Table 2. Commercial data sources such as Reebie identify the total transborder trucking flow to a reasonable level of commodity and geographic detail. The potential shortcoming is that no quantitative measure of accuracy can be used to evaluate these estimates since the true tonnage flows are not known. This may be rectified by the 1993 CFS if sufficient attention is paid to the transborder component of the survey. Another option is for Statistics Canada to add the collection of tonnage detail to its import and export trade merchandise statistics.

The Reebie estimates of overall truck tonnage flow could be used to supplement the TOD estimates of transborder tonnage handled by Canadian domiciled carriers. The TOD distinguishes between direct shipments by Canadian carriers and any interline involving a Canadian carrier, thus the interline involving U.S. carriers is known. The difference between the Reebie estimate of total truck tonnage is single line truck tonnage by U.S. domiciled for-hire carriers and private truck tonnage.

In contrast to the CFS and its predecessor the CTS, the Canadian Truck Origin Destination Survey (TOD) and the Trucking Activity Survey (TAS) use a carrier survey frame rather than a shipper survey frame. This leads to greater variability in the estimates (coefficients of variation) of traffic flow distinguished by commodity type since industry or commodity type was not considered in the sampling process. However, commodity flow of all industries using truck transportation would be surveyed. The CFS on the other hand may be as limited to the manufacturing industry as was its predecessor and therefore it will not contain a complete coverage of truck flows (for example, mining and agricultural movements would be excluded). Another contrast, especially significant to researchers investigating traffic between modes, is that the CFS will more closely represent mode selection behaviour since the same respondent indicates its mode split. Traffic flows for truck and rail are independently derived from carrier sources in Canada such that there is no control over the shipper respondent characteristics.

In summary, transborder freight flows are being produced from three distinctly different vantage points. The TOD and TAS/IAS collect basic traffic flow information from the carriers supplying the service. The CFS will collect the information from the shippers purchasing the service. The Customs based freight flow estimates are collected at points of entry and exit between the two countries. While each data collection strategy has its advantages, no one approach results in a comprehensive picture of the transborder freight flow environment due to jurisdictional limitations. We believe that economic integration of the North American economy is an essential prerequisite for survival in the new global

environment. As a consequence the integration and coordination of the data collection efforts of both countries is warranted in this sphere.

TABLE 2
Traffic Flow Data Sources

	For-Hire Trucking Survey (TOD)	1993 Commodity Flow Survey	Private Trucking Survey, Industry Activity Survey (TAS)	U.S. Customs Database	Canadian Customs Database	Commercial Services - Reebie Transearch
Commodity Flow detail	Truck only, $ tonnes & TKM by commodity and major O-D	By mode, O-D and commodity	Private truck only, by commodity and major O-D	Possibly by mode, by commodity value	by mode, by commodity, by major O-D, $ value only	by mode, by commodity, by major O-D, $ and tonnage
Latest Available/ Frequency	1988/Annual	1993/every 5 years	1988/Annual	Future, perhaps	1989/Annual	1990 estimates/ Annual
Industry Coverage	For-hire trucking domiciled in Canada	150,000 establishments out of 850,000	Private trucking firms domiciled in Canada with expenses > $500,000	Millions of records or transborder truck movements	All transborder transactions	All transborder transactions
Survey Unit	Carrier	Manufacturing/ shipper establishments	Operating unit	Transborder truck movements	Shipment	N/A
Agency/ Source	Statistics Canada	Magtape (in mid-'90s)	Statistics Canada	U.S. Customs; FTD of Census	Statistics Canada	Reebie Associates
Computer Output Available	yes, for special tabulations	none yet	yes	CD-ROM with only "all other modes" now; trucking not differentiated	yes	yes
Printed Report Title	Trucking in Canada, Chapter 4 & 5	none yet	Trucking in Canada, Chapter 5 & 6	none yet available	Export Merchandise Trade; Import Merchandise Trade	N/A

IV. OTHER DATABASES USEFUL FOR TRANSBORDER RESEARCH

1988 National Truck Activity and Commodity Survey

Although no output is yet available, another commodity flow database that may provide limited data for transborder trucking researchers is the National Truck Activity Survey (NTACS). NTACS is a follow-on study to the 1987 Truck Inventory and Use Survey (TIUS) whose results were released in late 1990. The NTACS sample is selected from the approximately 44,000 truck and truck-tractor owners who responded to TIUS. The original universe was all trucks registered in the U.S. Since NTACS does track the movement of

trucks in the sample into Canada and into Mexico, some results could be useful for transborder trucking analysis. The report and public user data tape are not available until mid-1991, so the usefulness of NTACS for transborder analysis remains to be seen.

Statistics Canada Survey on Vehicle Trips between U.S. and Canada

This survey is reported in the quarterly publication, Travel between Canada and Other Countries (Catalogue 66-001). It contains tabulations of the number of trucks used commercially, in which direction, and the domicile of the vehicle (as indicated by the plate) by port of entry or exit and time of year. This survey provides a general indication of transborder movement trends. For example extensive analysis of the survey was conducted by Ontario (Perera, 1982) to understand the trend and pattern of international truck movements. However, we conclude that this survey is not detailed enough to reflect characteristics of transborder movement relevant to business or public policy decisions. For example it captures all traffic including small vehicles such as step vans and large pickup trucks and there is not any indicator of the goods transported.

Transport Canada Survey of Transborder Movements and Ontario Surveys of Truck Movements

As part of a series of studies on transborder trucking, Transport Canada recently sponsored a survey of transborder movements at approximately 15 major border crossing points across Canada. Such a border crossing study is similar in design to studies conducted from time to time by various provinces and states on truck movements and their characteristics. For example the Ontario Ministry of Transportation conducted its Commercial Truck Surveys in 1971, 1975, 1983 and most recently in 1987. In most of these surveys, information on vehicles, commodities, carriers and origin and destination were collected as they pass through Ontario truck inspection stations.

These studies serve multiple purposes, for example to profile actual truck activity in various road corridors or to obtain information on truck costs. The Transport Canada sponsored survey will be particularly useful since it is focused on transborder trucking and may be the only source of triangulation and routing data other than direct surveying of carriers. However, these studies are costly to administer and therefore are only conducted periodically by some but not all provinces. No U.S. organization to the authors' knowledge have engaged in transborder trucking surveys. The Ontario studies have been used to approximate traffic flows by commodity and major origin - destination routes and are thus a complement to the major traffic flow surveys noted above.

National Transportation Agency (NTA) Survey Database

The NTA Annual Review has many comments on the performance of Canadian trucking since the Motor Vehicle Transportation Act, 1987 (MVTA) was passed, including specific comments on transborder trucking structure, performance and changes. Aggregated shipper and carrier responses are tabulated and summarized in the NTA Annual Review and available on PC disk for further analysis on the data relevant to transborder issues. The qualitative shipper and carrier interviews are confidential but summaries in the NTA Annual Review are sufficiently detailed to lend insight on carrier strategies, shipper satisfaction and trends. The NTA is mandated to continue this oversight of the effects of the MVTA through 1993.

Summary

We have purposely omitted any discussion of proprietary data sources which are not generally available to the public, or for that matter, to the government. These include the continuing traffic studies of the tariff bureaus and fuel and tax reports of organizations such as the American Association of Vehicle Administrators which administers the International Registration Plan. In addition the records at provincial and state regulatory agencies are so heterogeneous and varied that a complete review of the information on transborder transportation that could be obtained from these sources was beyond the resources of this research.

Some very important surveys that are now out of date and not updated were also omitted. For example, the Survey of International Goods Movement by Truck, 1977 was published in 1979 by the Ontario Ministry of Transportation and Communications. At that time, this was the only reliable source of transborder traffic flow by truck of any quality.

V. CONCLUSIONS AND RECOMMENDATION

Databases are designed at a point in time by people with certain objectives at the time; one cannot look into the future and design a database that is completely flexible and will provide data for such occurrences as increased U.S.-Canada and Canada-U.S. transborder trucking. However, it is imperative that the researcher apply a good deal of "20-20 hindsight" and scrutinize existing databases for new ways of manipulating data and new ways to create surrogates for data elements not originally designed into the database. Some existing U.S. and Canadian statistical data sources can be used for transborder trucking analyses, even though they were not designed for that.

Interestingly, few of the databases contain any information on the performance of transborder trucking as perceived by the users of transportation. Only the TOD has the potential to measure the prices paid by shippers but prices paid for transborder freight moved by U.S. carriers single line are not part of the survey. None of the U.S. databases, existing or contemplated, seek to explain actual economic performance, as measured by prices or service.

Looking toward the future, there must be greater international cooperation in the design of statistical data collection systems between the United States and Canada. Presently, one cannot track the behaviour of particular carriers across the border. In the U.S., company reports are not available through Canadian agencies. On the Canadian side of the border, detailed and data-rich carrier-based surveys are carried out but there is no comparable activity on the U.S. side of the border. The sharing of data on imports and exports by the two countries is a move in the right direction, and perhaps the U.S DOT/Census feasibility project will develop useful transborder trucking data that are "cross-border comparable." But certainly a proactive planning effort needs to be initiated between agencies and organizations on either side of the border to sit down together and design cross-border comparable data collection efforts that meet the long term objectives of the North American family of nations with an increasingly global marketing and trade perspective. The U.S and Canada should be as close to each other in their data collection efforts as they are on the globe.

NOTES

1. Monetary values are in the respective currency of the country under discussion except when indicated. Tonnes and tons refer to metric and U.S. tons respectively.

2. See for example Capelle (1990) and O'Callaghan and Hartgen (1990).

3. The MCF does distinguish between revenues exceeding and not exceeding 25 kilometres which for practical purposes segments intercity from local movement. It also requests tonnage estimates within specified shipment size blocks but these are deemed so inaccurate that they are not utilized.

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* Data sources described in Tables are not referenced due to space limitations.

A Preliminary Analysis of Factors Affecting the Results of Roadside Truck Surveys

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The need for relevant and reliable trucking statistics has never been greater. Good trucking data are required in order to monitor the effects of regulatory reform, free trade and the general status of the trucking industry. Border blockades by owner operators in the spring of 1990 emphasized the lack of reliable trucking information. Administrators did not have the appropriate information to determine the extent to which U.S. based carriers had captured Canadian markets.

Statistics Canada, by the nature of its surveys, is limited to providing information on financial statistics and general commodity flows of the trucking industry. Because Statistics Canada cannot provide information on how goods are moved by truck, both federal and provincial governments have found it necessary to supplement traditional Statistics Canada surveys by conducting roadside surveys of truck drivers.

Roadside surveys can be useful in supplementing Statistics Canada data but it must be realized that these types of surveys only provide a snapshot picture of what is occurring at a particular point in time and place. Variations in truck volumes and traffic characteristics may result from a number of factors which are directly related to the timing of the survey.

The purpose of this paper is to determine the extent to which the "snapshot" of activity obtained from a roadside survey can be used to generalize about activity throughout the year. Specifically, the paper will examine the degree to which truck volumes and traffic characteristics may vary by **time of day, day of week** and **season.** In this paper, it is assumed that the usefulness of road side surveys to generalize about the whole year declines as the degree of variability of the various factors increases. Although it is recognized that the statistical procedures used in this paper are quite basic, the approach still allows for some interesting insights to be developed about the usefulness of roadside surveys for forecasting purposes.

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

Methodology

Roadside surveys conducted by the Ministry of Transportation, Ontario have been used to collect information on both **truck volumes** and **traffic characteristics**. Although a great deal of information was collected on traffic characteristics such as vehicle type, trailer utilization, origins/destinations, carrier traits, driver profile, and commodities carried, only one or two aspects of these traffic characteristics are examined for variability in this paper.

Data for this analysis were taken from commercial vehicle surveys conducted in 1988 and 1990 at inspection stations located on the Queen Elizabeth Way (QEW) between Hamilton and St. Catherines for both directions. In 1988, twenty-four hour surveys were conducted in March, May, August and October and were used to analyze variability of the various factors by season. In 1990, the eastbound QEW lanes were surveyed for a full week in May while the westbound lanes were surveyed for a full week in June. The 1990 survey was used to analyze variability of the various factors by time of day and day of week.

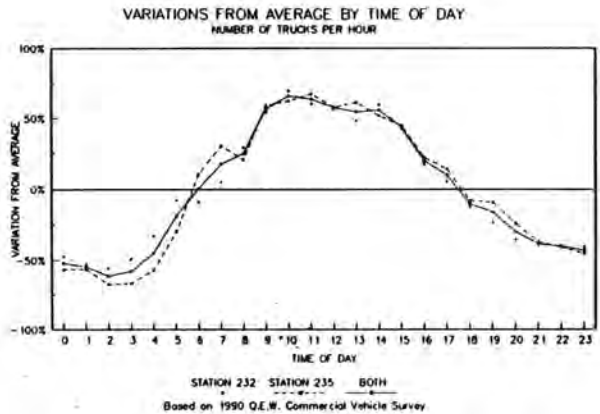
There are two components to a roadside survey, classification studies and truck driver interviews. Classification studies are conducted by recording the actual number of trucks passing an inspection station by truck type for each hour of day during the survey period. Classification studies were used to analyze the variability in truck volumes. The second component of a roadside survey is to conduct interviews with a random sample of truck drivers passing the inspection station. Sample sizes typically ranged from 4% during the day to 16% at night. To avoid an over-representation of non-peak traffic in the interview data, the interview results were weighted to equal the number of observed trucks in each hour. These weighted results were used for all traffic characteristic analyses.

In order to examine the degree to which truck volumes and traffic characteristics vary by time of day, day of week and season, the first step was to calculate an average for each factor being tested. The next step was to calculate the percentage that each factor varied from the average. In order to portray variations more clearly, a base value of zero was assigned to the average and variations were then calculated from this base. The results of this analysis are plotted in Figures 1 through 24 for station 235 (QEW eastbound towards the U.S.), for station 232 (QEW westbound from the U.S.) and/or for both directions combined. It should be noted that it was not always practical to use the same scale for all the graphs.

Time of Day

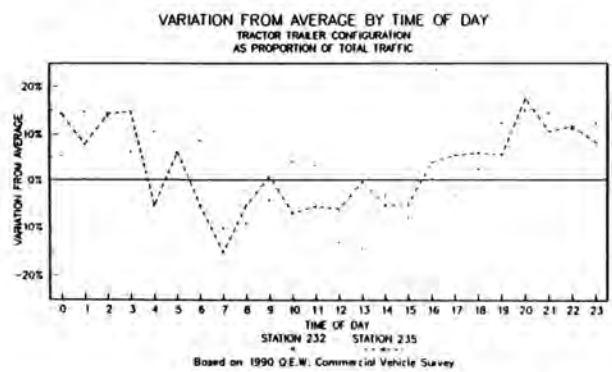
In a number of cases in the past, due to restrictions in available lighting and concerns about safety, commercial vehicle surveys have only been conducted during daylight hours. The data have then been expanded to represent a 24 hour period. This section of the paper examines the reliability of using such a technique.

FIGURE 1



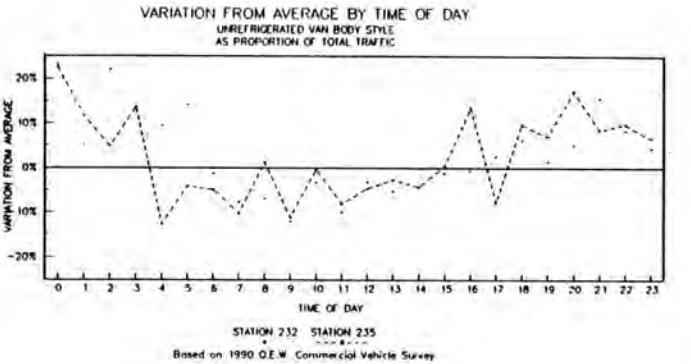
From Figure 1 it can be seen that there are considerably more trucks on the road per hour during the day than at night. In fact more than 50% of the traffic occurred in the 8 daytime hours between 8:00 and 16:00. It can be concluded that to just use daytime surveys to project total volumes for a 24 hour period would result in very misleading projections.

FIGURE 2



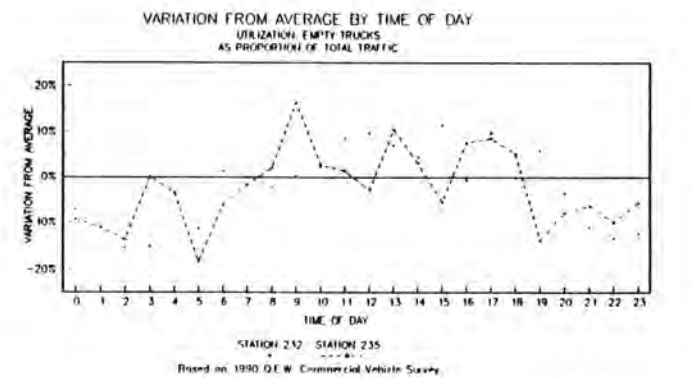
Not only are daytime surveys inappropriate to forecast 24-hour truck volumes, but daytime surveys are also inappropriate to project traffic characteristics for a 24-hour period. This can be seen from an examination of vehicle characteristics shown in Figures 2 and 3. In Figure 2, it can be seen that tractor trailers as a percent of total traffic vary by as much as 15% below the average during the day and by as much as 17% above the average at night. In Figure 3, an even wider variance for the occurrence of unrefrigerated vans is seen, ranging from 12% below the average in the daytime to 23% above the average at night.

FIGURE 3



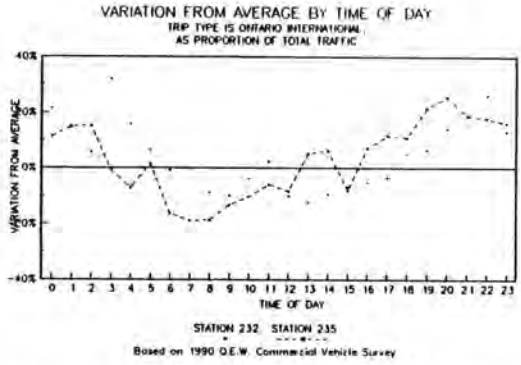
There are also wide variances in trailer utilization by hour of day, as shown in Figure 4. Empty movements are much more likely to take place during the daytime than at night.

FIGURE 4



Origin/destination information, represented by trip type in Figure 5, indicates that trips between Ontario and the U.S. make up a higher proportion of nighttime traffic than daytime traffic. The variance is as much as 12% below the average during the daytime and as much as 31% above the average at night.

FIGURE 5



Wide variances are also noted for carrier type in Figure 6, driver profile in Figure 7, and commodity types in Figure 8. However, the variances exhibited for these traffic characteristics tend to be randomly scattered above or below the average throughout the 24-hour period. For these characteristics then, a daytime survey to project 24-hours is unreliable because of the wide variances and random results of the survey, rather than because the daytime survey exhibits significantly different traffic patterns than during the night.

FIGURE 6

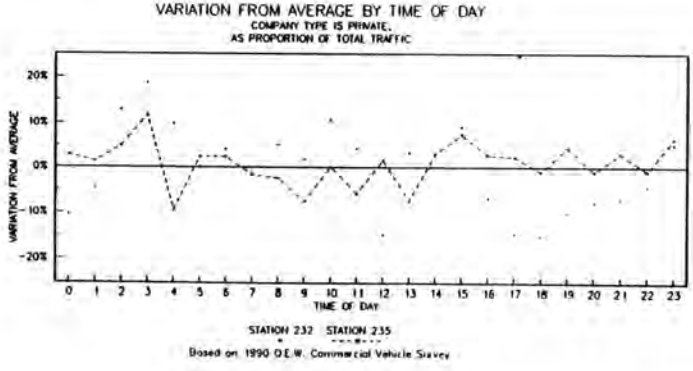


FIGURE 7

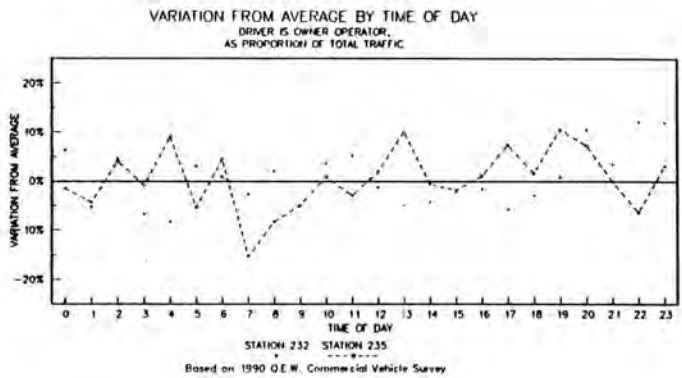
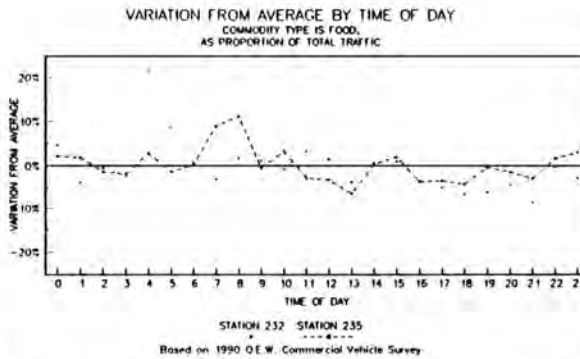


FIGURE 8



Sometimes when conducting roadside surveys, it is difficult to survey traffic flows in both directions. Often when this occurs the traffic flow in one direction is used to approximate the traffic flow in the other direction. Figure 1 through 8 provide some useful insights about the appropriateness of such estimates by hour of the day.

Although the actual number of trucks moving in each direction is not the same, the truck volume patterns as shown in figure 1 show a remarkably similar pattern for both directions throughout the 24-hour period. It would appear for this location at least, that using traffic flows in the one direction to approximate traffic flows by hour of day in the other direction has some merit. Unfortunately, this conclusion cannot be drawn for all locations because an initial analysis of other locations shows that depending upon the direction of travel, traffic volumes peak at different times of the day.

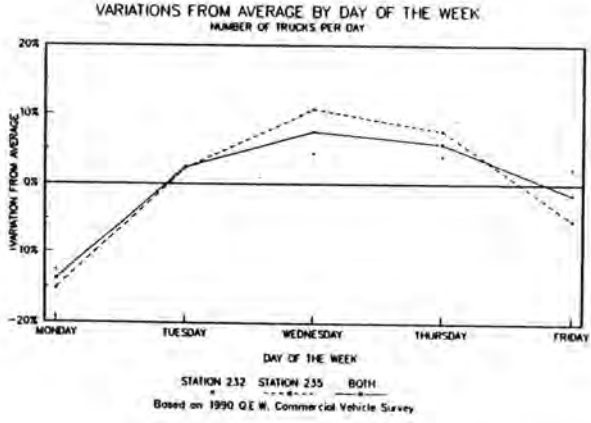
Each of the traffic characteristics examined in Figures 2 through 8 seem to follow the same general pattern when one direction is compared to the other. However, although the general patterns by direction are the same, the variances for some hours of the day are much too wide to allow the use of one direction of travel to predict traffic characteristics in the other direction. For example, if 4:00 am. is examined for each factor, considerable variance by direction is evident. In fact, the factor with the lowest variance by direction is seen in Figure 2. This figure shows that tractor trailers as a percent of total traffic is 10.6% above the average in the westbound direction compared to 5.4% below the average in the eastbound direction.

Day of the Week

Although an attempt is made by the Ministry of Transportation, Ontario to conduct roadside surveys for each survey location on the same day of the week as was done in surveys for previous years, it is not always possible to achieve same day surveys. For example, when a survey at a location is cancelled due to inclement weather, it is often difficult to reschedule the survey, let alone reschedule it for the same day of the week. This section of the paper examines the impact on survey reliability to project annual truck volumes and traffic characteristics if different days of the week are used.

The data for the analysis is taken from the week-long surveys conducted in 1990 on the QEW. The variance from the average is plotted for the same factors shown in the previous section.

FIGURE 9



From an examination of Figure 9, it is evident that truck volumes vary significantly by day of the week; ranging by as much as 15% below average for Monday to as much as 12% above average for Wednesday. The weekend varies even more from the weekday average with Saturday 70% below the weekday average and Sunday 85% below the weekday average. Depending upon the day of the week used, annual projections based on a one-day survey could lead to significantly different results. Unless differences in day of the week are accounted for in the analysis, roadside surveys cannot be used to project annual volumes.

However, when traffic characteristics are examined in Figures 10 through 16, variances from the average are not nearly as significant as variances for truck volumes.

FIGURE 10

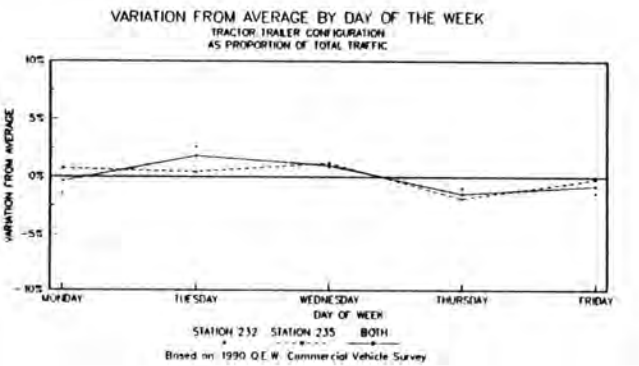
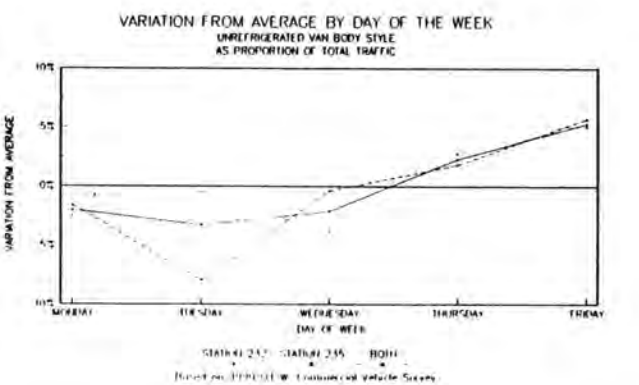
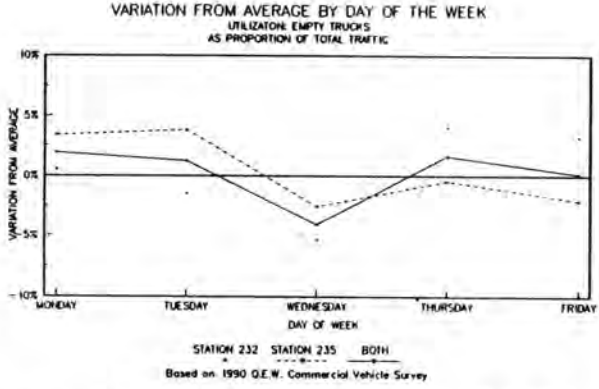


FIGURE 11



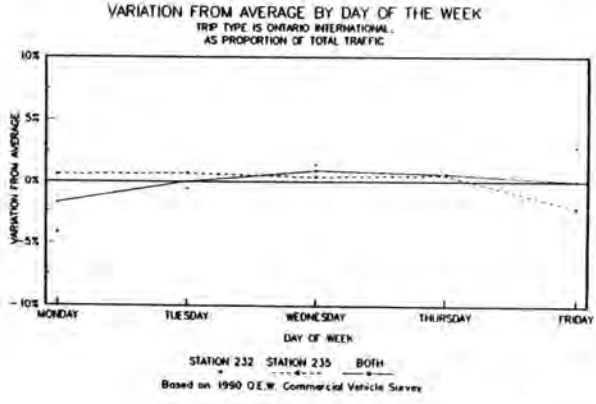
The largest daily variance in either direction from the weekly average is less than 5% for tractor-trailers (Figure 10), origin/destination information (Figure 13) and commodity type (Figure 16). When the directional surveys are combined together, the daily variance from the weekly average is even less for these factors.

FIGURE 12



With respect to trailer utilization (Figure 12), the largest variance from the weekly average is 5.4% in the westbound direction occurring on Wednesday while the largest variance for origin/destination information (Figure 15) occurs on Tuesday in the eastbound direction.

FIGURE 13



Only van type (Figure 11) and carrier type (Figure 14) have a significant daily variance from the weekly average. Even in these cases, the maximum variance from average is still under 10% and when the traffic flows are combined, the maximum variance falls to about 5%.

FIGURE 14

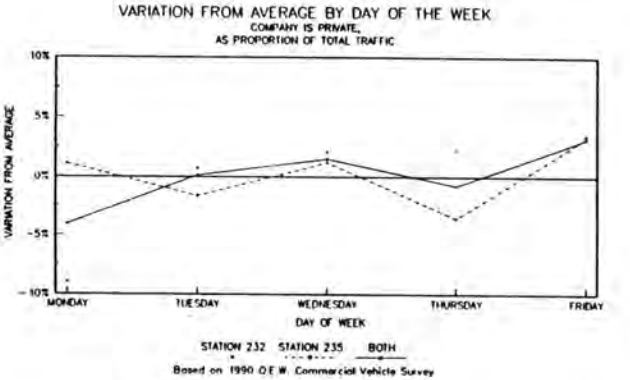
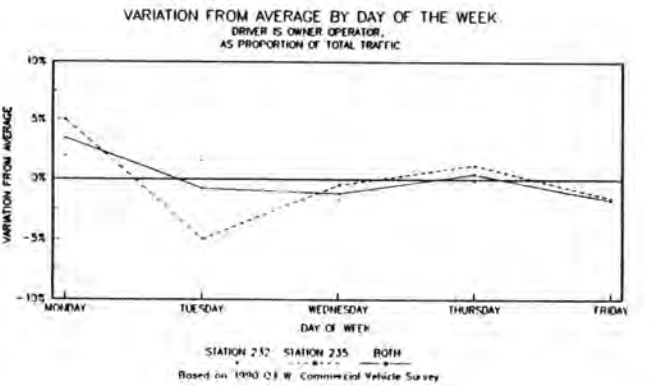
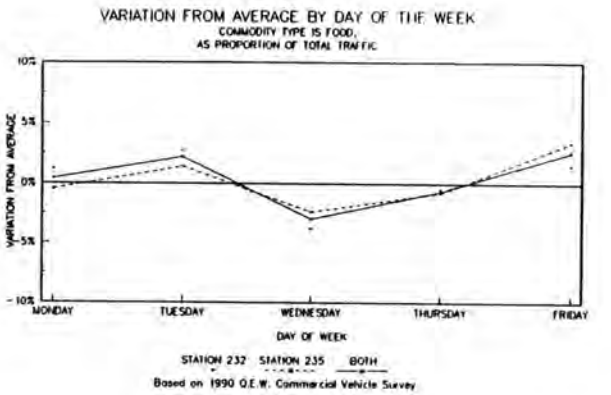


FIGURE 15



It would appear from these results that traffic surveys conducted on a particular day in the week are much more useful in generalizing about traffic characteristics than they are in projecting truck volumes. If survey results are combined from both directions, an even better projection of traffic characteristics is possible regardless of the day of the week being surveyed.

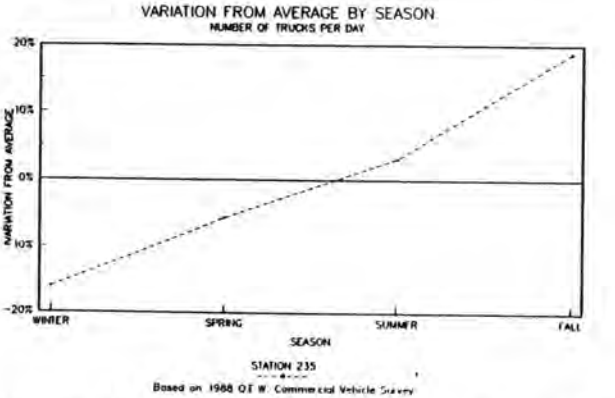
FIGURE 16



Season

Due to the expense of roadside surveys and the practice of hiring temporary staff to administer interviews, roadside surveys are often conducted during the summer months. In this section of the paper, the usefulness of summer roadside surveys to forecast annual truck volumes and traffic characteristics will be analyzed. The amount that each season varies from the annual average is plotted in Figure 17 for truck volumes and in Figures 18 through 24 for the same traffic characteristics as analyzed in the previous sections. A distinction is not made for directional traffic flows.

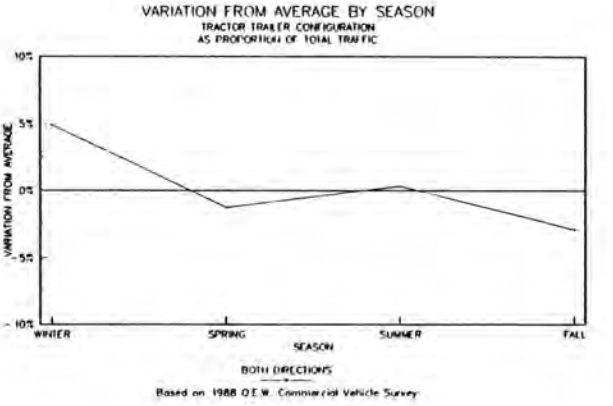
FIGURE 17



In 1988 the Ministry of Transportation, Ontario attempted to determine the impact of summer roadside surveys on

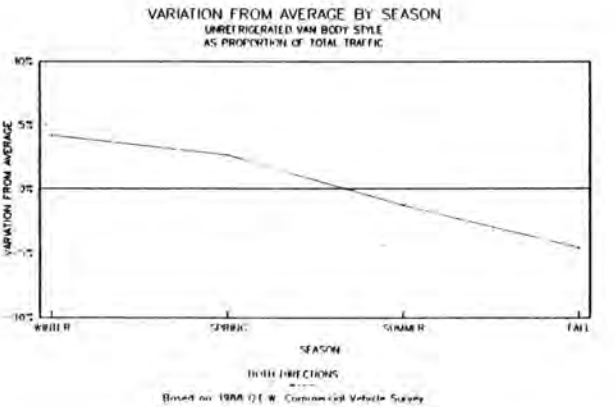
annual results. Roadside surveys were conducted for each of the four seasons. Unfortunately, due to poor weather conditions and timing problems associated with hiring part-time staff, the surveys for each season were not always conducted on the same day of the week. Adjustments have been made to account for this problem in order that general conclusions about seasonality could be made. However, a precise measure about the effects of seasonality on predicting annual traffic volumes and characteristics was not possible.

FIGURE 18



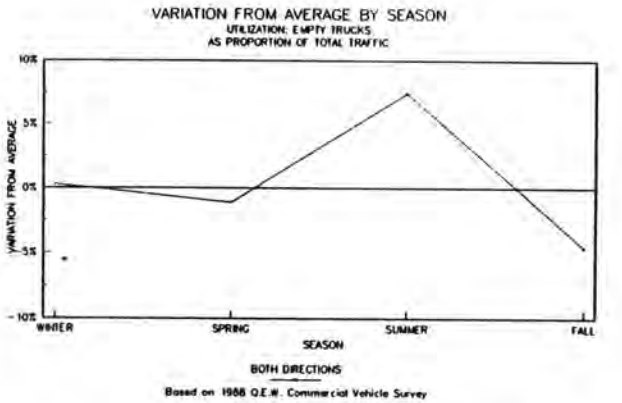
In Figure 17, it can be seen that summer truck volumes only vary from the annual average by 2.4% indicating that it might be possible to use summer roadside surveys to project

FIGURE 19



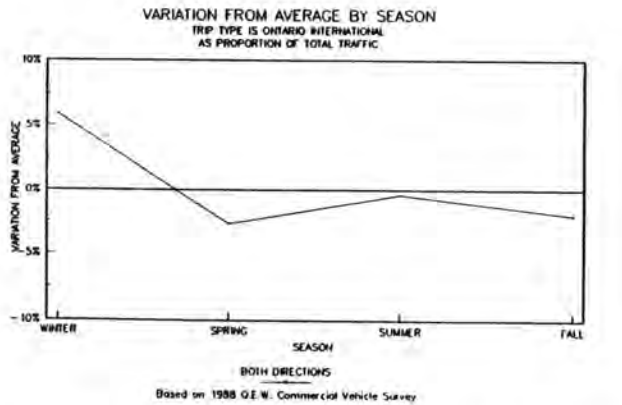
annual volumes. However, the other seasons show a significant variance from the average with considerably lower winter truck volumes and significantly higher fall truck volumes. Due to this wide variance in volumes by season, a great deal of caution would have to be exercised if summer surveys are to be used to generalize about annual volumes.

FIGURE 20



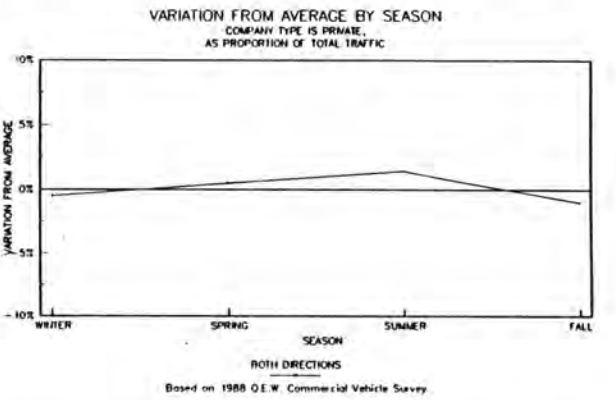
With respect to traffic characteristics, it would appear from an analysis of Figures 18 through 24 that the variances between seasons are minimal for most factors. It can be seen that the variations from average for company type (Figure 22) and for commodity type (Figure 24) are insignificant.

FIGURE 21



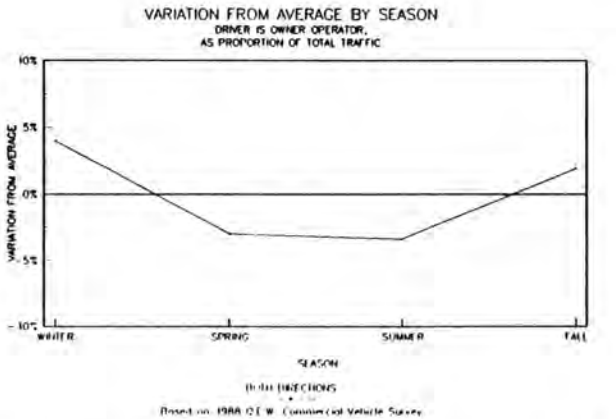
The largest variance from average for vehicle type (Figures 18 and 19) and driver type (Figure 23) is less than 5%.

FIGURE 22



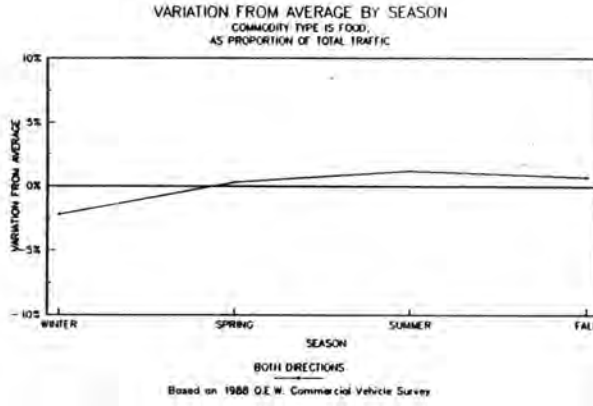
Only trailer utilization (Figure 20) and origin/ destination information (Figure 21) show variances from the average in excess of 5%. The maximum variance from average for trailer utilization is 7.4% and occurs in the summer while the maximum variance from average for origin/ destination information is 5.9% and occurs in the winter.

FIGURE 23



Although caution is required for some factors such as trailer utilization, it can be concluded from this analysis that summer roadside surveys can be a useful tool in analyzing annual traffic characteristics.

FIGURE 24



Other Factors

It must be emphasized that this analysis only applies to one location. A preliminary analysis of other inspection stations shows that although the extent of variability for time of day, day of week, and season is similar to the QEW location, the actual traffic patterns for these other locations are often significantly different. In other words, the traffic characteristics determined for one station cannot be used to project traffic characteristics for another station.

Even the best designed survey can be spoiled by uncontrollable factors. Poor weather conditions, accidents, road construction, work stoppages, etc. can all affect the results of a roadside survey and its usefulness in forecasting annual traffic characteristics.

Conclusions

Despite the above limitations, some general conclusions can be drawn from the analysis about the extent to which the "snapshot" of activity from a roadside survey at one location can be used to generalize about the activity for that location throughout the year.

First of all, roadside surveys that do not cover a full 24-hour period should not be used to generalize about truck volumes and traffic characteristics. **Secondly**, roadside surveys should not be used to predict annual truck volumes because of the significant variations in truck volumes by day of week and season. **Thirdly**, a full day survey in one location can be useful in projecting many traffic characteristics in the other direction.

Finally, a full 24-hour weekday survey can generally provide a good annual picture for most traffic characteristics.

In order for roadside surveys to provide useful data for monitoring trends and changes in trucking volumes, timing related variables should be held constant. In order to achieve this objective, several recommendations stem from the analysis. First of all, a more rigorous statistical analysis of the existing data for the QEW and other locations should be conducted in order to determine the statistical reliability of existing data. Finally, existing resources used for ad hoc roadside surveys should be used in the short term at least, to develop statistically sound sampling techniques for comparison purposes. It may be necessary to conduct five day roadside surveys for each of the four seasons at set locations across the province.

LES ENJEUX DE L'ACQUISITION DE VOIES FERRÉES ABANDONNÉES

I. INTRODUCTION

La Loi de 1987 sur les transports nationaux, L.R.C. (1985), chapitre 28 (3e supplément) en vigueur le 1er janvier 1988, modifie en profondeur les règles du jeu en matière d'abandon ferroviaire. En effet, ce nouveau mécanisme facilite l'abandon d'embranchements ferroviaires par leur exploitant.

À titre d'exemple, le nombre de kilomètres de voies ferrées abandonnées au Québec se chiffre pour l'année 1988 à 126 kilomètres et, pour l'année 1989, à 636 kilomètres. Dans un tel contexte, soit celui d'une accélération de l'abandon des voies ferrées, la problématique de l'acquisition de voies ferrées abandonnées se pose avec beaucoup d'acuité.

Le nouveau mécanisme d'abandon découlant des articles 159 à 177 de la Loi de 1987 sur les transport nationaux peut se résumer ainsi. En cas de non-opposition à une demande d'abandon, l'Office national des transports (O.N.T.) doit ordonner l'abandon. S'il y a opposition à la demande d'abandon, l'O.N.T. doit déterminer si la ligne est rentable ou non, s'il y a motif ou non de croire qu'elle puisse le devenir dans un avenir prévisible et s'il est d'intérêt public de la conserver.

Nous devons souligner le cadre législatif très rigide de ce nouveau mécanisme d'abandon. En effet, il est facile de constater que, dans ce cadre législatif récent, ces nouvelles règles du jeu restrictives ne permettent plus d'invoquer l'argument des conséquences socio-économiques de l'abandon sur la région concernée. Seul le critère strict de rentabilité est déterminant. Ainsi, le tableau figurant en annexe montre que sur 21 décisions de l'O.N.T. relatives à des requêtes en abandon provenant du Québec - années 1988, 1989 et 1990 -cinq seulement ont ordonné le maintien en exploitation, soit 23%.

Une année avant la révision complète de la Loi de 1987 sur les transports nationaux, il serait intéressant de mesurer les conséquences de ce nouveau mécanisme d'abandon sur la problématique de l'acquisition des voies ferrées abandonnées.

II. LA PROBLÉMATIQUE DE L'ACQUISITION DES VOIES FERRÉES ABANDONNÉES

Le problème fondamental de la création de chemins de fer d'intérêt local, de l'acquisition par Via Rail de tronçons de chemin de fer abandonnés ou susceptibles de l'être et de l'acquisition par divers groupes locaux de voies ferroviaires abandonnées pour des fins récréo-touristiques, pose toujours le même défi : le coût très élevé de l'acquisition des voies ferrées abandonnées ou sujettes à abandon. Pour débuter, nous allons examiner le cas de la création de chemins de fer d'intérêt local, avant de traiter ceux de Via Rail et des groupes à vocation récréo-touristique.

A. Création de chemins de fer d'intérêt local

En premier lieu, nous devons souligner que depuis l'introduction, en janvier 1988, de la Loi de 1987 sur les transports nationaux, aucun chemin de fer d'intérêt local ne s'est constitué au Québec sur l'un des nombreux tronçons ferroviaires abandonnés. L'une des raisons fondamentales est le coût très élevé d'acquisition de ces tronçons ferroviaires abandonnés.

En effet, l'évaluation du coût des tronçons ferroviaires abandonnés du Canadien Pacifique (St-Jérôme/Mont-Laurier et Beebe Junction/Lennoxville) serait de l'ordre de 10 millions $ pour le premier et de 14 millions $ pour le second.

Dans un tel contexte, il nous apparait difficilement concevable pour une petite société de chemin de fer d'intérêt local de procéder à l'acquisition de tels tronçons ferroviaires abandonnés ou sujets à abandon considérant la somme énorme de capital requis (plusieurs millions).

- Le premier chemin de fer d'intérêt local au Canada : le Central Western

Le cas du chemin de fer d'intérêt local Central Western est intéressant. Constitué par une loi de l'Alberta (chapitre 71 des Lois de 1974), le chemin de fer d'intérêt local Central Western commence les opérations le 21 novembre 1986 par l'acquisition du tronçon ferroviaire de 105 milles entre Ferlow Junction et Dinosaur, autrefois la propriété du C.N. Les opérations de ce premier chemin de fer d'intérêt local au Canada se limitent au transport du grain car il existe le long de la voie neuf élévateurs à grain, exploités par quatre sociétés céréalières.

Cette vente par le C.N. de ce tronçon au chemin de fer d'intérêt local Central Western se chiffre à 2 700 000 $ dont la moitié par un prêt sans intérêt remboursable au C.N. le 31 juillet 1997. Soulignons que le gouvernement fédéral a contribué pour 1 750 000 $ au chemin de fer local Central Western et 700 000 $ au C.N. pour une contribution initiale à l'acquisition du tronçon.

Le problème majeur du coût élevé d'acquisition de voies ferrées abandonnées ou sujettes à abandon pour fins de transport ferroviaire à courte distance se pose avec d'autant plus d'acuité qu'il n'existe aucun programme d'aide financière fédéral ou provincial : "Unlike the U.S. in the 1970's, there are no formal programs available for shortline railways for financial assistance at either the provincial or federal levels. In addition, there appears to be considerable reluctance on the part of local gouvernments to provide funds for the various proposed shortlines".[1]

Outre l'obstacle majeur du coût élevé de l'acquisition des voies ferrées pour la constitution d'un chemin de fer d'intérêt local, il faut souligner le problème des relations de travail.

- Le problème des relations de travail

En effet, la constitution du premier chemin de fer d'intérêt local, Central Western, pose le problème de la compétence provinciale ou fédérale de ses activités. "La question dans la cause opposant Central Western aux Travailleurs unis des transports devant la Cour suprême du Canada est de savoir lequel du gouvernement provincial ou du gouvernement fédéral a compétence, pour les fins de relations de travail, sur une voie ferrée de 105 milles située entièrement dans la province d'Alberta."[2]

Après un débat judiciaire de trois ans, la Cour suprême du Canada décide que le chemin de fer d'intérêt local Central Western n'est pas soumis aux dispositions du Code canadien du travail et n'est donc pas un ouvrage ou une entreprise fédérale au sens de l'alinéa 92 (10) a) de la Loi constitutionnelle de 1867. En d'autre mots, ce chemin de fer d'intérêt local relève de la compétence provinciale en raison de la nature distincte de ses activités par rapport à celles du C.N. Cette décision fondamentale favorise donc la création de chemins de fer d'intérêt local en ce sens que ceux-ci ne seront pas soumis aux conventions collectives très onéreuses des syndicats canadiens : "If, on the other hand, the Supreme Court rules in favour of the C.W.R., then there may very well be a steady growth in the number of shortline railways in Canada, as these railways will be able to more effectively utilize their labour."[3]

Cependant signalons le fait que la création du chemin de fer local Central Western ne peut constituer un modèle pour les futurs opérateurs de chemins de fer locaux parce que le chemin de fer local ne transporte qu'un seul produit, le blé, sujet à un encadrement légal très strict. De plus, l'aide de 2 700 000 $ accordée par le gouvernement fédéral dans le cadre d'une expérience pilote était exceptionnelle et ne peut être appliquée à d'autres chemins de fer locaux. Il s'agit donc d'un cas d'espèce bien particulier.

Toutefois, un élément favorisant l'émergence de chemins de fer locaux est la révision projetée par le gouvernement du Québec de la Loi sur les chemins de fer, L.R.Q., chapitre C-14. Cette révision de la loi a pour but de permettre la constitution de compagnies de chemin de fer par lettres-patentes au lieu du mode actuel (long et

coûteux) d'une loi spéciale ou "charte" et d'introduire, comme au niveau fédéral, la notion de certificat d'aptitude.

- Deux modes d'acquisition des voies ferrées

La Loi de 1987 sur les transports nationaux prévoit deux modes d'acquisition des voies ferrées par un opérateur de chemin de fer d'intérêt local. Le premier mode est prévu à l'article 158 de la loi, soit une acquisition de tronçons de chemin sans abandon. Le second mode, décrit à l'article 174 de la loi, prévoit un mécanisme d'acquisition de tronçons sujets à abandon. Ce mécanisme d'acquisition d'un embranchement ferroviaire par un chemin de fer d'intérêt local fixe le délai, détermine le montant (valeur nette de récupération) en l'absence d'un accord entre les parties, et confie à l'O.N.T. le rôle d'arbitre.

Notons qu'au Québec, depuis l'entrée en vigueur de la Loi de 1987 sur les transports nationaux, aucun promoteur de chemin de fer d'intérêt local n'a eu recours à l'article 174 de la Loi. Il n'existe donc pas encore de précédent québécois qui aurait permis à l'O.N.T. de déterminer le coût de l'acquisition de tronçons abandonnés selon le principe de la valeur nette de récupération, en l'absence d'un accord entre les parties.

Nous suivons avec attention l'acquisition par Rail Tex de San Antonio des subdivisions Exeter et Goderich du C.N., formant ainsi l'un des premiers chemins de fer d'intérêt local en Ontario.

- Le précédent des droits de circulation : M.O.Q. Rail Inc.

Nous devons souligner le précédent de la compagnie de chemin de fer M.O.Q. Rail. Incorporée conformément à l'article 10.1 de la Loi fédérale sur les chemins de fer, cette nouvelle compagnie de chemin de fer obtient de l'Office national des transports un certificat d'aptitude en janvier 1990.

Cette compagnie québécoise, voulant desservir différents corridors ferroviaires dans les provinces maritimes, en Ontario et au Québec, a développé avec Innotermodal un nouveau système de transport intermodal (un train bloc de 50 remorques de camions propulsé par une dizaine de motrices). Ce nouveau système de transport pourrait conduire à des réductions de 25% du coût de transport.

Avant de débuter les opérations, la compagnie M.O.Q. Rail demande à l'O.N.T. des droits de circulation sur les lignes d'une autre compagnie de chemin de fer, en l'occurrence le C.N. L'O.N.T. convoque les parties en audiences publiques le 2 avril 1991. Ces audiences portent sur la requête de la compagnie M.O.Q. Rail d'obtenir des droits de circulation pour sept corridors d'une autre compagnie de chemin de fer.

L'intérêt de ce précédent, si la requête de la compagnie M.O.Q. Rail est accordée par l'O.N.T., est de faire préciser par ce dernier

organisme une définition de l'intérêt public, critère déterminant dans l'obtention ou non de droits de circulation.

B. Acquisition par Via Rail de tronçons sujets à abandon

La Loi de 1987 sur les transports nationaux prévoit aux articles 168 et 174 le droit pour Via Rail d'acquérir un tronçon ferroviaire avec certaines modalités. Dans un tel cas, l'O.N.T. fixe, selon l'article 168, l'entrée en vigueur de l'abandon à un an après l'arrêté d'abandon et ce, dans le but de permettre à Via Rail d'arrêter sa décision. Si Via Rail est intéressée à procéder à l'acquisition du tronçon et, en absence d'accord sur le prix, l'O.N.T. détermine la valeur nette de récupération.

La problématique de l'acquisition par Via Rail de tronçons sujets à abandon est un problème préoccupant pour le Québec en raison de l'existence d'un service voyageurs menacé sur de nombreux tronçons en demande d'abandon. En effet, les demandes d'abandon (disparition du service de marchandises pour la subdivision Chandler, de Ste-Adélaïde à Gaspé, de La Sarre à Cochrane pour la subdivision Taschereau ainsi que pour celle de Montmagny d'Harlaka à St-Romuald) mettent en péril l'existence du service voyageurs de Via Rail, impliquant la fermeture de nombreuses gares dont celles de Gaspé, Percé, La Sarre et Lévis[4].

Dans un tel contexte, il est peu probable que Via Rail fasse l'acquisition de ces trois tronçons considérant les restrictions budgétaires. D'ailleurs soulignons qu'Amtrak, lorsque confrontée à des abandons de tronçons (service de marchandises) n'a jamais procédé à l'acquisition. Notons qu'Amtrak a recours pour les droits de circulation à la méthode des coûts évitables, c'est-à-dire le seul coût occasionné par l'existence d'un service voyageurs alors que Via Rail a une marge de manoeuvre très restreinte car celle-ci est essentiellement tributaire des coûts fixés par C.P. et surtout par le C.N. en raison de l'étendue de son réseau utilisé par Via Rail :

"L'administration du service ferroviaire de transport de voyageurs (AMTRAK) ne paie aux chemins de fer de qui elle loue et achète des services que ce que l'on appelle les «coûts strictement évitables». Ces coûts évitables, tels que définis dans la loi sur AMTRAK, sont essentiellement ceux que le chemin de fer peut démontrer uniquement attribuables à l'opération ou au service fourni à AMTRAK. Il est à noter que la définition exclut tous coûts non attribuables à la fourniture du service de transport de voyageurs et c'est aux chemins de fer qu'il incombe de démontrer que ces coûts satisfont à ces conditions... Au Canada, Via ne bénéficie pas d'un arrangement en termes de coûts évitables. Il doit plutôt acquitter des factures établies selon un «coût variable à long terme» ce qui l'amène à partager une partie des dépenses communes qui ne sont pas directement attribuables au service de transport de voyageurs."[5]

On peut constater que Via Rail est bien loin de bénéficier de l'autonomie d'AMTRAK puisque Via Rail ne bénéficie pas encore après

14 ans d'existence d'une loi constitutive fixant un cadre législatif défini et complet.

Sans l'aide financière du gouvernement fédéral, nous estimons que Via Rail, après l'acquisition éventuelle du tronçon, ne pourra assumer le coût très élevé d'exploitation d'un tronçon en raison du fait qu'elle sera la seule utilisatrice, ce qui n'est pas le cas d'AMTRAK.

C. Acquisition par des groupes régionaux pour fins récréo-touristiques

La problématique de l'acquisition d'emprises pour fins récréo-touristiques se pose de façon opportune.

En effet, au Québec, de nombreux groupes régionaux veulent acquérir les emprises de voies ferrées démantelées en vue d'y développer des projets de sentier récréatif, de parc linéaire ou de voie cyclable. Cependant, le prix astronomique de l'acquisition est sans commune mesure avec les moyens de ces groupes régionaux d'acquérir celles-ci : à titre d'exemples, l'évaluation du coût des tronçons ferroviaires abandonnés du Canadien Pacifique (St-Jérôme/Mont-Laurier) serait de l'ordre de 10 millions $ et de 14 millions $ pour le tronçon Beebe Junction/Lennoxville.

Dans un tel contexte, il nous apparait difficilement concevable pour un groupe régional d'acquérir à un tel coût des voies ferrées désaffectées pour fins récréo-touristiques sans l'aide financière du gouvernement du Québec.

Aux États-Unis, le gouvernement américain a adopté la "Federal Railbanking Law", loi permettant de préserver des tronçons ferroviaires désaffectés pour des besoins futurs, advenant des changements économiques et technologiques. En outre, il existe déjà 266 sentiers récréatifs représentant plus de 3 200 milles de voies ferrées abandonnées. Citons à titre d'exemple le cas du sentier récréatif "Illinois Prairie Path" d'une longueur de 92 kilomètres dont la gestion est confiée à trois structures régionales ou comtés. Au Canada, le dossier des voies ferrées désaffectées en voie de transformation en sentiers récréatifs évolue rapidement. En effet, la Nouvelle-Écosse élabore présentement un projet de loi visant la constitution d'un réseau de sentiers récréatifs. La Colombie-Britannique et l'Ontario ont déjà procédé à l'acquisition d'emprises en vue d'y aménager des sentiers récréatifs.

III. CONCLUSION

Les modalités de l'acquisition des voies ferrées constituent un obstacle majeur pour la création de chemins de fer d'intérêt local, pour Via Rail ainsi que pour les groupes à vocation récréo-touristique.

Dans le contexte de restrictions budgétaires de Via Rail, il nous apparait difficilement concevable pour celle-ci de procéder à l'acquisition de tronçons sujets à abandon sans une contribution financière du gouvernement fédéral.

Quant à l'acquisition par les groupes régionaux de voies ferrées démantelées pour des fins récréo-touristiques, elle ne peut être envisagée sans une aide substantielle du gouvernement du Québec.

En ce qui concerne l'un des points fondamentaux de notre étude, soit l'acquisition de tronçons en vue de la création de chemins de fer d'intérêt local, nous croyons fermement que le coût élevé d'acquisition de tronçons, évalué à plusieurs millions de dollars, justifie l'établissement d'un programme ponctuel d'aide financière des gouvernements provinciaux. 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 100 chemins de fer locaux exploitant plus de 17 000 milles de voie. Cette loi fédérale prévoit une aide financière substantielle aux États voulant susciter la création de chemins de fer d'intérêt local. 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'octroient pas de subventions pour couvrir des pertes d'exploitation.

Signalons que l'article 175 de la Loi de 1987 sur les transports nationaux prévoyant, en cas d'abandon, une aide financière pour d'autres moyens de transport ne peut être appliqué à la constitution d'un chemin de fer local. Certains promoteurs de chemins de fer d'intérêt local déplorent ce fait qui ne favorise guère la création de chemins de fer locaux.

En effet, une telle exclusion constitue un autre obstacle majeur à la constitution de chemins de fer locaux. Donc, nous croyons que cette situation est foncièrement inéquitable pour les futurs opérateurs de chemins de fer locaux. De toute façon, il faut nuancer la portée de cet article sur l'aide financière en raison du fait que dans la pratique, aucune somme n'y est allouée par le gouvernement fédéral à l'exception d'un cas d'une portée très limitée.

Dans un tel contexte, nous estimons que seule l'approche de la compagnie de chemin de fer américaine Norfolk Southern peut résoudre le problème du coût trop élevé de l'acquisition de tronçons par un opérateur du chemin de fer local.

En effet, la compagnie de chemin de fer Norfolk Southern, par son programme de filiation directe ("thoroughbred"), loue au lieu de vendre à un opérateur d'un chemin de fer local les tronçons dont celle-ci veut se départir mais avec une entente conjointe de marketing :

"A key objective of our program is to correct the economics of the line so that it will continue to generate traffic for Norfolk Southern. We think a shortline operator's got a better chance with a leasing arrangement than he has with a straight up-front cash transaction."[8]

L'approche locative devrait, selon nous, prendre la forme d'une entente de bail à long terme de l'infrastructure ferroviaire entre une compagnie ferroviaire de classe I et un chemin de fer d'intérêt local qui demeure toutefois autonome quant à ses activités propres ainsi qu'au choix de son personnel.

Voici une autre justification de l'approche locative par la compagnie américaine de chemin de fer Norfork Southern :

"Si la compagnie a opté pour l'approche locative, c'est essentiellement parce que le trafic de ces lignes n'était pas suffisant pour justifier de nouveaux investissements de sa part, mais était suffisamment important pour justifier leur exploitation sous forme de lignes d'apport par des gens entreprenants dont les dépenses seraient moindres. «Mais même ainsi, le trafic de ces lignes n'aurait pas pu soutenir la dette qu'un acquéreur aurait à assumer pour acheter purement et simplement la ligne et la NS ne tenait pas du tout à refiler ses problèmes à quelqu'un d'autre.'[7]

À nos yeux, seules des formules innovatrices telle l'approche locative de tronçons par C.N. ou C.P. à des opérateurs de chemin de fer locaux, ou des prêts sans intérêt ou à intérêt minime, peuvent permettre à court terme et moyen terme la constitution de chemins de fer locaux tant au Québec qu'au Canada.

Note : Les opinions émises dans cette étude sont celles de l'auteur et ne reflètent pas nécessairement les vues du ministère des Transports du Québec.

NOTES

1. Richard LANDE et Michael LOUGHMAN. Shortline railway industry in Canada, Concordia Transportation Management Centre, Septembre 1990, p. 29 (Étude rédigée avant la décision de la Cour suprême du Canada sur Cenetral Western, 20 décembre 1990).

2. Central Western Railway Corporation c. Travailleurs unis des transports, etc. Cour suprême du Canada, 20 décembre 1990, p. 1.

3. Richard LANDE et Michael LOUGHMAN. Shortline railway industry in Canada, Concordia Transportation Management Centre, Septembre 1990, p. 24.

4. Décision de l'O.N.T. autorisant l'abandon du tronçon Ste-Adélaïde-Gaspé (5 février 1991)
Décision de l'O.N.T. autorisant l'abandon du tronçon La Sarre-Cochrane (17 septembre 1990)

5. Rapport provisoire sur le service ferroviaire de transport de voyageurs, Le comité permanent des transports et des communications, Sénat du Canada, p. 15.

6. "Norfolk Southern's Arnold B. McKinnon : A strategy for the 90's", Railway Age, août 1989, p. 77.

7. Décision de l'O.N.T. sur la compagnie Port Stanley Terminal Rail Inc., p. 22.

DÉCISIONS DE L'OFFICE NATIONAL DES TRANSPORTS SUR LES REQUÊTES EN ABANDON DÉCOULANT DE LA L.N.T. DE 1987 POUR LE QUÉBEC

Points milliaires	Nombre de milles	Décision
	1988	
Jonction Baie-des-Ha Ha/Chic.	5,31	Abandon
Grenmont/St-André Est	17,70	Abandon
Val-Royal/Cartierville	0,81	Abandon
Clough/Farnham	14,24	Abandon
Granby/Chambly	35,00	Maintien
Hedley/Jackson's	33,88	Maintien
	1989	
Lennoxville/Beebe Junction	30,00	Abandon
Chaudière/Richmond	88,62	Abandon
Foster/Drummondville	48,60	Abandon
Granby/Clough	6,57	Abandon
St-Jérôme/Ste-Agathe	30,80	Abandon
Ste-Agathe/Mont-Laurier	93,80	Abandon
Jackson's/Rivière-à-Pierre	19,07	Abandon
Sorel/Nicolet	30,14	Abandon
Beebe Junctin/Rock Island	2,40	Abandon
Témiscaming/Gendreau	7,40	Abandon
Cabano/Edmunston Est	33,00	Abandon
Clough/Chambly	28,43	Maintien
Tracy/Sorel	9,16	Maintien
	1990	
La Sarre/Cochrane	132,60	Abandon
Franquet/Chapais	97,34	Maintien

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Louis Doyle

A Step Forward in Grain Handling?

A good place to start any story is the beginning. Anyone who is familiar with the grain industry will agree this is a very elusive concept in the business -- the beginning that is. So rather than spend any time on trying to determine where that might be with respect to this paper, we will start with a basic question.

What is the Graintainer?

The Graintainer is a container that has been adapted from its dry packaged goods orientation to bulk commodity requirements. Instead of flat floors and end doors, the Graintainer has rooftop longitudinal hatches and bottom dumping hoppers.

The Graintainer is also different from the containers we are used to seeing in other ways. It is longer than your normal twenty-foot marine container at twenty-nine feet five inches. At ten feet six inches, it is higher than the normal eight feet. It is the same width, eight feet.

These dimensions are necessary in order to create enough cubic capacity to accommodate the differing densities of the grain types we expect to carry. The objective is to maximize the allowable gross vehicle weights of the highways and the gross weight restrictions of the railway at the same time. These dimensions meet that objective.

The Graintainer is similiar to the normal containers with respect to its handling. It is handled to and from rail cars with the use of overhead gantries or toplifters. The same applies to on and off the truck chassis. The Graintainers are stackable in the terminals but are restricted to two high as opposed to three high for the marine variety.

The Graintainer is compatable with existing rail equipment. It currently moves on our eighty-nine-foot domestic container flat cars with three to a car. It is a little different when it comes to the truck chassis. Normal twenty and forty-foot containers are easily handled with basic chassis configurations. The Graintainer requires low bed tridem axel chassis to accommodate the high weight in the shorter space. We load in twenty-nine feet what trucks spread over forty-five feet.

Essentially then, we have adapted the ideas designed for packaged goods and customized them to meet bulk commodity handling characteristics. It sounds like this should work given all the experience we have had with intermodal operations. However, it is not the things we know that cause us to be cautious with our approach. It is the things we do not know. This is why you find us now testing

this concept in a controlled application.

Why the Graintainer?

This is a good question when we consider the investment that is already in place to handle grain to export and domestic markets. Canada is and should be very proud of its reputation in world markets. Why fix what isn't broken?

Well, simply put, we cannot afford more of the same. The industry as a whole, that is, cannot. Right now world grain markets are weathering the effects of the so-called subsidy war being waged between the EEC and the U.S. This aberration merely serves to exacerbate the underlying problem Canada faces.

It takes a leap of faith to believe this, but there is the concept of natural justice that says that which ought to be done will eventually be done. Taking this at face value, we can assume that sometime in the future this subsidy matter will be sorted out.

When that occurs, Canada will still be faced with the problem of not being able to afford more of the same. And if the subsidy debate does not get resolved we can, more than likely, forget about exporting grain to extent we do today. Our treasury simply cannot compete on the terms of the battle being conducted between the EEC and the U.S.

Assuming the subsidy issue is settled at some point in the future, grain prices will come back up and everything will be in order again -- right? Unfortunately, not. In a "normal" situation prices are volatile. There are ample checks in the market place to keep grain prices in balance. The periodic disaster certainly causes an upward swing. However, disasters are neither good for the market place from a social viewpoint nor are they financially sound investments.

Compounding the price checks is the fact that a very significant number of the demand sources for grain have severe problems with their ability to pay. It is a dilemma of diabolical proportions. The people who need the grain cannot afford to buy it. The people who need to sell it cannot afford to sell it to the people who need it. This is not your typical classroom supply/demand scenario.

That leap of faith referred to earlier is in order here. But the bottom line of this vein of thought is to say rising world prices will not provide the answer to Canada's inability to afford more of the same. Even if the prices rise to all-time highs, it wouldn't be enough. The reason for this is we have competitors out there who do what we do at less cost.

What about Canada's reputation for the quality of its product one might ask. There is no doubt we have that reputation. This is the very thing that earns us the sales volume we achieve. But it earns us precious little by way of extra income in the current environment.

The theory about quality goes that once a business has a reputation for quality it can increase profits by either increasing price or volume. The market place described above will allow us volume but it is not likely to be able to pay any extra for any quality edge we might be able to offer.

Our reward for our quality will be volume. It will be incumbent upon us to generate any profit by becoming more efficient at what we do. And the benchmark for this exercise cannot be simply our current level of cost. We have to be more efficient than our main competitors or we will find ourselves being dictated to as to how much profit we may earn as grain exporters.

Our major competitors have some inherent advantages that will challenge our collective skills and resources as we strive to be competitive. Fundamentally, they have less distance to cover when it comes to positioning their product for export. And they do it more efficiently. Part of this efficiency, in the case of the United States, comes from the sheer size of their operations. They have economies of scale that we do not.

We are not able to change that and it is something we have to cope with. However, we go ahead and compound the problem by instituting regulatory conditions and tax measures which create further advantage for the competition. I refer here to transportation policies in Canada which are not well co-ordinated and do not focus on the best allocation of resources to meet the needs of our domestic markets.

This has the effect of artificially adjusting the scale of operations of the various modes internally and ultimately the viability of the respective operations. This means the policies play favourites instead of allowing economic allocation of resources to produce the best mix.

We don't stop there, though. We go a step further and tax our transportation resources differently and at higher rates than our main competitor to the south does. This creates a higher cost base to work from than is the case in the United States. This translates into the users of transportation in Canada, including the grain industry, having to pay more to position their goods for export markets than do their competitiors in the United States.

The globalization of world trade and, closer to home, the trade agreement with the United States is bringing these factors home to roost. The advantages the producers in the United States have in accessing their export markets are carried with them as they serve their domestic markets. Under freer trade with the United States, Canada becomes one such domestic market.

The situation, so far described, addresses the transportation component generically. It establishes the base case of our competitive ability as we look at the grain situation as a whole. This is not a pretty picture, costwise, either. Essentially our grain handling system is

one that has evolved over a period of more than one hundred years. And it has done this virtually insulated from the market place.

Insulated, as such, it has taken on the characteristics of a system that does things to suit itself for the users it perceives will most benefit. Innately, this is not a bad thing. The producers of grain are well served in terms of their capability to deliver their grain and have it marketed. The buyers are well served in that they are assured they will receive what they have payed for.

So what is the problem again? We cannot afford to continue to do what we are doing at current levels of cost. In meeting the producer/customer-oriented objectives under the current system a very important element has been forgotten; the competition. We have to serve the needs of the users of the system but we have to be able to do it as effectively and cheaply as do our competitors.

What makes our system a high cost one?

Basically, the size of it is what it comes down to. We take more resources to do what we do. Our competitors do it with less. One can question the quality with which they do it but remember the market place is not likely to give us the added premiums we need to pay for our current ways.

When we look at the whole system we have in place today, we see miles upon miles of railway tracks across the Prairies that are there to solely handle grain. As we look more closely, we see endless numbers of stations with hundreds and hundreds of grain elevators.

This in itself is not a bad thing; that is, if all that infrastructure is busy. The problem is, it is not. We do not produce and market enough grain to keep that system fully utilized.

Consider the costs the system must be racking up. Each elevator represents a series of operating costs to receive and handle grain. There is machinery in the elevator and people to run it. There are grounds and access to be looked after. There is a railway siding required to connect to the railway line.

Each railway siding represents a stop a train must make to switch cars into and out of. Each siding has to be looked after and switching mechanisms provided for. Each elevator represents another location that requires rolling stock to load grain and motive power to get it there. The motive power is expensive to purchase in the first place. It then has to be operated, which takes money, and it requires costly maintenance.

Miles and miles of track are required to connect all these elevators. Each foot of track represents a cost to maintain roadbed and rail. These require expensive overhauls, upgrades, and changeouts as time goes forward. Each mile of track represents more time for rolling stock to run to obtain its loads and consequently deliver its

loads. The more time it takes to do this, the more rolling stock that is required. Freight cars are expensive to buy and maintain.

This description is slightly slanted to get the dollar signs flashing and mounting up as one considers the cost ramifications. This is not unfair because that is what each of these components do; generate cost.

This is not a problem if there is enough business to keep all the components busy and earning enough income to cover all the costs. Sorrily, this is not the case. It is not a re-distribution of income problem either. The users of the system are not directly paying for all the services rendered. This means it is already being subsidized.

Why is this a problem now when it has been with us for over one hundred years, as has already been pointed out? One factor is the insulation from the market place has camouflaged the problem. It has not been recognizable over the years. In addition, the railways and the government have been absorbing the brunt of the creeping infection.

The old railway rates kept the problems associated with that component fairly well disguised from the users. The government branchline and rolling stock support has further hidden the effects. As such, the elevator system has been able to eek out enough revenue to lead the operators to believe they could continue under status quo. They did not have to modernize and consolidate like their counterparts to the south did to remain competitive.

What has changed all of a sudden that we are only recognizing the problem now? The money ran out, as simple as that. The railways were the first to recognize what was happening to them. They were spending huge sums of money over and above what they brought in to handle the business. As taxpayers, you recognize the effects on your bottom line. We are all paying for this system along with a great many other things. Each year we work longer into the year to cover our obligations to the government. The government recognized as well it needed to find better ways to channel its support.

The coming together of all these forces led to the current legislation in place which addresses the transportation component of the system. This, in turn, has an impact on the rest of it. The process of resolving the tranportation problems heightened all the participants awareness of the malaise that has insinuated itself into the system. The attempt to resolve this did, on the one hand, bring exposure to the costs to the users. At the same time, it again insulated this exposure by extending the full force of it way out in time.

The resolution was a brave attempt to deal with thorny issues. It was a reasonable compromise. Considering everything, it was a masterful attempt to please everybody. The unfortunate part is that unless some great knight from out of the blue with loads of money arrives on the scene, we still have a serious problem.

There is a fiendish twist to this as well. Our answers to the problem have an element of predetermined self-destuction built into it. The charges the elevator system is allowed to levy by law are cost plus. The freight rates paid by the users of the system are cost plus.

The Western Grain Transportation Act does contain modicoms of incentive to reduce costs but they are remote, unconnected to the rest of the system, and short lived. The elevator price structure contains no elements of incentive to reduce costs, at least not in any visible way. It comes down to how much cost plus can we handle and for how long.

This is starting to sound pretty gloomy. Why don't we change the system? Good question. Any of the foregoing is not news to anybody in the industry or in any government department associated with the industry. All these people recognize the problems and are of the mind to effect change from their various perspectives.

But! But who is going to go first? What elevator company is going to stand up and close down operations leaving its customer base to its competitors? Or try to bring its customers to new locations by trucking their grain when freight rate differentials will not allow it?

What municipal official is going to stand up and recommend its local elevators close shop and leave town? Or recommend that its rail line be removed?

What producers are going to stand up and recommend that they themselves incur the additional costs of driving longer distances to deliver their grain with no appreciable additional value given to their grain for so doing?

What provincial government is going to stand up and volunteer to absorb additional highway costs without trying to extract some consideration from somewhere in the chain?

What railway is going to, if it could, wade into this mine field and remove railway lines at its own discretion? Not only is it against the law, it goes against all notions of doing business in partnership with its customers.

Obviously, it will require political will to provide the course through this maze. What politician is going to climb aboard any bandwagon to change, constructed the way this one is?

The answers to the overall problem are not food for thought for rocket scientists or brain surgeons. These are relatively simple. Effecting the answers is the hard part and not an area of endeavor for people with weak constitutions. But this is another whole debate.

What has the Graintainer to do with all this? It just might, and I stress just might, be a vehicle to pave the way through all this.

Current wisdom says we must reduce the number of miles of railway, the number of elevators where grain is handled, and the number of times grain is handled. This says we must truck the grain greater distances to fewer elevators and have it travel less rail miles faster.

The Graintainer concept starts with this premise. It accepts the fact that all grain starts off from the producers facility in a truck. This is where it parts company with conventional wisdom. It now says, let's see how far we can take this grain through the system before we have to handle it again.

We now have the grain loaded in a Graintainer. We pulled up into the producer's yard and used his auger to load the grain through the top hatches. Now we have to go somewhere with it. This will require a terminal where we can lift the Graintainer off the truck chassis and onto a railcar. Or we can put it on the ground and wait until we have more.

Here we can sort the grain by Graintainer; keep the similiar types and grades together. I forgot to mention we took samples while we loaded at the producer's yard. Now we roll in with a train of container flatcars. We load the Graintainers onto the flatcars with the top lifter. We arrange them in the order the terminal at the port wishes to receive them.

Now we are ready to head to the port with a trainload of pre-marshalled grain. Since we are running solely on main track, we arrive at the port in two to three days depending where we came from. We go to the designated terminal and unload the grain through the bottom hoppers of the Graintainer right from the flatcar.

Wait a minute, we can't do that. Existing rail equipment will not allow the product to flow through the car from the hoppers to the receiving hoppers. That is absolutley correct. But we will allow some license at this point and come back to this later.

And then we head back to an inland terminal point with the empty Graintainers. There we exchange empties for loads and set out again. Meanwhile, trucks take the Graintainers to the different load points and back to the terminal.

So what have we accomplished to this point? Well, it took a whole lot less space to describe this system as opposed to the way we do it now so it must be simpler. If it is simpler, it must be less costly. But we don't know that and even if it is less costly, we must have gotten someone from the old system upset.

Let's retrace our steps and see. First the producer. Well, he didn't have to drive any more miles to deliver his grain. In fact, he did less because we came to him to get his grain.

The elevator company sure missed out on this one. That is certainly true in the traditional role. But what else does an elevator manager do out in the country. Among other

things, he establishes a customer base to use his facility. Well, he can still work with his customer base. Only now he will order Graintainers from the railway instead of cars. And he will arrange to have them spotted at his customer's facility instead of his own. There could be cost savings here.

In addition, if the elevator manager wanted to have a physical presence to complement the inputs side of his business, he could still work with Graintainers. Now he would not need sidings and switches or have to rely on fluctuating branchline service.

What about the railways? How are they affected? Let's see now, they don't have to operate as many miles of track anymore so the maintenance costs would go down. The motive power wouldn't have to travel as far so we shouldn't need as many units. The rolling stock will only operate between the ports and the inland points so we won't need as many cars. It looks like some costs could go down.

More Graintainers will be required though. However, at the same time trucking requirements change as well as the holder of the costs. The elevator managers don't require as expensive a facility anymore and probably not as many. There could be room for re-distribution of costs in this framework to compensate for the number of Graintainers required.

Now what about the ports? The description says we will deliver the Graintainers on the flatcars and unload through the bottom hoppers. This no different than what we do today. Essentially then there is no apparent change for them. They might even be better off if they receive the grain in the order they want it in.

Well now, what about the political or social impacts? The municipalities, how are they going to react? Since they are faced with a situation paramount to writing on the wall in respect to branchlines and elevators consolidating over time, this could be a positive economic counter for them.

Graintainers will require servicing from time to time. They will have to be built somewhere first. The trucks that haul them will have to buy gas and parts. The people who drive them will have to eat, sleep, and live in different places unlike the railway crews who travel from other places and return to them. The opportunity just might exist to rejuvenate some local economies.

The provinces are going to be concerned with the obvious increased movement over their roads. This is coming regardless, but if we perform the majority of the service with properly configured tractor chassis axel ratios, the road impact will be less severe; unlike today where much of the damage is inflicted by farm vehicles with shorter axel spreads for the weight they try to carry. It might be an improvement.

Assuming for a moment the Graintainer concept could produce all the above, and that, admittedly, most certainly is a

leap of faith, it seems hardly likely any politician could have much difficulty in championing change that could be so evolutionary. The nice thing is the Graintainer can operate and be productive regardless of whether the overall system is insulated from the market or not.

However, we as business people cannot be investing, blindly, in leaps of faith. The Graintainer sounds good on paper. There is, however, that small matter of the license we took to overlook a physical defect in the railcar earlier. A design has to be developed and tested.

There are other obstacles, that literally boggle the mind, to think through. How would the country co-ordination be handled? How would we manage the thousands of Graintainers it would take to handle the grain? Could the existing inland container terminals handle the load or would we require additional capacity? What do we do with existing facilities and equipment? Is there a blended system in the future? How do we proceed to move towards the Graintainer system, if we do?

This brings us back to where we started. What is the Graintainer? We at CP Rail think there is enough to this concept to go out and obtain some real life experience with it. Presently, there are three protype Graintainers operating in a domestic application between Alberta and the lower mainland of Vancouver.

This pilot test is being operated in conjunction with Alberta Wheat Pool. To date, the results are more than encouraging. The producer receptivity is high. The logistical interface between grain purchases off the farm, the trucking to pick it up, the sales co-ordination and delivery by truck is workable and smooth. The customer receptivity at the destination is high.

The railway operating experience, to date, is extremely good. The handling is being done through existing intermodal facilites with no particular or special movements involved. Existing eighty-nine-foot domestic container flat cars are performing the road hauls with no changes required. The exciting part is the performance.

The test so far is showing that the Graintainers themselves are doing complete load-unload-load cycles from six to nine days. The cars simply roll between the terminals in their usual less than four days. To service this market conventionally today we consume anywhere from sixteen to twenty-two car days. This alone is encouraging enough for us to further explore domestic applications on their own merit. This is what we are doing.

The export market is a different case with by far the most significant potential for impact. There is that matter of the car to take of. To that end, we have commissioned a car builder to produce a design to surmount the obstacle. We expect one shortly, after which we will evaluate the benefits of proceeding to the protype stage. From there, it will be one step at a time.

No matter the outcome, it has been quite an experience introducing such a radical yet simple concept. We will be able to look back and say we "heard" it here first. I think we at CP Rail will be proud that we at least tried something new and different.

Only time will tell us whether the Graintainer was a simply novel idea or if it indeed did perform a role in allowing the Canadian grain industry to respond in a positive fashion to the challenges before it.

EVOLUTION OF PROVINCIAL JURISDICTION RAILWAYS

Without relating the story of the last spike/national dream and other colourful railway folklore, the political and commercial founders of our nation believed that a national railroad stretching from coast to coast would serve national unity and strengthen confederation while fostering and facilitating economic development by populating the hinterland with settlers. At more local levels, entrepreneurs and political leaders in communities at some distance from the main line of the national railroad, desirous of prosperity and development for their areas created movements, committees and assorted schemes (sometimes, scams) to establish railroads, in some cases linking communities to the main line and in other cases linking pairs/groups of communities (nowhere near the Canadian Pacific Railway) for the purpose of enhancing trade and all the good things associated therewith.

An important tool used by governments to coax the development of national and local/regional/provincial railways was the granting of land and certain other rights and privileges to those who would develop railways. In exchange for such grants, Parliament and legislatures required some control over railway companies specifically in the matter of the levels of tolls that could be charged for the transportation of goods and people and in matters pertaining to the safe operation of trains.

The year following the first regular Canadian Pacific transcontinental train's arrival in Port Moody, B.C. from Montreal in 1887, the Railway Act (Canada) of 1888 spelled out the rights and privileges of railway companies meeting certain requirements and the economic and operational behaviour expected of those companies in return for those rights and privileges. Following the example of Parliament, provincial legislatures passed similar acts usually using the same wording as in the federal "master act" and basically varying only in the specification of areas of jurisdiction and authority.

Into the second decade of the twentieth century, there existed three transcontinental railways (Canadian Pacific Railway, Canadian Northern Railway and Grand Trunk Railway) governed by the federal Railway Act and hundreds of local/regional/provincial railroads governed by provincial railway acts. Simplifying the story tremendously and without going into specific reasons, by 1923 some 221 railroads (including two of the so-called transcons) were amalgamated into Canadian National Railways (founded 1917); gradually, almost all rail lines in Canada have become part of either Canadian National's or Canadian Pacific's systems. Consequently over 90% of railway miles in Canada fell under the jurisdiction of the federal government making most of the provincial railway acts redundant if not totally irrelevant.

In the 1980's, the major revamping of Canadian transportation (particularly railway) law has led to a renewed interest by entrepreneurs and, in some cases, other levels of government in establishing local/regional/provincial freight-oriented railways as an alternative to allowing the two transcontinental (or, class I railways: CN and CP) to abandon certain rail line segments and branch lines that those railways consider to be marginally economic. Further, a growing nostalgia for the romance of the railway age has spurred the actual or proposed establishment of several tourist/passenger-oriented railways. While the incidence of establishment of these "short-line" railways has not yet been overwhelming, several provinces recognize the need to have in place

modern, up-to-date provincial railway acts which will see to the safe operation of railways within their jurisdiction.

Predicting the future on the basis of the past is often (usually) a dubious activity. However, some insight as to how Canadian railways might evolve into the next century can be gained by looking at the historical record of the "creation" of railways in a provincial jurisdiction like Alberta.

A Statutory History of Railways in Canada 1836-1986 (Robert Dorman and D.E. Stoltz, C.I.G.G.T., Queen's University, Kingston, Ontario, 1987) records in alphabetical order practically every railway ever established under the statutes of Canada or the provinces; dates of incorporation and dates of amendments to the various statutes (special Acts of parliament and the legislatures) also are given. In the following pages are listed every railway company established in or focusing on the province of Alberta. Included are in-province railways incorporated under special Acts of Parliament when Alberta was still part of the Northwest Territories, in-province railways falling under Alberta statutes after Alberta joined confederation in 1905 and interprovincial railways (established under special Acts of Parliament) for which the majority of route miles were to be situated in Alberta.

EVOLUTION OF RAILWAYS IN ALBERTA

DATE	NAME	FATE	DATE LAST HEARD OF
1884	- **North Western Coal Co. Navigation Co. Ltd. (C)**	Ultimately to CP via sale to Alberta Railway and Coal Co. (1889)	1890
1885	- Alberta and Athabasca Railway Co. (C)	Changes name to North Western Railway Co. of Canada (Never built)	1889
1886	- Bow River Coal Mine Railway and Transportation Co.(C>A)	Alberta incorporation 1908 and name changed to Bow River Collieries (Never built)	1913
	- Medicine Hat Ry and Coal Co. (C)	Never built	1902
1889	- Calgary, Alberta and Montana Ry Co. (C)	Never built	1889
	- Red Deer Valley Ry and Coal Co. (C)	Never built	1891
	- **Alberta Ry and Coal Co.(C)**	Ultimately to CP years after reincorporation as the Alberta Ry and Irrigation Co.	1904
1890	- **Calgary and Edmonton Ry Co. (C>A)**	To Canadian Pacific	1912
1893	- **Alberta Irrigation Co.(C)**	Ultimately to CP years after name change to Canadian Northwest Irrigation Co. (1899) and merger into the Alta Ry and Irrigation Co.	1904
1894	- Alberta Southern Ry Co. (C>A)	Incorporates provincially 1906	1906
	- Gleichen, Beaver Lake and Victoria Ry Co. (C)	Never built	1894

1896	- **Edmonton District Ry Co. (C)**	Ultimately to Canadian National after changing name to **Edmonton, Yukon and Pacific Ry Co.** (1899) and amalgamation with **Canadian Northern Alberta Ry Co. (CNAR)** (1910)	1927
1898	- **Western Alberta Ry Co. (C>A)**	Ultimately to Canadian Pacific years after sale to the Alberta Ry and Irrigation Co.	1906
1899	- Edmonton and Saskatchewan Ry Co. (C)	Never built	1899
	- **Edmonton and Slave Lake Ry Co.(C)**	Ultimately to CN via CNAR	1914
1901	- **Alberta Central Ry Co.(C)**	Sold to Canadian Pacific	1957
1902	- Medicine Hat and Northern Ry Co. (C)	Never built	1905
1903	- Cardiff Ry Co. (C)	Never built	1903
	- North-west Coal and Coke Ry Co. (C)	Changes name to Great West Ry Co. 1905 (Never built)	1907
	- Macleod, Cardston and Montana Ry Co. (C)	Never built	1903
	- Southern Central Pacific Ry Co.	Never built	1910
1904	- **Alberta Ry and Irrigation Co. (C>A)**	Sold to Canadian Pacific	1957
1905	- Calgary and Battleford Ry (C)	Never built	1905
	- Calgary, Red Deer and Battleford Ry Co. (C)	Never built	1905
	- Anthracite Coal Ry Co. (C)	Never built	1905
	- Athabasca Ry Co. (C)	Never built	1909
	- Athabasca Northern Ry Co. (A)	Never built	1917
1906	- Calgary and Fernie Ry Co. (C)	Never built	1930
	- Edmonton and Athabasca Ry Co. (A)	Never built	1906
	- Hillcrest Ry Coal and Coke Co. (C)	Never built	1906
	- Kootenay, Alberta and Athabasca Ry Co. (A)	Never built	1906
	- Strathcona Radial Tramway Co. Ltd. (A)	To municipal authority - Edmonton?	1909
	- Alberta North-Western Ry Co. (A)	Never built	1913
	- Alberta Oil, Coal and Wheat Ry Co. (A)	Changes name to Pincher Creek, Cardston and Montana Ry Co. (1909) which changes name to Alberta Pacific Ry Co. (1910) (Never built)	1912
	- **Edmonton, Dunvegan and British Columbia Ry Co. (C>A)**	Ultimately to Canadian National via Northern Alberta Railways Co.	1929

1907	- Lethbridge Radial Tramway Co. (A)	To municipal authority?	1913
	- Red Deer Railway Co. (A)	Never built	1909
	- Diamond Ry Co. (A)	Reincorporates under name Diamond Coal Co., Ltd 1910 (Never built)	1910
	- Calgary and Knee Hill Ry Co. (A)	Never built	1909
	- Knee Hill Ry Co (A)	Changes name to Calgary, Carbon and Red Deer Ry Co. 1911 (Never built)	1912
1908	- Alberta and British Columbia Ry Co. (C)	Never built	1910
	- Alberta and Brazeau River Ry Co.(C)	Never built	1908
	- Northern Empire Ry Co. (C)	Never built	1910
	- Edmonton Municipal Street Ry (A)	To municipal authority?	1929
	- Carbon Hill Ry Co. (A)	Never built	1923
1909	- Kootenay and Alberta Ry Co. (C>A)	Never built	1912
	- Lacombe, Bullochsville and Alix Electric Ry Co. (A)	Never built	1910
	- Strathcona Central Ry Co. (A)	Never built	1909
	- Pincher Creek and Southern Ry Co (A)	Never built	1909
	- Southern Alberta Ry Co.	Never built	1909
1909	**- Lacombe and Blindman Valley Electric Ry Co. (A)**	Ultimately to Canadian Pacific years after name change to Lacombe and North Western Ry Co.	1957
	- Alberta and Great Waterways Ry (A)	Ultimately to CN via NAR	1929
	- Alberta Midland Ry Co. (A)	Ultimately to CN via CNAR	1912
1910	- Alberta and Saskatchewan Central Ry Lines Co. (A)	Never built	1910
	- Alberta, Peace River and Eastern Ry Co. (C)	Never built	1912
	- Alberta Western Ry Co. (A)	Never built	1910
	- Lacombe and Brazeau Ry Co. (A)	Never built	1910
	- Pine Pass Ry Co. (C)	Never built	1910
	- Raymond Ry Co. (A)	Never built	1910
	- High River and Hudson Bay Ry Co. (A)	Changes name to Alberta-Hudson Bay Ry Co. 1917 then sells to Calgary and South-Western (Never built)	1917
	- Edmonton Interurban Ry Co. (A)	Never built	1912
	- Calgary Municipal Ry (A)	To municipal authority?	1910
	- Chestermere and Calgary Suburban Ry Co. (A)	Never built	1910
	- Canadian Northern Alberta Ry Co. (C)	Amalgamated into Canadian National	1956
1911	- Bassano and Bow Valley Ry Co. (A)	Changes name to Bassano Electric Ry in 1913 (Never built)	1915
	- Medicine Hat Electric Ry Co. (A)	Never built	1912
	- Magrath Ry Co. (A)	Never built	1912
	- South East Calgary Electric Ry Co. (A)	Never built	1912
	- Alberta Metropolitan Ry Co. (A)	Never built	1913

1911	- Alberta Electric Ry Co. (C)	Changes name to Alberta Interurban Ry Co. 1912 (Never built)	1913
	- Athabasca Valley Ry Co. (A)	Never built	1917
	- **Mountain Park Coal Co. Ltd.** (A)	Ultimately to Canadian National after lease to Grand Trunk Pacific Ry Co. (1912), merger with Grand Trunk Ry Co. of Canada, etc..	1912
1912	- Western Dominion Ry Co. (C)	Merges with Alberta Pacific Ry Co. (Never built)	1921
1913	- Brule Lake Ry Co. (A)	Never built	1917
	- Calgary and Fort McMurray Ry (C)	Never built	1913
	- Medicine Hat Southern Ry Co. (A)	Never built	1913
	- Wetaskiwin, Yellowhead and Revelstoke Ry Co. (C)	Never built	1913
	- Edmonton, Stony Plain and Wabamun Ry Co. (A)	Never built	1915
	- Calgary Petrol Interurban Ry (A)	Never built	1913
	- Chinook Ry Co. (A)	Never built	1913
	- Athabasca and Grande Prairie Ry Co. (C)	Never built	1915
	- **Central Canada Ry Co.** (A)	Ultimately to CN via NAR	1929
1914	- Edmonton North-Western Radial Ry Co. (A)	Never built	1914
	- Peace River Tramway and Navigation Co. (C)	Never built	1916
1915	- Athabasca and Fort Vermillion Ry Co. (A)	Never built	1915
	- Smoky Valley and Peace River Ry Co. (A)	Never built	1915
1916	- Edmonton and Southwestern Ry (C)	Never built	1916
	- Canmore Ry Co. (A)	Never built	1916
1917	- Red Deer Valley Ry Co. (A)	Never built	1917
1918	- Calgary and South-Western Ry Co. (A)	Never built	1935
1919	- Medicine Hat Central Ry Co. (A)	Never built	1919
1921	- Edmonton and Mackenzie River Ry (C)	Never built	1921
1923	- Canadian-American Collieries Ltd (A)	?	1925
1924	- Medicine Lake Collieries, Ltd (A)	?	1927
1926	- **Pembina Valley Ry** (A)	Ultimately to CN via NAR	1929
1928	- Highwood Western Ry Co. (A)	Never built	1958
1929	- **Northern Alberta Railways Co.** (C)	Consolidated into CN	1979

1951 - Alberta Coal Co. (A) ?

1965 - **Alberta Resources Ry Corp.** (A) Operated by Canadian National

1984 - **Central Western Ry Corp.** (A) Continues to operate

NOTE: Notation (C) refers to statute of Canada and (A) refers to statute of Alberta.

From the tables it can be seen that 100 Alberta railways were legally incorporated from 1884 to 1984 (none since 1984). The majority of the incorporations (97) occurred between 1884 and 1929. Of the 97, only 18 railways ever got beyond the stage of incorporation. Those 18 "successful" railways are highlighted in bold in the tables. The evolutionary "progress" of Alberta railways can be categorized as falling into 9 distinct periods featuring certain dominant species:

PERIOD	RAILWAYS IN EXISTENCE	EVOLUTIONARY EVENT
1984-1991	CP, CN, Central Western	Creation of CWR (1984)
1979-1984	CP, CN	Folding of NAR into CN (1979)
1956-1979	CP, CN, NAR	Folding of CNAR into CN (1956)
1929-1956	CP, CN, CNAR, NAR	Creation of NAR (1929)
1917-1929	CP, CN, CNAR	Creation of CN (1917)
1905-1910	CP, Alta Midland, Alta and Great Waterways, Lacombe and North Western, Edmonton Dunvegan and B.C.	Alberta joins confederation (1905)
1884-1905	CP, miscellaneous	Completion of CP (1887)
? to 1884	primordial soup	

That railways were (are) a fragile species is made even more clear upon examination of the legislative activity that was involved in their birth, sustenance and either maturation or demise. Examination of the statutes of Alberta (since 1905) reveals that 58 railways were incorporated by special Acts of that province. Furthermore, these 58 special Acts required 179 amendments, most often giving railways extensions of time to raise money and ultimately to begin laying track or granting permission for a railway to be taken over by another. Of the 58 incorporations, 44 (76%) occurred within the space of 9 years starting in 1905 and passage of special Acts of incorporation became essentially a very minor activity by 1913. Moreover, legislative activity continued in the form of 5 to 10 amendments to special acts per year up until 1929 after which Alberta's (and presumably other provinces') railway related legislative workload all but vanished.

In the last 60 years, railway formation in Alberta as evidenced by legislative inactivity has been all but dormant. The notable exception was the 1984 incorporation of the Central Western Railway which appears to be prospering to this day. Will CWR stand out as an exception or is the railway transportation world changing in a way conducive to the wider spread establishment of a substantial new short line "species" of railway? If there is any truth in the theory of evolution, it can be said that species will evolve or develop if and when the "right" environmental factors are in place. In terms of the economic environment, both Canadian Pacific and Canadian National are increasingly and aggressively talking about their willingness if not desire to spin off lines of marginal (to class I railways) viability.

In terms of the legal or regulatory environment, progress is being made in various degrees and at various paces to modernize and revitalize 1888-based provincial railway acts. Old generation acts are in place in Nova Scotia, Ontario, Alberta and British Columbia; Saskatchewan has passed new legislation and is working on regulations; Quebec has passed new railway safety legislation and is working on economic regulation aspects; Ontario, B.C. and Nova Scotia have plans to develop new railway acts; and, Alberta is actively engaged in the process of developing a new Railway Act to oversee its (currently) only railway, the CWR. Additionally on a combined legal and economic front, the December 1990 Supreme Court decision in favour of CWR gives clear indication that provincially regulated railways are able to have some control over at least the labour portion of their operating costs.

With all of the above factors leading to a very favourable environment, the next several years should witness the Canadian railway industry evolving into one with two main line trunk carriers being fed traffic by dozens of short line railways. If this situation does not materialize, we will have yet one more proof that the theory of evolution indeed is nothing more than a theory.

HALF A POLICY : COST RECOVERY PROPOSALS FOR CANADIAN AIRPORTS

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Transport Canada has proposed to increase the level of user charges at Canadian airports so as to recover a larger fraction of the costs of providing both the airports and other parts of the aviation system. The current proposal would generate about $40 million. Half of this would come from airport fees, the balance from aviation fees.[1] While it is difficult to disagree with the objective of revenue enhancement, there are, from an economic perspective, shortcomings to the approach. Primary among these are the neglect of demand side considerations and the lack of an explicit cost control mechanism. The policy must, therefore, be regarded as incomplete.

1.0. BACKGROUND: The public provision of airports permits airlines to earn rents by exploiting a passenger pool. With free entry, participants will increase the number of flights, placing increased pressure on airport capacity at least at the largest hubs. Such congestion generates social costs which, in the absence of congestion pricing, are externalized. This suggests the use of peak load pricing in order to optimize social benefits. At the same time, the public provision of such facilities involves both capital expenditure and ongoing costs. In order to optimize resource allocation, such costs must be fully borne by users which requires the implementation of a full user pay system. Since the former will maximize the revenues of the airport system, it is likely to enhance the cost recovery goal. A comprehensive pricing policy would address both issues simultaneously. A policy which focuses only on the cost recovery question must therefore be regarded as half a policy.

1.1 Cost Recovery: The extent to which the cost of facilities provided at public expense should be recovered from users has been an issue in Canadian transportation policy for several decades. In the extreme, it requires that the revenues earned by an airport network must be equal to

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[1] D.J. Cogliati, Chief, Cost Recovery Policy, Transport Canada *UNB Transportation Group Seminar Series*, Jan. 24, 1991.

the full economic cost, including the opportunity cost of capital, of providing them. There are two methodological issues of interest. The first of these is the level of aggregation at which the analysis should be carried out. With reference to the airprots, one needs to decide whether it is preferable to consider airports individually or as a system. The other question involves the time framework of the analysis. Here, one might focus on annual costs and revenues, determining a system of prices on an annual basis. On the other hand, one might consider costs and revenues on a life cycle basis, finding the prices on that basis. Each issue is considered in turn.

Ideally, the analysis would proceed with the national and international airports considered as a single system. In the Canadian context, this is appropriate given that these major airports are owned and operated by Transport Canada. There is thus a common management and decision-making structure in place at the system level. Furthermore major capital expansion decisions are centrally controlled. In fact, one could carry this line of thought further and suggest that it is only when airports are considered as a single system (whether commonly owned or not) that efficient expansion paths for system capital development can be evolved.[2]

To this proposition, one might add another. In order for airline service to be provided, there must be an airport system. Total infrastructure costs, both current and capital, associated with such air service is the sum of those at the individual airports plus associated air navigational aides. Ownership is irrelevant. The degree of central management control is also irrelevant. From the perspective of economics and finance, what is important is the system of airports. Thus, while one can identify individual airports, and might wish to carry out individual airport analysis (within the system context) for such purposes as determining capital expenditure priorities, this is not the most best level of analysis for price determination. Here system-wide analysis must be used.

In establishing the level of user charges, a life cycle approach must be used. Because of the lumpiness of airport investments, the focus must be on the recovery of cost over the life of the facility as opposed to cost recovery in a specific year. Capacity increases in relatively large increments, while demand for capacity increases (more or less) smoothly. This creates excess capacity early in the

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[2] Brander,J., Cook, B. and Rowcroft, J.,"Auctioning Runway Slots: Long Run Implications", *Journal of the Transportation Research Forum*, Volume XXIX, Number 1, 1988.

life cycle until demand for the use of the capacity catches up. At that point, congestion appears. Insisting on full cost recovery every year would result in a user fee which decreases over time thereby exacerbating congestion. In the context of the present debate over the imposition of additional user fees at Canadian airports, it is interesting to note that fees will not increase at Toronto in nominal terms since additional money is not required at that airport.[3] The result of this is, of course, that the real level of fees at Toronto will decline.

The basic user fee which would be charged for the use of the airport system depends upon the flow of costs over the life of the facility and the volume of traffic over the same period. The former are the net present value of costs over the life of the airport network expressed in constant dollars. The latter is the present value of the traffic flow forecast to use the network over the life cycle. Price is set so as to to recover full user cost. Over the planning period, the sum of the discounted costs and discounted revenues will be identical. In year to year terms, this results in an early deficit and a late surplus. The latter is of sufficient magnitude to cover not only the former but also the imputed interest on it.

1.2. Airport Congestion: Variations in traffic volumes result in non-uniform landing slot values. Landing slots at busier airports are more desirable than at other airports. Landing slots at peak periods are preferred to those off peak. A time-location specific optimization problem emerges and discriminatory pricing is required. Variable pricing of landing slots is consistent with the desire to improve the efficiency of the utilization of the system[4], and with the goal of full cost recovery. This approach has the advantage of placing constraints on the growth of costs because it explicitly incorporates the demand for the product (that is, air travel) into the analysis. There is more here than establishing price on the cost of supplying capacity. The question of the attainment of the second objective of making the airport system financially self-sufficient must now be explored.

One means of setting the variable landing slot fees would be to estimate the marginal social costs of capacity and to establish a set of prices equal to that amount. These, of

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[3] D.J. Cogliati, *loc. cit.* .

[4] Borins, S.F., "The Effects of Non-optimal Pricing and Investment Policies for Transportation Facilities", *Transportation Research - B*, Vol. 16B, 1982.

course are Ramsey prices[5], and if set at the proper level will reduce to one the number of buyers for any slot. As argued elsewhere[6], a second means of obtaining optimal runway slot prices is to auction the available capacity. The value of these slots to individual airlines is most easily estimated by the airlines themselves because they best possess the requisite information on both the cost and revenue sides. Auctions would increases the fraction of the airline's economic rents which the airports capture.

1.3 Policy Interrelationships: The two policies are thus complementary and properly structured, a policy of peak period pricing makes the attainment of full cost recovery easier in the long-run. One reason for this is that peak prices will automatically adjust to changing demand conditions resulting in more buoyant revenue patterns. Furthermore, there is a strong economic arguement in favor of raising the required system revenues from peak users alone. The justification for this position is that it is the peak period user who effectively determines the overall size (and hence total fixed cost) of the system. A weaker version is that peak users on a per unit basis should bear a relatively larger proportion of total costs with off-peak users being, in effect, a revenue source of last resort. Such a pricing policy would, even in the absence of explicit peak load pricing, assist in demand management while ensuring complete cost recovery. It also has the advantage of incorporating capacity associated costs into the analysis, perhaps dampening the demands for capacity expansion as a result.

Before assessing the new proposals, it is prudent to consider in overview Canadian experience with airport cost recovery. This will be accomplished by examining the performance of the Airports Revolving Fund in the decade of the 1980's.

2.0 FINANCIAL PERFORMANCE OF THE AIRPORTS REVOLVING FUND: The Airports Revolving Fund has existed since 1969. It was established to provide some measure of autonomy for Dorval and Malton (now Pearson) airports. It was expanded during the 1970's to include the second Montreal Airport (Mirabel) and Vancouver. On April 1, 1979 Treasury Board approved the

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[5] Oum, T.H. and M. W. Tretheway, "Ramsey Pricing in the Presence of Externality Costs", *Journal of Transportation Economics and Policy*, Volume XXII, Number 3, 1988.

[6] Brander, J., B. Cook and J. Rowcroft, "Allocating Scarce Runway Capacity via Slot Auctions", *CTRF Proceedings*, 1986.

expansion of the Revolving Fund to 23 national and international airports, an increase of 19. On April 1, 1985, the number was reduced to 9, the other 14 being transferred to the Financially Dependent Airports Group. More recently, the Montreal airports have been combined into a single administrative entity so that (in theory, at least) there are presently 8 members of the Revolving Fund. Only the last two iterations of the Fund will be considered here.

The 1979 expansion of the Revolving Fund to 23 airports followed the receipt of the *Draft Report of the Task Force on Airport Management*. The Task Force had been created in response to the financial problems being experienced by the Revolving Fund. Its mandate was to review the management structure of all national and international airports in Canada and to recommend chnages.[7] A year later, Parliament established the Self-Supporting Airports Group, providing it with statutory drawing authority of $80 million. The airports in question were to be

> operated and maintained in accordance with nationally promulgated policies, standards and procedures, **on a cost recoverable basis**, so as to provide safe and efficient facilities and services, consistent with the protection of the environment.[8]

In assessing the performance of the Self-Supporting Airports Group (here considered as a single financial entity), it has been necessary to divide the total period into two subperiods. The first of these covers fiscal 1979-80 to fiscal 1984-85 when the Revolving Fund contained the 23 airports. The second subperiod runs from fiscal 1985-86 through fiscal 1989-90, the last year for which data are available. In both cases, two sets of accounts are of interest. The first account is the Statement of Operations for the year, a profit and loss statement based on revenues on the one hand and expenses (both cash and noncash). The second is the Statement of Authority Provided (Used). This is an annual statement of the current fiscal year use of the drawing authority established by Parliament on April 1, 1980. A negative balance means that drawings from the authority are being made while a positive change means that the authority is being augmented. The two sets of statements will be discussed in turn.

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[7] Transport Canada, *Report of the Task Force on Airport Management*, Volumes I and II, TP 2181, (Ottawa, Transport Canada, 1979).

[8] Canada, *Public Accounts 1984-85* , page 27-24 (emphasis added).

2.1 Operating Performance Of The Revolving Fund: Data concerning the yearly operating performance of the Revolving Fund are shown in Table 1 (covering the period 1979-80 through 1984-85) and Table 2 (1985-6 through 1989-90). In both instances, both nominal revenues and costs and real revenues and costs are shown. The implicit GDP price index (1981 = 100) was used convert to real terms.

During the first period to be reviewed here, there were 23 airports in the Revolving Fund. From its inception on April 1, 1980 until the end of fiscal 1984-85, the Statement of Operations of the Self-Supporting Airports Group (SSAG) reveals When allowance is made for inflation, the "profit" for the period was $28.9. With respect to the operations statements for this period, it is to be noted that the SSAG did not show interest charges against capital which had been contributed to the Fund from time to time by the Government of Canada. In nominal terms, this contributed capital averaged almost $900 million in the five year period considered here. Even a modest return, say 4 per cent, would have generated additional operating expenses of $180 million over the period, an amount in excess of net revenues. The airports collectively were able to meet little more than ongoing expenses during the period. It is obvious that there was no possible scope on this accounting basis for the self-sufficiency on the capital side that was foreseen in this iteration of the Revolving Fund.

A variant of the private sector accounting practices found in the financial statements of the Fund is the approach of focusing only on cash costs when considering the performance of the group. In this approach, all expenses which do not require a cash outlay are omitted from the analysis. When this is done, the Revolving Fund shows a real "profit" of about $283 million for the period.

The second period of interest is that running from April 1, 1985 through March 31,1990, the latest data presently available. The data for this period cannot be directly compared with the earlier data. One reason for this is that the number of airports in the Fund was reduced to 9 (presumably now 8 with the administrative amalgamation of Mirabel and Dorval). The other is that, unlike the earlier period, interest charges on capital now appear as operating costs. Summary data on the performance of the Revolving Fund for the period 1985-6 through 1989-90 are shown in Table 2.

Over the period, real revenues earned by the Fund (excluding the air transportation tax allocation) increased by 29.9 per cent. Revenues inclusive of the allocation of the Air Transportation Tax (ATT) increased by only 10.1 per cent. The discrepancy is explained by the fact that in the first year of the "new" Fund, all of the proceeds of the

ATT, with the exception of the 14.4 per cent share earmarked for the air navigation system, were allocated to it. On the other hand, the increase in real costs was only 3.5 per cent. This increase in real costs jumps to 6.0 per cent when non-cash items are excluded from the analysis. Furthermore, the real increase in salaries and benefits was 10.7 per cent for the period.

Overall, the total real net income of this group of airports was $57.9 million. Losses were experienced in two years, positive net incomes in the other three. As in the earlier period, it is the air transportation tax allocation which tips the scales. With those revenues excluded, the cumulative loss for the period was $391.7 million. One would not suggest that such results attained the objective of financial self-sufficiency. Replacement of capital facilities at this level of earnings appears out of the question. Additional capital financing from government will be required.

2.2 The Unused Drawing Authority Through Time: The balances in the Fund at the end of each fiscal year are shown in Table 3. The table is in two parts. The upper part refers to the period to March 31, 1985 during which time, there were 23 airports in the group. The balance of the Table refers to the period during which there were 9 airports in the Fund. A rising balance in the Fund would indicate that, at least on a "cash-only" basis if not on a complete operating cost basis, the airports in the Fund were achieving a measure of financial success. A declining balance would suggest that not even cash costs were being covered. As of 31 March 1985, only $32 million of the Statutory Drawing Authority remained. As the Table shows, this had been the fourth consecutive year in which the unused authority carried forward had declined. In that period, the Fund had fallen to less than one third of its value at March 31,1981. It was apparent that the drawing authority would be quickly exhausted were the status quo to be maintained. So changes were made.

Effective April 1, 1985, the number of airports regarded as self-supporting was reduced to the 9 major airports. The remaining 14 were transferred to the Financially Dependent Airports category. Through the expedient of not allowing the exiting group to take with it any share of the Air Transportation Tax for 1985-86, the now slimmed down self supporting group managed to show a "profit" of some $56 million for the year. Without that largess, more than its share of the Air Transportation Tax revenues, the same group lost a total of $27 million in the following year. In the fiscal year 1987-88, the loss was $3 million.

However, it should be noted that interest charges are

included in a nominal way, and are treated in the same manner as other "non-cash" costs. More specifically, neither these financial expenses nor services received "free" from other government departments are charged against the drawing authority. On the other hand, capital acquisitions are included in Table 3 in such a fashion that they effectively are written off in the year in which the expenditure is made. In order to more closely approximate the private sector approach, it was decided to recalculate the accounts of the authority provided/used. This was done by leaving the non-cash items in the expenses and deducting the costs of the capital acquisitions made.

These changes result in a very different picture of the financial performance of the Revolving Fund in both of the periods being considered here. In the case of the early period, Table 3 reveals that $47.9 million of the drawing authority was used during the period. However, when the adjustments are made for the non-cash items and capital acquisitions costs, the Fund was augmented by $25.3 million, imputed interest charges excluded. Since capital acquisitions for the period totalled $359 million in nominal terms, it is clear that financial independence was not possible in the period. For the later period, Table 3 reveals that the authority provided during the period was about $290 million. As above, if adjustments are made to include non-cash costs and exclude current net capital acquisitions, a different picture emerges. The increase in the Fund is only $33.8 million. Capital acquisitions were $483 million in nominal terms during the period. As before, the test of self-sufficiency is not met.

The difference between the experiences of these two periods is explained partly by an innovative approach to the allocation of the proceeds of the Air Transportation Tax. In the first period, after 14.4 per cent of the proceeds had been credited to air navigational services, the balance was allocated among airports on the basis of the number of enplaned and deplaned passengers.[9] In 1990, a sufficient amount was allocated to the Fund to offset the estimated difference between on-site revenues and operating costs, depreciation and interest. That amount was then adjusted "to offset non-cash adjustments to terminal control costs and departmental overhead"[10]

Such changes do not alter social costs. All they do is to

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[9] Government of Canada, *Public Accounts 1985-86*, Volume II, Part II, page 1.31.

[10] Government of Canada, *Public Accounts 1989-90*, Volume II, Part II, Page 1.6.

move the various cost components out of (or into) Departmental accounts, altering perceptions of the costs to the taxpayer of the system under review. The major flaw in the approaches which have been taken in the past is the refusal to accept the notion that the individual airports are part of a system. Financial analysis is therefore valid only at the system level. More is involved than finding some combination which will give the appearance that the Self-supporting Airports group is achieving financial success.

The revenue enhancement proposals offered by Transport Canada would do little to alter the results depicted above. The real problem is not with the size of the increment to revenue, but the fact that the approach does little to solve the underlying problems. There is no mechanism for the control of the cost side (either capital or operating) incorporated into the package, nor is there any attempt to ration the use of capacity. While Transport Canada may remain "committed" to the policy of peak pricing, it is time it was applied as an alternative to expansion of the system. Finally, it must be said that the proposals represent one step backward. The focus on individual airports and their financial performance must be regarded as a regressive step. Attention must now be turned to peak pricing.

3.0 GAINS FROM PEAK PERIOD PRICING: This section of the paper presents the results of simulations of an airport system to illustrate in a general way the case for the use of congestion pricing to simultaneously manage demand and finance the relevant infrastructure. The model consists of three hub airports arranged such that the three inter-hub distances are different from each other and six non-hub airports. There are thus eighteen (unidirectional) routes. Each of the nine routes has two distinct markets, business and recreational, and two or three possible departure periods so that there are, in principle, 92 basic passenger demand curves. Service is provided by some or all of m carriers or firms.

Each firm seeks to maximise its total contribution over all markets subject to the capacity of the airports in the relevant periods and the anticipated behaviour of the other firms. There seems to be little basis for expecting a significant amount of collusion between carriers using the same airport and, therefore, the model is solved under a 'Cournot assumption'. To focus on the interaction of airport capacity at the hubs, and for analytic tractability, the non-hub airports were assumed to be uncongested in all periods. Capacity limitations at the hubs were taken to be effective only in the two peak periods. In other words, some measure of off-peak excess capacity exists at the hubs.

3.1 Pricing and Social Welfare: Ramsey pricing uses

constrained maximisation to derive a (second-best) set of discriminatory prices based upon the elasticities in, and across the market segments. In this case, the constraint can be taken as the generation generation of a certain minimum revenue, recovering the costs of the airport system, measured in some appropriate way (5).

The standard Ramsey solution is not directly applicable to the present model since peak load segments are strictly limited by capacity which is fully utilised over a very wide range of prices. Peak load pricing analysis [Steiner, 1964] indicates that the optimal strategy for the airport monopolist in this situation is to use marginal operating cost to set the price off-peak and to increase peak prices to cover the marginal value of capacity. Since the former are sufficiently low to be neglected, at least relative to the amortized capital cost, the revenue maximising strategy for an airport would seem to be to set off-peak fees where the marginal revenue from carrier demand equals zero and to add a pro-rated share of the marginal value of capital at peak. However this requires that the airport have detailed knowledge of the off-peak demand curve for slots. A simpler solution is to set the off-peak fee to zero and to obtain the desired revenue from a per slot charge at peak periods only. At these times the volume of traffic is fixed at capacity.

Ramsey pricing is concerned with social benefit. Therefore the present proposal is evaluated in the same way, the relevant measures of social welfare being consumers' and producers' economic surplus. However, in the present situation, these quantities may be evaluated at two levels. From the standpoint of airport slots, the airports are the producers of a commodity or service which is consumed by the carriers using the facility. However, at the level of air travel, passengers constitute the consumers of seat space produced by the carriers.

Producer surplus for the airports (PSA) is the sum of revenue received less the costs of operation. Assuming costs to be fixed for a given airport size, welfare comparisons are unaffected by taking PSA to be equal to the full amount of airport revenue. Producer surplus for each airline is simply the contribution to fixed cost. Consumer surplus is measured in the usual way. Combining the two, total surplus, CS + PS, provides a further means of comparing the impact on social welfare of the different expansion schemes.

3.2 Airport Cost: The relevant consideration here is the cost per runway slot including the (amortized) construction and operation of the infrastructure. Borins(4) suggests a capital cost estimate of $800 million for an additional

runway at an existing airport including all supporting services. Operating and maintenance are estimated to add a further $30 million per year. Using a social discount rate of 10% to amortize the capital cost arbitrarily over ten years provides a per annum cost of just over $160 million.

Spreading this cost over all possible runway slots will not lead to cost recovery since not all airport capacity is utilised off-peak. Moreover the level of use will depend on the model parameters including the landing fee structure. Since peak usage is constant at full capacity, the solution adopted here is to consider first the slot fee necessary to recover cost from peak charges only. By iteration it is then possible to determine the uniform slot fee which will generate the same amount of revenue. If peak congestion occurs only on weekdays then an extra runway provides a relevant increase in capacity on about 260 days per year. On each of these, each peak period consists of two hours and hence one -runway provides 160 peak slots per day.

3.3 Simulation Results: The model was run for a broad range of slot fees, from zero to a uniform fee of $4900 per slot. Then for each uniform fee the off-peak fees were reduced to zero and peak fees adjusted so that each hub received the same revenue as before after the carriers have reacted to the new fee structure. Since the network is not perfectly symmetric this implies different peak fees at each hub. Figure 1 shows sample values. A limit to these peak only fees is set by the shadow prices of capacity at each hub in each peak period. The μ represent the maximum prices which may be charged without producing unused capacity during a peak period. Thus $4900 represented the maximum uniform slot fee for which equivalent revenue could be generated at all three hubs. Setting peak slot fees to the marginal value of capacity generates about the same revenue per airport as a uniform slot fee of $2000.

Figure 2 illustrates the effect of increasing airport revenue under the uniform and peak only pricing schemes. Using carrier surplus as a measure of social benefit, even when compared with airport surplus, yields a net social loss under either price mechanism, although the loss is less for peak only pricing. However, looking at passenger and carrier producer surplus, the uniform pricing system is approximately welfare neutral. The decrease in consumer and producer surplus is balanced by the increase in airport revenue. With peak only pricing traffic reorganization triggered by the higher level of fees leads to an increase in passenger surplus at the expense of a larger reduction in producer surplus. The net effect including the gain in airport revenue is positive, and therefore it appears that raising the peak only slot prices towards the shadow or auction price level tends to increase overall social

welfare.

4.0 CONCLUSIONS: This paper has reviewed Canadian experieince with the Airport Revolving Fund in the 1980's. That experience leaves little hope for thre success of the most recent Transport Canada revenue enhancement proposals as these apply to the Canadian airports system. The simulation results above suggest that a valid alternative to the proposals is a peak period pricing scheme where most of the costs associated with capacity are recovered from peak users. Efforts are ongoing to calibrate these models to the Canadian system and it is anticipated that results will be forthcoming is a year or so.

TABLE 1
THE AIRPORTS REVOLVING FUND 1979-80 TO 1984-85

	79-80	80-81	81-82	82-83	83-84	84-85
REVENUES:						
(a) Including Allocation of Air Transportation Tax:						
Nominal	272.3	314.2	359.0	372.9	397.0	431.4
Real	313.6	325.6	340.8	331.2	337.6	358.3
(b) Excluding Allocation of Air Transportation Tax :						
Nominal	175.0	192.9	222.0	227.5	242.8	263.3
Real	201.5	200.0	210.4	202.0	206.4	218.7
COSTS:						
(c) Inclusive of All Costs:						
Nominal	284.9	305.8	345.9	400.0	399.6	426.3
Real	328.1	316.9	327.9	325.9	339.8	354.1
(d) Inclusive of Cash Costs Only :						
Nominal	232.0	253.4	292.7	312.2	340.1	365.0
Real	267.2	262.6	277.4	277.3	289.2	303.2
NET INCOMES:						
(e) Inclusive of Air Transportation Tax and All Costs:						
Real	(14.6)	8.7	13.0	5.3	(2.3)	4.2
(f) Inclusive of Air Trans. Tax, Cash Costs Only:						
Real	46.4	63.0	63.4	54.0	48.3	55.1

SOURCE: CALCULATED FROM THE PUBLIC ACCOUNTS

TABLE 2
THE AIRPORTS REVOLVING FUND 1985-86 TO 1989-90

	85-86	86-87	87-88	88-89	89-90
REVENUES:					
(a) Inclusive of Allocation of Air Transportation Tax:					
Nominal	482.1	396.4	433.1	508.5	531.0
Real	393.9	311.9	327.4	366.1	369.2
(b) Exclusive of Allocation of Air Transportation Tax:					
Nominal	277.0	314.9	347.8	399.7	422.9
Real	226.3	247.7	262.9	287.8	294.1
COSTS:					
(c) Inclusive of All Costs:					
Nominal	425.6	422.4	436.0	473.9	517.3
Real	347.7	332.3	329.6	341.2	359.7
(d) Inclusive of Cash Costs Only:					
Nominal	289.3	287.2	294.6	327.0	360.4
Real	236.3	226.0	222.7	235.4	250.6
NET INCOMES:					
(e) Inclusive of Air Transportation Tax and All Costs:					
Real	46.2	(20.4)	(2.2)	24.9	9.5
(f) Inclusive of Air Trans. Tax, Cash Costs Only:					
Real	157.5	85.9	104.7	130.7	118.6

SOURCE: CALCULATED FROM THE PUBLIC ACCOUNTS

TABLE 3
AIRPORTS REVOLVING FUND : AUTHORITY PROVIDED (USED)
FISCAL YEARS 1980-81 TO 1989-90
(MILLION OF DOLLARS)

EARLY PERIOD	FY 81	FY 82	FY 83	FY 84	FY 85
PROFIT (LOSS) FOR YEAR	9.3	13.7	5.9	(2.7)	5.0
ADD: NON-CASH ITEMS	52.9	55.2	58.6	60.7	61.6
OPERAT. SOURCES(NEEDS)	62.2	68.8	64.6	58.1	66.6
NET CAP. ACQUISITIONS	43.3	75.1	71.2	85.3	86.6
WORKING CAP. CHANGES	(0.4)	(1.8)	(2.2)	(2.1)	4.0
OTHER ITEMS	0.0	0.8	0.5	(2.0)	(2.9)
AUTH. USED (PROVIDED)	18.5	(7.3)	(9.0)	(31.3)	(18.9)
UNUSED AUTHORITY	98.5	91.2	82.2	50.9	32.1

LATE PERIOD:	FY 86	FY 87	FY 88	FY 89	FY90
PROFIT (LOSS) FOR YEAR	5.6	(27.3)	(2.9)	34.5	13.7
ADD: NON-CASH ITEMS	147.6	135.8	167.5	153.0	159.9
OP. SOURCES(NEEDS)	204.0	108.5	164.7	187.6	173.6
NET CAP. ACQUISITIONS	93.7	79.8	92.3	113.8	103.1
WORKING CAP. CHANGES	11.7	18.4	9.1	(1.3)	(15.9)
OTHER ITEMS	(14.7)	(20.6)	(14.1)	(17.4)	4.0
RCMP SECURITY CHARGES(1)			(24.3)		
AUTH. USED (PROVIDED)	107.3	26.5	43.1	55.0	58.5
UNUSED AUTHORITY	139.3	165.8	208.9	263.9	322.5

NOTES: 1. A one time reduction in the accumulated charge against the Fund's authority relating to RCMP security charges was taken in this year.

FIGURE 1: Representative Slot Prices

Uniform Fee:		0	100	4900
Equivalent Peak Only Fees:				
Hub 1		0	294	12238
Hub 2		0	272	11584
Hub 3		0	279	11747
Shadow Prices with Peak Only Pricing:				
Hub 1	period 1	17254	16870	2106
	period 3	2077	20382	5454
Hub 2	period 1	20359	20004	5589
	period 3	20941	20535	9592
Hub 3	period 1	17295	16932	1821
	period 3	21055	20684	202

FIGURE 2: Effect of Increasing Airport Revenue (AR) on Measures of Social Benefit (SB) - Representative Values

Fees:	all slots	peak only
MEASURE (SB)	MULTIPLIER (SB/ AR)	
Passenger Surplus (PS)	- 0.8	+ 0.6
Carrier Prod. Surplus (CPS)	- 0.2	- 1.3
Total Surplus (PS+CPS)	- 1.0	- 0.7
Carrier Cons.Surplus (CCS)	- 1.5	- 1.3
Total Surplus (CCS+AR)	- 0.5	- 0.3

Upper table treats the carriers as producers
Lower table treats the carriers as consumers of slots

OWNER-OPERATORS IN INTERCITY FOR-HIRE TRUCKING 1978-1988

Owner-operators, also called brokers, are a crucial part of intercity for-hire trucking. They drive much of the freight moved and their employment by trucking firms gives the firms additional operational flexibility. An understanding of the behaviour and role of owner-operators is important in understanding the industry.

The small size and high failure of rate of owner-operators has made it difficult to collect data on owner-operators and there are relatively few studies available on them. As shown below, owner-operators frequently operate only a single vehicle, a semi-trailer tractor. Few of the many entrants into the ranks of owner operators remain there long. In 1981, 6 out of 10 new entrants failed (Motor Truck May 1981, 28). In 1990, owner-operators interviewed in a government study felt that only about 15 per cent of their colleagues had the skills needed for success as owner-operators (Employment 1990, 37).

It is even difficult to define who is an owner-operator in Canada. The line between owner-operators can shift as one moves across the country. (Clayton 1984, 1-7) This paper will define owner-operators as those who are paid as such by trucking firms. Owner-operators own or lease one or more vehicles which they supply, with driver, to a trucking firm for a specified time period.

This paper examines the behaviour and role of owner-operators in intercity for-hire trucking during the period from 1978, by which time the first oil crisis had subsided, to 1988, the start of current industry trucking crisis. Because of data limitations, a picture of the period can only be sketched in broad strokes and using many assumptions. First, a profile of the expenditure pattern per kilometre of "a typical owner-operator" is sketched and its evolution over the period 1978-1988 is traced. Second, the evolution of owner-operators' rates and income is examined. Third, their output and their role in intercity for-hire trucking is identified. A conclusion summarizes the findings.

The Typical Owner-Operator

Ontario owner-operators costs provide a reasonable proxy for the costs of owner-operators in Canada. During 1978-1988, between 35 and 45 per cent of operating expenses were incurred annually in Ontario (Statistics Canada 1 & 3, various). The costs of owner-operators in Ontario were similar to, or only slightly higher than, costs in the Prairies and Quebec and were intermediate between those in the Maritimes and in British Columbia (Transport Canada, various).

This paper is a direct result of my work at Statistics Canada, but the views expressed are my own and do not necessarily reflect those of Statistics Canada. Special thanks are due to the people in the Surface Transport Section of Statistics Canada, D. Dodds, R. Harris, F. Nix and A. Clayton.

Most owner operators use a single vehicle, normally a tractor. The two major studies of owner-operators during the period bring this out clearly. The 1985 survey carried out by Trucking Canada for Energy, Mines, and Resources found that between 75 and 80 per cent of highway owner-operators had only a tractor (Van Dusen 1986, 9). The 1988 survey of the Com Car Owner-Operator's Association for the National Transport Agency of Canada found approximately 75 per cent of belonging owner-operators had a tractor as their single vehicle (National Transportation Agency of Canada 1989, 4-5).

This paper assumes that, in 1988, a typical tractor cost approximately $100,000 and was equipped with a sleeper, a 300 to 400 horse power engine, a 9 to 15 speed transmission (much depends on the make chosen), and had a 12,000 pound front axle and 40,000 pound rear axles. Depending on the area of operation, the maximum permitted weight for the tractor and a semi-trailer weighed 80,000 to 120,000 pounds (Ship by Truck 1988).

Most owner-operators enter long-term (over 90 day) contracts with a trucking firm for the employment of their tractor. In 1988, 73 per cent of Com Car's respondents operated solely under long term contract. The remainder operated under short term contract, or worked on a per trip basis, or hauled loads under their own license authority, or did a combination of these. (NTA 1989, 2)

Most owner-operators prefer purchasing a tractor to leasing it. In 1988, only 17 per cent tractor-owner operators and only 20 per cent of responding truck owners leased vehicles. (NTA 1989, 2)

Owner-operators may supply both tractor and semi-trailer. The 1985 Trucking Canada survey reported up to 70 per cent of its respondents occasionally supplied both pieces of equipment (Van Dusen 1986, 9).

Owner-operators with a single tractor drove an average of approximately 149,000 kilometres according to the 1988 Com Car study (NTA 1989, 6). The 1985 Trucking Canada survey found that owner-operators drove about 91,000 miles, 146,444 kilometres, annually, working about 12 hours a day on work days. Few owner-operators were able to greatly exceed the average mileage driven. Only about 15 per cent of the 1985 study's respondents drove over 200,000 kilometres a year, working over 15 hours on an average work day. (Van Dusen, 7). A typical owner operator, therefore, is assumed to drive about 148,000 kilometres a year and work a 12 hour day.

The average distance travelled by owner-operators' equipment employed by private trucking firms during 1984-1988, according to Statistics Canada figures, are consistently much lower than those found in the 1988 and 1985 studies. This is not surprising. If an owner operator was employed by more than one firm during a year, he would appear as a separate owner-operator for each firm employing him.
As originally proposed, Canadian regulations for truck drivers permitted drivers to work a 15 hour day twice a week, 12 hours of which could be behind the wheel (Truck New, February 1988). This suggests owner operators are generally assumed to drive about 4 hours out of every 5 hours they work.

The return trip between Toronto and Winnipeg takes about 60 hours of normal driving (Truck News, December 1988, p 24). Over a long distance, therefore, trucks cover about 70 kilometres per hour. In a 12 hour work day, driving 9.6 hours and covering about 70 kilometres per hour, an owner operator would drive about 672 miles. He would thus need about 220 days to cover about 148,000 kilometres. This excludes any time spent doing maintenance.

TABLE I
CAPITAL COSTS
1978-1988

YEAR	1978	1979	1980	1981	1982	1983
Price of New Truck	$47,100	$54,300	$51,900	$69,600	$77,900	$84,300
Financing Interest Rate	12.75%	17.00%	10.50%	22.30%	20.0%	13.25%
Savings Interest Rate	6.5%	6.5%	9.5%	12.0%	10.0%	7.5%
Average Annual Tractor Payments	$10,368	$12,840	$14,800	$19,612	$19,500	$19,224
Average Annual Tractor Capital Cost	$10,309	$11,527	$13,946	$19,035	$18,932	$18,662
Tractor Interest	$3,279	$3,605	$3,087	$3,971	$4,826	$5,387
Tractor Depreciation	$6,930	$6,649	$7,274	$8,227	$9,262	$10,416
Interest Forgone on Tractor Downpayment	$492	$723	$885	$1,337	$1,234	$969
Interest + Depreciation+ Forgone Interest	$8,909	$9,977	$11,346	$13,435	$15,322	$16,963
Licensing	$1,000	$1,320	$1,000	$1,000	$1,000	$1,000
Average Tractor Capital Cost Per Kilometre	$0.070	$0.078	$0.087	$0.113	$0.114	$0.126

YEAR	1984	1985	1986	1987	1988	
Price of New Truck	$88,500	$93,700	$96,500	$99,500	$100,000	
Financing Interest Rate	14.25%	14.75%	14.75%	13.75%	13.00%	
Savings Interest Rate	8.0%	7.1%	7.0%	6.0%	7.2%	
Average Annual Tractor Payment	$20,544	$21,072	$21,720	$21,696	$22,620	
Average Annual Tractor Capital Cost	$20,500	$21,997	$23,903	$23,630	$24,470	
Tractor Interest	$5,099	$5,429	$6,412	$6,105	$5,169	
Tractor Depreciation	$11,349	$12,606	$13,650	$14,301	$14,672	
Interest Forgone on Tractor Downpayment	$1,172	$1,122	$1,200	$1,148	$1,350	
Interest + Depreciation + Forgone Interest	$18,020	$20,157	$21,1630.21 3	$21,634	$22,390	
Licensing	$1,760	$1,840	$1,920	$2,000	$2,080	
Average Tractor Capital Cost Per Kilometre	$0.139	$0.149	$0.156	$0.160	$0.165	

Sources: Information on the income of fire drivers and on operating revenue/tonne-kilometre in for-hire trucking, obtained from Statistics Canada.

The maintenance done by an owner-operator depends on his skills, his interest, and on the conditions of operation. Owner-operators hauling logs in northwestern Ontario spend perhaps 203 hours on maintenance (Dudka and Raney 1990, 92). However, a third of the distance driven by these owner-operators was over gravel, or worse, roads so more maintenance was required than is commonly necessary.

The typical owner operator's capital costs, intermediate input costs, and net personal income will be considered in turn.

Owner-Operator Tractor Capital Costs

The typical owner operator is assumed to purchases his vehicle. His capital costs include the tractor's interest costs, depreciation, and licensing as well as the interest forgone on the tractor's downpayment. These are summarized in Table I.

It is assumed a new vehicle is purchased every fifth year to avoid

the increase in maintenance costs likely after 750,000 kilometres. Depreciation after five years is assumed to be 79.2 per cent following Transport Canada's Costs of Tucking in Canada. In 1985, Van Dusen estimated the price of a five year old vehicle to be about 25 per cent of that of a new vehicle (Van Dusen 1985, 26). This, however, was the price set by dealers and not that received by the operator selling the tractor.

It is assumed downpayments were 20 per cent and financing was over 5 years. This pattern was common from the mid 1970s (Diamond 1980, 57). Lower downpayments were possible for a few years in the mid 1980s, but the financing period remained similar (Truck News 1983, 11). At the opening of the 1990s, conversations with dealers suggest the percentage downpayments required for new tractors rose and the financing period was reduced in response to the current crisis.

Tractor prices are assumed to have evolved in line with the Statistics Canada price index for heavy domestic trucks. This gives estimated truck prices for the mid 1970s of about $40,000, which are in line with Diamond's research (Diamond 1980).

Tractors are assumed to be financed at rates which are slightly more than 4 per cent over the average prime rate for the year. This is in line with rates shown in various advertisements for trucks. The interest rates actually paid by drivers vary widely depending on their method of financing. It is much cheaper to finance a truck with a second mortgage on a house rather than by a mortgage on the equipment (Truck News 1989, 102).

Using the above assumptions, the yearly total of interest and depreciation is usually within a few hundred dollars of the annual payments made on the truck, as shown in Table I. The theoretical capital cost of the tractor, as presented in this paper, and the capital cost experienced by the owner-operator in the form of his tractor payments, is thus close.

The interest forgone on downpayment is assumed to be about thirds of the prime interest rate. It is assumed that the owner operator would have deposited the funds in a savings account and that he would have spent the interest as received, rather than re-investing it. The yearly licensing costs were based on those appearing in the Cost of Trucking in Canada series of publications.

Based on these assumptions, depreciation fluctuated between about 55 and 60 per cent of tractor capital costs and the financing cost fluctuated between about 22 and 30 percent of tractor capital costs. The high interest rates of 1980-1982 meant average financing costs were highest during 1983-1985.

As can be seen in Table VI, during the decade, the cost of capital per kilometre has more than doubled in price. The proportion of tractor operating costs taken up by capital expenditure declined from 27-29 per cent at the end of the 1980s to about 26 per cent in the early 1980s, as fuel costs became more important. By the late 1980s, however, it had risen to over 30 per cent as the importance of fuel costs declined. Overall, the proportion of owner-operator rates per kilometre going to capital, in the form of a tractor, increased from about 16 per cent at the end of the 1970s to about 22 per cent in the later 1980s.

Capital costs played an important role in owner-operator expenditures throughout the period and became increasingly important after the early 1980s. Depreciation was the most significant element in capital costs, but interest payments also played a significant role,

TABLE II
COSTS OF MATERIAL INPUTS
1978-1988

YEAR	1978	1979	1980	1981	1982	1983
Fuel Cost/Kilometre	$0.097	$0.091	$0.113	$0.179	$0.208	$0.212
Fuel Litres/Kilometre	1.761	1.775	1.730	1.810	1.797	1.858
Index of Fuel Cost/Litre in Constant Dollars (1978 = 100)	100	87	112	134	146	146
Cost of Material Inputs Other Than Fuel/Kilometre	$0.093	$0.103	$0.113	$0.121	$0.125	$0.129
Cost of Tires/Kilometre	$0.010	$0.010	$0.010	$0.011	$0.011	$0.012
Cost of Maintenance/Kilometre	$0.043	$0.048	$0.054	$0.054	$0.054	$0.054
Cost of Meals, etc./Kilometre	$0.013	$0.014	$0.015	$0.017	$0.019	$0.020
Cost of Insurance/Kilometre	$0.024	$0.028	$0.030	$0.033	$0.036	$0.037
Business Costs/Kilometre	$0.004	$0.003	$0.004	$0.004	$0.005	$0.005

YEAR	1984	1985	1986	1987	1988	
Fuel Cost/Kilometre	$0.217	$0.226	$0.220	$0.218	$0.207	
Fuel Litres/Kilometre	1.851	1.847	1.898	1.916	1.917	
Index of Fuel Cost/Litre in Constant Dollars (1978 = 100)	142	143	137	129	120	
Cost of Material Inputs Other Than Fuel/Kilometre	$0.131	$0.144	$0.142	$0.141	$0.144	
Cost of Tires/Kilometre	$0.013	$0.014	$0.014	$0.015	$0.016	
Cost of Maintenance/Kilometre	$0.054	$0.054	$0.054	$0.055	$0.055	
Cost of Meals, etc./Kilometre	$0.021	$0.022	$0.022	$0.024	$0.022	
Cost of Insurance/Kilometre	$0.039	$0.049	$0.045	$0.042	$0.043	
Business Costs/Kilometre	$0.005	$0.005	$0.005	$0.005	$0.006	

Note: Information on the cost and consumption of fuel in the For-Hire Trucking Industry obtained from Statistics Canada

particularly in some years.

Owner-Operator Tractor Intermediate Input Costs

Intermediate input costs include the cost of fuel and the cost of other material inputs. The evolution of these costs is summarized in Table II.

The cost of fuel and the rate of fuel consumption per kilometre for vehicles operated by owner-operators is assumed to be the same as in the for-hire trucking industry as a whole, as calculated by Statistics Canada. Throughout the period, virtually all the fuel used was diesel, 85 per cent in 1978 (Statistics Canada 2 1978, 64) and 95 per cent in 1988 (Statistics Canada 4 1988, 56). The cost of fuel per kilometre in current dollars rose from 1978 to 1985 and then began to decline. There has apparently been a slow improvement in fuel efficiency in the industry throughout the decade. The improvement was most rapid in the early 1980s when the cost of fuel in constant dollars was highest.

The main items included in material inputs other than fuel are: tires, maintenance (including repairs, cleaning, and the cost of miscellaneous operating equipment and lubricants), insurance, business costs, and the costs of living on the road. In 1988, these amounted to $0.144/kilometre.

In 1988, tires cost at least $0.016 a mile. This was the estimate of CLOD&LOA and Robert Hawley (Motor Trucking 1988, 19) and is in line with a 1986 examination of trucking costs (Trucking Canada 1986, W9). Surprisingly, tire cost estimates based on fleet data were higher (Kimberly 1986, 61; Cost of Trucking in Canada 1988). The cost of tires in 1978-1987 was indexed using Cost of Trucking in Canada data.

Freight insurance is a significant cost to the owner-operator. It likely averaged about 6 per cent of revenue. It can run up to 7 per cent of gross revenue. (Motor Truck 1990, 12) Truck News advertisements in 1989-1990 suggest that experienced drivers with good records can reduce it, in some cases, to 5 per cent or less.

Business and administration costs were likely to have been at least .006/kilometre in 1988 (Motor Truck 1990, 12). Much higher estimates for these costs have appeared (Trucking Canada 1986, W9).

Long periods of time on the road can lead to sizable expenses for food, showers, motels, and telephone calls. Estimates in 1988 range from 5 cents a kilometre (Truck News March 1988, 24) to 2.5 cents a kilometre (Motor Truck 1988, 19). The lower estimate is preferred because not all owner-operators work predominately long haul routes. It is also in line with Canadian tax policy (Trucking Canada April 1984, 21). Both business costs and living expenses are assumed to have evolved in line with the Canadian Consumer price index.

Estimates on the cost of maintenance fluctuate widely because many owner-operators do much of their own maintenance. In 1988, maintenance certainly cost owner-operators less than the $0.137/kilometre estimated in Cost of Trucking in Canada for tractor maintenance, cleaning costs, and miscellaneous items of transport equipment. This figure assumed all tractor maintenance was done by union labour in a firm's depot.

Tractor maintenance probably cost about $0.055/kilometre for owner-operators in 1988. In 1988, Com Car estimated the cost of maintenance at 8 cents per kilometre, including tire costs (Motor Trucking 1988, 19). The 1985 Trucking Canada survey suggested about 11 per cent of revenue was spent overall on maintenance and repairs, which seems to include tire costs (Van Dusen 1986, 14). If owner-operator revenue was $0.72/kilometre. that would allow again about 8 cents per kilometre for maintenance and repairs, including tires.

Overall, the cost of fuel played a critical role in the life of owner-operators, as can be determined from Table VI. From 37 per cent of tractor costs in 1978, it rose to over 46 per cent in 1982, before beginning a slow decline to about 40 per cent in 1988. The cost of fuel rose from about 20 per cent of owner-operator rates in 1978 to almost 33 percent in 1982 before declining to a little over 25 per cent of owner-operator rates in 1988. The role in tractor cost played by intermediate inputs other than fuel declined at the opening of the 1980s as the role of fuel increased, and has been relatively constant since 1982. The share of owner-operator rates taken by intermediate inputs other than fuel shows basically the same pattern.

Owner-Operator Salary and Profit

The typical owner operator pays his capital costs, his fuel costs, and the cost of his other intermediate inputs. He then takes whatever remains as his personal income, neglecting to divide it between salary and profit. This paper will follow their example.

The Com Car survey reported the net income of its respondents in 1988. If it is assumed that those respondents operating more than one vehicle accounted for the top 22.5 per cent of reporting net income earners, then the owner operators with only one vehicle earned an average net yearly income of about $25,500 (NTA 1989, 12), or about 17.1 cents per kilometre on 148,000 kilometres.

As shown in Table VI, the estimated average net income of owner-operators per year has been subject to wide fluctuations from year to year. It, for example, more than doubled between 1984 and 1985, and fell by more than thirty per cent between 1986 and 1987.

The net income of owner-operators has also tended to be below the income earned by company employed drivers in the for-hire trucking industry, often considerably lower. In only three of the eleven years examined was the net income of owner-operators estimated to be higher than the average income earned by firm drivers. In 1983 and 1984 the net income of owner-operators was only about two thirds that of firm driver income, and in 1982 and 1987 it was about three quarters that of firm driver income.

Although the owner-operator frequently earned less than a firm driver, he was, to some extent, his own boss. In addition, there was always the hope of a really good year. In 1979 the figure for owner-operator income was about a quarter higher than that for a firm driver, and in 1985 it was over 45 per cent higher.

In summary, owner-operators suffered from a very variable net income which was frequently been less than that available as a firm driver. This was perhaps compensated for by the fact he was his own boss and by the hope of a good year.

Trailer Allowance

As noted above, 70 per cent of the owner-operators surveyed in 1985 reported that they occasionally supplied both the tractor and the trailer. It is assumed that in 50 per cent of trips, the owner-operator received extra for supplying a trailer, which might or might not have been his own. This amount is assumed to be equal to the cost of operating a general freight van, as provided in Operating Costs of Trucking in Canada. (The capital cost was adjusted, however, on the assumption that trailers travelled 148,000 kilometres rather than 160,000 kilometres a year). Stan Kimberly, however, put semi-trailer costs appreciably lower in 1988 (Kimberly 1989, 95)

Anecdotal evidence is available on the rates paid in 1984 to owner-operators supplying both a tractor and a temperature controlled trailer, commonly called a reefer. One owner-operator received $1.14 a mile (Trucking Canada 15), while a husband and wife team received $1.16 (Trucking Canada Nov./Dec. 1984, 17). When compared to the owner-operator rates appearing in Table VI, and to rates reported by various owner-operators featured in a series of profiles in Trucking Canada in 1984 and 1985, these figures suggest owner-operators providing a trailer could receive a rate at least 20 cents a mile, 12.4 cents a kilometre, higher than those who did not. This is in line with the allowance of $0.063 for trailers given in 1984, as shown in Table VI.

The Evolution of Rates for Owner Operators

Because different sources are available at different times during the decade, the examination of the evolution of payment rates received by

TABLE III
OWNER-OPERATOR RATES
per mile
1978-1984

YEAR	1978	1979	1980	1981
Saskatchewan Carrier (Western operations)	$0.44		$0.50	$0.58
Saskatchewan Carrier (Prairie and USA operations)		$0.39		
Saskatchewan Carrier (Prairie operations)	$0.47	$0.54	$0.60	$0.71
Saskatchewan Carrier (Prairies and central Canada)	$0.50	$0.60	$0.62	$0.68
National Carrier (Prairie rates)	$0.47	$0.53	$0.61	$0.71
National Carrier, Sask. (central Canada rates)	$0.52	$0.58	$0.66	$0.78
Average Rate	$0.50	$0.57	$0.62	$0.71
Index of Average Rate	70.4	80.3	87.3	100.0
Canadian Consumer Price Index	74.0	81.0	90.0	100.0
Canadian Private Transportation Price Index	68.3	76.0	84.1	100.0
Five Net Income/Operating Costs	0.033	0.038	0.030	0.025
Index of Operating Revenue/Tonne-kilometre (1981=100)	77.3	82.0	89.9	100.0

Sources: Material on the rates of various firms obtained from Clayton and Nix, "Owner-operators in Canadian Trucking" Proceedings, Canadian Trans-portation Research Forum - 1984, pp. 6,7. Figures for the Canadian Consumer Price Index and the Canadian Private Transportation Price Index are from Statistics Canada.

owner-operators is broken into three periods, 1978-1984, 1984-1988, and 1988. It is assumed that there was no systematic or significant change between 1978 and 1988 in the loads moved owner-operators. The evolution of owner-operator rates is placed in the context of firms operations by following the evolution of operating revenue per tonne-kilometre, as collected by Statistics Canada through its for-hire trucking survey.

The level of operating revenue per tonne-kilometre is indicative of the earnings of the for-hire trucking industry relative to the amount and distance of cargo it moves. Any changes to it will also likely result in changes to owner-operator rates. Many owner-operators are paid using formulas directly involving a proportion of the total revenue of their trip. In the 1988, 39 per cent of owner-operators were paid entirely on a percentage of revenue basis and another 12 per cent were paid partly on this basis (NTA 1989, 9). In the 1980s, an owner-operator, paid on a percentage of revenue basis, frequent received about 70 per cent of the revenues (Motor Truck, 1983 16), but both the proportion of revenue paid by a company, and the services provided to an owner-operator, varied.

The movement of owner-operator rates during 1978-1984 can be followed using Clayton and Nix's 1984 article, supplemented by information from trucking periodicals of the period. This period is broken into two sub-periods, 1978-1981 and 1981-1984, because the rates of different firms are used to look at the evolution of rates for each sub-period.

During both 1978-1981 (Table III) and 1981-1984 (Table IV), owner-operator rates rose faster than the ratio of revenue to tonne-kilometres. Owner-operators thus tended to improve their positions relative to that of the employing firms. Rates varied considerably between firms. Rates also varied nationally with costs. The prairies, for example, had lower costs than central Canada (Costs of Trucking in Canada 1978, 1980) and lower rates than central Canada.

Both 1982 and 1983 were "a totally depressed operating environment". This put downward pressure on trucking freight rates throughout the industry. (Trucking Canada Jan./Feb. 1984, 15) Although there ap-

TABLE IV
OWNER-OPERATOR RATES
PER MILE
1981-1984

Item	1981	1982	1983	1984
Saskatchewan Carrier (Western operations)	$0.69	$0.74	$0.74	
Saskatchewan Carrier (Prairie operations)	$0.71	$0.72	$0.72	$0.72
Saskatchewan Carrier (Prairies and central Canada)	$0.68	$0.72		$0.77
Alberta Carrier (average of Manitoba, Saskatchewan, and Alberta rates)			$0.88	
National Carrier (Prairie rates)		$0.80	$0.80	$0.80
National Carrier, Samo, (central Canada rates)	$0.81			$0.88
Average Rate	$0.72	$0.75	$0.77	$0.80
Index of Average Rate	93.5	94.3	96.5	100.0
Canadian Consumer Price Index	91.0	93.0	93.0	100.0
Canadian Private Transportation Price Index	91.7	93.1	96.4	100.0
Firm Net Income/Operating Costs	0.029	0.013	0.034	0.042
Index of Operating Revenue/Tonne-kilometre (1981=100)	94.7	100.0	96.8	100.0

Sources: Material on the rates of various firms obtained from Clayton and Nie, "Owner-operators in Canadian Trucking" Proceedings, Canadian Trans-portation Research Forum - 1984, pp. 4,7. Figures for the Canadian Consumer Price Index and the Canadian Private Transportation Price Index are from Statistics Canada.

pears to be a steady rise in owner-operator rates from 1982 to 1984, rates tended to be at best be constant in 1983 compared to 1982. By the end of 1983 some owner-operators were suffering reductions in their rates (Trucking Canada Nov./Dec. 1984, 15). In 1984, however, slightly better times returned.

During 1984-1988 information is only available on the revenues and distances driven of owner-operators working for private carriers. It is assumed that rates paid owner-operators by private and for-hire carriers moved together. A similar proportion of owner-operators, 30 per cent and 33 per cent respectively, worked for these two types of carriers (Van Dusen, 11).

Table V traces the evolution of the revenue per kilometre received by owner-operators driving for private trucking firms during 1984-1988. Based on the results of the 1985 Trucking Canada survey, allowance is made for the different per mile cost of tractors and straight trucks in calculating the revenue per kilometre received by owner-operators driving tractors. Two indexes are presented. The first shows the average revenue per kilometre of owner-operators working for firms involved in private trucking in those sectors of the economy where it is most likely that the firms were involved in the intercity movement of freight. These sectors were the manufacturing, wholesale and retail sectors. The second shows the revenue per kilometre enjoyed by owner-operators working in all areas in private trucking.

In 1988, the average revenue per (adjusted) kilometre received by private trucking owner-operators in these three industry sectors was higher than that received by owner-operators in for-hire trucking, $0.96/kilometre (Table V), compared to $0.72/Kilometre (Table VI). Within the three sectors, the revenue per (adjusted) kilometre also varied considerably. It was about $1.09 in manufacturing, $0.86 in wholesale, and $0.064 in retail (Statistics Canada 2 1988, 128-129). The differentials may be due to a number of causes. These include different operating conditions, different levels of service being provided to brokers by firms, and different proportions of trailers being provided by firms and owner-operators.

The period saw constant fluctuation in both the revenue per kilometre

TABLE V
OWNER-OPERATOR REVENUE/KILOMETRE
IN PRIVATE TRUCKING
1984-1988

YEAR	1984	1985	1986	1987	1988
Private Trucking Owner-operators in the Manufacturing, Wholesale and Retail Sectors)					
Kilometres Driven	120,481	127,861	121,226	149,226	154,299
Sale of Straight Trucks			12.1%	24.7%	23.4%
Tractor Kilometres (Adjusted)	120,481	127,891	122,121	131,622	126,626
Revenue	$162,903	$169,229	$133,121	$169,152	$159,969
Revenue/Kilometre	$0.832	$1.082	$1.018	$0.929	$0.977
Revenue/Kilometres (Adjusted)	$0.832	$1.062	$1.006	$0.926	$0.963
Index of Revenue/Kilometre (Adjusted)	88.4	112.4	104.7	96.1	100.0
Private Trucking Owner-operators in All Sectors					
Revenue/Kilometre	$1.094	$1.227	$1.121	$1.182	$1.070
Revenue/Kilometre (Adjusted)	$1.094	$1.227	$1.118	$1.052	$1.049
Index of Revenue/Kilometre (Adjusted)	103.4	110.0	106.7	110.9	100.0
Canadian Consumer Price Index (1980=100)	85.9	88.3	92.1	96.1	100.0
Canadian Private Transportation Price Index (1980=100)	88.1	91.9	93.3	96.7	100.0
For-hire Trucking					
Index of Operating Revenue/ Tonne-kilometre	104.4	114.4	107.2	94.8	100.0
Firms Net Income/Firms Operating Revenue	0.042	0.038	0.044	0.035	100.0

Source: Statistics Canada

of owner-operators, as indicated by their experience in the private trucking sector, and in the operating revenue per tonne-kilometre in for-hire trucking. Throughout the period, however, the average revenue per (adjusted) kilometre of owner-operators working for firms in private trucking in manufacturing, wholesaling, and retailing moved in the same direction as the operating revenue per tonne-kilometre in the for-hire trucking sector. In 1985, the index of the former rose more than did the index of the latter. In 1986 and 1987 it fell less.

In 1988, however, the pattern changed. The index of the former rose less than the index of the latter. It would seem likely, therefore, that the position of owner-operators continued to improve relative to that of the employing firms until 1988. In 1988, however, it apparently began to deteriorate for the first time since 1978.

In 1987-1988, the experience of those owner-operators not involved in intercity trucking was apparently somewhat different from those in intercity trucking. The index of all private trucking owner-operators' revenue/(adjusted) kilometre moved together with that of the private trucking owner-operators in the selected (intercity trucking related) economic sectors in 1984-1986, but oppositely in 1987-1988. The former continued to increase in 1987 but declined in 1988. Many owner-operators in private trucking, though not the majority of those in the selected (intercity trucking related) sectors, thus experienced a deterioration in absolute terms in 1988. When private trucking is combined with all other trucking, a similar picture emerges. In 1988, 36 per cent of all owner-operators suffered a decline in their rates while only 9 per cent enjoyed an increase in their rates (NTA 1989, 20).

In 1988, Statistics Canada began to collect information on both the

TABLE VI
OWNER-OPERATOR RATES AND COSTS
1978-1988

YEAR	1978	1979	1980	1981	1982	1983
Rate (excluding fuel)/Kilometre	$0.484	$0.461	$0.392	$0.377	$0.401	$0.418
Rate (including fuel)/Kilometre	$0.476	$0.467	$0.520	$0.509	$0.534	$0.547
Index of Rates (1980=100)	96.1	94.1	89.7	98.1	93.4	93.4
Tractor Capital Cost/Kilometre	$0.078	$0.078	$0.087	$0.107	$0.114	$0.126
Fuel Cost/Kilometre	$0.097	$0.091	$0.133	$0.179	$0.208	$0.213
Other Input Costs/Kilometre	$0.093	$0.103	$0.113	$0.121	$0.125	$0.129
Trailer Allowance/Kilometre	$0.046	$0.044	$0.043	$0.043	$0.049	$0.056
Due to Trailer Capital Costs	$0.009	$0.008	$0.009	$0.009	$0.009	$0.011
Due to Other Trailer Costs	$0.038	$0.036	$0.033	$0.036	$0.040	$0.045
Net Income/Kilometre	$0.121	$0.171	$0.194	$0.171	$0.137	$0.127
Owner-Operator's Annual Income	$17,700	$20,004	$22,590	$22,029	$20,197	$19,543
Firm Driver's Annual Income	$16,043	$20,005	$22,200	$26,337	$25,305	$27,761
Index of Operating Revenue/Tonne-Kilometre (1980 = 100)	77.4	91.0	89.0	99.6	104.9	101.2

YEAR	1984	1985	1986	1987	1988	
Rate (excluding fuel)/Kilometre	$0.527	$0.969	$0.754	$0.693	$0.729	
Rate (including fuel)/Kilometre	$0.572	$0.854	$0.796	$0.729	$0.760	
Index of Rates (1980=100)	88.4	112.4	104.7	96.1	100.0	
Capital Cost/Kilometre	$0.129	$0.142	$0.156	$0.160	$0.168	
Fuel Cost/Kilometre	$0.217	$0.226	$0.220	$0.215	$0.207	
Other Input Costs/Kilometre	$0.131	$0.144	$0.142	$0.141	$0.144	
Trailer Cost/Kilometre	$0.063	$0.064	$0.063	$0.062	$0.072	
Due to Trailer Capital Costs	$0.013	$0.013	$0.013	$0.014	$0.014	
Due to Other Trailer Costs	$0.051	$0.051	$0.052	$0.055	$0.058	
Net Income/Kilometre	$0.122	$0.273	$0.212	$0.147	$0.172	
Annual Income of Owner-Operators	$17,833	$20,760	$21,109	$21,499	$25,218	
Annual Income of Firm Drivers	$26,920	$27,266	$28,290	$28,268	$30,489	
Index of Operating Revenue/Tonne-Kilometre (1980 = 100)	108.1	114.6	107.2	94.8	100.0	

Sources: Information on the income of firm drivers and on operating revenue/tonne-kilometre in for-hire trucking, obtained from Statistics Canada.

distance travelled by owner-operators working for for-hire carriers and on the revenue of these owner-operators. The average revenue/kilometre in 1988 was $1.22/mile, including free fuel, of which $1.16 was cash. The average rates received by for-hire owner-operators in the last quarter were lower than they had been in the first quarter. (Statistics Canada 2, various)

Summary of Owner-Operator Rates, Income, and Expenditure

Over 1978-1981, owner-operators were able to slightly improve their real level of net income, as shown in Table VI. After enjoying a steep increase in real net income in 1979, in 1980 they fell back to only slightly above their 1978 level when payment rate increases fell sharply behind the rise in input prices, particularly fuel. In 1981, however, they enjoyed a sufficient rise in rates to avoid a further decline in real net income. As noted above, the position of owner-

TABLE VII
INTERCITY FOR-HIRE TRUCKING
1978-1988

YEAR	1978	1979	1980	1981	1982	1983
Number of Intercity Firms Examined	2,720	2,945	2,853	1,216	1,230	1,270
Freight Revenue of Firms (Million $)	$3602.5	$4,253.0	$4,757.2	$4,689.7	$4,532.3	$4,871.9
Distance Driven Moving Freight (Million Kilometre)	3,121.8	3,403.8	3,61969.9	3,330.7	3,017.3	3,737.6
Distance Driven by Company Drivers (Million Kilometre)	1,926.6	2,047.4	2,144.4	1,793.3	1,745.6	2,300.1
Distance Driven by Owner-Operators (Million Kilometre)	1,195.2	1,356.4	1,475.5	1,527.4	1,271.6	1,437.5
Role of Owner-Operators in Driving Freight	38.3%	39.8%	40.8%	46.0%	42.1%	38.5%
Firms' Total Operating Expenses (Million $)	$3,496.0	$4,147.0	$4,770.1	$4,701.2	$4,576.0	$4,825.3
Cash Payments to Owner-Operators (Million $)	$402.6	$625.9	$748.1	$801.0	$763.8	$804.1
Role of Cash Payments to Owner-Operators in Operating Expenses	13.8%	15.1%	15.5%	18.7%	16.7%	16.3%
Owner-Operator Revenues, Including Free Fuel (Million $)	$509.3	$660.0	$781.2	$930.1	$906.0	$932.6

YEAR	1984	1985	1986	1987	1988	
Number of Intercity Firms Examined	1,202	1,430	1,386	1,498	1,720	
Freight Revenue of Firms (Million $)	$5,637.0	$6,385.4	$6,907.2	$7,424.5	$7,743.3	
Distance Driven Moving Freight (Million Kilometres)	4,245.5	4,367.6	4,817.1	5,310.6	5,655.6	
Distance Driven by Company Drivers (Million Kilometres)	2,532.4	2,700.0	2,817.1	2,825.2	2,648.4	
Distance Driven by Owner-Operators (Million Kilometres)	1,713.1	1,667.6	2,000.1	2,483.3	2,648.4	
Role of Owner-Operators in Driving Freight	40.4%	38.2%	41.5%	46.9%	46.8%	
Firms' Total Operating Expenses (Million $)	$5,532.2	$6,284.1	$6,752.2	$7,307.3	$7,743.3	
Cash Payments to Owner-Operators (Million $)	$1,090.6	$1,349.9	$1,508.1	$1,725.6	$1,905.9	
Role of Cash Payments to Owner-Operators in Operating Expenses	19.7%	21.5%	22.3%	23.6%	25.0%	
Owner-Operator Revenue, Including Free Fuel (Million $)	$1,138.7	$1,474.8	$1,590.8	$1,830.3	$2,011.2	

Sources: Information on the income of firm drivers and on operating revenue/tonne-kilometre in for-hire trucking, obtained from Statistics Canada.

operators improved relative to that of their employers.

During 1978-1981, in for-hire trucking, the operating revenue per tonne-kilometre, representing the cost to society of moving freight by truck, increased less than either the consumer price index or the private transportation component of the consumer price index (Table III). This suggest that intercity trucking became relatively cheaper to society and that the industry did not fully compensated itself for increases in the cost of vehicles, fuel, and insurance. There is also a clear decline in the ratio of firm net income to operating costs between 1978 and 1980. The apparent relative improvement in the position of owner-operators is, therefore, somewhat surprising.

Over 1981-1984, owner-operators suffered a continuous decline in both real and nominal net income. This occurred despite the slow decline in the cost of fuel as an input after 1982. Nevertheless, the position of owner-operators relative to their employing firms

continued to improve during this period.

During 1981-1984, operating revenue per tonne-kilometre again rose less than either the consumer price index or the private transportation cost component of the consumer price index (Table IV). Intercity trucking thus continued to become relatively cheaper to society and again seems not to have fully compensated itself for the increases occurring in input costs. In fact, the ratio of firm net income to operating costs was lower in 1982 than in 1981, but by 1984 it had improved well past its 1981 level so firms clearly become more efficient at using resources during the early 1980s.

During 1984-1988, the real and nominal net incomes of owner-operators in intercity for-hire trucking apparently peaked in 1985. By 1988 their net incomes had declined considerably compared to their 1985 level. The 1985 peak was due to increases in payment rates at a time of low increases in input prices. Operating revenue per tonne-kilometre fell in 1986 and 1987, making a small recovery in 1988. Table VI accepts these movements were paralleled in the behaviour of owner-operator rates. The result was owner-operator income fell considerably in 1986 and 1987 and did not return to even 1986 levels even in 1988. Also in 1988, as noted above, the position of owner-operators relative to their employing firms began to deteriorate.

In 1987 and 1988, the ratio of for-hire firms net income to their operating cost was slightly lower than it had been from 1984 to 1986, but it was still better than it had been at the start of the 1980s. The economic position of the firms may have been starting to come under pressure but was still better than it had been in the early 1980s when the relative position of owner-operators had continued to improve.

The last year in the period under study, 1988, marked a watershed for owner-operators. By its end, there was a decline in the position of owner-operators in intercity for-hire trucking relative to firms and the income of owner operators was considerably less than it had been in 1985.

The Role of Owner-Operators in Intercity Road Transport 1978-1988

Owner-Operators have played a major role throughout the decade in the movement of freight by for-hire intercity carriers. Their role is highlighted in Table VII.

During the period 1978-1980, the number of firms recorded by Statistics Canada as being for-hire intercity carriers rose from 2,720 to 3,252 and their operating freight revenue rose from $3,603 to $4757 million, as shown. Payments to owner-operators, as a percentage of operating costs, rose from 13.8 per cent to 15.5 per cent. At the same time, the percentage of kilometres being driven by owner operators rose from 38.3 to 40.8 per cent of the total.

During 1981 to 1988, the number of firms making at least $500,000 annually in this industry rose from 1,216 to 1,720. The proportion of operating expenses paid to owner-operators during 1981-1983 fluctuated between 16.7 and 18.7 per cent. It then began a steady rise in 1984 and reached 25.0 per cent in 1988.

The role of owner-operators in moving freight declined during the difficult years from 1981 to 1983. It fell from 46.0 per cent in 1981 to 38.5 per cent in 1983. It then fluctuated between 38.2 and 41.5% per cent during 1984-1986. In 1987 and 1988 it returned to the relative importance that it had in 1981. It was 46.9 per cent in 1987 and 46.8 per cent in 1988.

Owner-operators, therefore, have tended to provide close to 40 per cent of driving in intercity trucking operations. At times they provided considerably more. Although their importance fell considerably during the period of recession in the early 1980, it returned to levels not much below 50 per cent after 1986. It is also interesting to note that their relative importance in moving freight has shown more fluctuations than is suggested by an examination of their relative importance as an element of operating costs.

CONCLUSIONS

Owner-operators have seen their net income fluctuate widely from year to year. In periods of unexpected price increases they suffered severely. At all times, their average net income has been quite low, at times, disastrously low. Movements in the price of fuel, and in the efficiency of its use, have played an important role in these fluctuations along with changes in their payment rates.

Throughout the decade, owner-operators played a key role in intercity for-hire trucking. This role has expanded in good times and has shrunken in bad times. They have thus acted as a buffer for their employing firms, allowing these firms to maintain a lower number of permanent drivers, and a smaller inventory of equipment than would otherwise have been needed. Their importance to their employing firms apparently allowed them to improve their relative position to that of their employers until 1988. The last year of period, however, marked a turning point for owner-operators. Their net income was lower than it had been and their position vis a vis their employers began to deteriorate.

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HUMAN RESOURCES IN THE TRUCKING INDUSTRY

Louis-Paul Tardif

The trucking industry is involved in a volatile intensely competitive world where the capacity to respond and act is perhaps more important than the characteristics of today's products and markets. Every company is looking for factors that will assure it of a sustainable competitive advantage. But for most of the sources of competitive advantage e.g. core competence, time compression, continuous improvement and partnership, companies must pay more attention to human factors. In fact, the barriers to adaptive capability are largely social not strategic.

For the trucking industry the question of human resources is characterized by four distinct levels of resources i.e. top management, operational management, front line employees and sub-contractors. This paper will focus specifically on the first, second and third levels.

A) Definition of the Human Resources in the Trucking Industry:

The employee side:

Using a breakdown that was done using 1986 statistics, the occupational profile of the for-hire trucking industry shows that more than 50% of the employees are truck drivers (Exhibit 1). Of the other occupations, none represent more than 8% of the total number of employees. Drivers are, therefore, the central elements of the trucking business. These are the people that customers and the public at large see on a daily basis. In Canada, we have some difficulties in being able to pin down exactly how many commercial drivers there are but the best estimate provided, thus far, comes from provincial transportation departments and it gives us, for 1988, a total of 411,205 class 1 license holders. These drivers are working in various sectors of the economy (Exhibit 2) and are either working as employees or owner-operators (Exhibit 3).
One will recognize that the job of a truck driver can be divided into two aspects: the commercial and the safety aspects. The latter has occupied

a significant amount of our time over the past five years with the definition of national standards under a National Safety Code. As for the commercial aspect, there are a few companies that have started quality programs. Generally speaking though, truck drivers receive little training either as new recruits or after employment.

Compared to other industries the trucking industry, and for that matter the whole transportation industry, fared very poorly in a national survey on Human Resource Training and Development (Exhibit 4). The fact that only 22% of the transportation companies surveyed provided formal training shows that the industry has not yet embarked on that new training culture wave. In fact, Canada as a whole is only spending 0.5% of gross wages and salaries on employer sponsored training. This compared rather poorly with some OECD countries such as France at 2.3% and Australia at 2.3%. The United States are at 1%.

But there has been signs of improvement over the last seven or eight years. The Transportation of Dangerous Goods Act and Regulations have initiated a training mentality that was not present or noticeable before. The liability and the onerous penalties contained in the TDG Act have focused the transportation industry's minds on the need to do "whatever is reasonable" to avoid heavy fines. Furthermore, the realization that the complexity of the regulations meant that it could not be done in-house was another key factor in promoting the need for national training standards.

The management side:

On the management side things do not necessarily look any brighter. There is a tendency in the industry to attract management employees from competitors. In fact, it is very rare to see ads in the career sections of any newspaper advertising a managerial position for trucking companies. The fact that the industry is rationalizing explains partly this phenomena but the inner-circulation of candidates could explain some of that as well. As a result, there is ignorance on the part of the supply of the possibilities of careers and there is ignorance on the part of the demand of the potential existing out there.

We also know that transportation training at the university level is not being funded adequately and that trucking is not an attractive research area for various reasons. One of them is the poor quality of our statistical base. Most researchers are reduced to imprecise survey results, qualitative delphi measurements and anecdotal notations from sources from within the industry.

The research on the adequacy of training on the management side of the industry is quite limited. One of the measurements, albeit imprecise, that may be used is the number of registrations in the Continuing Education Programs in Canadian universities. The figures show that transportation and communication were last in 1976-1977 with 0.7% of the total registrations and last again in 1986-1987 with only 0.1% of the total registrations. As expected business and commerce is first in both academic years with respectively 24.5% and 18.5% of the total registrations.

Obviously there are some students registered in a business class that could be coming from the transportation sectors and attending administrative courses but one can fairly assume that motor carrier management employees are not lining up to upgrade their skills in transportation.

As far as CEOs are concerned, the trucking industry is dominated by family-owned companies and as a rule the majority of the CEOs have learned their skills "from the cab" or have some university or college tr aining that may be generic in nature. There are little or no "Senior Management" programs in Canada to complement the skills of these entrepreneurs.

B) The Road Ahead

The nice thing about training in the trucking industry is that it is a field with tremendous potential and one that has been barely explored, or at least, one that needs to be re-explored. Let's examine new and potential developments in the three levels of human resources I specifically focus my attention on.

1. The Drivers

As some of you may be aware, a major initiative is now underway in order to address the question of training of new drivers. Using an Employment and Immigration Program called Industrial Adjustment Service Agreement, five major industry's stakeholders are developing training standards that should result in programs that will address the cyclical shortage of qualified drivers. The solution they are proposing is close to the german "dual" approach where a new recruit is spending some time with a motor carrier before receiving a diploma from training schools. As you will note, I purposely did not use the word apprentice-ship because it is not an apprenticeship program. But because it is not an apprenticeship program

the matter of funding will still have to be addressed.

As for the existing driver population, some training has been delivered for some time under the so-called Professional Driver Improvement Course (PDIC) programs. These, however, are strictly addressing the safety aspect and not the commercial part of the driver's job. Some companies have developed some of these commercial programs in-house but again, this is limited to a very few companies.

There is also the "regulatory" training that is constantly going on due to new regulations. This is a fairly new area but one that will increase in size and complexity in the years to come.

The above are just snap-shots of what is being done to address the training needs for drivers. Some of the discussions taking place between the stakeholders and the provincial governments also include the need for accreditation of training schools. Once these two aspects are in place and operational i.e. the on-the-job training and the accreditation of training schools, we will then have met the two most important recommendations of the EIC study on Human Resources in the Trucking Industry as far as training is concerned.

2. The Operational Management

Over the years the majority of people in that category of employees were coming from the rank and file of the industry. I suspect the majority will in the future as well. We, however, can detect a slight change of attitude on the part of some companies. They realize that trucking is part of a broader world; the world of logistics. These companies want their operational managers to be trained with this new approach in mind. More and more of these managers, be it terminal managers or in any other mid-managerial position, will be fewer and farther between but will be given more responsibilities by the top management.

There are some courses that exist in Canada to train line people to access these mid-management positions. These programs are generally accepted as valid for new entrants. I am not familiar enough with these programs to comment on any of them. If, however, I was to look at any of them here are the areas I would be looking for in terms of skills provided through their curriculum: broad-based education, communication skills, computer skills, analytical skills, strategic thinking, entrepreneurship, negotiating skills, group dynamics, global perspective and language training.

Like drivers, existing operational managers need to be trained and re-trained. Very little is done to address that type of training. Some universities offer as part of existing programs some courses dealing with transportation and are accessible to every individuals provided that person has the necessary academic qualifications. However, more could be done as part of a continuing education program. Such a program could focus on the following themes: specialized training to update technical skills, transportation management for new executives with transportation responsibilities who come from non-transportation backgrounds and general management courses for rising stars who are being groomed to assume high-level executive positions.

The second theme may take more importance in the near future in view of the aging mid-management population and the lay-offs and early retirement packages given to senior mid-managers because of the recession.

3. Top Management

With profound changes taking place in the trucking industry's competitive posture, and with so many traditional attitudes and practices to be adapted, where and how can the process begin? The answer, of course, is at the top. Without consistent leadership and direction, change cannot begin.

In the trucking industry, because most of the CEOs are individuals who often started behind the wheel, there is sometimes that feeling that the industry has remained non-complicated as it was not too long ago. Strategic thinking and planning are just the way to get by until next Monday morning. That feeling of short-termism exist in the industry and will by far be the most difficult challenge to any Human resources planning. But it can be done as others have shown us elsewhere. Europe is, of course, the place where the most practical experiments are taking place.

For instance, it could be possible to design programs for Senior Executive Officers. The process could range from a few hours to full-day sessions and take the shape of a think thank. These could be regional and delivered by universities across Canada. The Westac format is not far from this format. But we need more industry-focused programs and also, more forward thinking ones.

C) Conclusion

Over the last ten years there has been at least 40 reports containing no less than 600 recommendations on the issues of education and training. In my best evaluation, these reports and recommendations have had few discernable effects. However, without stating the obvious, and we may ignore this fact at our expense, the greatest competitive advantage a nation has is its productivity. While Canadian resources commanded premium prices, we lived well. The skills and motivation of the workforce at all levels are now the resources to be counted on in order to get a larger share of high value-added trade.

It should be up to individual industries to set their own targets and this must be done in concert with all stakeholders within an industry. Governments will be needed to facilitate action with financial assistance, incentives and with help and information.

Specific programs addressing training needs for drivers are well underway. Once this is in place we must not stop there. We will, at that point, need to put the research at a higher level and maybe start looking at such matters as driving simulators: their needs, functions and applicability. In fact,our biggest problem with driver training may be our capacity of the targetted audience to absorb all new material.

On the management side, we must start thinking the European way and start seriously working on the establishment of a Canadian Training Institute for Road Transport. In Europe most countries have a training Institute that deals specifically with the questions of training for road transport personal. The tasks and objectives of this Institute could be to develop curriculum, standards of training and programs for senior managers.Possibly, it could as well,maintain the integrity of the programs developed under the joint EIC/Industry IAS program for truck drivers. But most important, the mission statement of this Institute should be to focus on quality and productivity standards for our human resources.

It is important, however, that we adopt a cautious approach with Human Resources development in the trucking industry. Everything must be accomplished step-by-step or risk not being understood by any of the three levels mentioned above. But again, the one level that must understood what is being done is the senior managemnt level. Otherwise, the chances of success are significantly reduced.

Note: The views expressed in this paper are those of the author and not of the Association.

EXHIBIT 3

SEGMENTATION OF HUMAN RESOURCES IN TRUCKING

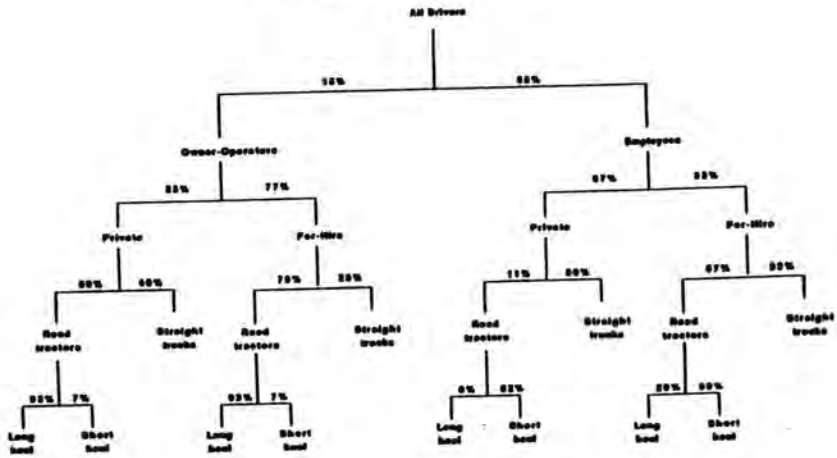
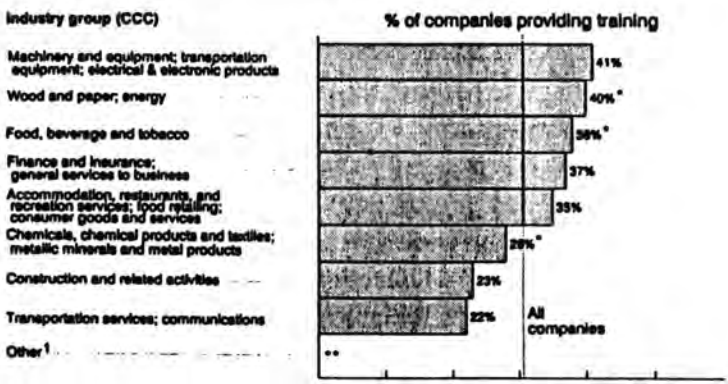


Exhibit 4

Companies providing formal training for employees, by industry, 1987



[1]Includes government services; education, health and social services, and industry not known.

Source: Human Resource Training and Development Survey, 1987.

EXHIBIT 1

1986 OCCUPATIONAL PROFILE OF FOR-HIRE TRUCKING

OCCUPATION	CANADA (%)	ATLANTIC (%)	QUEBEC (%)	ONTARIO (%)	PRAIRIE (%)	B.C. (%)
Manager	5.6	5.7	6.0	6.0	4.9	4.7
Bookkeeper	4.6	4.8	4.0	4.6	4.7	5.6
Other Clerical	7.8	6.4	8.4	8.2	7.7	6.6
Sales	1.6	1.5	1.5	1.9	1.1	1.2
Product Fabrication/ Assembly/Repair	4.9	5.7	5.1	5.3	4.4	4.2
Construction	1.0	2.1	1.2	0.7	1.2	0.8
Truck Driver	56.7	52.7	57.5	55.6	57.3	60.0
Foreman - Motor Transport	5.1	4.4	6.7	4.1	5.9	4.1
Other Equipment Operator	2.9	2.9	2.8	3.4	2.4	2.6
Freight Handler	3.3	4.9	3.0	3.3	3.0	3.1
Other Material Handling	3.2	4.1	1.3	3.6	3.8	4.0
Other Occupations	3.3	4.8	2.3	3.4	3.5	3.1
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

Source: Statistics Canada, *1986 Census*.

EXHIBIT 2

1986 INDUSTRIAL PROFILE OF TRUCK DRIVERS

INDUSTRY	CANADA (%)	ATLANTIC (%)	QUEBEC (%)	ONTARIO (%)	PRAIRIE (%)	B.C. (%)
Farming/Forestry/Fishing	2.2	3.3	1.6	1.6	1.6	5.6
Mines/Quarries/Oil	2.5	2.8	1.5	1.4	4.7	3.7
Food/Bev MFG	4.9	6.9	6.4	4.8	2.9	4.1
Other MFG	10.0	7.7	11.7	12.5	5.9	6.2
Construction	5.8	9.3	5.4	5.9	5.4	4.2
Truck Transport	36.9	34.2	31.6	35.0	45.8	42.1
Other Transportation/ Communications/Utilities	6.3	6.3	6.3	6.0	6.1	7.6
Wholesale Trade	12.8	13.0	13.5	13.4	11.5	9.4
Retail Trade	7.8	7.3	9.8	8.2	5.9	5.8
Services	6.1	4.6	6.4	6.4	7.9	8.9
Finance/Gov	3.1	4.7	3.9	2.7	2.5	2.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

Source: Statistics Canada, *1986 Census*.

OWNER-OPERATORS IN ONTARIO

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ABSTRACT & ACKNOWLEDGEMENTS

In 1988 Ontario conducted one of its periodic road-side surveys, resulting in a large data base on commercial trucks. This paper reports on an effort to use this information to describe owner-operators. It does not reveal everything a transportation analyst would like to know about owner-operators, but it goes a long way in developing characteristics of a segment of the trucking industry that may now account for one-third to one-half of all long-distance drivers. This effort to describe owner-operators also shows how much the industry has changed since 1983 (the previous road-side survey). There has been a very large increase in the number of owner-operators on extraprovincial--particularly international--operations and this has had a major impact on owner-operator characteristics in Ontario.

The research was funded by the Ontario Ministry of Transportation; the opinions and any errors are the responsibility of the authors.

1 INTRODUCTION

Owner-operators own or lease vehicles (tractors, trucks, trailers) and work as contractors for for-hire or private motor carriers. In fact, no single and precise definition fits all circumstances, particularly given the diverse legal context within which owner-operators work in each province. [1] To further complicate matters, their status as a contractor, rather than as an employee, is contentious. [2] In Ontario, they are defined in new legislation as persons with either "owner driver authorities" (one vehicle, one driver, one contract) or "single-source authorities" (a person with one or more vehicles working solely for one company). The thousand or so persons who have obtained such authorities to date, however, are only a small fraction of the people who consider themselves owner-operators. [3]

Owner operators are important for several reasons. First, their use has grown so much over the last several decades that they now constitute one of the largest parts of the trucking industry. Second, the existence of owner operators raises difficult issues for the regulatory and enforcement agencies: these institutions were originally designed to deal with carriers and drivers; the introduction of something in between has complicated the picture.

Third, given the increased competition within transportation markets, and the resulting pressure on owner-operator rates, there exists the possibility that a financially troubled group of owner-operators has the potential of disrupting the whole transportation system. The border blockades by owner-operators (and other drivers) of the summer of 1990 give testimony to this last point.

In this paper the results of an Ontario road side survey are used to develop characteristics of owner-operators. These characteristics are compared with earlier data to see what changes are occurring, and StatsCan data is used to gain a broader perspective.

2 DATA SOURCES

The main source of information for this paper is an Ontario 1988 road-side survey, details of which may be found elsewhere. [4] For this research, information was separated into five categories corresponding with the drivers identified in the survey. In the final expanded data base, the numbers are as follows.

1988 Road-Side Survey: Driver Categories

Broker/Owner-Operator	17 410.2	16.3%
Employee: Agency (eg, driver pool)	6 222.3	5.8%
Employee: Company	69 812.8	65.3%
Self Employed (1-person/truck firm)	1 997.5	1.9%
Don't Know	11 388.4	10.7%
	106 831.2	100.0%

In most cases, "don't know" responses have been discarded where the "don't know" variable is the one under examination. For example, in the above case, the number of owner-operators is 18.2 percent (17,410.2 out of 95,424.8) rather than the 16.3 percent shown. However, when attention is focused on another variable- say, for example, configurations used by various drivers -the information from the "don't know" drivers is used. In this case, it is the "don't know" response to "configuration type" that is discarded in the calculations. A second source of data is information from a 1983 road-side survey, published in an earlier paper. [5]

There is a serious methodological issue about road side surveys, specifically, what it is the sample actually captures. It purports to measure AADTT (average annual daily truck traffic) but there may be problems. This paper does not address this; however, its existence has to be recognized to put the findings in perspective. The number and the comparisons given here are better seen as "tendencies" or "trends" rather than as absolute values.

A third source of information is three surveys from Statistics Canada: the annual census survey of all for-hire carriers; the private truck survey; and the relatively newer Quarterly Survey. [6] These provide the most accurate and consistent information available on owner operators over a long period of time.

3 THE IMPORTANCE OF OWNER-OPERATORS

The 1988 road-side survey indicates that 18.2 percent of the trucks on Ontario highways are operated by owner-operators. This compares with 9.2 percent in 1983. Further, in 1988, owner-operators accounted for 23.9 percent of all freight, as measured by weight, compared to 12.6 percent in 1983.

StatsCan provides a more broadly-based measure of the importance of owner-operators. The amount spent by all for-hire carriers in Canada on owner operators has risen from 11.2 percent of operating expenses in 1975 to 22.9 percent in 1988, the latest annual figures. In Ontario, the increase has been from 9.2 to 20.0 percent. There may have been some levelling off in this rate of growth since 1988, as indicated in the new quarterly survey of for-hire carriers.

Owner-Operator Payments (incl. fuel) as % of Total Expenses

	Canada	Ontario
1989 - 1	21.8%	19.1%
- 2	20.8	17.6
- 3	20.9	16.9
- 4	20.2	17.1
1990 - 1	22.2	16.8
- 2	22.4	19.1

StatsCan's data on private trucking indicates no similar trend, either for Canada as a whole or for Ontario. A relatively constant annual five to seven percent of private trucking expenses are accounted for by owner-operators. Ontario-domiciled private truckers account for 30 percent of the total owner operators in Canada in 1988 and 38 percent of total kilometres, and 41 percent of total owner-operator payments.

In 1990, using its latest annual data, StatsCan published information on for-hire trucking in a new format. [7] Rather than showing information on the basis of domicile, they show it on the basis of where the activity occurred. For the interprovincial and/or international carriers included in this survey, owner-operators accounted for one-third of the fleet and 46 percent of the total distances driven. The comparable figures for Ontario are 29 percent of the fleet and 40 percent of the total distances. While owner operators are relatively less important in Ontario than in other parts of the country, the shear size of trucking activity in Ontario means that close to 38 percent of all owner operators in the country work mainly in this province. ("All" means the universe of all for hire, class 1 and 2 interprovincial and/or international carriers.)

4 WHO USES OWNER OPERATORS?

For hire carriers use owner operators more extensively than private carriers. This can be seen in the following figures: three quarters of the owner-operators in the 1988 road side survey identified themselves as engaged by for hire trucking firms. To turn this around, 28.5 percent of all for hire truck trips were accounted for by owner-

operators versus only 8.7 percent of private truck trips. In both cases, these percentages are sharply higher than in 1983.

Use of Owner-Operators by Fore-Hire and Private Carriers

Ontario Road-Side Surveys

	. . total trips . . for-hire	private
1983 owner-operators	17.3%	2.6%
1988 owner-operators	28.5	8.7

StatsCan Data: O/O Payments as % of Total Expenses

	Canada for-hire	Canada private	Ontario for-hire	Ontario private
1984	18.3%	6.2%	15.6%	5.3%
1988	22.9	6.3	20.0	5.9

Large for-hire carriers are more likely to use owner-operators than small ones. This can be shown by considering StatsCan's data on Level 1 carriers' annual earnings of $5 million or more: in 1988 26.8 percent of the expenses of these carriers were accounted for by owner-operator payments, versus only 22.9 percent for the industry as a whole. Further, this tendency has been growing over the last decade. In the late 1970s Level 1 carriers spent about the same proportion of total expenses on owner-operators as did all carriers.

Owner-Operators on Long-Distance, Extraprovincial Hauls

1988 Ontario Road-Side Survey

	owner-operators	all other drivers
intraprovincial trip	38.1%	61.5%
extraprovincial trip	61.9	38.5
- interprovincial	26.4	18.6
international	26.8	15.5
- in transit	8.6	4.4

StatsCan 1988 Data, For-Hire Carriers

	O/O Payments as a Percent of Revenues	Distribution of Total O/O Payments
Local Carriers	10.9%	10.1%
Off-Highway Carriers	11.2	1.5
Intercity Carriers	23.1	88.3

Owner-operators are used more extensively on long hauls, particularly extraprovincial hauls: 62 percent of the owner-operators in the 1988 road-side survey were on an extraprovincial trip, split almost evenly between interprovincial and international. This tendency to use owner-operators on extraprovincial hauls has increased significantly since 1983 when 12 percent of all extraprovincial trips were accounted for by owner-operators. By 1988 this had increased to 27 percent.

The StatsCan data also shows this tendency to use owner-operators on the longer runs--at least for for-hire carriers. The data on private carriers (not shown here) indicates that local and intercity private carriers spend about the same proportion of their total expenses on owner operators.

Given this use of for-hire owner operators on the long-distance routes, it is not surprising that a large proportion of owner-operators captured in the road-side survey have vehicles which are registered outside the province.

Vehicles by Jurisdiction of Registration: Ontario 1988

	owner operators	all other drivers
Ontario	75.3%	82.5%
Other provinces	16.0%	10.9%
United States	8.8%	6.6%

Another way to show where owner-operators are used is to examine trailers or truck bodies. In the 1988 road-side survey, the distribution of trailer or truck body types by owner-operators and all other drivers is quite similar. Owner-operators are slightly more represented with stake, flat bed, float, and container trailers and are slightly under-represented with dry vans, tankers, and car carriers. The main change since 1983 is that the use of vans, dry freight and refrigerated, by owner-operators has increased: 58.3 percent of the total in 1988 versus 45.9 percent in 1983. Further, there has been a sharp decline in the relative number of trailers such as dump, stake, and car carriers. This is a relative decline only as, with the increase in the overall number of owner-operators, the actual number of dump, stake, and car-carrier trailers has increased.

StatsCan 1988 Data, For-Hire Carriers

	Percent of Total Expenditures On Owner Operators	Distribution of Total Owner-Operator Payments	
	Canada	Canada	Ontario
General Freight	22.7%	50.7%	66.5%
Bulk Liquids	20.0	7.6	0.8
Dump Trucking	19.3	3.8	8.2
Forest Products	17.3	6.3	3.2
Other Commodities	25.1	29.0	19.0
Household Goods Carriers	11.4	2.6	2.3

The proportion of expenses accounted for by owner operators in StatsCan annual survey also show who uses these drivers. As can be seen, owner operators are used in all segments of the industry, but tend to be used the most in "other" (whatever that encompasses). Even though all sectors use owner operators, the very size of general freight carriers dictates that most owner operators--particularly those engaged by Ontario domiciled firms--are hauling general freight.

The one peculiarity between Ontario and the rest of the country is that owner-operators are not used much in Ontario by bulk-liquid haulers. This was also seen in the 1983 road-side survey results.

The picture is different for private carriers where owner-operators are concentrated with carriers engaged in construction, manufacturing, wholesale businesses, and "other" (primary industries), but are most important with the first of these, construction, on a relative basis (ie, as a percent of trucking expenses).

5 OWNER-OPERATOR CONFIGURATIONS

Most owner-operators working for for-hire carriers drive tractors: StatsCan's survey of Level 1 carriers indicates that 98 percent of the owner-operators engaged by large extraprovincial carriers operate tractors as compared to straight trucks. Given that there are three to four times as many for-hire owner-operators as there are private, this accounts for the high proportion of tractors showing up in the road-side survey: 90 percent of the owner-operators were driving tractors versus only 81 percent for the other drivers. This trend towards owner-operators using tractors is growing. StatsCan's data indicates that half of the private-carrier owner-operators drive straight trucks, but these do not show up in the road-side surveys: they tend to operate in urban areas or, perhaps, on rural roads.

Configurations Used by Owner-Operators: Ontario 1988

	Owner Operators		All Other Drivers	
straight truck	9.2%		17.2%	
tractor-semitrailer	83.6		75.6	
doubles	6.1		5.4	
A-train		3.2		2.7
B-train		2.6		2.4
C-train		0.3		0.3
truck + trailer	0.6		1.3	
other	0.6		0.5	

The owner-operators on the highway operate the larger configurations: 23 percent have six or more axles versus 20 percent for the other drivers, and 6.1 percent drive double-trailer units versus 5.4 percent of the other drivers. But this tendency to operate larger trucks cannot disguise a basic fact: the 5-axle tractor semitrailer is, by far, the most common configuration. It accounts for two-thirds of the fleet. Further, its popularity has grown since 1983 -from 55 to 66 percent of the total fleet. This suggests that more owner operators are working on transborder routes (weight and dimension regulations in the United States favour the use of this configuration).

In terms of changes in the distribution of configurations between 1983 and 1988, these are the apparent trends: (i) owner operators have shifted more to tractor-semitrailers and shifted away from trucks and truck-plus-trailers; (ii) there has been an increase in the number of

double-trailer units (6.2% of the total in 1988 versus 5.2% in 1983); (iii) A-trains account for the increase in popularity of doubles (again, a reflection of transborder operations); and (iv) as previously noted, there has been a growing trend towards the use of 5-axle tractor semitrailers. Finally, and expanding on an observation made about the use of vans in the previous section, just over one-half of the owner-operators fleet in 1988 on Ontario highways consisted of tractor-semitrailer vans (dry freight and refrigerated). This compares with 38 percent in 1983.

All of these trends are relative. That is, they compare distributions of configurations between two years; they do not take into account the growth in the number of trucks. There are several ways this can be done and the following figures show one. They depend for their accuracy on the AADTT estimates produced by road-side surveys. [8]

AADTT Estimates of Owner-Operators on Ontario Highways

	1983	1988	Growth
straight trucks	523	1 789	X 3.4
tractor-semitrailers	3 287	16 352	X 5.0
doubles	219	1 186	X 5.4
truck + trailer	190	117	X 0.6
A-trains	97	622	X 6.4
B-trains	122	506	X 4.1
5-axle configurations	2 507	12 832	X 5.1
5-axle tractor-semitrailers	2 330	12 813	X 5.5
tractor-semi vans (incl reefer)	1 585	9 897	X 6.2
8-axle doubles	126	564	X 4.5

The observations on these figures modify, somewhat, the earlier ones: (i) while there has been a relative trend away from straight trucks, the absolute number of such vehicles driven by owner-operators has continued to grow; (ii) the only case where the relative trends are confirmed by the absolute values is in the case of truck-plus-trailers (an actual decline in numbers); (iii) the earlier observation about A-trains becomes quite apparent in the above figures--they are the fastest growing component of the owner-operator fleet; and (iv) the above numbers re-confirm the very large increase in the number of tractor-semitrailers driven by owner operators and, in particular, the number of tractor-semitrailer vans.

6 CHARACTERISTICS OF OWNER OPERATOR EQUIPMENT

This section is similar to the previous only here, rather than looking at configurations (the number of axles and the manner of joining vehicles together) the emphasis is on other aspects of the fleet. Five points can be made about the 1988 road side survey.

First, there is a slight tendency for owner operators to drive newer equipment than other drivers: 59 percent of the owner-operator fleet

consisted of 1986 or newer models versus 54 percent for other drivers. In the 1983 road-side survey, owner-operators tended to drive slightly older equipment than other drivers.

Second, there is a greater chance that owner-operators drive trucks that are owned rather than leased: 19 percent of the owner-operator fleet was leased versus 29 percent for other drivers.

Third, more owner-operators drive COE tractors (cab-over-engine as compared to the longer "conventional" tractor) than do other drivers: 20 percent for owner-operators versus 14 percent for others. This finding, which is unexpected, may have something to do with the number of owner-operators on transborder routes. [9] Also, owner-operators are twice as likely to have a sleeper on the tractor than other drivers: two-thirds of owner-operator tractors had sleepers.

Fourth, and consistent with the information in the previous section (more axles, more doubles), owner-operators tend to operate heavier equipment than other drivers: 29 percent had vehicles with RGVWs (registered gross vehicle weight) above 50,000 kilograms versus 24 percent for other drivers. The mean RGVW for owner-operators in the 1988 road-side survey was 36,841 kilograms versus 34,395 for other drivers. Moreover, the average RGVW for owner-operators has fallen significantly since 1983: 36,841 in 1988 versus 43,730 five years earlier. Again, this likely is related to the increase in transborder activity.

Fifth, owner-operators do not appear to be as energy conscious as other drivers (or the carries who buy the equipment). That is, 62 percent of the owner-operator equipment had no aerodynamic devices, compared to 57 percent for the equipment driven by other drivers. While the measures used in the 1983 road-side survey were different, they, too, suggested that owner-operators did not use as many energy-saving devices as did company drivers.

7 OWNER-OPERATOR CHARACTERISTICS: THE DRIVER

Most owner-operators do not belong to a union or owner-operator association, according to the findings of the 1988 road side survey: the unionized component (29.3%) is only slightly smaller than the unionized component of other drivers (33.6%), and only 0.8 percent belong to an owner operator association.

The road-side survey results also suggest that there tends to be fewer young owner-operators--only 16 percent are under the age of 30 whereas 22 percent of the other drivers are, and there tends to be slightly more middle aged owner operators--two-thirds of the owner-operators are between 30 and 49 versus 60 percent of other drivers.

Owner-operators are slightly more experienced than other drivers, although the differences are not great. Two-thirds of the owner operators in the 1988 road-side survey had more than ten years driving experience, versus 63 percent for other drivers.

Owner operators are better trained than other drivers, at least to the extent that taking a course is synonymous with training. Whereas 40 percent of the other drivers had taken no courses in defensive driving, first aid, or dangerous goods, only 26 percent of the owner-operators were in this category.

8 OWNER-OPERATOR CHARACTERISTICS: WORKING CONDITIONS

From the results of the 1988 Ontario road-side survey, owner-operators appear to work slightly longer days than other drivers; although the two distributions of hours worked are so similar that the importance of this observation should not be exaggerated. Owner-operators, however, do drive longer hours. Fifty-six percent of them had driven (or were going to drive) eight or more hours, whereas only 47 percent of the other drivers were driving this many hours.

The information from the survey also suggests that most owner-operators are paid on the basis of distance driven (so much per mile). The information shown below on owner-operator rates of pay has to be interpreted with care as it is not clear that the rates for private and for-hire truckers are comparable, given that by many private owner-operators drive straight trucks in urban areas.

Distance-Based Pay Rates for Owner-Operators

private trucking, StatsCan, 1988		$1.07 km
advertised rates, fall 1990		$0.56 - $0.65 km
WOOA/Union demand in B.C., May, 1990	5 axles	$0.75 km
	8 axles	$1.06 km
APCRIQ demand, May 1990		$0.80 km

StatsCan's Quarterly Survey: For-Hire Carriers

		Canada	Ontario
1988	1	$0.85	$0.87
	2	0.88	0.94
	3	0.66	0.64
	4	0.70	0.81
1989 -	1 [10]		
	2	0.75	0.77
	3	0.74	0.74
	4	0.73	0.71
1990 -	1	0.71	0.68
	2	0.71	0.69

The average of $1.07 for private truckers probably disguises many differences among private carriers. The second set of rates ($0.90 to $1.05/mile) shown were advertised in trucking magazines in the fall/winter of 1990/91. The third rate, for 5- and 8 axle equipment, is the rate contained in a contract drawn up for negotiating purposes

by the Western Owner Operator Association and three union locals in Western Canada (whether these rates are being paid is not known); and the fourth rate is a similar sort of thing developed by the Association des Proprietaires de Camions Remorques Independant du Quebec following the border blockades. Finally, at the bottom, the rates shown are from StatsCan's Quarterly survey; they include both payments to owner-operators and fuel supplied (where applicable). As shown, there has been a downward trend in for-hire owner-operator rates over the last year or so.

9 LOAD CHARACTERISTICS

Owner-operators tend to drive with full loads more often than other drivers--28 percent of the other drivers in the 1988 road-side survey had partial loads, versus only 24 percent of the owner-operators. The likely explanation is that fewer owner-operators are engaged in peddle runs or in LTL freight operations . In comparison to 1983, the most significant change is the decrease in the number of empty loads accounted for by owner-operators. This is probably accounted for by the decrease in the relative number of dump trucks operated by owner-operators ("relative" in the sense that there was a sharp jump between 1983 and 1988 in the number of owner-operators hauling dry freight or refrigerated vans).

In terms of commodities carried, the surprising aspect of the figures from the 1988 road-side survey is the degree of similarity between owner-operators and other drivers. Owner-operators appear to be slightly less involved with the hauling of food (etc) commodities and slightly more involved in the hauling of crude materials.

Commodity Carried (load weight): Ontario 1988

	owner-operators	all other drivers
food, beverages, tobacco	14.8%	18.0%
live animals	1.0	0.3
crude material, inedible	15.9	10.4
fabricated products, inedible	45.8	48.8
end products: transportation/comm	8.7	8.5
end products: other	8.9	8.2
mixed	5.0	6.0

Owner-operators tend to carry heavier loads than other drivers; this could be the influence of partial loads noted above. The average is 17,085 kilograms versus 14,775 for other drivers. This average load for owner operators has dropped considerably since 1983 (19,887 kg), probably because opf the relative increase in transborder activity. Another point to note about the difference in the distribution of load weights between 1983 and 1988 is the large increase in 1988 in the number of shipments in the 15 to 20-tonne range. The significance of this is simply that this weight group encompasses a full load as far as transborder trucking regulations allow (an 80,000 pound truck generally carries a load of about 22 tons, or about 20 metric tonnes).

10 TRIP CHARACTERISTICS

Little information has been developed from the 1988 road side survey on trip characteristics. What can be said about owner-operator trips, in comparison to other trucks on the road, has largely been given in previous sections: (i) owner-operators working for for-hire carriers are used more extensively on extraprovincial operations; (ii) this same point is not, apparently, true for owner-operators working for private carriers; and (iii) the majority of owner-operator trips are long-distance (whether or not they are extraprovincial) as evidenced by the number of tractors with sleepers (two-thirds).

The following numbers expand on the first point: in the 1983 road-side survey, there were 1,719 extraprovincial owner-operator trips per day in Ontario [11]; by 1988 this had risen to 12,035 (this assumes the "don't know" drivers are distributed among the other driver types in the same proportion as these other drivers). In other words, if these surveys are accurate at measuring AADTT, there as been a six to seven-fold increase in the number of owner-operators crossing provincial boundaries in the five year period. Even allowing for errors in the estimates, the evidence suggests that this had been one of the significant features of trucking in Ontario during the 1980s.

11 ANNUAL UTILIZATION

The limited information on annual utilization is summarized below. The point of the (selective) numbers shown is simply to try to isolate what intercity owner-operators are doing.

Measures of Owner-Operator Annual Utilization

	kilometres	earnings
StatsCan Private Trucking, 1988		
- all sectors	50,008	$ 52,687
-wholesale sector		
-tractors	119,706	$ 89,719
-retail sector		
tractors	187,006	$ 84,829
StatsCan For-Hire Trucking, 1988 (class 1 & 2 extraprovincial)		
- all tractors	136,120	
X $0.71 /km (Can)		$ 96,658
X $0.685/km (Ont)		$ 93,255
NTA (Com Car), 1988		$122,000

The averages for StatsCan's private truckers disguises notable differences among groups of carriers. The "wholesale" and "retail" carriers singled out have been done so as they appear to be the two groups who use owner operators on intercity operations in a manner similar to for hire carriers. (Average annual kilometres for owner-

operators in the "retail" sector my include some double driver operations.) The only real measure available from StatsCan on for-hire carriers is their new "area of activity" survey from which it may be noted that owner-operator tractors had an average of 136,138 kilometres in 1988. To gain a sense of what this means in terms of annual gross earnings, the next two figures in the above list simply multiply this distance times the average "rate" calculated from StatsCan's Quarterly survey for the first two quarters of 1990. By way of comparison, the final figure shows the annual average earnings reported in an NTA survey. [12]

12 AN ESTIMATE OF THE OWNER-OPERATOR POPULATION

In the spring of 1990, during the border blockades, it was widely reported that there were 60,000 owner-operators in Canada. The Ontario Trucking Association estimates there are about 12,000 owner-operators engaged by Ontario carriers. In fact, it is unlikely that anyone can use the available data to make more than a rudimentary estimate.

Using the two StatsCan surveys as the most reliable basis on which to develop this estimate, here are the figures for 1988:

- For-hire carriers spent $2.1 billion in 1988 on owner-operators. Estimating annual gross earnings in the range of $80,000 to $120,000, this would translate into an estimate of between 17,600 to 26,300 for-hire owner-operators in the country (or, more correctly, engaged by Canadian-domiciled trucking establishments).

- Private carriers (with 15 or more vehicles) spent $292 million and engaged 5,542 owner-operators in 1988.

At best, then, these sources suggest between 23,000 to 32,000 owner-operators. The StatsCan surveys, however, exclude certain carriers. In the case of for-hire, the very small (annual revenues less than $100,000) and the specialized (courier, armoured car, freight forwarders) are excluded. At the time StatsCan initiated its surveys it estimated these two groups might be about one third the size of the surveyed for hire carriers. Since there is a strong possibility that many of the small (less than $100,000) carriers are themselves owner-operators, it would be a mistake to use this part of the missing universe to expand the above estimates. However, the larger specialized carriers are known to use owner operators and StatsCan estimates these companies have annual revenues of about 15 percent the level of all for-hire carriers included in their surveys. Accordingly - and this is speculative - there may be 20,000 to 30,000 for-hire owner-operators in Canada (roughly 1.15 X 17,600 and 26,300).

As for private carriers, the StatsCan survey only covers those with 15 or more vehicles. Although the number of carriers with fewer vehicles is not known, StatsCan speculates that it might be more than double the size of the large firms. It's unlikely, though, that the small private carriers use owner-operators in the same relative numbers as

the larger carriers but, and putting this objection aside, for the sake of the illustration, it can estimated here that there may be as many as 15,000 private owner operators in the country (3 X 5,542).

Here is the final tally:

for-hire owner-operators	20,000 to 30,000
private owner-operators	15 000
Total	35,000 to 45,000

However, there is one more bit of data in the puzzle: Ontario's 1988 road-side survey measured 17,410 owner-operators on Ontario highways on any given day. (These road-side surveys would not capture those owner-operators--primarily the private ones driving straight trucks--who work in urban areas.) If the "don't know" drivers are factored into this estimate, the total number of owner-operators may be as high as 19,443. Even if the owner-operators based in the United States are excluded from Ontario's figures, this still leaves 16,000 to 18,000 Canadian owner-operators on Ontario highways on any given day. This suggests that an estimate of between 35,000 and 45,000 may be low. Surely a good proportion of the total Canadian population on any given day is: (a) parked (maintenance, days off, etc); (b) loading or unloading in some urban area; (c) operating in one of the other provinces or territories; or (d) operating south of the border.

In the end, all that can really be said is that, while the available StatsCan data seems to suggest a total population of Canadian owner operators of between 35,000 and 45,000, other evidence suggests the actual total may be considerably higher.

13 SUMMARY

The data developed here on owner-operators indicates a period of significant change within the trucking industry. Not only has there been a relatively sharp increase in the use of owner-operators in Ontario, but also there has been a dramatic increase in absolute numbers. If AADTT figures from road-side surveys are accurate--there may be questions about this--total truck traffic on Ontario highways has more than doubled between 1983 and 1988. At the same time, owner-operator traffic has increased by a factor of four. Much of this increase, as the evidence described in this paper suggest, has been the very dramatic rise in the number of extraprovincial owner-operator truck trips; over 60 percent of the owner-operators in the 1988 survey were on such trips. The total number may have increased by a factor of six to seven between 1983 and 1988.

Without more analysis of the 1988 raw data from the road-side survey, it is difficult to be more precise about the nature of these extraprovincial trips. All that is known is that they are about evenly split between interprovincial and transborder. There is much circumstantial evidence, however, to suggest that it is transborder activity which is accounting for the growth in the owner-operator fleet: (i) the biggest change in configurations used by owner-operators between 1983 and 1988 has been indicative of transborder

activity (5-axle tractor-semitrailers and A trains); (ii) the decrease in RGVW and average load also indicates the influence of the lower weights allowed in the United States; (iii) the large use of cab-over tractors with sleepers is only explainable in terms of transborder operations; and (iv) the fact that in 1988 almost one quarter of owner-operator loads were in the range of what constitutes a "full load" for most transborder activity is one final piece of evidence suggesting that the growth in owner-operators has been caused in large part by transborder operations.

All of these changes in the trucking market, and the further evidence of the falling owner-operator rates, are related to changes in government policy (deregulation) and other changes in the industry (north/south flows, truck/rail competition, etc). None of these subjects, though, can be examined here. Neither can the equally interesting subject of how these changes themselves affect government policy and/or programs. In particular, the large increase in the use of owner-operators on transborder routes has an impact on everything from enforcement activity, the remaining economic regulation, the new safety programs, weights and dimension regulations, highway safety, etc. While the paper itself has not explored these subjects, the main purpose in developing this data on owner operators has been with these points in mind.

ENDNOTES

1 Clayton, A.M., Nix, F.P., 1984, "Owner-Operators in Canadian Trucking: Their Role and Status and Implications of Their Use", Proceedings, CTRF, 19th annual meeting, Jasper, pp 130 - 157.

2 Carriers maintain O/O's are independent contractors; others -- particularly a recent ruling by the Ontario Workers Compensation Board--claim they are employees. If they are employees, carriers are liable for payments of such things as Workers Compensation assessments, UIC, CPP, and other charges.

3 In fact, though, O/O's in Ontario may also be one truck for hire carriers. That is, instead of an "owner driver" or a "single source" authority, an owner-operator may apply for a general freight authority. They may continue to operate as they always have by having their trucks re-registered in some other carrier's name (for hire carrier or shipper).

4 Gorys, J., 1991, "1988 Ontario Commercial Vehicle Survey: Roadside Survey Methodology and Principle Findings," Transportation Research Board, Washington.

5 Ontario Ministry of Transportation and Communications, 1984, Ontario Commercial Vehicle Survey - 1983. The earlier paper which examined owner-operators is: Nix, F.P., 1987, "Ontario Owner-Operators", Proceedings, CTRF, 22nd annual meeting, St John's, pp 373 - 391.

6 Statistics Canada, annual, Trucking in Canada, cat #53-222 (Earlier versions of this catalogue were also used); Statistics Canada, Surface and Marine Transport Service Bulletin, cat #50-002; and, tabulations done by J.R. Larocque of StatsCan.

7 "An Analysis of Employment, Equipment and Vehicle-Kilometres of For-Hire Carriers Using the Province of Domicile versus Province of Operation Concepts," Trucking in Canada 1988, pp 167 - 172.

8 These have been calculated in the following way. First, the relevant AADTT figures for all commercial truck traffic are assumed to be 45,800 in 1983 and 106,831 in 1988. Second, for 1988, it is assumed that 18.2% of the AADTT is owner-operators (ie, the "don't knows" have been distributed over all other categories of drivers). Third, the distributions by configuration types that are used eliminate the "other" category on the grounds that there appears to have been some differences in the way the surveys in 1983 and 1988 were conducted--specifically, there is a suspicion that the 1988 survey did not stop bobtail tractors, or at least to the same extent as these vehicles were stopped in 1983).

9 It is generally assumed that drivers--particularly owner-operators who buy or lease their own vehicles, prefer long wheelbase tractors. Although U.S. federal regulations impose no overall length limit on combinations operating on the Interstate highways, many states do have limits for non-Interstate highways. For example, Michigan limits lengths to 65 feet, and New York has some quite restrictive length limits in effect.

10 The number of kilometres driven by owner-operators was not estimated for the first quarter of 1989.

11 Ontario Commercial Vehicle Survey - 1983, p 141. This counts owner-operators as the sum of "broker" (1 226) and "for-hire self" (493).

12 National Transportation Agency, 1989: "Owner Operators in The Trucking Industry; Report on Survey of Com Car Members," Staff Report, Hull.

CHANGES IN WORLD TRADE AND THE FUTURE OF THE ST. LAWRENCE SEAWAY

The St. Lawrence Seaway was constructed jointly by Canada and the United States, with Canada owning the larger share (72 percent). Opening in 1959, the Seaway replaced a shallow draft canal and brought oceangoing ships into the industrial heartland of North America. It was built largely with the bulk trades in mind, particularly inbound iron ore from Labrador and outbound Canadian and U.S. grain to foreign markets. The Seaway was also expected to capture a growing share of the general cargo trade between Europe and the industrial Midwest.[1] While the bulk and general cargo trades did indeed grow rapidly through the 1960s and 1970s, a dramatic decline has taken place since the early 1980s that casts doubts about the long term future of the waterway. The nature of this decline in cargo and the variety of factors at work - commercial, political and technological - are the subjects of this paper.

The St. Lawrence Seaway was constructed mainly to serve inbound iron ore and outbound grain. The iron ore movement is from Labrador in eastern Canada to steel mills along the shoreline of the Great Lakes. Iron ore from the interior of Quebec and Labrador is shipped by rail to Sept-Iles on the Lower St. Lawrence. From there it moves by vessel through the St. Lawrence, Lake Ontario and the Welland Canal to steel centers such as Buffalo, Cleveland, Toledo, Detroit and Chicago (Figure 1). The iron ore is also transshipped to the Pittsburgh area from locations such as Conneaut and Ashtabula on the shore of Lake Erie. The dominant outbound movement is grain exports from both Canada and the United States. The main export grain from Canada is wheat, whereas the U.S. exports are corn, soybeans, wheat, barley, rye and other small grains. This movement of downbound grain in "lakers" (non-oceangoing) with a return haul upbound of iron ore, is a very efficient move. Grain is unloaded for storage and transferred to ocean vessels at Montreal, Quebec, Baie Comeau, and other ports on the Lower St. Lawrence. In addition to the iron ore/grain movement, grain is exported direct from ports on the Great Lakes (such as Thunder Bay) to overseas destinations. Other commodities moving on the Seaway include other bulks (coal, salt, potash, etc.), chemicals and petroleum products, and general cargo.

Construction of the Seaway overcame the extreme topography of the region (Figure 2). The rise is about 20 feet from the Atlantic Ocean to Montreal, about 1,000 miles from the sea. From Montreal the seven Seaway locks overcome rapids in the St. Lawrence River and raise vessels to 248 feet above sea level on Lake Ontario. The next climb,

FIGURE 1

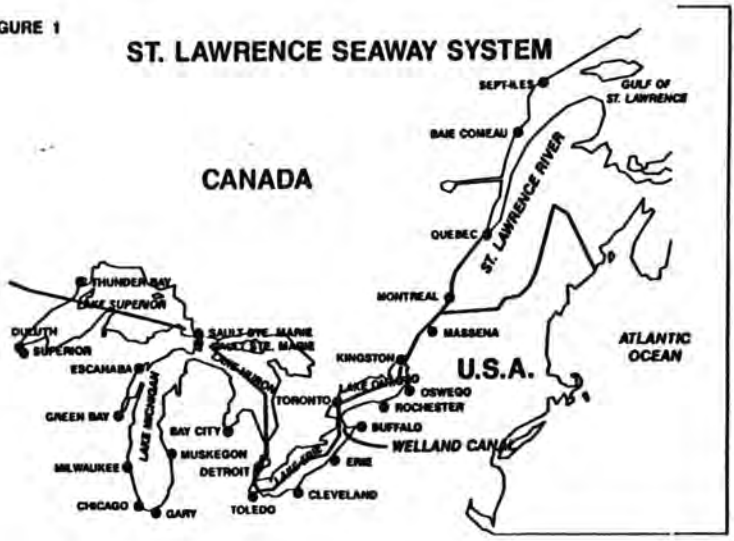
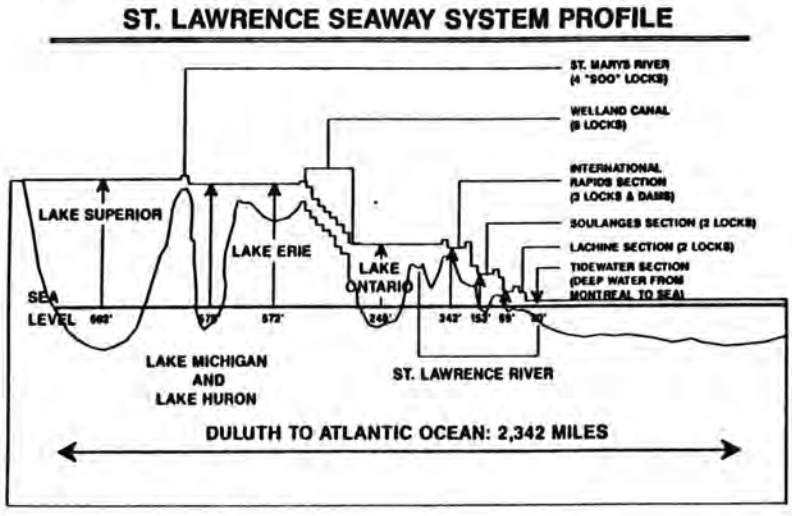


FIGURE 2



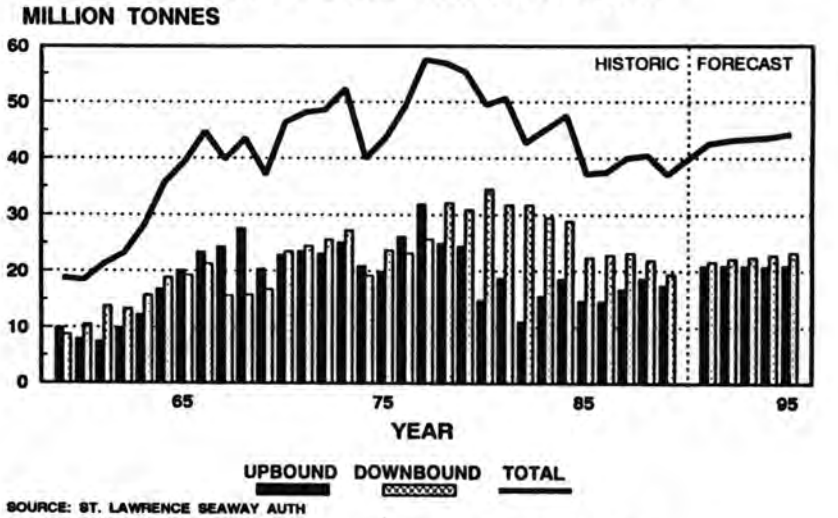
a very steep one in the vicinity of Niagara Falls, lifts ships via the Welland Canal from 248 feet to 572 feet above sea level to Lake Erie. The seven Seaway locks were designed to complement the eight locks of the Welland Canal, built in the 1930s. Navigation from Lake Erie to Lakes Huron and Michigan requires no locks or canals. However, the next jump up to the 602-foot elevation of Lake Superior is about a 27-foot rise over the St. Mary's River Rapids, at Sault Ste. Marie, Michigan and Ontario. This gives a total distance from the Atlantic Ocean to Duluth, Minnesota, at the head of the lakes, of 2,342 miles. The Seaway and Welland locks are 80 x 860 feet, with a controlling depth of 27 feet. Such lock dimensions limit the maximum ship size to 76 x 730 feet and a 26-foot draft.[2] As will be discussed, this vessel size limitation has a profound effect on the mix of ships in the world fleet calling at Great Lakes ports.

Traffic on the Seaway (Montreal to Lake Ontario) grew rapidly in the early years after opening in 1959 (Figure 3). Some slippage in tonnage occurred with economic downturns in the late '60s and in the mid '70s, but otherwise tonnage continued to grow to a peak of 57.5 million metric tonnes in 1977, with upbound tonnage slightly exceeding downbound tonnage. In the late '70s and early '80s upbound tonnage--dominated by iron ore--faltered, dropping from 31.8 million tons in 1977 to 11.1 million tonnes in 1982. Downbound tonnages--dominated by grain--held up longer, peaking at 34.5 million tonnes in 1980, before they too began to decline. Total traffic through the late '80s has hovered around 40 million tonnes, with 1990 traffic showing a small decline to 36.6 million tonnes.[3] Traffic forecasts for the Seaway show flat tonnage for upbound cargoes and slight growth for downbound traffic (largely attributed to direct export of U.S. goods) bring total traffic back up to 44.3 million tonnes by 1995.[4] The decline through the '80s has been particularly significant for grain, which dropped from 27.7 million tonnes in 1978 to a drought-induced low of 11.4 million tonnes in 1989 (Figure 4). Grain traffic recovered only slightly to 12.2 million tonnes in 1990. Other bulks, including iron ore, declined steeply in the early '80s as recession and import substitution devastated the North American steel industry. With economic recovery and restructuring of the industry, bulk traffic levelled off in the mid '80s and grew somewhat in the late '80s. General cargo, on the other hand, peaked long ago in 1971 at 7.8 million tonnes, declined to 2.5 million tonnes by 1980, and has hovered between 3 and 4 million tonnes since.

A variety of factors--commercial, political and technological--have come together to produce this dramatic change in fortunes for Seaway traffic. While many traditional cargoes have been affected, nowhere is it more evident than in grain movements (Figure 5). Both Canadian and U.S. grain exports via the Seaway have shown dramatic declines--Canadian since 1983 and U.S. since 1978. This loss of tonnage has translated into a loss in ships and employment, as well. Between 1980 and 1990, Canada's Great Lakes fleet diminished from 175 ships to 120.[5] U.S. vessels declined from 120 to 70 over this same period, with available per-trip capacity declining from 2.4 to 1.7 million tonnes.[6] The loss in vessel capacity makes regaining earlier tonnage levels ever less likely.

FIGURE 3

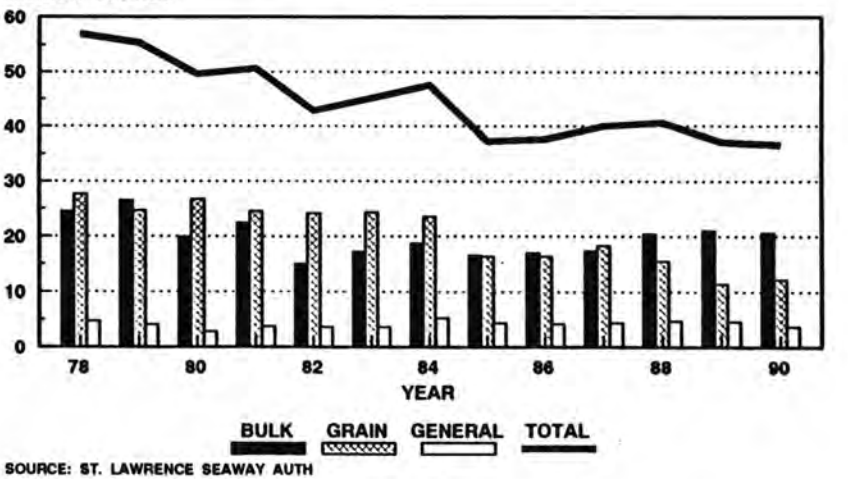
ST. LAWRENCE SEAWAY TRAFFIC
MONTREAL - LAKE ONTARIO SECTION



SOURCE: ST. LAWRENCE SEAWAY AUTH

FIGURE 4

ST. LAWRENCE SEAWAY TRAFFIC
MONTREAL - LAKE ONTARIO SECTION
PRINCIPAL COMMODITIES



SOURCE: ST. LAWRENCE SEAWAY AUTH

Changing world trade patterns account for part of the loss of grain exports off the Lakes. Through the '70s and early '80s Europe was a major customer for both Canadian and U.S. grain. Grain exports to Europe via the Great Lakes and St. Lawrence Seaway was a competitive routing for this trade. Canadian exports to Europe (including the Soviet Union) were 43 percent of Canada's total grain exports in 1985 (Figure 6). By 1990, this share had dropped to 25 percent, and is forecast to fall to 19 percent by 1994.[7] Grain exports via the Lakes suffer accordingly. Farm policies and generous subsidies in the European Community have promoted self-sufficiency in wheat and other grains, turning the EC-12 from net importers into competitive exporters in the world market. Meanwhile, the economic problems of the Soviet Union and Eastern Europe cast near-term doubts as to the viability of these markets. In the longer term, successful restructuring of their economies could lead to increased grain self-sufficiency, further diminishing trade prospects.

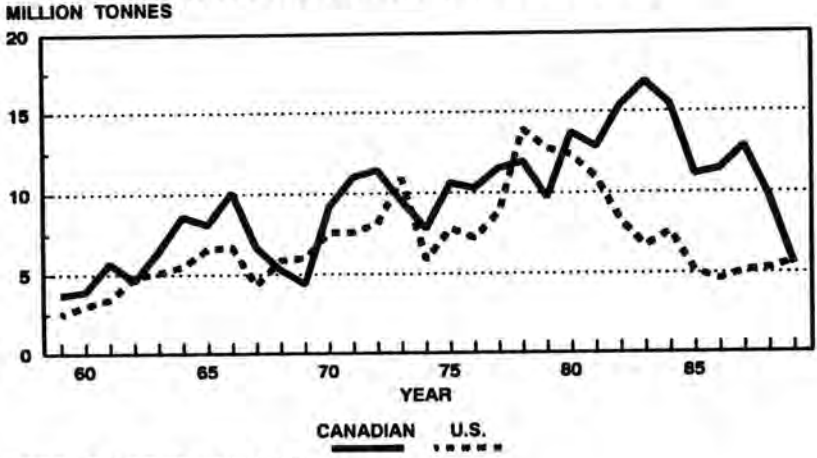
The growth areas for Canadian (and U.S.) grain exports have been in the Pacific Rim and, to a lesser extent, Middle East markets. Canadian exports to Japan and other Pacific Rim nations mushroomed from 5.5 million tonnes in 1985 to 10.8 million tonnes in 1988. While the drought reduced exports in 1989, renewed growth in exports to Japan and the Far East is forecast through 1994. Geographically, the Great Lakes ports are at a competitive disadvantage to serve Far East markets. Pacific ports, handling the large grain vessels of the world fleet, are the natural export points for this trade. The growing Middle East market, on the other hand, would seem to be a logical trade area for the Lakes, but pressures from other modes and trades routes have hampered this market as well.

Deregulation of U.S. rail rates and the high capacity, low rate situation of the U.S. barge industry have combined to provide a competitive alternative to the Lakes for many foreign markets. Passage of the Western Train Transportation Act in 1983 also changed the Canadian grain transporation equation by providing prairie farmers with subsidized rail (but not Seaway vessel) transportation. Since passage of this Act, grain exports have switched from roughly two-thirds eastward to the Atlantic (largely via the Seaway), to roughly two-thirds westward to the Pacific.[8] The combined pressures of rail subsidies and the shift of markets from Europe to the Pacific Rim account for much of the change in shipping patterns. However, the structure of the rail subsidies plus the lack of any subsidy on the Lake/Seaway leg (indeed tolls are imposed), can make it cost effective to load grain for Atlantic destinations off the West Coast. Reportedly some 37 percent of South American grain shipments and 13 percent of European and African shipments from Canada originated off the West Coast in the 1988/89 season.[9]

While not quite as geographically distorted by subsidies, U.S. grain exports via the Lakes are nonetheless under similar competitive pressures from other modes. Deregulation of U.S. railroads has led to significant cost reduction and rationalization, plus the ability to negotiate proprietary volume contract rates. Meanwhile, the U.S.

FIGURE 5

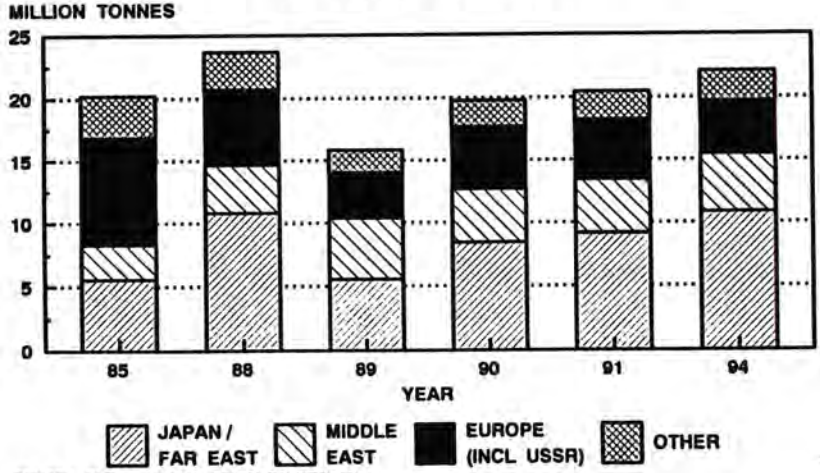
ST. LAWRENCE SEAWAY TRAFFIC MONTREAL - LAKE ONTARIO SECTION CANADIAN AND U.S. GRAIN EXPORTS



SOURCE: ST. LAWRENCE SEAWAY AUTH

FIGURE 6

CANADIAN SEABORNE GRAIN TRADE HISTORIC & PROJECTED: 1985 - 1994 BY TRADE REGION



SOURCE: DRI/TBS WORLD SEATRADE SERVICE

inland waterway industry, beset by over capacity and low rates, makes the movement of export grain to deepwater ports on the Lower Mississippi River very competitive. Deepening of the Mississippi to 45 feet was completed in 1989, allowing large grain ships to be loaded more fully, further reducing the cost per tonne. As an example, for grain originating in Northern Minnesota in the vicinity of Bimidji, only about 150 miles from Duluth, the Seaway route is only marginally cheaper ($2-4 per tonne) to Europe or the Mediterranean than via New Orleans (Figure 7).[10] The economies of a large vessel over longer distances quickly shift the economic advantage to New Orleans for markets in South Africa or the Far East.

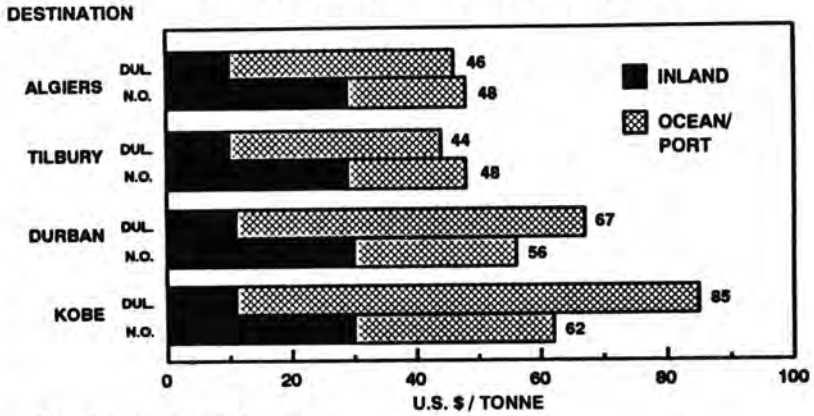
As was alluded to in the discussion of Seaway lock dimensions and the consequent maximum vessel size, technological changes in the world fleet play an important role in the competitiveness of the Seaway. The mix of vessels on the Seaway has generally trended toward ever larger sizes. Today about 65 percent of Seaway traffic is at the maximum allowable size (Figure 8). However, this maximum vessel size represents perhaps 15,000 - 30,000 deadweight tons (dwt) of capacity, while a typical Panamax size grain ship may be in the range of 50,000 - 70,000 dwt or more.[11] As average vessel sizes in the world fleet continue to increase, proportionately fewer ships in this fleet are able to transit the Seaway.

Like grain, and perhaps to a greater extent, the impact of larger vessel sizes coupled with changing trade patterns and innovations in overland transportation have had a clear impact on the general cargo trade on the Seaway. As noted earlier, general cargo traffic peaked in 1971 at 7.8 million tonnes. By 1990 volume had fallen to half that level. At the peak, 60 separate ocean lines were offering over 600 sailings out of the Lakes per season.[12] Currently, Lakes officials are excited by plans of a single Soviet carrier, Baltic Shipping Company, to offer the first regularly scheduled general cargo service to U.S. Great Lakes ports in several years.[13] Technology has played a major role in the loss of general cargo traffic off the Seaway.

The trend away from breakbulk toward containerization and the increasing size of containerships have shifted U.S. Midwest cargo to coastal ports with adequate channel depth (Figure 9). The demand for fast and frequent service in the container trade makes the slow transit of the Seaway uncompetitive. The shift of markets to the Far East and the advent of "minibridge" double-stack rail service has led to U.S. West Coast ports capturing an increasing amount of the Asian trade to Midwest and East Coast destinations (Figure 10). The use of double-stack rail not only offers faster service (by cutting a week to 10 days off the all-water route through the Panama Canal), it can be less costly as well, depending on the cargo and ports involved. The high cost of all-water service to Chicago for Far East cargo (at about $2500 per container) compared with stack train service from the West Coast (at less than $1500) shows clearly why this traffic has been captured by rail.[14] Not only has double-stack rail captured Midwest cargo to and from the Far East, it can also be competitive with all-water service to the Gulf Coast and the North Atlantic, leading to the erosion of liner traffic market share in these port ranges as well.

FIGURE 7

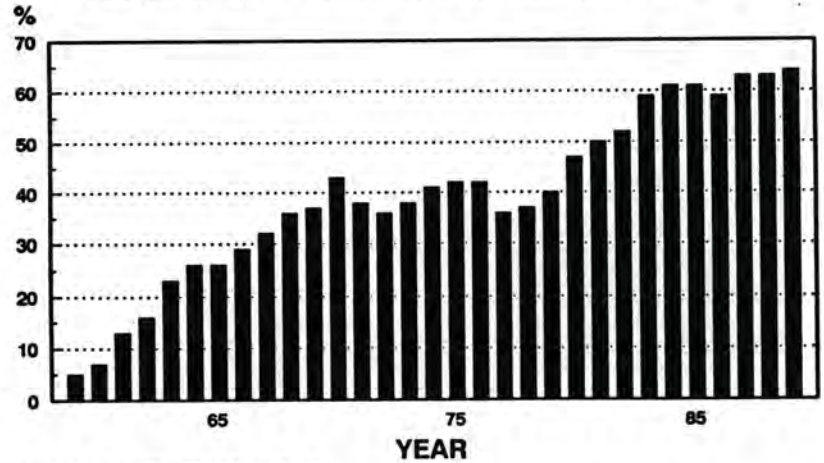
GRAIN EXPORT TRANSPORTATION COST FROM BIMIDJI, MN TO ALTERNATIVE PORTS VIA DULUTH AND VIA NEW ORLEANS



SOURCE: MARTIN O'CONNELL ASSOC

FIGURE 8

ST. LAWRENCE SEAWAY TRAFFIC MONTREAL - LAKE ONTARIO SECTION PERCENT OF TONNES IN VESSELS OVER 217 M



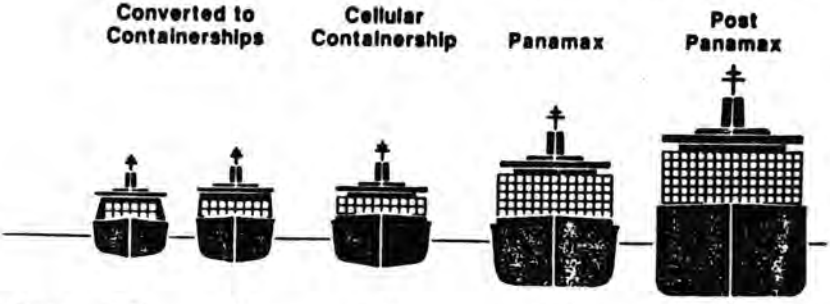
SOURCE: ST. LAWRENCE SEAWAY AUTH

FIGURE 9

PORT OF OAKLAND

Containership Evolution

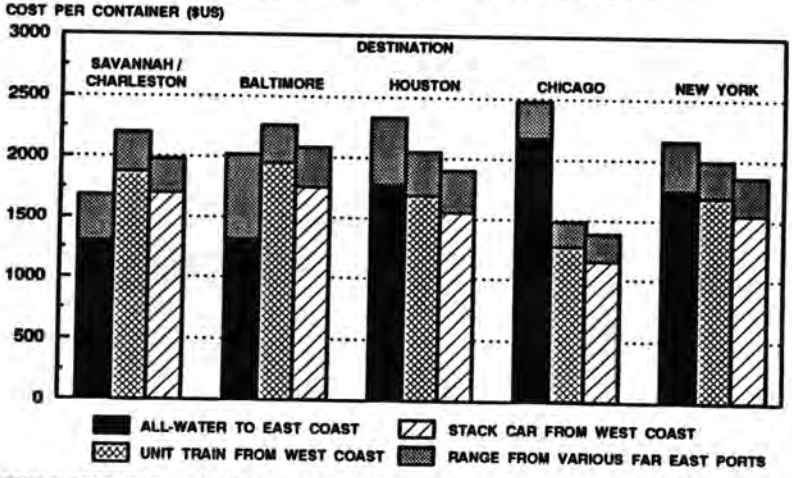
Beam Size and Draft



© 1989 Port of Oakland

FIGURE 10

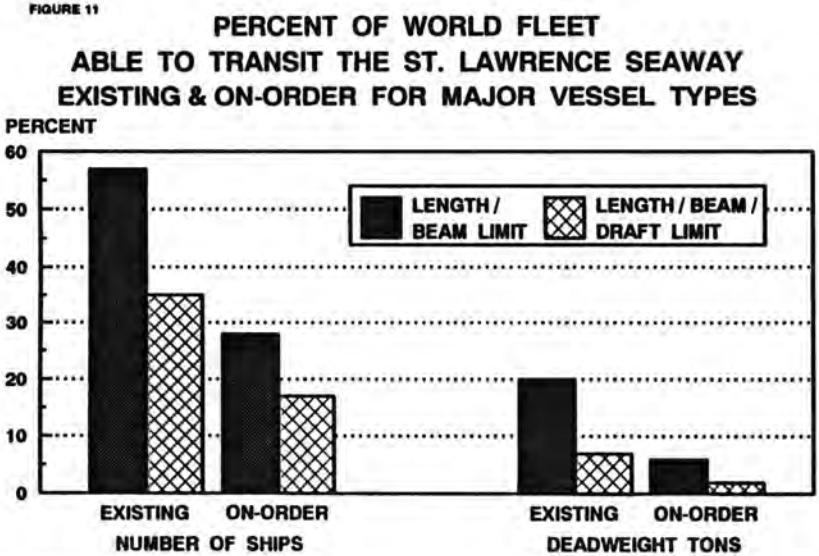
ALL-WATER VS. BRIDGE & STACK CAR OPERATING COSTS FROM ASIA TO SELECTED DESTINATIONS



SOURCE: BOOZ, ALLEN, HAMILTON / AMERICAN SHIPPER

The evolution in vessel sizes to ever larger dimensions continues to shrink that portion of the world fleet able to transit the St. Lawrence Seaway (Figure 11). According to Lloyds, about 57 percent of the world fleet (based on an average of all vessel types), in terms of number of ships, fall within the length and beam restriction of the Seaway.[15] These vessels can use the Seaway, but many would have to be less than fully loaded. If the 26-foot draft constraint is imposed, the number falls to 35 percent of the world fleet. Looking at vessels on-order (as of 1989), 28 percent fall within Seaway length and beam dimensions, while only 17 percent meet the length, beam and draft restriction. Taking the analysis further and viewing the world fleet in terms of available deadweight tons, only 20 percent of the fleet meets the length and beam restrictions. This falls to 7 percent if the draft restriction is imposed. For vessels on-order, only 6 percent by dwt meet the length and beam restriction, while a mere 2 percent of future additions to the world fleet meet the combined Seaway dimensions for length, beam and draft. The problem of increasing vessel sizes versus the fixed dimensions of a canal system is all too clear.

FIGURE 11



SOURCE: LLOYDS MARDATA

Then what of the future of the Seaway? Is a future rebound in traffic possible as new markets evolve, such as low sulphur western coal, or with an enlarged lock system? Will traffic simply remain stable, finding a market balance and holding at its current levels as it has for the past several years? Or are further declines likely to ensue as markets shift, "smoke-stack" industries shrink, and other modes compete to siphon traffic off the Seaway? It would seem any of these futures is possible, depending on political decisions, changes in competitive relationships, and advances in technology.

Political Factors: A variety of political factors could shape the future direction of traffic trends on the Seaway. On the positive side, the Western Grain Transportation Act could be amended to reduce the subsidies for rail or to modify the approach so that Seaway moves receive equal treatment. Internationally, efforts to reach a consensus on grain export subsidies either through the GATT talks or an another forum may yet produce results. Financially strapped governments in North America and in Europe may be compelled to compromise to reduce onerous agricultural subsidies. At the national level, local, state and provincial governments may unite with industry in more effective lobbying efforts to protect Seaway interests. Other modes succeed at this quite regularly and it is conceivable that Seaway interests could achieve similar results. On the negative side, the "food for peace" Great Lakes set-aside was not renewed by the U.S. Congress. The current legislation's 75 percent U.S. flag vessel requirement and "lowest landed cost" formula may make it difficult to regain this cargo.[16] Another negative would be a policy of continued toll increases in the face of declining traffic in order to recover Seaway operating costs. The result is to spread an ever-increasing cost burden over a dwindling number of operators.

Commercial Factors: Any measures that lower Seaway costs and improve service would help restore confidence, enhance the image of the waterway among shippers, and potentially increase traffic. The use of incentive tolls is one step in this direction. Following a limited experiment over the summer of 1990, a new toll package was announced for the 1991 to 1993 seasons.[17] While the tolls include a 5.75 percent annual increase, the plan allows discounts for high volume shippers and new traffic. (The U.S. tolls have been fully rebated for several years.) Reining in other Seaway cost components - such as pilotage fees - would also make the system more competitive. The concept of "total transportation" may be implemented more fully. Intermodal cooperation, volume contracts, and through bills-of-lading offer the opportunity for lower costs and more traffic. For instance, by controlling an entire movement of potash between Saskatchewan and Rotterdam, the Canadian National Railroad has realized a 20 percent savings by transshipping at Thunder Bay and using the Seaway over direct unit train deliveries to Lower St. Lawrence ports.[18] Other positive commercial measures include increased marketing efforts abroad, seeking out and promoting new growth commodities (such as low sulphur coal and specialty steel products), and a visible emphasis on customer service and quality. On the negative side, other modes will

be employing the same tactics to enhance their respective market shares.

Technological Factors: The most obvious positive technological innovation for the Seaway would be the construction of larger locks, perhaps of Panamax dimensions. Larger locks would permit most of the world fleet to again call at Great Lakes ports and offer shippers enormous economies of scale that would greatly reduce the per tonne transportation cost. However, the tremendous investment costs involved (not to mention environmental concerns) in building larger locks, deepening channels and modifying terminals make this option unlikely. But some technological measures can be more easily implemented. Greater use of self-unloading vessels reduce handling costs and offer flexibility for "top-off" operations in deeper water. Studies continue as to the possible extension of the shipping season - if not to all-year, at least by an additional month or so. On the negative side, changing vessel technology reinforces the trend toward larger ship sizes unable to use the Seaway. Industrial innovations, such as new steel technology, reduces raw material requirements. While abroad, changing agricultural practices may increase yields and reduce the demand for Canadian and U.S. grain exports.

The ultimate mix of this melange of potential factors, plus many more not even envisioned here, will likely determine the fate of the Seaway. The political dimension of both the management of the Seaway and of the demand for its principal commodity - grain - makes forecasting probably an exercise in futility. However, based on events, Seaway interests cannot afford to take a complacent attitude and wait to see what happens. It will be necessary to lobby hard in the political arena for equitable treatment of each transportation mode. It will be necessary to look for cooperative and complementary relationships with other modes in order to create an environment for efficient cargo movements at the lowest possible cost. With an increasingly global economy, being as efficient and competitive as possible has become as necessary for survival in the transportation industry as in any other. The liner services have learned this. The railroads and the barge industry are also discovering it. To remain viable, Seaway shippers, carriers and managers will have to ensure they do the same.

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Current Issues in European Shipping

Mary R. Brooks and Kenneth J. Button*

Abstract

As the European Communities (EC) seeks a common transport policy by 1993, it must face the politicization of the market for these services. Efforts to resolve major issues like flags of convenience, seafarers' working conditions, and shipbuilding subsidization bring out the political forces even in the best of situations. The additional objective of avoiding internal market distortion after 1992 means that action taken to meet common intra-Community goals cannot be easily isolated from the global context. For the EC, the turning point was the passage and subsequent implementation of the *Single European Act* of 1986. Its goal was to speed up the move towards the objective of free movement of goods, labour, and capital by December 31, 1992. The Act, which updated the Treaty of Rome, replaced unanimity with majority vote for many decisions, thereby reducing the likelihood of minority matters paralysing the legislative process. Unanimity was retained for major matters, such as tax policy and implementation, and matters concerning the free movement of people and workers' rights. Its promulgation has assisted in facilitating the progress made in the past few years towards a common marine transport policy. A number of issues, however, continue to plague European shipping — cabotage, a proposed EC shipping register and inherent manning issues, and state aid to shipping to name a few. Dissension within the EC shipowning community is still evident and philosophical differences have yet to be reconciled. The U.K. House of Lords has recently issued its assessment of the Euroregister and cabotage and this paper will examine it in the process of providing a current snapshot of European shipping related to the Single Market. The paper leaves issues relating to both seafarers and port state control for another occasion.

Introduction

Europe is going through a period of fundamental change. The past decade has seen a coming together of Western Europe as the EC has both expanded and moved to strengthen its internal cohesion. In the East there have been major political and economic changes which, while still incomplete, suggest that more liberal attitudes towards trade will develop. Further, the state of most Eastern European economies indicates that more openness, at least in terms of trade, is almost inevitable. In the West, however, it is fairly easy to predict that we will see the completion of the Single European Market alongside an almost inevitable expansion in the membership of the EC.

This paper outlines the main changes taking place in Europe which are directly related to maritime matters, and especially those stemming from actions associated with the move to the Single European Market.

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Maritime Transport Policy

The *Cockfield Report*,[1] which in 1985 set out the conditions perceived necessary for the achievement a Single European Market, clearly stated that changes in Community maritime policy would be necessary. This is not surprising since some 35% of the international trade carried on by Member States involves maritime transport and over 90% of the community's aggregate imports and exports are moved by sea. Explicitly, action would, therefore, be required:

> ... for freedom to provide sea transport services between Member States shall be established by the end of 1986 at the latest, though with the possibility of a limited period for phasing out certain types of restrictions.[2]

Much of the spirit of the *Cockfield Report* was embodied in the subsequent legislation designed to achieve the Single Market[3] but actual progress has proved much slower than initially expected. The overall strategy for transport[4] embraced the Cockfield's notions of equality of treatment within and between different forms of transport, freedom of competition and free choice of uses and coordination of infrastructure development but added to this greater emphasis on ensuring that the polluter-pays-principle be consistently applied in order to contain environmental degradation.

An initial set of measures regarding maritime matters — what is often refereed to as the 'First Package' — had already been tabled by the Commission[5] just prior to the publication of the *Cockfield Report*; these were generally accepted by the Council of Ministers in December 1986. In particular these were:

- Council Regulation (EEC) No. 4055/86 applying the principle of freedom to provide services to maritime transport between Member States and between Member States and third countries.
- Council Regulation (EEC) No. 4056/86 laying down detailed rules for the application of Articles 85 and 86 (covering Competition Policy) of the Treaty of Rome to maritime transport.
- Council Regulation (EEC) No. 4057/86 regarding unfair pricing practices in maritime transport.
- Council Regulation (EEC) No. 4059/86 concerning coordinated action to safeguard free access to cargoes in ocean trades.

The main aims of these measures were to improve the competitive structure of the European shipping industry and its ability to counteract unfair competition from third countries.[6] In this, the measures may be viewed as successful; they provided the Commission with the power to react to predation or unfair rate-setting by third party ship owners — in only one case, that of Europe-Australian trade and involving Hyundai Merchant Marine of Korea, has this power ever actually been used and it was done so successfully.[7] The measures and the subsequent Hyundai case also seem to have exerted a demonstration effect on Eastern bloc shipowners who have changed their strategies without legal proceedings being brought.

Efforts since 1986

As already stated, liberalization of the shipping market was not seen as the primary objective of the First Package although internal efficiency within European shipping was viewed as important. Further evidence in support of this policy was made when the Council of Ministers, concluding a debate on 4-5 of December 1989, stressed

> ... that the active and consistent implementation of the Regulations adopted in 1986 should also help considerably in strengthening the competitive position of Community fleets.[8]

Consistent with this philosophy was the Council's approach to liner shipping. While the measures regarding application of Articles 85 and 86 provided block exemptions to the full force of the competition rules for liner conferences, safeguards to ensure that this privilege was not abused were put in place. Specifically, conferences (i) must not discriminate between ports or shippers on non-justifiable economic grounds; (ii) should consult shippers on matters of common interest; (iii) where they have 'loyalty agreements' with their customers these should fulfil reasonable criteria; (iv) should publish tariffs and (v) should not act predatorily towards competitors.

In 1989 a second package — the "Positive Measures Package" — was brought forward by the Commission.[9] By this time, the problem of addressing the decline in the competitiveness of European Community fleets in the world market had become even more pressing.[10] It was perceived that a policy was needed to develop a competitive and efficient shipping industry in Europe by reducing disparities in operating conditions between fleets from Member States and foreign (non EC) competitors. Cooperation had become seen as necessary at the Community and national levels, in order to improve operating conditions. While there are a number of courses of action recommended in the second package, the emphasis was on encouraging European shipowners to register their ships in Europe and to man their ships with European seafarers. The policy made it clear that there must be

> ... sufficient incentive for Community shipowners to register their ships within the Community and man those ships to the highest possible proportion with Community seafarers.[11]

A number of institutional and economic factors have been detrimental to the European shipping industry and proved influential in stimulating this proactive approach; primarily these were the continuing decline in European-registered shipping and the attendant job loss for European seafarers. These issues will be addressed before the proposed register is discussed.

Flagging Out — The Declining European Flag Fleet

Growth in the world economy has been mainly due to the increased importance of services, while growth in demand for primary commodities has slowed. As newly industrialized countries have been establishing production, often as a result of large multinational companies seeking low cost global production facilities, a gradual shift in the type of trade between Europe and NICs has occured, one involving less bulk and more containerized traffic. These trends are at the root of declining demand for shipping, especially European shipping. World sea-borne trade decreased by 9% between 1980 and 1988, but capacity of

the world fleet fell by only 5%, leading in 1988 to an estimate of excess capacity in the order of 20%.[12] The already existing problem with over-supply has been reinforced; with the continuing weak demand for shipping services in the world, the prospects look bleak.

While the 'First Package' achieved some of its objectives,[13] the measures did not stop the decline in the Community merchant fleet — the share of the world fleet registered in the European Community dropped to 15.4% in 1988 from 32.3% in 1970.[14] The tonnage was practically halved between 1980 and 1988, whereas it had grown in the previous five years. (See Table 1.) Although the three largest registers in the Community — The UK, Greece and France — have faced varying situations, they have borne the brunt of this decline. The UK, the largest, has been the hardest hit. France's register has declined by half while Greece has maintained its register at approximately 1975 levels; the significant growth between 1975 and 1980 having disappeared.

Table 1: Analysis of Community Ship Registers (millions of GRT)

Flag	1975	1980	1985	1988
Belgium	1.3	1.7	2.3	1.9
Denmark	4.3	5.2	4.8	4.2
France	10.4	11.6	7.9	4.2
Germany	8.2	8.0	5.9	3.7
Greece	22.4	39.4	30.9	21.8
Ireland	0.2	0.2	0.2	0.1
Italy	9.9	10.9	8.6	7.4
Netherlands	5.4	5.3	3.7	3.2
Portugal	1.1	1.2	1.3	0.9
Spain	4.8	7.5	5.6	3.8
UK	32.2	26.1	13.3	7.2
EEC 11	100.2	117.1	84.5	58.5

Source: Developed from Table 3 in European Communities Commission, *A Future for the Community Shipping Industry: Measures to Improve the Operating Conditions of Community Shipping*, (COM (89) 266), Brussels: Office for Official Publications of the European Communities, 1989

Notes: (1) Merchant fleet excluding fishing vessels, tugs, dredgers, ice-breakers, research vessels, supply ships, tenders and miscellaneous. Vessels 100 GRT and over.

(2) These figures include various "second" registers eg. the Isle of Man and Kerguelen Islands.

Open registries have grown to accommodate 35% of world shipping. Although the Liberian registry is now a third smaller, the Panamanian and Cypriot registries have grown tremendously.[15] Off-shore registries have become more widespread recently, created by countries in an effort to stem the flow of their shipowners from going to open registries. Off-shore registries, have lower registry costs, little or no taxation, and allow the use of foreign seafarers with lower wages, enabling shipowners to compete with non-Community operators who employ crews from low wage areas of the world. Off-shore registries that exist now include Isle of Man, Hong Kong, Cayman Islands, Bermuda, Kerguelen (French Antarctic Territory), and Dutch Antilles. In addition, international registers in Norway (the pioneering NIS), Denmark and Germany have been set up. As can be seen in Table 2,

within the EC only Greek and UK shipping interests have fled in a significant way to such registers.

While these registries keep Community shipowners from going to open registers, they do not encourage the use of Community seafarers, and may increase disparities in operating conditions between fleets of different Member States. Traditionally, Community fleets have been technically superior and have provided a higher quality of service than other fleets. However, fleets from other countries have caught up and more use modern vessels and technology, containing costs by operating under flags of convenience. The Community fleets have also increasingly become handicapped by relatively limited investment which has pushed up their average age and consequently kept manning requirements, fuel consumption and maintenance costs high. To combat this, action has been taken by Member States, including operating subsidies to shipping companies which will be discussed later.

Table 2: European-owned Shipping, 1981 and 1987 Vessels of 500 DWT and Over

	EC National Flag Fleet (1000 DWT)		EC-Owned Open Registry Fleet (1000 DWT)	
	1981	1987	1981	1987
Belgium	2948	3654	45	224
Denmark	7978	6961	724	870
Germany	12409	5659	5774	7340
France	20112	8407	1258	1768
Greece	73513	42776	22586	45155
Ireland	342	163	10	28
Italy	17429	12178	2195	703
Netherlands	8599	5123	2483	2004
Portugal	2181	1703	107	211
Spain	13101	8387	166	262
UK	41272	11676	3140	5676
EEC	199884	106687	38485	64244

Source: Developed from Table 4 in European Communities Commission, *A Future for the Community Shipping Industry: Measures to Improve the Operating Conditions of Community Shipping*, (COM (89) 266), Brussels: Office for Official Publications of the European Communities, 1989

Employment in EC Shipping

As can be seen in Table 3, employment for seafarers has been particularly hard hit by the current situation facing Community shipowners. A number of the fleets have only half the seafarers employed in the late 1980s they had in 1980. Particularly hard hit are the major employers — the UK, Greece and Italy, with Spain and Germany exhibiting similar trends on a smaller scale. Particularly noticeable is the UK situation; the total number of positions available on UK registered vessels by 1987 was one-third of the 1980 level. There is some evidence that efforts to protect jobs for nationals has occured although small (see the UK figures).

Table 3: Personnel Employed in Member State Fleets By Nationality

Member State	Own Nationals			Total (incl. Nationals)		
	1980	1987	1988	1980	1987	1988
Belgium	2526	2162	2016	3304	2720	2539
Denmark	11975	8028	7214	14682	8809	7940
France	14947+	6038	••	15154+	6123	••
Germany	20894	13284	11816	27041	16673	15077
Greece	52518	••	••	79459	••	••
Ireland	1990	861	••	2002	980	••
Italy	54700**	25959	25237	54700**	25959	25237
Netherlands	6139	8099	7098	9912	11162	9680
Portugal	5856+	2201	1790	5856+	2201	1790
Spain	22928	14701	12977	22928	14701	12977
UK	58650+	24808	••	72061+	28772	••

Source: Developed from Table 9 in European Communities Commission, *A Future for the Community Shipping Industry: Measures to Improve the Operating Conditions of Community Shipping*, (COM (89) 266), Brussels: Office for Official Publications of the European Communities, 1989

Notes: + previous year's figures
•• no information available
** estimate (ISL, Shipping Statistics Yearbook 1988)

Proposed EC Shipping Register — EUROS

The "Positive Measures Package" embraces the idea of a Community Register (EUROS) on several grounds:

- An EUROS-registered vessel with valid certificates and classification and conforming to the technical requirements laid down by Community law could be transferred to the register of another Member State automatically;
- Seafarers' qualifications and licences conforming to minimum requirements laid down by Community law must be recognized for the purposes of employment on an EUROS-registered vessel;
- EUROS-registered vessels would be entitled and obliged to fly the European flag in addition to their national flag;
- Rights of cabotage would be accorded to nationals of Member States established outside the Community and shipping companies established outside the Community and controlled by nationals of a Member State, in respect of EUROS-registered vessels;
- Preference in the carriage of food aid would be given to EUROS registered vessels; and
- Fiscal and financial advantages would be made available by member States pursuant to the objectives of EUROS.[16]

A Community register would, as a first stage, be a parallel register, where ships would remain on the register of a Member State and under its control and jurisdiction. The parallel register would have requirements for manning ships (nationality requirements) and would seek to have such requirements observed throughout the Community. It would allow for the recognition of qualifications of seafarers throughout the EC, and their free movement on EC vessels. It would also allow for mutual recognition of technical equipment to facilitate the transfer of ships between Member States. In addition to these, and the financial advantages of a parallel register, it would also have a symbolic significance, uniting European shipping by giving it a powerful presence around the world, as well as promote a greater cohesion of operating conditions in the Community.

The creation of EUROS appears to be technically and legally feasible. The Community does not view it to be in conflict with the 1986 UN Convention on Conditions for Registration of Ships since it would not lead to registration in two different states.[17] Entry to the registry would be simple, especially since ships would still remain on the register of a Member State.

The advantages for a vessel owner to join a Community Register would be freer access to the Community market (free flow of services, technology and seafarers). Belonging to a third country register may make a shipowner vulnerable to barriers around the Community. However, the regulations of EUROS in terms of the nationality of seafarers and their wages and working conditions could increase costs for shipowners. It is difficult to determine from existing data whether the benefits of a Community Register to shipowners will outweigh the costs.

The European Parliament has attempted to lubricate the decision-making framework by suggesting that very definite fiscal benefits would be needed to attract ships to EUROS. In particular, it argues for (a) a specific tax system based on ship tonnage and no other form of taxation; (b) seafarers being exempt from income tax; and (c) Community financial aid be made available for shipbuilding, and so on. While tax exemptions are already granted for seafarers in several EC states and extension of such a policy would be relatively easy, the other two measures are unlikely to prove acceptable. Specific taxation for shipowners opens up the possibility of tax shelters for multi-functional companies which is unacceptable to many national governments. Subsidies for ship building are equally unacceptable within the Community given the nature of the Common Transport Policy.

The debate surrounding EUROS has extended into 1991 with no sign of agreement. Those objecting to the idea do so on a variety of grounds.[18] At the general level there are concerns that the measure has little economic foundation and that it is essentially serves a socio-political objective. Further, there are concerns that it could lead to legal problems in the event of a major accident or pollution incident. In terms of the specific advantages claimed for EUROS, while there is some agreement that it would facilitate easier transfers between registers and help in the mutual recognition of qualifications, the UK House of Lords Select Committee on the European Communities has concluded that these could be achieved without the creation of a European registry.

Cabotage

One of the objectives of the Single European Market is the creation of Community-wide cabotage and some modest movements towards this end are being made in sectors such as aviation and road haulage. This is not yet the case with shipping. Currently, Community Member States can restrict the ability of carriers of other Member States from providing

service in domestic coastal markets. In an attempt to liberalize trade within the community, the EC is aiming "to prevent any Member State from discriminating in favour of its own shipping companies to the disadvantage of shipping companies in another Member State".[19]

The 1986 First Package of measures achieved free movement of services for international shipping services between Member States and between Member States and third countries but it did not achieve a decision on the participation of the non-resident carrier in the national shipping services in another Member State. Cabotage in shipping services is seen as desirable in stimulating the efficient use of the Community fleet in intra-EC trade. However, access to a Member State's domestic trade by another Member State's vessels provokes a range of strong feelings. At one extreme, Italy and Greece are determined that outsiders, especially those operating large vessels, should not be permitted to enter their coastal and island trades while at the other, the UK believes that any protection is contrary to the spirit of the Treaty of Rome. Countries such as the UK, Denmark and the Netherlands have in practice long pursued policies of opening their coastal waters to ships of all nationalities.

Indeed, as part of the Commission's original proposals in 1985 it had sought to apply the principle of freedom to provide services so as to remove restrictions on the provision of shipping services between ports of a single Member State by shipowners established in another Member State.[20] The aim was to remove existing restrictions in cabotage trade over a ten year period. However, the First Package of measures agreed by the Council of Ministers in 1986 contained no agreement to lift cabotage restrictions in part because it was not construed as a significant issue given the limited amount carried by non-Community ships.

In the late 1980s, to circumvent the opposing views within the Community on cabotage, a trade-off between Member States was suggested: northern European countries would allow a relaxation of the EC shipbuilding subsidies in return for movement on the cabotage issue by southern EC members. This proposal, while keeping the discussion open, was, however, far from being adopted by the Community.[21]

The Positive Measures Package of 1989 contained new proposals for the establishment of Community-wide cabotage rights.[22] To protect the Mediterranean coastal fleets of Portugal, Greece, Spain, Italy and France, the rights would be limited to Community shipowners and EUROS-registered vessels not exceeding 6000 grt. A Member State could impose public service obligations as a condition where this was deemed necessary to ensure adequate services between islands. Greece, in particular, has opposed this on the grounds that its affords insufficient protection for island services required on a year round basis or for national security needs (especially with regard to any threat from Turkey) as permitted under Article 224 of the Treaty of Rome. There seems to be acceptance by the Commission that in this, and other less pronounced cases, full cabotage would be inappropriate and the issue is the practical one of defining a tractable mechanism to incorporate such exceptions in the final arrangements; the 6000 grt limit is not seen by Greece as that mechanism.

Other members, such as the UK,[23] have been concerned that the link with EUROS would be excessively restrictive and impede genuine liberalization.

Failure to reach agreement on cabotage in 1990 on the basis set out in the Positive Measures Package has led to a new initiative to speed progress towards at least a degree of cabotage being adopted. In December 1990 there was majority acceptance by the Council of

Ministers of a proposal to phase-in cabotage with its introduction for mainland traffic by 1993 with cabotage for the islands and peninsulas coming later at an unspecified date. Lack of unanimity, however, has meant the Council has not pushed the point further at this time.

Eventually, the EC will have to move to address its cabotage policy towards coastal shipping — indeed, the legal advice given to the Commission is that some form of agreement must be reached by 1993 — with the goal of liberalizing trade between Member States. Primarily, a single cabotage policy for other transportation modes will be the impetus for changes to domestic coastal trade and may indeed even see rationalization between sea and land-based modes for intra-Community traffic. The harmonization of cabotage policies will further promote the development of efficient hub-and-spoke port calls by shipping lines calling at EC ports.

European Competition Policy

The 1986 package of measures (especially Regulation 4056) essentially exempt EC liner conferences from the Competition Rules (Articles 85 and 86) of the Treaty of Rome.[24] The regulations accepted that shippers want to move goods of any size and type at their convenience and that liner conferences are the most efficient way of doing this. The block exemption for conferences was also designed "to give fair consideration to the interest of users," especially the shippers' councils, and the precedent of the Hyundai case has protected users against predatory pricing. Since that time there has been considerable dialogue between users and the suppliers. Nevertheless, developments in Europe have now left most EC countries with a few major liner carriers. As one commentary puts it

> The shake-out in the European liner shipping industry has left most countries with one dominant carrier. P&O, Nedlloyd and Hapag-Lloyd are virtually unchallenged in their national markets.[25]

Commission policy with regard to consortia has been under review since 1986. Although an interim report issued in January 1988 concluded that there was no evidence to justify a block exemption for consortia, the 1990 House of Lords report has called for urgent further clarification.[26] The primary argument is that consortia are the current market practice which, rather than large conferences like the Far East Freight Conference, may be important as a counterbalance to the single operation, world players such as Sea-Land and Evergreen.[27] This issue, therefore, links with the mergers policy of the Community since integrated transport systems tend to be developed via acquisition if the financial strength of the entity can tolerate this method of development.[28]

Many shipping companies see the move towards a single market as an opportunity to develop a truly intermodal network and rationalization of their total service package; for some this includes gaining control of their port connections. For example, in 1988 Holland's Royal Nedlloyd Group merged its 44% of Europe Container Terminus and its wholly-owned Quick Dispatch BV. (stevedoring) with a trading company, Internatio-Muller NV, whose subsidiary Muller-Thomsen Rotterdam BV, afforded the new company formed, Europe Combined Terminals, the opportunity to seek control of container operations through Rotterdam.[29] Similar activities have taken place in the port of Antwerp, with consolidation of stevedoring and shipping companies.[30] Such merger and acquisition activity could further distort the competitive environment but the Competition Directorate is not currently convinced that such activity approaches a harmful level and needs its attention.

The mergers element of the Competition Policy of the Community has traditionally been reactive in its approach. Article 86 of the Treaty of Rome sets out the general principles regarding market dominance,

> Any abuse by one or more undertakings of a dominant position within the Common Market or a substantial part of it shall be prohibited as being incompatible with the Common Market in so far as it may affect trade between member states.

The experience of the Commission's case against the Continental Can Company[31] showed that Article 86 of the Treaty of Rome can be employed against mergers but only in a specific way. The Commission had to show that a merger was actually harming Community interests; in other words, market power had to be demonstrated before action could be taken. The Commission could not, therefore, act prior to a merger although it could seek divestiture once a merger had taken place and monopoly power demonstrated. Of course, this was a somewhat more powerful weapon than the *de jure* interpretation might indicate since the simple threat of Commission intervention *ex post* would in itself deter many mergers.

The move to the Single Market has seen this policy modified and since the autumn of 1990 the Competition Directorate of the Commission can act to stop mergers which would run counter to EC interests.[32] The criteria for their investigation rests with the degree of post-merger market concentration of a Community dimension which would be generated. The parameters for investigation being defined in terms of threshold levels of world-wide turnover and threshold levels of Community-wide turnover. To date this new set of powers has only been exercised in a limited number of cases, one being the merger of Air France and UTA, and none have any direct implications for maritime trade. Given the growth of integrated transport systems, however, and the increasing size of the undertakings involved, this situation may well change in the future. This possibility is enhanced if in future the Commission gains the powers it is currently seeking to lower the turnover thresholds which make investigation possible.

State Aid to Shipping

There has been a long-standing practice in Europe of subsidizing shipping and port investment although the levels of subsidy differ very considerably between Member States of the EC. This is in spite of the fact that Article 94 of the Treaty of Rome gives the Commission power to act in situations where state aid is provided. Instead the Commission has looked at state aid from the perspective of Article 93 which says;

> 1. Save as otherwise provided in this Treaty, any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the common market.

However, exceptions are permissible and these include:

> (c) aid to facilitate the development of certain economic activities, or certain economic areas where such aid does not adversely affect trading conditions to an extent contrary to the common interest.

Fiscal measures have traditionally been justified in the maritime context as a means to combat subsidies and similar measures such as cheap loans and tax concessions adopted by fleets outside of the EC. The United States, Japan, Australia, Norway, Finland, Sweden and Switzerland are oft cited as examples of nations falling into this category.[33] Assuming a pre-tax rate of return of 10%, a discount rate of 8% and inflation of 5%, calculations by R.O. Goss for the General Council of British Shipping indicate that effective subsidies to invest in new ships expressed per £1 million of investment amount to over £300,000 in Denmark, £150,000 in France, over £100,000 in the Netherlands and about £60,000 in the UK.[34] In countries such as France and Italy, direct state involvement has led to subsidization of operating costs.

Recently the Commission has attempted to spell out more clearly and consistently the conditions under which subsidies and the like to national shipping are permissible under Article 92 — the article concerned with basic principles.[35] The guidelines offered provide seven categories of aid to shipping companies together with detailed criteria to their appropriate implementation. These are: aid in the field of social security and income tax to reduce manning levels; payment or reimbursement of costs of repatriating seafarers; assistance with training costs; special tax treatment of shipping earnings; operating aid to improve liquidity; aid to investment; and aid in the form of public authority holding. The upper limit to permissible national aid would be defined in terms of cost gaps with the cheapest Community flag providing the base line.[36] The EC scheme also links with the notion of a European Registry in that the Community,

> ... will regard in a more favourable manner state aid granted to shipowners in pursuance of the above mentioned [i.e. those related to the objectives of EUROS] common interest ... *(words in parenthesis added)*.[37]

Intermodalism in Europe

One of the major problems facing European shipping is not to be found as a marine issue but is a landside one.

> A truck transporting goods from Rotterdam, Netherlands to Genoa, Italy now averages slightly less than 20 kilometres (12.3 miles) per hour over the entire distance because of border delays of up to eight hours (often the rule rather than the exception). Some trans-European trucking actually moves more slowly than world-class marathon athletes can run.[38]

Road haulage is a very contentious subject in Europe. Congestion and cabotage are not the only issues. Reconciliation of the plethora of rules, regulations, permits and quotas is also required to increase the efficiency of inland links. While a degree of agreement has been reached within the EC on some topics, such as the removal of quantitative limits on international quotas, the adoption of simplified paperwork and the introduction of a

limited form of cabotage, these only partly solve the problem. Switzerland and Austria, two non-Community countries caught in the middle of the debate, have not, for example, agreed with the Commission's view on through traffic. Indeed, Switzerland still maintains a significantly lower maximum weight limit for trucks than any EC state.

It appears that German land transport is in the most difficulty. At present, Germany restricts truck traffic, with no heavy vehicle traffic allowed weekends and holidays; coupled with road congestion, these rules have led to pressure on the Continent to move a greater percentage of freight by rail.[39] As it is, German rules make it cheaper to ship German products via other EC ports rather than German ports[40] calling into question the viability of Germany's total transport system.

Until early 1990, intermodal inland connections were viewed by many to be the major transport handicap facing European transport. (The A.T. Kearney study notes that it is possible to double intermodal traffic by 1994 and triple it by the year 2005.[41]) There has not been a co-ordinated and integrated policy; each country has tended to put national interests above Community interests. Combined transport movements have a minute market share at the moment with trucks enjoying the lion's share of inland distribution on the continent. In the UK a similar picture emerges with Freightliner Ltd., British Rail's main container concern, carrying almost the same tonnage of container traffic now as it did a decade ago.[42]

Intermodalism in Europe is a major hurdle to be jumped on the track to a successful Single Market. Shippers now face significant difficulties and there is a serious shortage of transhipment capacity in the hinterlands of continental ports.[43] The short distances within Europe plus the lack of rail infrastructure for international moves and the preference of national carriers to call at national ports brings into question the ability of combined transport initiatives to succeed, at least in the next decade.

Commentary

In the first years after the Treaty of Rome there was little impetus for the development of a Community maritime transport policy. The original six nations were not major maritime nations, although France and the Netherlands had significant flag fleets during an era when their mercantilist ambitions saw overseas colonies as significant trading partners. With the joining of the United Kingdom in 1973 and Greece much later, the importance of a maritime policy grew and, by 1985, the *Cockfield Report* concluded that a maritime transport policy was needed for the effective implementation of the Single European Market initiative.

Two packages of measures to promote European shipping have subsequently been brought forward, the recent need for a policy being spurred on by the flagging out and employment issues, and the experience of the Gulf War, as much as the requirement for a competitive European fleet. But it appears doubtful that a successful conclusion to current negotiations will take place in the time remaining to the December 31, 1992 deadline. The EUROS register, without creating tax concessions tantamount to a European flag of convenience, also appears far from appealing to European shipowning interests and achieving its aim of retaining or creating jobs for European seafarers. In fact, the UK House of Lords Select Committee on the European Communities has indicated that the creation of the EUROS register is not a precondition for achieving many of the stated objectives of the register. With such a conclusion, it may be a long time before a consensus on the shape of EUROS is reached, if one ever is.

In the area of cabotage, agreement is also difficult to achieve although a limited variant of cabotage will probably be gained, one which excludes islands and peninsulas, an area of concern for the Mediterranean Member States. An agreement to include peninsulas and islands does not even have a target deadline although the UK House of Lords Select Committee is pushing for one by 1998.

On the competition policy side there may be movement on the consortia issue but the acquisition of landside operations by large worldscale container shipping interests appears to provoke little, if any, concern.

Not to be completely negative, there are some positive points to be made. Inland infrastructure and landside cabotage will better meet shippers needs in the coming decade. We can expect the border delays to disappear and the overall speed of inland transport to improve as the less efficient trucking operations of Germany and France lose market share to the more efficient UK, Belgian and Dutch operators. Shipping lines will continue to play one port off against another as services rationalize, replacing more efficient hub-and-spoke networks for the current multiport strategies most carriers use. As long as the megacarriers serve to balance each other, shippers will be better off. In the long-run, this will depend on how much more rationalization and consolidation takes place among liner operators.

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EDI IN OCEAN TRANSPORTATION: THE LEGAL LOGISTICS OF PROCESSING A TRANSACTION ELECTRONICALLY

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Introduction

As documentary transactions give way to EDI (electronic data exchange), how are the shipping industry and the business community going to process the movement of goods? This is a question of immediacy and importance. The computer technology for EDI has been available for some time. Methods for rendering different computer systems compatible have been achieved. Standards for electronic interchange have now been agreed, nationally and internationally. Uniform messages for typical trade data are actively being developed. In short, EDI is up and running as a major business tool, but how will it work for ocean transportation?

In June 1990 the Comité Maritime International, or CMI, put forward a set of rules to solve this question. Entitled the CMI Rules for Electronic Bills of Lading, they aim to accommodate the expectations and procedures of the carrier and the cargo owning communities alike. This paper will examine the system of electronic communications proposed by these model rules. It will also evaluate their suitability as a legal basis for executing carriage transactions by EDI.

EDI Applications and Bill of Lading Functions

The central document in a shipping transaction is the ocean bill of lading. So the central question is: how can EDI be applied to achieve everything an ocean bill of lading has always done? This question does not imply that EDI must fulfil the role of a bill of lading in exactly the same order of operations or the same way. Indeed, the change from the paper to the electronic medium of communications ensures that the transaction will not be processed in the same fashion. What is essential is the replication of the functions of the ocean bill of lading by EDI.

Technologically, EDI can accomplish the functions of the bill of lading in a number of different ways. For the most part carriers and cargo owners are free to choose their own in-house computer systems, including the software they use to store trade data and to generate the necessary instructions for such typical operations as consignment, storage, transhipment, delivery and the like. At the application level, it is obvious that the carrier and cargo owner, as well as all the other parties they involve in the execution of the

transaction, must follow the same procedures and standards in order to communicate effectively by EDI. Many applications systems, often developed within particular industries or national EDI bodies, already exist, but this variety of choice is itself an inhibitor to international trade.

These proliferating technological developments have encouraged efforts to create a single acceptable set of applications standards for the use of EDI internationally. The efforts have been spearheaded by the Working Party on Facilitation of International Trade Procedures of the U.N. Economic Commission for Europe. Over the course of the last decade or so, international agreement has been reached on the UN/EDIFACT, which is short for the United Nations Rules for Electronic Data Interchange for Administration, Commerce and Transport. UN/EDIFACT is a set of syntax rules for the application of EDI. The rules set the structure and format for electronic messages and specify the data elements that may or must be included in transmissions. The syntax rules will also be accompanied by at least fifty standard trade messages which are currently being developed.1 The whole of these international arrangements for trading by EDI are set forth in the U.N. Trade Data Interchange Directory or UNTDID.

UNTDID is complemented by the U.N. Trade Data Elements Directory or UNTDED. This manual, as its name suggests, is a directory of the agreed and standardized data elements from which electronic messages are constructed. They represent all the pieces of information that typically flow in an international trade transaction, including ocean transportation. Together UNTID and UNTDED provide the prerequisite international uniformity to constitute a sure basis for the application of EDI.2 Indeed, their achievement has greatly helped to propel EDI to the forefront of widespread business consideration as a practical, reliable and efficient way of processing international trade and transportation.

When it comes to applying EDI to ocean bills of lading, however, there is yet one more level of standardization of practice that is necessary. This is because the bill of lading is relied upon by shippers, carriers, consignees and bankers as a document of title that by law has to be processed in a particular way. Legal significance was attached to the manner of processing bills of lading some two hundred years ago,3 and ever since has operated in a recognized uniform way world-wide. Unfortunately, the law which regulates ocean transportation is couched in terms of the paper medium in which bills of lading have traditionally been inscribed. The replacement of paper bills of lading by EDI methods consequently creates great uncertainty about the legal reliability of an electronically processed transaction. To complement the successful standardization of the application of computer technology, it is equally necessary to provide a well understood and widely acceptable legal regime in which the functions of bills of lading can be validly fulfilled by EDI. Only then can traders and transport operators be sufficiently confident of the merits and the integrity of EDI.

In summary, EDI may be employed in a manner of ways to maritime transportation, provided it accomplishes all the functions of an ocean bill of lading. Further, the process of application of EDI must subscribe to an uniform set of rules to endow the functions it performs with the legal consequences equivalent to the bill of lading. It is these objectives which the new CMI Rules for Electronic Bills of Lading are intended to achieve. If the CMI Rules prove acceptable to the shipping and banking industries, there is every reason to expect they will go into active operation and EDI will rapidly become the new common way of processing international trade and ocean transportation.

As a preliminary step to the examination of the CMI Rules, it is appropriate to make a brief review of the functions of, and procedures associated with, the bill of lading which EDI is required to replicate. In the traditional documentary export or import transaction the bill of lading has three functions. First, it acts as a receipt for the cargo taken in charge by the carrier. The document, signed by the carrier's employee or agent, represents that the goods described on its face have been received into the custody and care of the carrier. The bill of lading therefore provides proof4 of the shipment of cargo.

Secondly, the bill of lading is usually the best evidence of the terms and conditions of the ocean carriage.5 Typically, the contract of carriage is concluded long before the goods are shipped. It is made when the shipper, or his forwarding agent, and the carrier's agent, by a combination of telephone, telex or letter agree upon the reservation of cargo space aboard the shipping line's sailing on a particular date. Their communications may include a reference to the terms of carriage. Even if nothing is said, it will usually be understood that the transit is to be undertaken upon the carrier's standard trading conditions. The bill of lading, which may not be issued until after the goods have been loaded and the ship has sailed, is the first occasion when the carrier's standard terms are spelled out to the shipper, in the form of the fine print on the back of the document.

Lastly, the ocean bill of lading, in its customary form of issuance to the order of the cargo owner, is a negotiable document of title to the goods while in carriage.6 That is to say, the document itself stands in place of the goods during carriage. The lawful holder of the bill of lading has the sole right to possession and control of the goods it records. In practice that means the holder alone can instruct the carrier as to the destination of the goods and is the only person able to demand delivery by presenting and surrendering the title document. Further, because the bill of lading is negotiable, the holder can endorse and deliver it and thereby transfer all legal interest in the goods. In short, by negotiating the document itself, the holder may mortgage or sell the actual goods. It is this negotiable feature, above all others, that makes the ocean bill of lading a most complex document for EDI to replicate.

The CMI Rules for Electronic Bills of Lading

The CMI Rules for Electronic Bills of Lading deal with the three functions of the bill of lading in a novel and imaginative fashion. Each is addressed by separate operational rules. First the CMI Rules specify the common basis for electronic communications. Article 3 calls for the contents of documents to be formatted to the standards of the U.N. Layout Key. The EDI itself is to be governed by the ICC Uniform Rules of Conduct for Interchange of Trade Data by Teletransmission (UNCID) and to be conducted in conformity with UN/EDIFACT standards. The article also imposes obligations on the recipient of a message to transmit a confirmation of receipt, and to maintain the security and confidentiality of the trade data exchanged.

As a matter of practice, these requirements cover only some of the items that have to be considered in communicating electronically. Sensibly, they impel the use of the newly worked out international standards for teletransmissions which have been designed to promote the efficient operation of EDI. They impress these international standards at the application level of EDI, where a mutually respected system of operation between shipper and carrier is essential to ground the subsequent rules to replicate the bill of lading's functions. They avoid interfering in the parties' choice of computer systems, for instance in their individual decisions about the degree of security desirable or the means of maintaining confidentiality of data. In referring to electronic monitoring systems,7 the Rules do not prescribe their form or even their use, but merely establish their legal value when employed. The Rules make the important point that, in the event of dispute, an electronic monitoring system may be used to verify the data communicated. Thus they establish that electronic evidence is acceptable proof of the transaction so far as the parties are concerned and thereby avoid the legal uncertainties about non-documentary records.

1) Receipt Functions

The receipt functions of the bill of lading are addressed in Article 4 entitled the Form and Content of the Receipt Message. The CMI Rules recognize that amongst all the transmissions between the parties to arrange the carriage, the most crucial one is the message sent by the carrier upon receiving the goods from the shipper. In substance, this message replaces the issuance of the paper bill of lading on which so much rides in the traditional documentary transaction. Hence this message must contain the data essential to the replication of the bill of lading's functions.

Much of the required data is obvious. The receipt message should include the name of the shipper, the description of the goods, including any reservations as to quantity and condition, the date and place of their receipt by the carrier and a reference to the terms of carriage. When cargo is loaded the shipper may call for an updated receipt message to include this additional fact. These are all customary details in shipping practice which are also required by the

Hague Rules of international transport.8 With respect to the effect of this message, the CMI Rules expressly state that the data shall have the same representational force as the contents of a bill of lading. Hence the receipt message will exactly duplicate the receipt functions of the bill of lading.

The novel feature of the receipt message is the requirement that the carrier shall create and include a Private Key to be used in subsequent transmissions. The use of this data is crucial to the negotiability of the rights in the goods and so will be considered later under that topic. But it is important to note that the Private Key must be issued at the receipt stage because it is the means, in place of the documentary bill of lading, by which the cargo owner retains control of the goods while they are in carriage.

ii) Contractual Functions

The receipt message, as noted previously, is required to carry a reference to the carrier's terms and conditions of carriage. This obligation raises questions as to the legal effect of such a reference and, more generally, about the content of the carriage contract. Article 5 of the CMI Rules provides a partial answer. It establishes the parties' agreement that a reference by EDI to the carrier's usual trading terms will incorporate them into their carriage contract. This Rule obviates any lingering uncertainty about the legal validity of the carrier unilaterally imposing carriage terms in what is supposed to be an agreement. There is, in fact, no practical way both to exploit EDI and to negotiate and transmit all the detailed terms of the carriage, even if it were desired. Consequently, there has to be a reference out of the electronic system to the carrier's standard conditions recorded somewhere in a paper document.

The CMI Rules merely require that the carrier's terms must be made readily available to cargo owners. It is left to the ordinary law of contract to determine whether in fact the carrier has made adequate provision for access to its terms of carriage and whether other representations, by either party, made in negotiations before the receipt message and possibly through a medium other than EDI, also form part of the parties' agreement. It is possible, but uncommon, even under traditional documentary procedures for terms other than those in the bill of lading to be implied or agreed as part of the contract of carriage. As has often been said, the bill of lading is the best, but not necessarily conclusive, evidence of the contract of carriage.9 For the same reasons this small measure of uncertainty cannot be avoided by the use of EDI.

The CMI Rules go on to establish two important principles of priority where there are conflicting terms and rules of carriage. Article 5 makes the CMI Rules prevail over any inconsistent terms of the carrier's trading conditions. Remembering that the CMI Rules themselves only apply upon incorporation by agreement of the parties in the same way as the carrier's standard conditions, this principle avoids the inevitable uncertainty that would arise when two

conflicting sets of standards of the same contractual status apply to the carriage.

The second principle, contained in Article 6, ensures that the Hague Rules or other set of international rules of carriage which are compulsorily applicable by national law to a bill of lading shall govern contracts made by EDI. This provision overcomes any doubts raised by the fact that the Hague Rules are only expressed to regulate contracts of carriage "covered by a bill of lading or any similar document of title,"10 which on a literal reading would exclude all electronic transactions. It also implies that the norms of the Hague Rules when invoked by national legislation, rather than the parties' agreement, shall take precedence in the event of consequential conflict over both the CMI Rules and the carrier's standard trading terms. In this way, though the receipt message will not, as it cannot, contain the whole of the contract of carriage, the CMI Rules adequately provide for the inconsistencies and the avoidance of uncertainty that might otherwise arise from discovering the carriage agreement from several different sources.

iii) Negotiability Functions

The hardest problem in applying EDI to bills of lading is to replicate their negotiability. Technically, the task is not difficult; the security mechanisms available to protect the transfer of data by teletransmission are at least as good, and probably better, than those surrounding the delivery of paper documents.11 The problem has been to devise an expedient process of EDI transmissions that is acceptable to all interested parties so that they can rely upon this procedural system in the way the shipping, trading and banking communities have faith in the handling of bills of lading. Recall that the shipper to whom the bill of lading is issued has control of the cargo by reason of the document. It entitles the shipper to instruct the carrier regarding the carriage and destination of the cargo. The shipper may also call for delivery of the goods upon presentment of the document. Finally, the shipper can transfer all these powers by negotiating the bill of lading, that is by endorsing and delivering the document to a new holder.

The method adopted in the CMI Rules to enable negotiation of the rights to cargo in a controlled fashion is by the introduction of the "Private Key". Article 2 defines the Private Key as "any technically appropriate form, such as a combination of numbers and/or letters, which the parties may agree for securing the authenticity and integrity of a transmission." This is a simple idea to comprehend, indeed it is a common method of protecting electronic data.12 The significance lies in the way the Private Key is used. In this the carrier plays a central role as the issuer and controller of Private Keys. It is crucial to note that, by Article 8, the Key itself is not transferable, so that for every successive party which takes an interest in the cargo the carrier must generate a new and unique Key.

For each carriage transaction the procedure is begun by the carrier issuing a Private Key in the receipt message to the shipper. As

possessor of the Private Key, designated the Holder by the Rules,13 the shipper has the equivalent rights to those acquired by the issuance of a bill of lading. To be precise, Article 7 states:

> The Holder [of the Private Key] is the only party who may, as against the carrier:
>
> 1. claim delivery of the goods;
> 2. nominate the consignee or substitute a nominated consignee for any other party, including itself;
> 3. transfer the rights of Control and Transfer to another party;
> 4. instruct the carrier on any other subject concerning the goods, in accordance with the terms and conditions of the Contract of Carriage, as if he were the holder of a paper bill of lading.

The procedure by which the Holder exercises these powers involves the transmission to the carrier of suitable instructions which are verified by the Private Key. Since the carrier issued the Key, it can rely on the transmissions received and secured by that Key, both as to origin and content.14

If the Holder/shipper wishes to give instructions to the carrier, say to change the destination of the cargo,15 the procedure is very straightforward. The seller simply transmits a suitable message secured by the Private Key. Thus verified, the carrier knows the instructions are authoritative. It is obliged to send a confirmation of their receipt16 and to carry them out. This procedure provides rather better assurance to the carrier that the party giving instructions, as well as their contents, are legitimate compared to the much looser control under the traditional bill of lading system.

When the Holder wants to receive the cargo, a procedure is followed that results in delivery of the goods against cancellation of the Private Key.17 At the destination the carrier first notifies the Holder of the place and date of intended delivery. In response, the holder gives the carrier delivery instructions which are verified by the application of the Private Key. The carrier is then bound to deliver the goods in accordance with the instructions to the nominated consignee upon production of suitable identification. The delivery having been made and the carriage thus accomplished, the Private Key, as Article 9 states, is automatically cancelled.

This procedure is comparable to the documentary system in which the bill of lading must be surrendered by the holder in order to receive delivery of the goods. The cancellation of the Private Key when the goods are delivered ensures that the Holder, or some other fraudulent person, is prevented from giving the false appearance of rights to goods in carriage. It behooves the carrier actually to erase the Private Key, but its automatic cancellation protects the carrier from any responsibility for subsequent attempts to misuse it. In addition, the carrier is not responsible for misdelivery of the goods to the wrong consignee if it exercised reasonable care in ascertaining their identity.18

If the shipper, or current Holder, wishes to transfer his rights to the cargo to another person, a procedure involving the replacement of the original Private Key by a new one in favour of the successor in interest is entailed. The transfer of the right to control and transfer of the goods is effected in five steps.19 First the current Holder transmits a message to the carrier notifying it of his intention to transfer his rights to a proposed new Holder. The carrier must confirm receipt of this message and then transmits the contents of the original receipt message, minus the current Private Key, to the proposed new Holder. This party must then advise the carrier whether he accepts the transfer of rights to the goods described in the receipt message. If he does, the carrier finally cancels the current Private Key and issues a new one to the new Holder.

There are two significant effects of this sequence of messages, which match the endorsement and delivery of a bill of lading. First, the transmission of the receipt message, like the delivery of the bill, informs the new Holder about the nature, condition and quantity of cargo that the carrier admits to being responsible for care and carriage, as well as about the terms and conditions of carriage. This message is an authoritative communication to the new Holder about the goods to be made available to him. Then the allocation of a new Private Key and the cancellation of the old one actually accomplishes the transfer of the rights in and control over the goods represented in the receipt message. Since the carrier has complete management of the Private Keys, cancellation of one Key will effectively shut out its Holder while the issuance of a new one will give exclusive access to the rights in the cargo to the new Holder.

This process differs from the method of negotiating and transferring a bill of lading in that it is conducted through the carrier. A bill of lading may be negotiated among several successive traders and their banks without the assistance of the carrier. It learns only incidentally about these transactions in the goods when the fully endorsed document is presented by the last Holder for their delivery. The difference in procedure has several commercial and legal implications. From the cargo owner's side, new and additional reliance must be placed in the carrier. The system will depend upon the reliability and integrity of the carrier's administration of the Private Keys. Cargo interests must have confidence in the carrier's system. In particular, bankers must be persuaded that it is safe to give up extending credits against documents in their possession and, instead, to pay upon the allocation of a new Private Key.

For carriers, the system requires them to accept responsibility for the administration of the Private Keys and thus the management of the transactions in the cargo. These present new and additional obligations and liabilities for the carrier, which have very little to do with the performance of its business of carrying cargoes.

For both sides, there is ample opportunity for abuse of the process by either fraud or error. For instance, the shipper might inadvertently but wrongly, contrary to his obligations of

confidentiality,20 transmit the contents of the receipt message including the Private Key to the consignee of the goods. The carrier, for example, might issue a new Private Key without cancelling the old one. Computer programmes can be put in place to limit these kinds of risks, but there is no way that all frauds or mishaps can be prevented. However, the system of transferring bills of lading is recognized to be very open to misadventures,21 yet the shipping industry has not found the burden of losses and liabilities a sufficient inducement for change. Judging by this experience, there is no reason to believe the use of Private Keys is any more likely to create unacceptable risks.

In summary, the electronic system of Private Keys permits the transfer of the rights to and control of the cargo as fully as the negotiation of a bill of lading. To be doubly sure that the law takes cognisance of this result and gives it the legal validity the parties intend, Article 7 states: "The transfer of the Right of Control and Transfer in the manner described... shall have the same effect as the transfer of such rights under a paper bill of lading."

iv) Options to Revert to Paper Procedures

Even though computer systems and EDI applications are widely available, sometimes a paper document may still be demanded. During a period of transaction at least, certain national laws, Customs procedures or banking practices in particular places in the world may demand the production of a paper bill of lading or impose the requirement of some other document in writing. The CMI Rules also take account of this likelihood and make provision for it.

Article 10 grants two options to receive a paper document. Either the Holder may demand, or the carrier may choose, to issue a paper bill of lading and thereby terminate the EDI procedures.22 Alternatively, the Holder can call for a print-out of the receipt message, less the Private Key, marked as a "non-negotiable copy". Such a print-out is not a bill of lading and so it does not terminate the transaction by EDI. Yet it may be sufficient acknowledgement in writing to satisfy the immediate documentary need of the Holder without interfering with the continuing procedures of EDI.

The CMI Rules have also done their best to assure that electronic data will be regarded as equivalent to writing. Article 11 establishes an agreement between the carrier, the shipper and all successive parties that transmitted and confirmed electronic data will satisfy their legal obligations to provide written information. They agree not to raise the lack of writing as a defence to their responsibilities under the carriage transaction concluded by EDI. It is recognized, however, that no agreement of the parties can overreach mandatory national laws that continue to impose trade and cargo reporting requirements on specific documentary forms.

Conclusion

The CMI Rules constitute a set of model procedures and responsibilities for the use of EDI. They are not mandated by law but may be adopted voluntarily by contracting carriers and cargo owners.23 Their success, therefore, will be measured by how widespread in application they become. That will depend first upon perception, and later on the experience, of the shipping industry as to whether the CMI Rules establish a practical and reliable set of operational rules.

There is no doubt that some such set of uniform procedures is essential for the application of EDI in international trade and ocean transportation. It is not difficult to think of other systems of processing transactions by EDI. However, the CMI model appears to satisfy all the requirements of bills of lading trade and to permit the use of EDI in a manner that is likely to be legally effective and enforceable. Hence there are strong grounds to suggest the CMI Rules ought to find general acceptance.

The actual proof of their acceptability will have to await the evidence of interest from shippers and carriers, insurers and bankers themselves. One important indicator will be the reception of the ICC Banking Committee, to which the CMI Rules have been sent for consideration. Since that body regulates the banking procedures for the letters of credit that support the sale of goods carried by sea, its recognition of the CMI Rules would signal adoption by the banking community and thus would open the way to their general acceptance in the shipping industry as well.

Notes

1. Per M. Bellego, Secretary to the U.N. ECE Working Party.

2. For a thorough discussion of UN/EDIFACT see H.B. Thomsen and B.S. Wheble, Trading with EDI (London: IBC Financial Books Ltd., 1989).

3. In Lickbarrow v. Mason (1787), 2 T.R. 63, 100 E.R. 35 (K.B.), rev'd. (1790), 1 Hy. Bl. 357 (Ex.Ch.), restored (1793), 4 Bro. P.C. 57 (H.L.).

4. Whether the proof is rebuttable or not depends upon the party holding the bill of lading and the applicable local law. Cp. the Hague Rules Art. III (4) as enacted in Canada, R.S.C. 1985, c. C-27 and the Hague/Visby Rules Art. III (4) as implemented in U.K., 1971, c. 19.

5. See Sewell v. Burdick (1884), 10 App. Cas. 74, at 105; The Ardennes, [1951] 1 K.B.55.

6. For an excellent discussion of bills of lading as documents of title see C. Debattista, Sale of Goods Carried By Sea, (London: Butterworths, 1990) ch. 2.

7. Art. 2(h) and 3(e).

8. Art. III(3), (7) enacted in Canada by R.S.C. 1985, c. C-27. The CMI Rules set out the minimum data required to be transmitted: more may be added as the parties wish or local law demands.

9. Supra, n. 5.

10. Art. I(b), supra, n. 8.

11. See Trading with EDI, supra, n. 2, at 32-37.

12. Note that the Private Key, as Art. 8(c) confirms, is separate from an unique identifier given to the cargo container or the carriage contract, as well as being distinct from any password or security code which is required to access the computer network being used for the transaction.

13. Arts. 2(q), 4(b).

14. The integrity of this system depends upon the confidentiality and security of the Private Key itself, which, by Art. 8(a), both the carrier and the Holder are obliged to maintain.

15. Provided they are consistent with the terms of the carriage contract.

16. Arts. 3(d), 8(b).

17. See Art. 9.

18. Art. 9(c).

19. See Art. 9(b).

20. See Arts. 3(f), 8(a).

21. See UNCTAD, "Review and Analysis of Possible Measures to Minimize the Occurrence of Maritime Fraud and Piracy," U.N. Doc. TD/B/C.4/AC.4/2 (21 Sept. 1982) at paras. 13-24.

22. Without prejudice to either party's rights and responsibilities under their contract of carriage while performing it by EDI. See Art. 10(d).

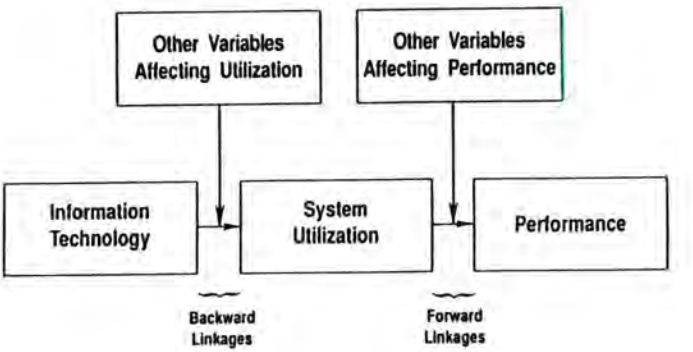
23. Art. 1.

Determining DSS Performance in Marine Transport

Introduction

A decision support system (DSS) does not provide any direct or immediate value to an organization. The DSS must be utilized to provide any benefit to the enterprise. Utilization of a DSS is the channel through which information technology (IT) can alter performance (Trice and Treacy, 1988). DSS utilization serves as a key intervening variable, linking the IT and performance, as shown in Figure 1. There is no direct link between IT and performance. The IT and performance must be bridged by utilization. The relationship between IT and utilization is known as the "backward linkage" and the relationship between DSS utilization and performance is known as the "forward linkage" (Trice and Treacy, 1988, p. 28).

Figure 1. Utilization as an Intervening Variable



Forward-linkages must exist if a DSS is to affect performance, since IT cannot have an impact on performance if the technology is not used. Increased utilization conceptually could be correlated with either improvement or degradation in performance. Therefore, utilization alone is not sufficient to accurately predict performance. Consequently, DSS utilization is a necessary but not sufficient condition for IT to affect performance in the desired fashion.

To achieve a more complete and extensive understanding of the linkage between IT and performance, it is advantageous to employ DSS utilization as an independent variable affecting performance instead of as an indicator of achievement itself. This analysis will investigate the "forward linkage" between continuous scales of DSS utilization and an objective measure of performance. Utilization will be measured in two ways: 1) actual DSS users as a percentage of total potential users; and 2) the number of DSS supported events as a percentage of total events. Neither the information systems literature nor the transportation literature reports any prior empirical research studies which employed the rate of system usage as an explanatory variable - directly relating utilization rate of the information technology with the desired changes in enterprise or organizational level performance.

DSS Evaluation and DSS Utilization

This analysis relates continuous and objective measures of DSS usage with an objective measure of enterprise performance. This is in contrast to most research studies previously reporting about DSS utilization (even as a dependent variable) which employ a self-report from users on their usage of an information system. This approach may suffer from validity problems, as self-reported usage rates could have little correlation with actual usage (Srinivasan, 1985). In further comparison to past studies which employed system utilization as the dependent variable, the research reported herein employs continuous measures of DSS utilization as an independent or explanatory variable. This approach to DSS evaluation relates DSS usage directly with the performance criterion to establish a "forward linkage" between IT utilization and enterprise performance.

The Research Setting

DSS Performance Criteria

Under the authority of the Ports and Waterways Safety Act of 1972, the U.S. Coast Guard responded to the need for improved vessel safety and established a vessel

traffic service (VTS) for the lower Mississippi River in October of 1977 (Center for Wetland Resources, 1981). This DSS employs a VHF-FM communications network to distribute information from the computer-simulated tracking of vessels. The VTS attempts to reduce the probability of vessel casualties in order to protect lives, property, and the environment while expediting the movement of vessels.

The strategic mission of the New Orleans Vessel Traffic Service (NOLA-VTS) is to improve vessel safety by providing advance information about reported maritime traffic on the lower Mississippi River between Baton Rouge and the Gulf of Mexico. Accordingly, the key performance indicators include the various types of vessel accidents such as collisions, rammings, groundings and barge breakaways (Center for Wetland Resources, 1981).

DSS/VTS Technology

According to the "framework for DSS" as developed by Sprague (1980), the NOLA-VTS is a specific DSS built from "tools". The specific DSS is the hardware/software combination that allows a specific decision maker or group of decision makers to deal with a specific set of related problems, such as those encountered by marine navigators on inland waterways. DSS tools are the portfolio of rudimentary hardware and software elements which facilitate the development of specific DSS. In the case of a VTS, this fundamental level of information technology includes microprocessors, computer languages, graphical display terminals, input devices such as keyboards or radar, and communication equipment such as microwave relays, etc.

DSS/VTS Components and General Operation

The NOLA-VTS utilizes a VHF-FM communication network, which is continuously manned by U.S. Coast Guard personnel at the Vessel Traffic Center (VTC) in New Orleans. The VTC processes and disseminates information received from participating vessels operating in the VTS area. Before entering or getting under way in the NOLA-VTS area, which represents 360 miles of navigable waterway, the pilot of a vessel radios to the VTC his position, destination and estimated time of arrival, plus other data such as type of cargo if hazardous.

This information is input to a computer simulation program, which tracks the vessel by dead-reckoning (updates vessel position as a function of direction and speed of movement) and registers it as a "blip" on the VTC display terminals. These terminals are similar to air traffic control displays.

The processing software was custom developed in a procedural language to simulate the movement of vessel traffic. A series of VHF-FM transceiver stations are positioned along the Mississippi River, and micro-wave relays beam transmissions to and from the VTC via antennas.

User-System Interface

Watching their consoles, Coast Guard personnel at the VTC provide vessel navigators with the information represented by the blips on the scopes relevant to developing situations and the proximity of other vessels. Displayed on each console on command, the following details are conveyed on request by radio to participating vessels: the name, type, cargo, and mile mark of overtaking or meeting point for each vessel that the participant in the VTS will encounter as they make headway to their destination (U.S. Coast Guard, 1985).

This information is utilized by the vessel operators in making decisions as to the proper navigation strategy in plying the lower Mississippi River. Vessel pilots have an extensive knowledge base of this area which allows them to effectively use the information provided by the VTS. Perrow (1984) describes the detailed decision processes involved for marine carriers to safely navigate inland waterways.

Decision Making with VTS Support

Navigating the lower Mississippi River involves decisions which are relatively unstructured and usually relate to the passing and overtaking of vessels. These decision-making processes of vessel pilots generally cannot be described in detail before making the decision. A navigation decision may be unstructured because of its novelty, time constraints, or lack of knowledge.

Decisions on how to pass (face-to-face meeting of vessels) or overtake (one vessel passes another going in the same direction) are usually quickly reached but gradually implemented due to the slowness of large ships and barge tows to react to decisions to change course and/or speed. These decisions have very permanent effects with severe consequences if they are not made in the best fashion. Poor decisions cannot be reversed quickly because of the nature of vessel steerage and propulsion and may result in a serious accident. Such accidents can result in significant dollar losses as well as deaths. According to Carpenter (1988) and based on historic casualty records for the Port of New Orleans, the average cost of each VTS preventable casualty is estimated at $545,000.

The decision support offered by a VTS is the central collection and broadcast of traffic and related information. This reduces the uncertainty about other vessels' positions as well as their intentions. Advanced warning of critical or hazardous areas is also included in this central distribution of information by the VTS. From this more accurate and complete information, vessel pilots are better able to make decisions about when and where to pass or overtake other watercraft.

Methodology and Variable Selection

A DSS is designed to enhance the effectiveness of decision making. If utilization of the DSS can be associated with the desired changes in the criterion variable, such as the decreased frequency of accidents, then decision making has likely been improved through increased use of the DSS. The measurement of a "forward linkage" between DSS utilization (measured as continuous scales) and enterprise level performance provide a new approach to DSS evaluation. Field studies are sparse in DSS utilization research because of the difficulty of controlling system usage in an actual organizational setting. Regression analysis was selected as the most appropriate technique for constructing models of the factors, including DSS utilization, which contribute to the changes in the performance criterion, namely vessel accident frequency. The methodological approach taken was to incorporate variables in the regression equation which would account for all possible sources of variation in the performance measure and identify those factors which contributed at a statistically significant level to changes in the criterion.

Criterion Variable

The NOLA-VTS audits shipping accidents that occur in its operating area and records them on a daily log according to the following casualty types: 1) collisions; 2) rammings; 3) grounding; and, 4) barge breakaways. A collision is defined as any contact between vessels which are underway, anchored, moored, or in the process of docking or undocking. A ramming is the collision of a vessel with a fixed object such as a wharf, dock, pier, bridge, submerged object, or aid to navigation. Groundings are vessel contacts with the river bottom, and may or may not result in damage to the vessel. A barge breakaway is the slipping of a barge (or barges) free of its mooring. For purposes of this study, all categories of accidents are aggregated as they should respond in a similar fashion to external factors.

The NOLA-VTS statistics used in this research span more than two and a half years and constitute two time series of equal length (68 weeks each). The first time series extends from late March of 1983 until mid-July of 1984. The second time series commences in mid-July of 1984 and ends in August of 1986. In addition to the strictly temporal distinction, the major differences between these series is how the utilization rates were calculated by NOLA-VTS. This distinction will be discussed in the next section of the paper. Tables 1a and 1b list various descriptive statistics about the criterion and explanatory variables used in the respective regression equations. All statistics in the Tables are weekly figures. Accidents include collisions, rammings, groundings and barge breakaways.

Table 1a. Descriptive Statistics - Time Series A (March 1983 - July 1984)

	Accidents	System Utilization (Percent)	River Stage (Feet)	Traffic (Vessels)
Mean	9.53	53	9.45	432
S.D.	6.39	4	5.14	88
Min.	1.00	45	2.44	307
Max.	27.00	66	17.21	621

System utilization is the number of actual DSS users as a percentage of total potential users.

Table 1b. Descriptive Statistics - Time Series B (July 1984 - August 1986)

	Accidents	System Utilization (Percent)	River Stage (Feet)	Movements (Vessels)
Mean	5.71	34	7.15	1,775
S.D.	4.34	4	4.00	202
Minimum	0.00	26	2.20	1,300
Maximum	18.00	42	15.70	2,144

System utilization is the number of DSS-supported vessel movements as a percentage of total movements.

Source: U.S. Coast Guard and U.S. Army Corps of Engineers, New Orleans, LA.

Explanatory Variables

Five general categories of explanatory variables were identified: 1) river stage; 2) traffic level or vessel movements; 3) system utilization calculated by two different formulas; 4) length of system use; and, 5) weather.

River Stage - The stage of the river (height above sea level measured in feet) is a very critical element of vessel safety, because river stage directly determines the velocity of the current. The hazardous conditions that often accompany the changes in the river stage (hence, river current) precipitate many vessel casualties on the lower Mississippi River between Baton Rouge and the Gulf of Mexico.

Traffic Level - According to maritime authorities, traffic level is another major element influencing the occurrence of accidents in the study area. Weekly measures of traffic volume include ocean-going ships, barge tow assemblies, tugs, as well as excursion craft. Weekly observations on traffic levels were constructed by aggregating the daily peak traffic load on the lower Mississippi River. This measure of marine activity was employed in the first time series only.

Vessel Movements[1] - In the second time series, traffic level was replaced with the number of vessel movements. This variable represents the number of transactions the could be supported by the VTS rather than just the number of vessels. Weekly movements were significantly greater than the number of vessels by a factor of four (see Tables 1a and 1b). NOLA-VTS reasoned that the number of movements was a better representation of the DSS' potential load than just the number of possible individual users (i.e., vessels). A single vessel could make several transits per day through the VTS area. Vessel movements or transits is equivalent to the number of transactions which a DSS might support.

System Utilization - In the initial time series, system utilization is defined as the percentage of total vessel traffic that is communicating with the VTC. This variable was constructed by averaging the daily utilization figures to provide a weekly estimate. The U.S. Coast Guard calculates the level of utilization for the New Orleans VTS at the hour of peak daily traffic.

In the second time series, the system utilization variable is defined as the percentage of total vessel movements for the week which were VTS-supported. As shown in Tables 1a and 1b, the average utilization dropped from 53 percent to 34 percent when the formula was changed to

incorporate vessel movements as the indicator of shipping activity. However, the average traffic level increased from 432 vessels to 1775 movements when the utilization formula was modified. Thus, 34 percent of 1,775, or 604 movements, gave a more representative estimate of actual VTS support per week than 53 percent of 432, or 229 vessels.

Length of System Use - Trend variables can be employed in statistical models to measure the dynamic impact on the criterion variable resulting from the introduction of DSS technology. In this modeling effort, a trend effect represents the impact of the NOLA-VTS on navigational safety over time, to the degree that it is independent of other factors. Both linear and curvilinear forms of trend inclusion were evaluated.

Weather - Meteorological conditions that are hazardous to navigation in the study area are those which produce strong winds, heavy rainfall, and fog. Indicator variables were constructed to model these seasonal weather patterns which affect navigational safety on the lower Mississippi River.

Results

Time series regression models were constructed and evaluated to determine the "forward linkage" between utilization of the DSS/VTS technology and enterprise performance as measured by changes in vessel accidents. Explanatory variables incorporated in these two equations include measures of river traffic or vessel movements, system utilization, river stage (a proxy for river current), length of system use, and weather indicators.

These two evaluation models were based on 136 continuous weeks of DSS operating data extending from March 1983 through August of 1986. The specification of these regression models differed only in how their respective utilization variable was defined. In the first equation, DSS utilization was formulated as the number of actual users as a percentage of total potential users. In the second equation, DSS utilization was calculated as the number of DSS-supported vessel movements as a percentage of total movements in the VTS area.

Time Series A - Utilization Based on User Participation

The best model for the initial time series which incorporated weekly data from March 1983 through July 1984 (68 uninterrupted weeks of NOLA-VTS operation) explained 65 percent of the variation in the performance criterion

(see Table 2a). The overall fit of the regression function, as given by the F-statistic's high level of statistical significance, was quite good. The utilization variable was not statistically significant, and therefore the "forward linkage" between system utilization and the performance criterion was not supported by this correlation technique.

Table 2a. Regression Model - Time Series A

Explanatory Variables	Coefficients
Constant	-8.8548724
Length of Use	-0.0755380 *
Traffic	0.0351033
Utilization	0.1672756
River Stage	-1.8374575 **
River Stage^2	0.1338374
Dec - Jan	-2.4891488
Feb - Mar	-0.8919372
Apr - May	-1.8000739
Oct - Nov	-2.0785336
R-Squared	.648807
D-W Stat	2.492241
D.F.	58
F - Ratio	11.90569 **

** 1 percent level of significance
* 5 percent level of significance

Note: River Stage^2 indicates a quadratic term.

System utilization is the number of actual DSS users as a percentage of total potential users.

The following section will describe and interpret each explanatory variable which was statistically significant.

Independent Variables

Traffic Level - According to the regression, river traffic had a statistically significant (at the five percent level) effect on the level of vessel accidents. For every ten unit increase in vessel traffic, the model predicted a one-third unit increase in accidents per week.

River Stage - The initial regression model included a proxy variable for speed of river current, namely river stage, with quadratic effect. Differentiation of the

river stage portion of the model, which was significant at the one percent level, indicates that marine accidents began to decrease when the river stage reached about four feet.

Time Series B - Utilization Based on Transactions Supported

The best model for the second time series which incorporated weekly data from July 1984 through August 1986 (68 uninterrupted weeks of NOLA-VTS operation) explained 76 percent of the variation in the performance criterion (see Table 2b). The overall fit of the regression function, as given by the F-statistic's high level of statistical significance, was quite good. As in the initial regression equation, the utilization variable was not statistically significant, and therefore the "forward linkage" between system utilization and the performance criterion was not supported by this correlation analysis.

Table 2b. Regression Model - Time Series B

Explanatory Variables	Coefficients
Constant	0.3533241
Length of Use	-0.0082453
Movements	-0.0009519
Utilization	0.1612445
River Stage$_2$	-0.7687980**
River Stage	0.0893538**
Dec - Jan	4.1869262**
Feb - Mar	2.6415139
Apr - May	1.7298637
Oct - Nov	1.3081828
R-Squared	.761909
D-W Stat	1.520688
D.F.	58
F - Ratio	20.62275**

** 1 percent level of significance
* 5 percent level of significance

Note: River Stage^2 indicates a quadratic term.

System utilization is the number of DSS-supported vessel movements as a percentage of total movements.

The following section of the paper will describe and interpret each explanatory variable which was statistically significant in the second regression.

Independent Variables

River Stage - The second regression model included a proxy variable for speed of river current, namely river stage, with quadratic effect. Differentiation of the river stage portion of the model, which was significant at the one percent level, indicates that marine accidents began to decrease when the river stage reached just over four feet.

Weather - The weather indicator variable for December-January was statistically significant at the one percent level. The coefficient for this weather indicator suggests that four additional accidents would be expected to occur during December and January for reasons of weather.

Discussion

The utilization formula based on the percentage of DSS-supported transactions (i.e., supported vessel movements) provided a more representative estimate of VTS coverage. It included a more accurate estimate of actual DSS support than a percentage of user participation. However, neither regression equation estimated a statistically significant relation or "forward linkage" between changes in DSS/VTS utilization and enterprise performance.

Timing of DSS Evaluations

There are a number of plausible explanations for these empirical findings that do not necessarily suggest an ineffective or non-performing DSS. The nearly three years covered in this analysis were not the initial implementation period. Rather, the time series extending from March 1983 through August of 1986 incorporated the sixth, seventh, and eighth years of operation. At this stage in the NOLA-VTS life cycle, it may have reached a steady state of operation when continuous changes in the utilization rate might have no significant impact on the performance criterion of vessel accidents (i.e., marginal benefit from incremental changes in utilization is greater in initial period of DSS operation).

Recent research findings indicate that, after a DSS has been successfully implemented, the presence or absence of DSS has more impact on performance (Le Blanc, 1990). In other words, a dichotomous utilization variable may

have a "forward linkage" with enterprise performance at a later stage in a DSS life cycle; and, there may be other kinds of "forward linkages," such as between a continuous measure of utilization and performance, at other (initial) periods of the DSS life cycle.

For the NOLA-VTS, a "forward linkage" between utilization and performance has been established for an initial implementation period from April 1979 to March 1982 (Le Blanc, 1986). A ten percent increase in DSS utilization rate was associated with a .5 unit reduction in the weekly number of vessel casualties. The level of statistical significance for the utilization rate variable indicated that this effect of system usage on the measure of DSS performance (i.e., forward linkage) had only a five percent chance of being a random phenomena.

Measurement Problems in DSS Field Research

Since the NOLA-VTS is a voluntary system, it does offer the chance to study utilization measured as a continuous variable. DSS which have mandatory utilization do not usually present this opportunity. Furthermore, it may be difficult to operationalize a continuous utilization variable in an experimental laboratory setting.

In a field setting, it is difficult to measure the impact of the presence or absence of DSS support. Such a research design would suggest denying support to either an experimental or control group for a period of time in a longitudinal investigation. It is much easier to measure a utilization variable in a dichotomous fashion within a laboratory research environment.

Other difficulties with field research in DSS utilization is that utilization formulas can be changed, thereby making it difficult to investigate a continuous and uninterrupted time series with the same method of calculating this variable. (From 1979 through 1988, NOLA-VTS defined utilization in three different ways.) This practice limits the sample size and affects the quality of inferential statistics.

From an analytical standpoint, it is unfortunate that NOLA-VTS did not simultaneously measure utilization in the two ways described herein. However, the two time series investigated in this analysis were continuous and uninterrupted. Even though NOLA-VTS had calculated a "participation" since April 1979, they did not monitor and record utilization figures until this DSS had been in operation for about 18 months. Recording utilization was an afterthought to justify this DSS rather than an intentional strategy as part of a post-implementation review or evaluation.

Conclusions

A DSS is designed to enhance the effectiveness of decision making. If the rate of DSS utilization can be associated with the desired changes in the criterion variable, such as the decreased frequency of accidents, then decision making and the resulting performance (i.e., the "forward linkage") has likely been improved through increased use of the DSS. As suggested by this research and related studies, the "forward linkage" may have to be estimated in different ways depending on the stage of the DSS life cycle.

During initial implementation of a DSS, utilization and performance could be correlated, with DSS usage measured as a continuous variable. And at other times, possibly at a steady state in later years of operation, utilization might be more appropriately operationalized as the presence or absence of DSS support. In other words, the "forward linkage" between utilization and enterprise performance may vary over time, and DSS evaluation approaches based on utilization measures should take this into account.

DSS developers should pay particular attention to the exhibited relationship between DSS utilization and the performance criteria - the "forward linkage." In the performance appraisal of DSS, the correlation between objective measures of system utilization and objective measures of performance would clearly establish the linkage between IT and DSS effectiveness.

Future research designs to evaluate the effectiveness of a DSS should relate objective and quantitative measures of DSS usage with objective performance criteria. Objective measures of performance, when associated with DSS utilization, are superior to subjective measures of user "happiness" or satisfaction. This correlation, known as the "forward linkage," relates the usage of the DSS technology and organizational performance. Utilization of the IT alone is not sufficient to document an effective DSS. Establishing the linkage between DSS utilization and performance is a preferred approach to DSS evaluation. To effectively implement such evaluation programs, DSS builders must plan to employ this approach at the onset of the development effort rather than as an afterthought.

Endnotes

1. In the middle of July 1983, NOLA-VTS intentionally changed the method for calculating utilization rate from a formula based on user participation to a calculation based on VTS-supported movements. Average user participation rates had dropped nearly 25 percentage points (from over 75 percent to about 50 percent) in the three years from April 1979 to July 1982 (Le Blanc, 1986). (The NOLA-VTS began operation in September of 1977, but it did not monitor and record user participation rates until April of 1979).

   Of the major U.S. VTS installations (Houston, San Franciso, Puget Sound, New York, etc.), only NOLA-VTS was a voluntary marine DSS (U.S. General Accounting Office, 1988). This change in the utilization formula was modified in order to possibly show a higher participation rate on the part of vessels in the NOLA-VTS area. A higher utilization rate was desired in order to show NOLA-VTS more favorably when it was compared to other VTS operations which had mandatory participation (i.e., 100 percent utilization).

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Determinants of Small Volume Trucking Rates

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1. INTRODUCTION

Increasing interest in Just-in-Time production scheduling has lead to the consideration and implementation of much smaller inventory levels in various industries. Such a strategy is particularly appealing to firms using small high value components since parts may be transported quickly and large reductions in inventory holding costs are likely to offset increased shipping expenses. The interaction between the usual freight rate structure and inventory decisions is well known (e.g. Roy and Delorme, 1989 and Arcelus and Rowcroft, 1990a). However, the adoption of JIT programs may cause manufacturers to place special demands on carriers. (See, for example Bagchi, *et al.* 1987 and Lieb and Millen, 1990.) In particular, interest in reducing order size focuses attention on freight rates for small shipments such as less-than-truckload (LTL) and, ultimately, small parcel rates (SPR).

In an earlier paper (Arcelus and Rowcroft, 1990) the authors showed that small volume rates did not necessarily reflect a simple "scaling down" of large volume charges. Thus a firm which decreased its inventory order size without considering the full implications for transportation could find its expected savings eroded by disproportionate increases in shipping costs. As part of that analysis it was shown that small parcel rates from one maritime destination to four major Canadian centres could be represented by a simple double logarithmic relationship between shipping price and package weight. Different destinations were recognised by an intercept term which was an increasing function of distance. Such a characterisation is potentially useful for modelling inventory-transportation problems. Therefore the present paper presents an examination of the relationship between rate, package weight and distance for routes throughout Canada and for weights up to 500lb., the limit on the LTL category in the "freight all kinds" schedule.

Discussion with a small package carrier produced the assertion that rates were set in part to reflect market

conditions on a particular route. Since the extensive implementation of JIT methods could have significant impact on the demand for services, it is of interest to consider the sensitivity of small volume rates to changes in demand. In the second part of this paper we examine the major determinants of the rates, and the possible form of a "demand curve" for small volume shipments.

The paper is organised as follows. In section two the small volume rate data is described and a model of the rate schedules is constructed. From this model we derive a price index which represents the cost of shipments of all sizes on each route. This index is computed for twenty-two origins and ten destination areas in Section 3. Hence we attempt to explain the variation in the index for different routes in terms of distance and traffic volume variables. The results of the analysis are discussed in Section 4, and tentative implications are suggested for the development of the market for small volume freight. A conclusions section completes the paper.

2. SMALL VOLUME RATE STRUCTURE

The analysis was performed using the CANPAR tariff for September 1990 for packages from 1lb to 500lb. each. This tariff is divided into eleven schedules or "zones" and each route is assigned to a zone based on the postal codes of its end points. Thus a 50lb. package sent from anywhere in Nova Scotia to Montreal (postal code H) costs $14.34 (zone 5) whereas the same package sent to Winnipeg (postal code R2) would be classified as zone 7 and billed at $17.04. Examples of the schedules for different zones are illustrated in Figure 1.

Previous estimation on small parcel rates up to 75lb. (Arcelus and Rowcroft, 1990) suggests that the schedules may be represented by equations of the following form:

$$\ln(R) = a_i + b_i \ln (W) \qquad (1)$$

where R is the cost in cents per package to send a package of weight W lbs on a route classified as zone i. Separate estimation of each equation using the CANPAR data yields a good fit, but one which is substantially improved by omitting package weights under 10 lbs. It seems plausible that the carriage of such very light items may be subject to direct competition from mail and courier services to an extent which heavier shipments are not. Therefore the data was restricted to values of W between 10 and 500.

The revised data set supports the form of equation (1) very well with all r^2 values above 0.98. Typical log data are shown in Figure 2. It is apparent from the figure and

from examining the values of the b_i that the schedules are close to parallel in this functional form. Hence the equations in (1) were re-estimated jointly with the restriction of a common value for b. Thus the whole schedule for a particular zone i may be represented by the value of a_i, or in non-logarithmic form by P_i where:

$$P_i = R\ W^{-b} \qquad (2)$$

The values for b and for P_i for each zone are shown in Table 1.

TABLE 1: Price Indices by Zone

variable	parameter estimate	standard error	T for H_o: parameter=0	Prob>|T|
b	0.6033	0.0014	428.41	0.0001

zone	1	2	3	4	5	6
P_i	61.02	54.60	52.26	169.63	199.74	223.24

zone	7	8	9	10	11
P_i	216.53	217.36	273.44	308.18	383.70

While the zone numbers are approximately related to route distance, it is apparent that the price index is not a simple function of the zone. However, the ability to characterise each schedule of rates by a single value of P_i means that we can explore the variation between schedules using conventional regression techniques. In the next section we turn to a consideration of the relationship between P_i and the routes to which it applies.

3. MODELLING THE PRICE INDEX

Data on the volume of shipments between different locations in Canada was taken from the Statistics Canada survey of for-hire trucking [1985]. While this survey includes all shipments, it was hypothesised that small volume shipments were approximately the same proportion of total shipments on each route. Thus the various measures of shipping volume provided a suitable indicator of the relative quantity of small shipments on each route.

Data were extracted on 22 cities in Canada, giving

shipment volume by number, revenue and tonnage to each of the ten provinces, and the average distance shipped for each province. In addition, the same data for return shipments from each province to the cities was recorded. The return data was included to gauge the availability of return shipments which it was suggested might influence the rate schedule for outbound shipments. Average distance provided a direct proxy for variable cost. It was also compared with the "standard road distance" obtained from a road atlas as follows: starting from the city of origin, the distances to the major centres in the destination province were determined. The standard road distance was the major centre distance closest to the average shipment distance given by the survey. While subject to several shortcomings it was hoped that this comparison might serve as an indicator of the degree to which shipments on a particular route were dispersed to smaller communities, at increased cost.

A major difficulty with using data of this kind for modelling rather than simple prediction is that, as they stand, the variables are highly correlated with each other. Therefore any estimates of their relative contribution to the variation of P_i would be highly unreliable. Thus a sequence of experiments was performed to find a functional form which explained much of the variation in the schedule index while keeping the entries in the correlation matrix as low as possible. The results of this process are reported in Table 2.

Once estimated the particular form of the model may be simplified to yield:

$$P_i = \beta_0 + (\beta_1+2\beta_2)\ln(avd) + \beta_2\ln(nr) + \beta_3(west) \quad (3)$$

The model appears to be a good fit to the data and generates coefficients which are highly significant and of the expected sign. Thus the price index increases with route distance reflecting increasing cost. A larger volume of traffic on the return route will, *ceteris paribus*, reduce the value of P_i, which supports the contention that the probability of a return load influences the outbound rate. The cheaper rates into the west may reflect the economies which result from the greater concentration of destinations around one or two large centres in the western provinces. However there is little in the data set to confirm or refute this conjecture.

Perhaps the most notable feature of this model is the absence of a volume variable for outbound shipments. As might be expected, outward and return volumes are highly

TABLE 2: Regression of Price Index on Survey Data
Model 1

Fitted Equation:

$$P_i = \beta_0 + \beta_1 \ln(avd) + \beta_2 \ln(nr*avd^2) + \beta_3(west)$$

where:

avd	=	average shipment distance
nr	=	number of shipments on return route
west	=	dummy which takes on the value 1 if the shipment is destined west of Ontario and is 0 otherwise.

Regression Results: Adjusted $R^2 = 0.84$

variable	parameter estimate	standard error	T for H_0: parameter=0	Prob>|T|
β_0	-202.3618	41.4701	-4.880	0.0001
β_1	102.1750	3.3302	30.681	0.0001
β_2	-13.5327	1.4594	-9.273	0.0001
β_3	-78.3531	6.2652	-12.506	0.0001

Correlation Coefficients

	P_i	ln(avd)	ln(nr*avd²)	west
P_i	1	0.7846	-0.2997	-0.2731
ln(avd)		1	0.0403	0.1634
ln(nr*avd²)			1	0.2068

correlated with each other. However standard stepwise techniques, as well as more heuristic approaches consistently picked nr as the preferred variable. From this point of view it appears that there is no demand curve in the usual sense connecting price with quantity shipped. In an effort to detect such a relationship, the model was re-estimated using a variety of forms but insisting on the inclusion of a measure of outbound volume. The results are reported in Table 3.

TABLE 3: Regression of Price Index on Survey Data
Model 2

Fitted Equation:

$$P_i = \beta_0 + \beta_1\ 1/(avd) + \beta_2\ 1/n + \beta_3\ rn + \beta_4(west)$$

where:

avd	=	average shipment distance
n	=	number of shipments on outbound route
rn	=	(average dist. - standard dist.)/avd
west	=	dummy which takes on the value 1 if the shipment is destined west of Ontario and is 0 otherwise.

Regression Results: Adjusted $R^2 = 0.64$

variable	parameter estimate	standard error	T for H_0: parameter=0	Prob>|T|
β_0	305.7120	7.8124	39.132	0.0001
β_1	-67343	4081.8143	-16.498	0.0001
β_2	2014.4542	456.8847	4.409	0.0001
β_3	7.73632	2.2675	3.247	0.0014
β_4	-79.1247	9.3146	-8.495	0.0001

Correlation Coefficients

	P_i	1/avd	1/n	rn	west
P_i	1	-0.6746	0.3344	0.0957	-0.2731
1/avd		1	-0.1592	0.0447	0.1427
1/n			1	0.0073	-0.0982
rn				1	0.0250

The proportion of the variation in P_i which is explained by the model is reduced although all coefficients are highly significant as before, and in the original estimated form the signs are as expected. An increase in average distance serves to increase P_i, which is inversely

related to the volume of shipments, n. An increase in rn implies a greater distribution outside major centres at the destination and therefore may be expected to increase P_i.

However, once estimated the particular form of the model may be simplified by using the definition of rn:

$$P_i = \beta_0 + \beta_3 + \beta_1/avd + (\beta_2 - \beta_3 * st.\ dist)/n + \beta_4(west) \quad (4)$$

Here the coefficient of n continues to have the expected sign provided $\beta_2 > \beta_3$*standard distance. Rather than evaluate this directly, we report the implied own price elasticity of demand for shipments, ϵ_D. Since ϵ_D is dimensionless it may be calculated from n as long as the original assumption that small shipments are a fixed proportion of total shipments remains valid. Typical values of ϵ_D are shown in Figure 3 and sample demand curves for shipments over different distances are depicted in Figure 4. No numeric scale is shown on the horizontal axis since n is treated as an index of the number of small volume shipments.

The demand curves in Figure 4 are drawn on the usual assumption that the only variables which change are quantity (outbound) and P_i. Both the curves and the elasticity data confirm the findings from model 1 that outbound quantity appears to have very little influence on the overall level of the relevant rate schedule, P_i. The implications of these results are discussed in the next section.

4. IMPLICATIONS

Within the limitations of the data set, certain tentative conclusions can be drawn from the analysis at this stage. Firstly, the parameterization of the small volume schedules for each zone seems to be well supported. Thus we are able to place some reliance upon our ability to capture price variation by means of the single index, P_i. Secondly, it appears that rate setting in this market is almost entirely cost driven. The most useful explanatory variables are those which relate directly to the cost of shipping, namely the length of the route and the ease of obtaining a backhaul load. Even when the number of outbound shipments is forced into the model at the expense of some explanatory power, the influence of quantity on price is small as shown by the inelasticity of the estimated demand curves in Figure 4.

The apparent insensitivity of small volume rates to changes in demand is of especial interest to the firm contemplating a JIT strategy and to the carriers who may provide the appropriate shipping services. It suggests that the firm can plan on facing a set of rate schedules which

are likely to be stable relative to the prices of other goods and services, at least in the short run. On the other hand the apparent cost based nature of the rates makes generalisations about the nature of demand somewhat precarious. The slight negative slope of the "demand curve" in Figure 4 may in fact represent very modest economies of size on the supply side.

Figure 4 may be interpreted as a very inelastic demand curve or as the effect of increasing volume on per unit shipping costs. In either case there is little to suggest that the rates have been set optimally with regard to the market being served. It is a commonplace of microeconomics that a seller does not maximise profit where demand is inelastic, and it would be extraordinary to do so by ignoring demand elasticity altogether. With the increasing emphasis on smaller shipments arising from JIT there is a growing importance to responding to changing market conditions in the small volume market. Such a response requires a degree of sensitivity to different market conditions which is not apparent from the data examined here.

5. CONCLUSIONS

Two results of interest emerge from the analysis. The first is the ability to represent a set of small volume rate schedules by a single scalar parameter. This extends the conjecture of an earlier paper (Arcelus and Rowcroft, 1990) based on small packet rates between Moncton, N.B., Canada and four major Canadian Cities to a larger range of LTL rates for routes across the whole country.

Secondly it appears from attempts to model this price index that the index applicable to a particular route is very insensitive to the volume of business on that route, although it depends heavily on cost related variables. This suggests either that the demand for small volume shipping services is very inelastic or that rates are set without close consideration of the market demand prevailing on the relevant route. In part these results may reflect the reluctance of carriers to engage the JIT market which was noted by Lieb and Millen [1990]. They emphasise the need for a reconsideration of carrier strategy in this market, a need which will become more acute with the growing number of proponents of just-in-time production and inventory scheduling.

The second set of results should be treated with care since they are dependent on the representation of the number of small volume shipments by total shipments of eight years earlier. To the extent that relative volumes for different routes and different sizes of shipment are reasonably stable

over time, the analysis and conclusions are valid. However, if changing business activity including new inventory practices have already had an uneven effect on small volume shipping the results may be compromised. Given the derivation of a reliable price index, further examination of more recent freight volume data appears to be a worthwhile subject for further research.

ACKNOWLEDGEMENTS

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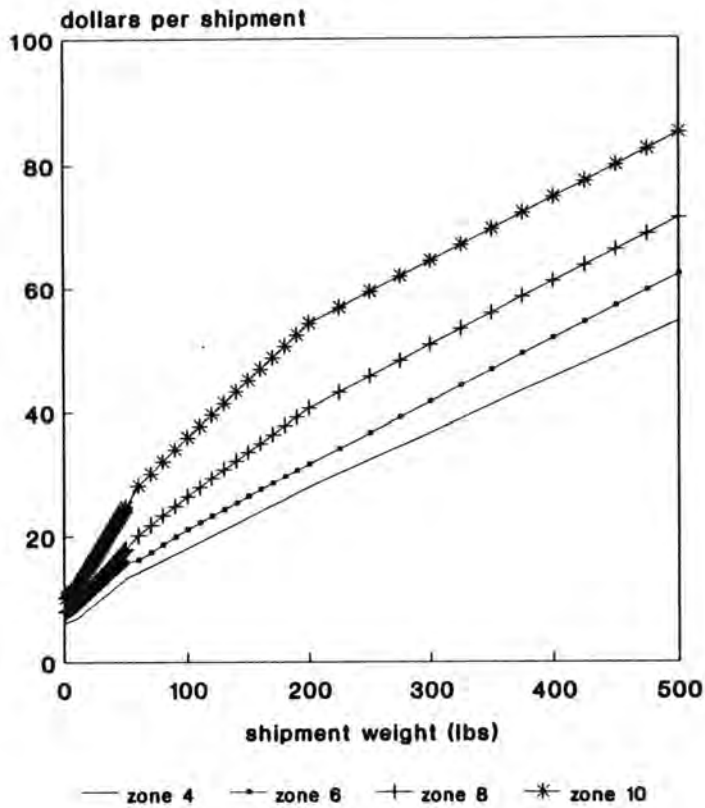
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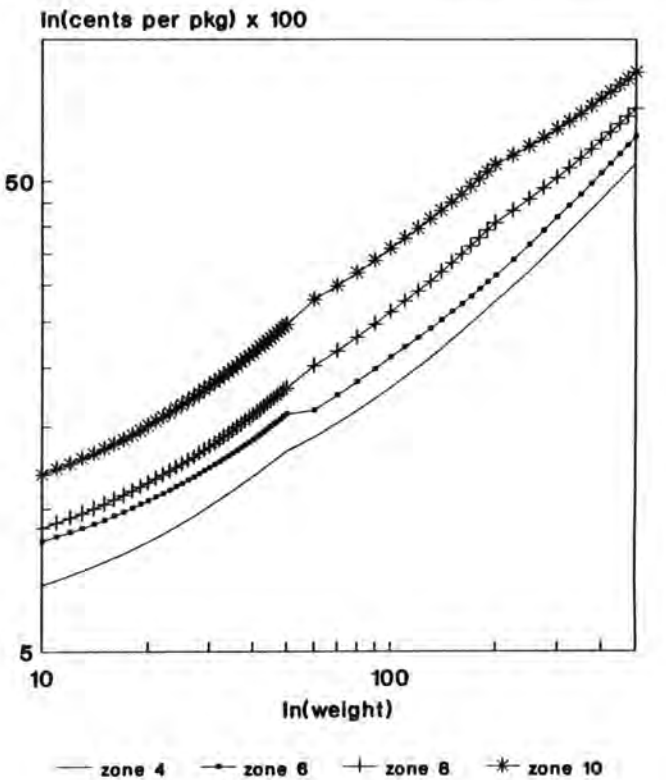
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FIGURE 1: CANPAR RATES BY ZONE



September 1990

FIGURE 2: LOG RATES BY ZONE



September 1990

FIGURE 3: ELASTICITY OF DEMAND

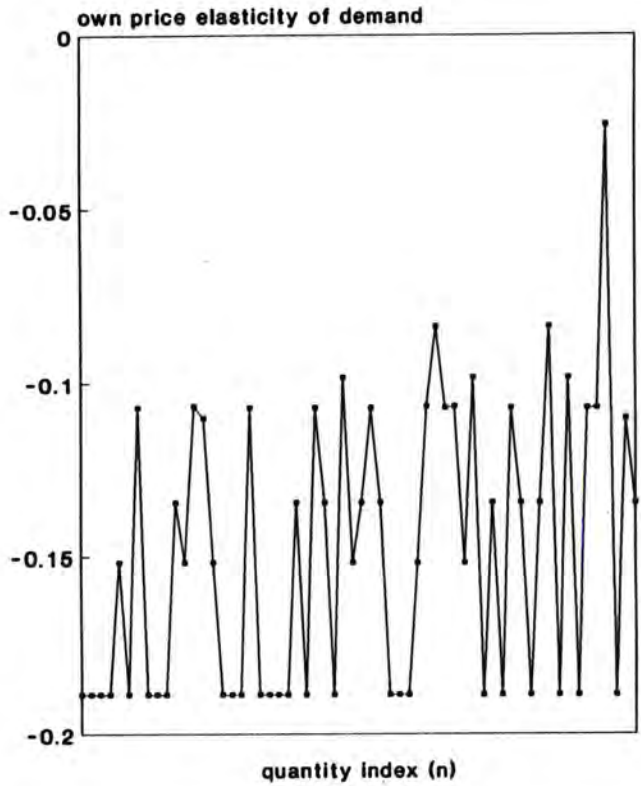


FIGURE 4A: 1000 - 1500 KM

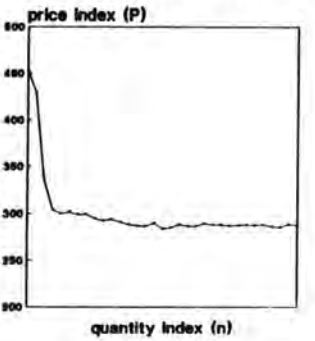


FIGURE 4B: 2000 to 2500 km



FIGURE 4: "DEMAND" CURVES

FIGURE 4C: 3000 - 4000 km



THE POOL CAR INDUSTRY - AN UPDATE

Introduction

The objective of this paper is to examine one specific aspect of the domestic freight forwarding industry, namely the pool car operator industry. Seldom engaging the attention of the public, or indeed transportation professionals, the freight forwarding industry performs an important role in the provision of inter-city freight transportation in Canada. This paper is intended to contribute to an understanding of the pool car industry in Canada and its commercial and competitive relationships within the transportation industry in the following contexts:

- definitional aspects;
- past attention in the literature;
- historical development;
- industry profile;
- regulatory environment; and,
- current situation.

Definitional Aspects

Virtually every author who has approached the subject of freight forwarding has addressed the problem of defining the activities of the freight forwarder. Sandra Wing, in her 1984 paper presented to the Canadian Transportation Research Forum, cites some of the main characteristics of the forwarder that are most helpful in defining their activities:

- the freight forwarder offers a service to the public, that is, the service is for public hire;
- the freight forwarder consolidates small shipments as part of the transportation service being rendered;
- the freight forwarder assumes responsibility for the shipment but does not assume liability for the shipment and this distinguishes the forwarder from the carrier; and,

- the forwarder has multi-modal options which can include road or rail services for the shipment of the traffic.

For the present purpose, the domestic surface freight forwarder is defined as a pool car operator, an organization which assembles less than carload (LCL) freight shipments at a central location for consolidation into rail carload lots. This is accomplished either by the delivery of the shipments by the consignor to the consolidation point, or by local trucking firms hired by the forwarder to collect the individual shipments. Rail cars are provided on a basis negotiated with participating rail carriers. The forwarder loads the rail cars and then turns over the loaded cars back to the railway carrier. Carloads arriving at the termination of the rail linehaul operation are transferred to terminal distribution centres usually located on the main lines of the railway network. There, the rail cars are unloaded and shipments distributed by local trucking companies to the consignees. All of the services in this respect are handled by the pool car operators.

The pool car operators' market niche, and hence its revenue potential, is derived principally from the revenue spread achieved between the less than truckload (LTL) rates and the rail carload rate. The forwarder pays the negotiated carload rate to the rail carriers in addition to local trucking costs for the collection and final delivery of shipments. The income level of the pool car operator is dependent upon maximizing the spread between the less than truckload rate and the freight forwarder costs. Pool car rates are generally set at levels that minimize the difference between the LTL rates and pool car rate, without encouraging traffic attrition to the trucks. As LTL rates decrease as a result of market pressure to approach the pool car rates, these differences decrease. The cost advantage, however, of long distance rail linehaul ensures that the forwarder can maintain an economic advantage on that portion of the movement.

To maximize this difference between LTL and pool car costs, the forwarder must load railcars so as to maximize the volume advantage of the railcars and the allowable weight restrictions while minimizing the risk of shipment damage. This must all be achieved for each origin/destination pair of cities, within the constraints of the car supply available from the railway carriers and in a timely fashion to ensure prompt delivery at the

final destination within the negotiated time period. The forwarder maintains terminal facilities for both consolidation and final distribution, staffed with skilled labour able to load railcars in such a way as to maximize revenues per carload. Both are supported by competent sales and administration forces. The pool car operator can carry on its business without any ownership of motor truck or railcar equipment, except for trucks that it may own locally for pick up and delivery.

Literature

The examination of the pool car operator industry in the Canadian trade press and public policy discussion about the industry is indeed limited. This is likely due to the lack of any regularly published data on the subject and the costliness associated with any serious investigation of the industry. Unlike the US forwarders, Canadian domestic freight forwarders have eluded the hand of economic regulation and are therefore seldom the focus of public policy debates. More extensive, however, is the coverage of the international freight forwarders, particularly those making extensive use of the air mode. In these cases, special attention has been given to the documentation and liability aspects of international traffic.

Notable, however, in the context of the domestic pool car traffic are a number of papers dealing with the freight forwarding industry. At the 1978 Transportation Research Forum, Sloss and Harrington contrasted the Canadian and US domestic rail forwarding industries, particularly the regulatory regimes in both countries. Sandra Wing's research into the freight forwarding industry in Canada is the most extensive Canadian work on the subject although its focus is on the international aspects of the industry. Thus, little attention is given to the domestic forwarders using rail carriers as the principal mode. Wing's 1984 Canadian Transportation Research Forum paper is based on a more extensive report of the research undertaken at the Strategic Planning Directorate of Transport Canada.

W.D. Scott has included the role of the pool car operators in his treatment of Canadian Railway Freight Pricing in which he details the historic efforts of the rail carriers to be competitive. He describes the role of the pool car operators particularly after the rationalization of the cumbersome freight rating and classification systems and the introduction of the

Freight All Kinds (FAK) rate structure under the 1967 National Transportation Act. The reduced rate complexity allowed the rail carriers to maintain some access to the important less than carload revenues. It was the pool car industry, on the specific traffic lanes identified, that turned LCL revenues around - beneficially for the railways. Elsewhere in Canada, highway LTL service had reduced the railways' less than carload traffic, along with their mixed traffic, almost to the vanishing point.

An intriguing document prepared by the Canadian Transport Commission in 1975 studied the structure of the freight forwarding industry and examined the need for economic regulation of the forwarding industry at the federal level. This work was the first attempt at a study of the freight forwarding industry in Canada. The reporting of industries' attitudes towards regulation found during the research, indicates that attitudes toward proposed regulation have been generally consistent over the time period. That is, the regulated components of the transportation industry, namely the trucking industry, part of which was regulated and the other part desirous of being regulated, supported the proposed regulation of the forwarders while non-regulated interests discouraged government intervention.

With these limited exceptions the material in the literature pertaining to freight forwarders is considered quite sparce.

Historical Development

As early as the 1930's US railway companies recognized that in addition to the successful erosion of traditional rail freight by the trucking industry, the freight forwarders were also making noticeable incursions into traditional railway traffic. This erosion of traditional traffic marked the beginning of the demise of the railways' less than carload freight business. Railways handled less than carload freight in the following manner. Small shipments were collected, sorted, and consolidated in boxcars at railway depots by railway workers, then assigned to way-freight trains which were routed through the series of intermediate transfer stations and station stops along the individual rail lines. This service was very time consuming and very costly.

The decline in this business market began slowly as it became apparent that the trucking industry possessed a high level of flexibility in terms of

equipment assignments, physical access, timing and a different cost structure sensitive to new technology and public policy support for the infant industry. The motor transport industry was able to respond quickly to the shipper's needs, although tariff premiums could be expected for improved service. Shippers generally agreed to pay the going rates for better service; better service being defined as faster service, with less incidence of damage. In response to the trucking companies' emerging competitive position, forwarders began to capitalize on rail routes where the rail carriers had equipment imbalances necessitating the movement of empty railcars to loading positions, often in different cities. As well as loading empty boxcars, the freight forwarders utilized local motor transport carriers for the collection of shipments from the territory nearby the railside loading platforms. Thus, the freight forwarders were able to use both types of equipment in the most efficient manner to forward shipments to their final destinations.

It has been reported by Sloss and Harrington that the first pool car operator in Canada began business in 1919; the services provided then are essentially the same as today. The pool car operators were able to obtain some of the lowest available rates from the rail carriers per unit of weight; rates per unit of weight which decrease as carload weights increase. By relieving the railways of many of the costly functions related to the conventional LCL business operated through the railway system of freight sheds, the pool car operators made it possible for the railways to participate in the revenues of the LCL traffic at remunerative charges. On their own, as direct providers of LCL freight service, the railways had been beset by financial losses as costs rose and traffic, lured by the trucks, dropped off precipitously.

Scott notes that by the 1960's the pool car operators were the principal freight forwarder in Canada. He cites fast freight trains and intermodal services, in addition to the pool car services as evidence of the railways' efforts to adapt to the changing business conditions. Scott notes that between 1967 and 1972 pool car rates become more cost-oriented to meet effectively truck competition. As already noted, concurrent with the passage of the National Transportation Act of 1967 and the establishment of the FAK rates, the complex classification terms and conditions previously associated with pool car traffic were eliminated. As a result the pool car operators were able to reduce costs further. The pool car operators continue to handle LCL freight as

carload freight. It remains traffic that is largely considered pool car - truck competitive.

Industry Profile

Prior to the advent of economic regulatory reform and the enactment of the National Transportation Act, 1987, rail carriers were required to publish tariffs of rates for available services. Tariff series Canadian Freight Association (CFA) 505 and 3505 cover mixed carload freight traffic shipped by named commercial pool car operators between points in Canada. The tariff provisions came into effect July 1, 1969 and have maintained essentially the same principles through the period ending December 31, 1988.

Since January 1, 1988 confidential contracts and confidential agreed charges have replaced the regulatory requirement for the issuing of tariffs. Nevertheless, the tariffs previously published represent the best source currently available to improve understanding of the relationships of the pool car operators and the railway companies and the impact on the competitive interrelationships of domestic surface transportation services.

Ten commercial pool car operators named in the last tariff issued, effective until December 31, 1988, had established their compliance with the terms and conditions of the tariff. These companies were:

- Clarke Transport Canada Inc.
- Consolidated Fastfrate Transport Inc.
- Cottrell Forwarding Co. Ltd.
- CSR Cooperative Inc.
- SSF Distribution Inc.
- TNT Railfast Division of TNT Canada Inc.
- Transwestern Express Division of Northern Pool Express Ltd.
- Westway Forwarding Ltd.

Atlantic Express Container Division and ColeRay Forwarding Ltd. were also named in the tariff for traffic destined to the Maritime Provinces.

Since that time, Reimer has entered the fray and has established a pool car operation. Over the period of time in which the tariff has applied, the companies have been largely the same; however, there have been some exceptions.

Throughout the two decades from 1969 onward, additional pool car operators participated in the tariff. They ceased to participate at various times: Security Freightways Limited in 1970; Cooke Forwarders Limited in 1971; Gordon Forwarders Limited in 1979; Rock Island Express Limited in 1986; and, Maritime Forwarding in 1987. All of these departures were the subject of withdrawal references in the tariff. Others faded from the scene with no tariff references: H'WK Forwarding in 1972; Harkema Forwarders Limited in 1984; Interline Forwarders Limited in 1984; and, Howell Forwarding, in respect of services from Quebec and Ontario to the west, in 1985.

The conditions under which the pool car operators utilized the special rate provisions specified in the tariff provide some useful information about the operators. In general, the tariff applies to traffic originating at Montreal, the greater Toronto area, and along the Montreal/Windsor corridor, destined to western Canada, the Maritime provinces and Newfoundland. Only traffic outbound from central Canada is covered. The major traffic flow is from Ontario to western Canada.

Probably most notable of the provisions governing the contractual relationship between the pool car operators and the participating railway companies was the agreement between the operators and the Canadian Freight Association, the tariff issuing body, guaranteeing payment of a stipulated amount of revenue on traffic shipped between specific named origins and destinations.

Separate guarantees were specified for traffic along the following lanes:

- Toronto to named points in western Canada
- Montreal to named points in western Canada
- Kitchener/London to named points in western Canada
- Montreal to named points in the Maritime Provinces
- Toronto to named points in the Maritime Provinces
- Named points in Ontario and Quebec to named points in Newfoundland

Penalty for non-compliance and non-payment was the assessment of freight charges on subsequent traffic based on normal open class or commodity rates. The level of penalty was equal to the traffic guaranteed and was large enough to indicate that the pool car operators are major companies. For example, in October 1972 at the time when the guarantees were first included in the tariff, a

company having access to all railway services offered guaranteed revenues of almost $2 million for the period of one year. By 1988 a single operator involved in moving traffic in each of the designated traffic lanes would have made guarantees totalling over $9 million per year. No evidence has emerged to confirm the assessment of penalties or the incidence of failure to meet the stipulated guarantees.

Another provision specified that traffic must originate outside the railway interswitching limits and the weight of a single commodity loaded in a car from one consignor to one consignee must not exceed 50 percent of the weight of the car. The commercial pool car operator was defined in the tariff as a company engaged principally in the pooling and forwarding industry and not engaged in, nor controlled by, interests engaged in common carrier activities providing transportation between provinces in which named origins and destinations are located. Specific terms pertaining to terminal priviledges and stop-off conditions for partial unloading were included. Freight not accepted for carriage included:

> freight shipped in bulk; freight requiring protection from heat and cold or likely to contaminate or otherwise damage other articles in the car; aircraft; designated explosives under the "Regulations for the Transportation of Dangerous Commodities by Rail"; and, fresh and frozen foods.

The first issue of the subject tariff covered shipments from named points in the Toronto area only. Rates for shipments originating at Montreal were soon included in subsequent issues. The rate structure was relatively stable for several years: rates were the same from named points in Ontario and Quebec to specific destinations. Rates were expressed in cents per hundredweight specifying minimum carload weights of 25,000 lbs. in 1969. Discounts of up to 20 percent could be secured by achieving minimum weights of 43,000 lbs. and on the longest hauls, discounts of 25 percent were common. Weight exceeding the 43,000 lbs. level was subject to further rate discounts of 50 percent. The number of minimum weight categories in the tariff, each with a specific rate per hundredweight, were greater for movements to western Canada.

Generally, higher discounts were quoted for westbound traffic. By 1975, separate westbound rates from Montreal were added to the tariff which were

slightly higher that those from Toronto, ending the equal treatment of carloads originating in Toronto and Montreal. Higher minimum weight groups were added in 1975. The rate structure included rates for 50,000 lbs. minimum, and a 50 percent discount for weight in excess of this minimum. Overall loadings in excess of 50,000 lbs. resulted in a discount of about one-third from the highest rate.

The rate structure was streamlined during the 1980s. By 1986, a single rate was published for minimum loadings of 39,000 lbs. or 50,000 lbs., depending on the boxcar size. Rates assessed against loadings in excess of the minimum were subject to 75 percent discounts over the base rates.

The firms listed in the tariff are generally well-known in the transportation business. The precise business arrangements of each of their respective businesses are not generally known, nor should they be. It is possible, however, to gleen a helpful amount of information from articles and reports in the trade press. The following industry profile emerges from such a review.

Pool car operators may hire local cartage firms to collect shipments, however, the shipper can negotiate the option to deliver the goods to the consolidation facilities. It has been reported that under certain arrangements shipments delivered to the local terminal are guaranteed to be loaded into railcars and shipped out the same day. Consolidation terminals are generally large, efficient, and sophisticated facilities, including several truck unloading bays and large covered areas for the loading of a large number of boxcars simultaneously. Some companies lease warehouses directly from the railway companies at their major terminals. The operations of the pool terminals are similar in both Toronto and Montreal. Companies offer the same rates to western destinations for the pick-up of freight throughout the Toronto area, extending as far as London. It is understood that consolidation of shipments includes large tributary areas. A considerable volume of freight is believed to be trucked to Brockville from New York state for forwarding to western Canada.

Among these firms, TNT Worldwide was probably the most sophisicated and most highly integrated transportation conglomerate, with annual revenues near $5 billion. It has since closed its Canadian pool car operation and a major component of its Canadian for-hire

trucking operations. However, other companies offer exceptional transportation products and services within the national context. The important issue is that the major commercial pool car operators offer forwarding, not in isolation, but as a component of the transportation services package.

In 1970 Statistic Canada first published data for the "Freight Forwarder and Shipper Association Traffic," also referred to as "pool car traffic", a new commodity classification used for statistical reporting purposes. The data published by Statistics Canada is the only source of public information that provides a measure of the contribution of this category of traffic to total Class 1 (CN and CP) railway operations. In 1984 rail revenues from pool car traffic were $152.2 million. This represented 2.9 percent of total railway revenues for 1984. The top ten commodities by revenue accounted for 48 percent of total railway revenue generated. The freight forwarders commodity group was the seventh largest contributor to railway revenues as reported by commodity group, but ranked 32nd in terms of tonnes handled. The situation was similar in 1983 when pool car traffic ranked sixth in revenue generation for the railways at $152 million, again, and 31st in terms of tonnes handled.

In 1987 revenues for the pool car traffic reached $182 million, and ranked nineth, at 2.4 percent, in terms of total railway revenue of $7.65 billion. A total of 63,019 pool cars were loaded, representing 1.5 million tonnes loaded. In 1988 revenues for the pool car category reached $187 million, ranked tenth in terms of total railway revenue of $7.7 millions, having loaded 47,843 pool cars of some 1.4 million tonnes. Combined, the top ten commodity groups accounted for 51 percent of total revenues in 1988. The freight forwarders contributed 2.5 percent to total rail revenue and 0.75 percent to total tonnes loaded in 1988.

The Class I railway companies derived $137 per one tonne of freight handled. This revenue of $137 per tonne is considered exceptional and exceeds the levels for all of the top ten ranked rail revenue generators, by commodity classification, with the exception of commodity categories related to the automobile sector. Shipments of passenger automobiles and related parts and chassis generated greater revenues per tonne handled than the pool car operators. Nevertheless, the rail revenues from pool car operators are exceptional because the pool car operators are actually incurring costs associated

with the marketing, collection and loading of rail cars and final distribution costs. In other words, the actual cost to the railways in securing this traffic may be somewhat lower than that involved in the shipment of many other commodity groups, yet the pool car traffic is yeilding revenues among the highest obtained by the rail carriers per tonne handled.

Tonnage of "Freight Forwarder and Shipper Association Traffic" had increased by about 25 percent from 1970 to 1988; however, year to year fluctuations have been large. Most significant is the overall increase in CN's tonnage carried, combined with the reduced number of carloads loaded. CP has suffered decreases in tonnages, but strong increases in car utilization. In 1970 the average carload weight was 12.6 tonnes; in 1988 the average tonnage was 23.3 tonnes per carload. CN has achieved very strong increases by loading an average of 34.6 tonnes per carload.

Detailed origin/destination flows of pool car traffic is not published by Statistics Canada. However, in 1987 and 1988 regional origin/destination tables were published for the five largest commodity movements. These tables report the significance of the freight forwarder/pool car traffic as the largest commodity shipped on the following lanes in 1987:

- Quebec to Manitoba, Saskatchewan and Alberta - 158 tonnes representing 21 percent of total tonnage on the lane;
- Quebec to British Columbia - 75 tonnes representing 20 percent of the total tonnage on the lane;
- Ontario to Manitoba, Saskatchewan and Alberta - 593 tonnes representing 19 percent of total tonnage on the lane; and,
- Ontario to British Columbia - 295 tonnes representing 23 percent of total tonnage on the lane.

In addition, freight forwarder traffic from Quebec to the Atlantic Provinces ranked fourth at 50 tonnes or 3.7 per cent of total tonnage on the lane. Patterns and the relative significance of the traffic densities are similar for 1988.

Regulatory Environment

It was 20 years ago that the Canadian Transport Commission's International Transport Research Group began an investigation into the need for the economic regulation of the freight forwarding industry in Canada. Essentially, however, the industry remains unregulated. It has been pointed out by Sloss and Wing that the regulation pertaining to the modes of transport utilized by the forwarders has the affect of regulating the movement of freight forwarders' traffic; they, independently, it seems, conclude that the goods move within a regulated environment. This can be related in some respects to the physical environment of the move, inlcuding such matters as safety, however, the economic environment is considered to be quite free from regulation.

The CFA tariffs published and filed at the Canadian Transport Commission fufilled a reporting requirement, but did not infer, implicitly or explicitly, that the activities are or ever were regulated. Neither the pool car operators, nor the tariff specifying the terms and conditions on which the participating rail carriers handled the traffic, have ever been a subject or an issue before any hearing - file or public - of the Canadian Transport Commission or the National Transportation Agency. Neither the Commission nor the Agency has been approached on any matter related to the subject tariffs.

The contractual obligations assumed by the pool car operators in their relationships with rail carriers are a product of business negotiation - a somewhat different process than that of economic regulation. Perhaps these arrangements can be considered in the context of the railway control over the freight forwarder, by virtue of the business agreement, but it is considered incorrect to consider these obligations as exercising any degree of regulation over the forwarder.

The Canadian Transportation Commission's staff study of the early 1970s notes that the pricing actions of the pool car operators led to the lowering of the less than truckload rates in Canada. It did not find any evidence, however, to make an assessment of whether the rate reductions undermined the compensatory rate structure of the trucking industry. The extent to which the pool car operators can affect freight rate levels for traffic that is considered competitive to other modes is considered to be unknown at this time. Indeed, other

authors have pointed to the inability to assess the effectiveness with which the forwarders promote efficient modal choice. Nevertheless, some knowledge of the effectiveness of the pool car operators in facilitating and promoting an efficient and adequate national transportation system is a notable objective and likely to be quite useful and important in the future as competition stiffens. Much work, however, is required before tackling conclusions.

Current Situation

On May 1, 1987, federal investigators from the Bureau of Competition Policy of Consumer and Corporate Affairs raided the offices of seven pool car operating firms suspected of participating in an anti-competitive conspiracy. The alleged conspiracy, that is said to be contrary to the conspiracy provisions of the Competition Act, is suspected by the Bureau to have occurred over the period from February 1986 to May 1987 on forwarding services between Toronto and Thunder Bay, Winnipeg, Regina, Saskatoon, Calgary, Lethbridge, Edmonton, Kamloops, Kelowna, Prince George, Vancouver and Victoria. According to a June 15, 1987 report in the Globe and Mail, the search "warrants permitted the seizure of any pertinent records, meetings or other communications among the firms with respect to special rate notices, rate quotes and pricing policies...and materials indicating geographical or customer markets or market shares."

In September 1990, price-fixing charges, which are indictable offences, were finally laid against Clarke Transport Canada Inc., Cottrell Transport Inc., TNT Canada Inc., Consolidated Fastfrate Transport Inc., and Northern Pool Express. According to the Globe and Mail's September 26, 1990 report of the contents of the federal documents supporting the requests for warrants, the alleged price-fixing activities included agreements by the commercial pool-car operators not to undercut each other's rates for rail forwarding services and regular meetings held to discuss rates. In seeking authorization for the warrants, the federal investigator advised the granting judge that unlike other sectors of the transportation industry, the pool car operators were not subject to either federal or provincial regulation and did not have to publish rate tariffs.

The conspiracy provisions of the Competition Act are considered by some to represent the backbone of the new competition legislation. However, a Nova Scotia

Supreme Court judge has recently ruled that the conspiracy section is unconstitutional. This decision is not binding in other jurisdictions, nor is it expected to impede the progress of the Bureau of Competition Policy's case against the pool car operators charged. In fact, the authors suspect that the pool car case will go a long way to determine the power of the new Competition Act.

The compelling issue pertaining to the commercial pool car operators, freight forwarders, and indeed the transportation industry in general, is the difficulty of defining the market in which pool car operators allegedly conspired to reduce competition. The various modes of transportation and the various services offered within those broad categories have always struggled to identify their chosen market, the market which in which they can best operate, and the market in which revenues can be maximized.

Conclusions

The Canadian domestic surface freight forwarding industry, as represented in this paper by the Canadian pool car operators, is an important aspect of the inter-city transportation system in Canda because:

- it utilizes equipment otherwise believed to be moved empty or partially empty to positions for loading;
- it utilizes the economic advantages of long linehaul rail service to achieve low cost transportation;
- it utilizes a labour force which is independent from the railway craft union cost scales;
- it utilizes local truck cartage firms for collection and final delivery of shipments;
- it utilizes consolidation facilities often leased from railway companies, located within railway operating areas;
- it utilizes its negotiating position of strong potential revenue generation and improved rail car utilization to achieve the best rates and conditions from the participating railway companies;
- it generates almost $200 million in rail freight revenues per year, consistently ranking within the top ten commodities on the basis of revenue generation;
- it ships 1.5 million tonnes of freight per year from central Canada to provinces to the east and the west;

- it utilizes, as divisions or arms of fully integrated transportation companies, the best available services to suit Canadian shippers;

The pool car operators began offering service which maximized the economic advantages available to the industry and successfully carved a stop in the transportation industry. It has served a useful role in Canada. Only time will tell if, in law, there was any abuse of the market or whether the pool car operators will be able to continue in the future to operate in the same manner. The effect of any changes in their way of operating will be an important issue to follow in the future.

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BROKERAGE OF PRODUCE TRUCKING

by

Richard Beilock and Timothy Shell

ABSTRACT

The role of truck brokers in the transport of produce from Florida is examined. Brokers are used for a majority of all loads trucked from the state. Important broker services include carrier screening for shipper/receivers and the provision of cash advances for carriers. Brokerage commissions range between 10 and 12 percent of the freight rate. Two troubling aspects of brokering discussed in the study are exorbitant effective interest rates charged for cash advances and low carrier confidence in broker business ethics.

INTRODUCTION

The last major study of exempt commodity truck brokers appeared in 1979, Taff's "A Study of Truck Brokers of Agricultural Commodities Exempt from Economic Regulation." Taff found brokers to be key factors in the produce transportation/distribution system, described several aspects of broker operations, and predicted an increased role for brokers of other commodities if interstate economic regulation of transportation was relaxed. This prediction was realized. Between 1935 and the late 1970's there were fewer than 100 active Interstate Commerce Commission (ICC) licensed brokers, versus nearly 6,000 by 1988 (Brown).

It is common, though inaccurate, to refer to the past decade's interstate motor carriage regulatory reforms as "deregulation." Rather, there was a loosening, but not the elimination of regulations. That step (i.e., total deregulation) remains an option for public debate. Brokers of produce trucking remain the only significant example of brokering in the absence of economic regulation. Indeed, as produce trucking never has been regulated, it may be considered an example of conditions after long-run adjustments to deregulation. It seems appropriate, therefore, to reexamine produce truck brokering.

In this paper, the overall importance and specific practices of produce truck brokers will be examined and compared to earlier results by Taff and others. In the next section, the principal data sources for the study are briefly described. This is followed by an examination of the frequency of use of brokers for arranging loads. Included are arrangements for both produce hauls outbound from a growing area and inbound return hauls which are primarily regulated freight. Next, broker characteristics, services and the fees they charge are discussed. Then, carrier and shipper/receiver satisfaction with brokers is explored. Finally, the results are summarized and conclusions drawn.

DATA

Data for the study come from interviews with owner-operators, brokers, and shippers. In January, March, and June of 1990, interviews were conducted with 199 owner-operators who were then hauling produce from Florida. The sites for the surveys were the Florida Agricultural Inspection Stations located on U.S. I-10, I-75, and I-95. During the survey times, interviews were attempted with every owner-operator passing through the inspection stations. Refusal rates were low, normally under 10 percent at each site. For these reasons, the owner-operator sample is believed to be representative of all owner-operators serving the Florida produce industry.

At their places of business, in-depth interviews were conducted with eight truck brokers. The sample was drawn from the broker listing compiled by the National Agricultural Transportation League. Due to the small size of the sample and the absence of a systematic or random sampling approach, no claims can be made regarding the representativeness of the sample.

Telephone interviews were conducted with a sample of nine Florida produce shippers. The sample was drawn from the 1989 Blue Book. As with the broker survey, no claims can be made with regard to the representativeness of this sample.

FREQUENCY OF USE OF BROKERS

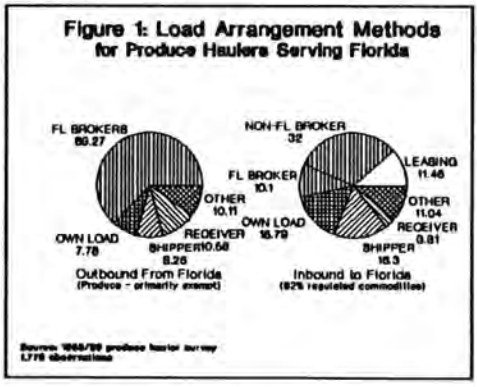
Outbound Produce Movements

The importance of brokers appears to have grown over time. Gaibler estimated truck brokers arranged 36 percent of all over-the-road produce hauls in 1959 and 51 percent in 1974. In each year of the Florida produce hauler surveys, brokers were used for between 60 and 66 percent of

the loads being hauled by the respondents at the time of the interview.

It should be stressed that the methodologies employed by Gaibler and by us differ markedly and cross-study comparisons of results may not be valid. Gaibler's estimates had the advantage of being for the entire U.S., whereas ours strictly apply only to loads originating in Florida. However, Gaibler's procedures were both complex and somewhat tenuous.[1] However, if Gaibler's approaches in 1959 and 1974 were consistent, his estimates are indicative of long-term growth in broker importance. Moreover, the Florida survey results demonstrate that today brokerage is the dominant load arrangement method for produce in the nation's second most important production state.

Across the 1982/83 - 1988/89 study period for the Florida survey, the percent of loads arranged by brokers varied over a fairly narrow range, with no apparent trend. The results for 1988/89 are typical of the entire period (leftmost chart in Figure 1). In that year, an estimated 63 percent of all produce hauled by truck from Florida were arranged through brokers. Just under a fifth of the loads were directly arranged between the carrier and either the shipper or the receiver. Eight percent of the produce hauls were private or own-account carriage. Finally, 10 percent of the loads were arranged by some other, unspecified means. For the most part, the "other" specification indicated driver ignorance of the load arrangement method, rather than a different method of arranging loads.[2]



Inbound Movements

Only about 12 percent of the carriers hauled produce both into and out of Florida. Between 75 and 80 percent of the loads carried into Florida by the outbound produce haulers are commodities subject to ICC regulation. It is not surprising, therefore, that differences exist between inbound and outbound load arrangements (compare the charts in Figure 1). The largest single difference was with regard to the use of Florida-based brokers. Over 60 percent of the outbound loads were arranged by brokers,

virtually all of which were based in Florida. In sharp contrast, only 10 percent of the inbound loads were arranged by Florida-based brokers, suggesting that produce brokers normally do not arrange return hauls. This is supported by evidence from the broker interviews. The brokers in the sample indicated that in the past season they handled over 14,400 loads from their Florida offices. Only 17 percent of these were inbound into the state, while 83 percent were outbound. Thirty-two percent of the inbound loads were arranged by non-Florida brokers.

Leasing is rarely resorted to for arranging outbound movements, but accounts for over 11 percent of inbound loads. Not surprisingly, carriers not possessing ICC Authorities were much more likely than those with ICC Authorities to resort to leasing (21 percent versus 8 percent).

Approximately 20 percent of both inbound and outbound loads were arranged by carriers directly with either shippers or receivers. For outbound loadings, direct arrangements with receivers are more common than with shippers. The opposite is the case for inbound loadings. This is thought to reflect two factors. First, it is a nearly universal practice to ship produce F.O.B., origin -- i.e., the receiver is responsible for transportation. Second, approximately three quarters of the carriers interviewed were based outside of Florida. Carriers may be more likely to deal with shipper/receivers located near their own base of operations.

BROKER CHARACTERISTICS, SERVICES, AND FEES

Characteristics

The produce truck broker's Florida operations in the sample tended to be small, but very stable. All but one broker operated in Florida out of a single office and employed 5 or fewer individuals (Table 1). Half of the brokers simultaneously maintained offices in other states and one regularly relocates operations outside Florida during the summer (Florida's low production period). The average number of years in business was 22, with only one broker being in business for less than 10 years. This result is consistent with a 1982 survey of 110 Florida brokers which found that 72 percent were in business for at least 10 years (Beilock, Stegelin, and Freeman).

Broker longevity is suggestive of the importance of reputation. Shippers (carriers) rely upon brokers both to

TABLE 1: SUMMARY OF BROKER CHARACTERISTICS

CHARACTERISTIC	MEAN RESPONSE (range)	COMMENT
Years in business	22 (1 - 36)	Only one broker in business less than 10 years.
Number of Florida locations	1.4 (1 - 4)	All but one broker had one location.
Total number of employees in Florida	8.5 (2 - 44)	All single-location brokers had five or fewer employees.
Have ICC broker's license	50% Yes 50% No	
Percent of brokered loads which are exempt	79.3% (25% - 100%)	Average of those with (without) ICC license was 64% (95%).
Number of carriers served on a regular basis	91.3 (15 - 200)	
Number of shippers served on a regular basis	106.4 (6 - 500)	All single-location brokers regularly serve 100 or fewer shippers (average 50.1).
Number of produce loads brokered in Florida per year.	2,405 (650 - 5,000)	
Average brokerage fee without advance	10% (10% - 10%)	Percent of the freight rate.
Average brokerage fee with advance	11.6% (10% - 13%)	Percent of the freight rate.
Broker also owns trucks	37% YES 63% NO	
Number of other states with offices	2.3 (0 - 9)	

'screen' carriers (shippers) and to act as financial intermediaries. An unscrupulous or inept broker can cost its clients tens of thousands of dollars on a single transaction. It follows, then, that experienced, 'known' brokers would have an advantage over entrants. This is not meant to imply there is a low rate of entry into brokerage. Indeed, conversations with industry participants indicates considerable entry. However, the failure rate appears high among these entrants and most of the survivors remain marginal for several years. In other words, there appears to be a stable 'core' of brokers in Florida which handle the large majority of brokered produce loads, and a variable 'fringe' group.

The brokers in the sample tended to specialize in exempt freight. For all but one of the brokers in the sample, exempt freight accounted for the majority of the loads arranged. Half of the brokers had ICC broker's licenses, for this group exempt freight averaged 64 percent of all hauls, compared to 95 percent for those without such licenses. The average broker in the sample served 91 carriers and 106 shipper/receivers and brokered 2,405 produce loads per year.

A minority (37 percent) of the brokers also owned trucks. Taff also found that most brokers do not own trucks. He noted that brokers often found it difficult to have in-house trucks without there being the perception that in-house trucks were favored over those of carrier-clients with regard to securing the most profitable loads. This sentiment was echoed in conversations with the authors by both brokers and carriers.

Services

Market Information

All brokers indicated that market knowledge, including access to loads and carriers, was the major service they provided to their clients (both shippers and carriers). All of the brokers had maintained extensive lists of carriers and shippers along with "short lists" of regularly used clients.

Screening carriers was viewed by all brokers as a vital facet of their knowledge. All brokers required carriers to present proof of insurance. In addition, half of the brokers visually inspect the equipment and half require carriers to provide at least two references from previous business associates. Broker assessments of the importance of screening carriers is shared by shippers. On a ten point scale (1 being unimportant and 10 being very

important), shippers were asked to gauge the importance of three aspects of service provided by brokers:

Service Aspect	Average score (1=unimportant, 10=very important)
Screening carriers	8.89
Finding transport quickly	8.67
Help negotiate claims	8.33

Clearly, all three service aspects are considered important by shippers. It is interesting, however, that screening carriers is rated on a par with, indeed somewhat higher than, quickly locating transport. Evidently, the quality of information is at least as important as its volume and timeliness.

Cash Advances

All brokers indicated they advance expense monies to carriers. About half the brokers place no restrictions on the amounts advanced. The rest have upper limits for advances, either set dollar amounts (usually $500-$600) or a percentage of the freight rate (usually about a third).

The average owner-operator interviewed indicated that he/she asked for advances for 56 percent of all produce loads. In terms of importance to them, owner-operators rated cash advances ahead of assistance with claims and assistance with securing insurance:

Service Aspect	Average score (1=unimportant, 10=very important)
Cash advances	7.1
Help with claims	6.0
Help securing insurance	4.1
Other	1.0

Taff noted some brokers felt their primarily function was as financial intermediaries. The frequent use of and importance placed on advances by owner-operators suggests this may not be much of an exaggeration.

A cash advance is, in reality, an unsecured loan covering the period from pickup until the shipper/receiver pays for the transport. Effective annual interest rates for cash advances can be staggering. As will be discussed below, brokers usually charge two percent more commission on freight rates when there are cash advances. Assuming a freight rate of $1,800, a cash advance of $600, and a loan period of two weeks; the effective annual interest rate would be 144 percent. The implications of these high rates are discussed in the final section of this paper.

Claim and Freight Rate Coverage

Unlike freight forwarders, brokers do not take direct responsibility for transport. As such, they usually do not bear responsibility for freight claims or for non-payments by shipper/receivers. However, it is common practice for brokers to involve themselves in these problems. One of the brokers interviewed, which had only been in business for one year, had never handled a load resulting in a claim. All of the remaining brokers indicated they take active roles in freight claim negotiations. The majority stated flatly that they always paid the shipper/receiver, regardless of their ability to collect compensation from carriers. As indicated above, shipper/receivers value this aspect of a broker's service (8.33 average response on a 1-to-10 scale of importance). All but one of the brokers interviewed indicated they paid carriers even if the shipper/receiver reneged on payment.

Insurance and Bookkeeping

Several brokers indicated they assisted with securing insurance and a few brokers directly assisted carriers with bookkeeping. These facets of broker service, however, appear to be of secondary importance.

Rates

Both Gaibler and Taff found that brokers commonly charged commissions between 8 and 10 percent of the freight rate. The higher figure normally applied only when cash advances were given. Based on informal conversations with brokers and carriers, it is believed that throughout most of the 1980's this level of brokerage commissions was common both in Florida and elsewhere in the country. However, in the past few years, commissions have risen. All of the brokers interviewed indicated their commissions without cash advance were 10 percent of the freight rate. With a cash advance, most brokers indicated their commissions were 12 percent of the freight rate (11.6 percent average, see Table 1). Owner-operator responses

regarding commission levels were consistent with the broker responses.

THE BROKERS' IMAGE

Trust is vital to brokers. For better or worse, brokers frequently have the potential to cheat their clients. The primary reason for this is that shipper/receivers and carriers normally negotiate freight rates through brokers and payments are, in virtually all instances, routed from the shipper/receiver to the broker and then (less commission) to the carrier. In other words, when brokers are used, carriers rarely confirm with shipper/receivers what the actual freight rate was and shipper/receivers rarely confirm with carriers if and what they were paid.

As might be expected, brokers feel those in their profession are relatively honest. When asked what percentage of their fellow brokers are dishonest, the average response was 15 percent. Shippers also have a generally good impression of brokers. When asked what percent of brokers quote transport charges higher than what the trucker actually receives (less the customary commission), the average response was 13 percent. However, carrier opinions regarding broker trustworthiness are extremely negative. Owner-operators were asked what percent of brokers lie to them about the freight rates actually paid by shipper/receivers. The average response was a startling 72 percent. Moreover, when asked what percent of brokers fail to pay the agreed upon amounts to owner-operators, the average response was 40 percent. Finally, just under 70 percent of owner-operators indicated that brokers made more than a fair return.

SUMMARY AND IMPLICATIONS

In this paper, the role of truck brokers for produce has been examined. Based on data regarding the Florida produce industry, brokering is the dominant load arrangement method, accounting for just under two-thirds of all outbound loads. There is near-universal agreement that providing market information is the most important service brokers provide. A significant aspect of this is client screening. For example, shippers rated knowledge regarding carrier reliability somewhat above the ability to secure transport in a timely manner.

Outside of locating loads, the most important service to carriers appears to be the provision of cash advances.

Owner-operators rated this as the most important service and the average owner-operator reported requesting advances for 56 percent of all produce loads. All brokers interviewed indicated they gave such advances. Brokers normally charge two percent more of the total freight rate when cash advances are taken. Cash advances are, in reality, unsecured loans from brokers to carriers. The advances normally account for a small proportion of the total freight rate and are for fairly short periods, a few days to a month. The result is that the effective annual interest rates can be exorbitant, often over 100 percent.

The existence of such exorbitant effective interest rates suggests either high transactions costs associated with the loans or market failure or both. In the opinion of the authors, it is primarily market failure. At first glance, however, the 'culprit' appears to be transactions costs. Clearly, the transactions costs would be high for any third party making equivalent loans based on the income potential of each load. In the example given in the body of this paper, the "interest" paid on a two week, $600 cash advance was $36 (2 percent of $1,800). The costs of processing any individual loan may approach or exceed this amount. This would be particularly true under circumstances likely to exist with carriers. When the loans are needed, carriers are likely to be distant from their homes (and, therefore, distant from any credit references), there is not likely to be any written contracts of haul, and the carrier's future whereabouts may be uncertain.

The transactions cost difficulty is greatly reduced if the loans are treated as entirely unsecured and if the credit check on the carrier is done once or periodically, rather than with every cash advance. An example of such arrangements are cash advances available, on demand, through several of the major credit cards. Credit cards do not have a reputation for low cost loans, but their rates are considerably lower than the effective rates charged by most brokers. Moreover, using money wiring services, such as Western Union, on demand loans potentially could be secured from any financial institution, regardless of location. Finally, unless the elasticities of supply of transport by carriers are absolutely inelastic or the elasticities of demand for transport by shipper/receivers are infinitely elastic, carriers <u>and</u> shipper/receivers will share the high costs of cash advances. Therefore, it would seem to be in the interest of shipper/receivers to offer cash advances. Why then, are such alternatives not generally employed?

Our unsupported suppositions regarding the persistence of high cost cash advances are as follows. The small absolute dollar amounts of each loan and of the associated

'interest' charges tend to dampen close scrutiny by either carriers or shipper/receivers. While carriers may resent paying a higher commission to brokers when cash advances are made, they are likely to view the additional cost as negligible or unimportant. Moreover, carriers are cognizant that advances are a tangible service to them and, as such, merit some form of recompense. It seems doubtful most carriers asking for advances have ever translated the additional commission into an effective interest rate. In other words, they are not aware that the charges are usurious. It also seems doubtful that many third parties are aware of the existence or volume of these small loans. Most shipper/receivers are, in all probability, likewise ignorant of this activity. Also, few, if any, shipper/receivers would realize that they are likely to share the burden of high effective interest rates. In sum, we believe there is market failure due to imperfect information.

In recent years, brokerage fees have climbed from 8-to-10 percent of freight rates to 10-to-12 percent of freight rates. The reasons behind this increase are unclear. Over the 1980's, motor carrier costs calculated by the U.S. Department of Agriculture, Agricultural Marketing Service and freight rates for produce were nearly stable. It may be that marketing costs associated with the brokering function increased at a faster rate, precipitating the increased percentage charged. Alternatively, there may be changes in the conduct of brokers, perhaps because of reduced competitive pressures. There is, however, no evidence of this. Indeed, it seems likely that eased entry for regulated truck brokerage would tend to heighten competitive pressures in all sectors of truck brokerage, including produce. Still, it is disturbing that transactions costs have increased during a period which has witnessed considerable increases in communications and data processing capabilities.

These enhancements in communication and data processing technologies may presage the development of alternative load arrangement technologies for produce. Indeed, there already is limited use of electronic load postings of (primarily) dry freight. Finally, the high level of mistrust expressed by carriers towards brokers suggests that they [the carriers] would welcome alternative load arrangement technologies.

FOOTNOTES

1. Gaibler's estimation procedure had two principle weaknesses. First, the assumption was made that the average volume of all brokers was equivalent to that for a sampling of brokers (246 and 63 brokers, respectively, in 1959 and 1974). It seems likely that the brokers successfully located tended to be the larger ones, with established offices. The second and more serious potential flaw relates to the estimate of the total number of brokers. This number "was identified from several trade organization lists" (Gaibler, p. 3). There is no way of ascertaining what proportion of brokers belong to any such organization. The difficulty of determining the total numbers of brokers was graphically described by Taff "One state, for example, that maintains a list of licensed brokers domiciled in its state lists 55 brokers. Yet, 40 were counted by the author in one 25-mile area and another 25 in two truck stops..." (Taff, p. 6).

2. This assertion is based primarily on conversations with respondents. Further evidence of this are the disproportionate numbers of drivers for for-hire fleets and private carriers which so answered compared to owner-operators (15, 11, and 8 percent, respectively). It seems reasonable that company drivers would be less likely to know how loads are arranged than would owner-operators. At least a portion of the owner-operator "other" arrangement situations are leasing.

3. Brokerage seems to be a good example of what Swatterthwaite calls a 'reputation good'. These are goods or services for which consumers must rely primarily upon recommendations of others when searching for new vendors. Swatterthwaite demonstrates that the search process becomes less efficient as the numbers of sellers increases and, as a result, the equilibrium market price can actually rise. This suggests an interesting area for future research.

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THE IMPORTANCE OF TRANSPORTATION IN THE CANADIAN ECONOMY

Pierre Zalatan
Jean-Pierre Roy

TRANSPORT CANADA
ECONOMIC, SURFACE AND MARINE
STATISTICS AND FORECASTS

1. Introduction

Transportation is ubiquitous in business as well as in personal use. Every commodity that Canadians consume and every service they use has in it a transportation component. This characteristic has given transportation a vital role in the economy, in many ways similar to the one associated with energy. Because of that attribute, there is considerable divergence within the transportation community as to what constitutes an appropriate measure of the importance of transportation in the economy.

It is not unusual to define the transportation "Sector" as being that group of firms which produce transportation services; indeed, this is how most economists refer to it. However, beyond the resources that go into the production of *transportation services* by rail, air, truck, marine and other modes, every day, a vast amount of other scarce resources are allocated to support these services (viz. road building etc.). There are also other transportation services not accounted for, such as those provided by the private automobile.

Thus, from automobile manufacturing to the construction of an air passenger terminal; to fuel consumed by private automobiles and related auto insurance services, and; to payments for the use of land or a natural resource (rent), all share one basic characteristic: they are all scarce resources diverted from the production of other goods and services to the production of transportation services. These are basic elements in a transportation system that is using resources (capital, labour and rent) to produce transportation services in order to sustain eco-

nomic activity. Such a system may, more appropriately, be referred to as the Aggregate Transportation Function (ATF).

And such a function may be defined in much the same way as one would define a health, leisure or an education function. Indeed, there are as many functions as may be necessary for the analysis of a specific aspect of economic activity. Characteristically, each function reserves the use of resources for the provision of a specific service; however, since resources are scarce, the existence of each function prevents them from being used for the provision of other goods or services in the economy and could exclude them from another alternate use.

It should be noted, however, that the sum of all possible functions could, conceivably, exceed the sum total of economic activity since certain functional activities may overlap. For instance, a leisure function overlaps with an education function when it includes resources used in the training of leisure specialists, part of the education function. It would also overlap with the transportation function since it also includes personal travel and the like.

The search for an adequate definition of an ATF is, in many ways, crucial. First, it would indicate the magnitude and ramifications of transportation in the economy and, secondly, it helps to assess the broader impact of transportation policies.

Although many business and non-business decisions are based on the adequacy of the ATF, by itself, transportation does not add any intrinsic value to the goods and services it helps bring to market, nor does it increase the usefulness of a pleasure trip between an origin and a destination in most cases. Therefore an ATF must remain as efficient as possible. Given the reality of Canadian economic geography, the closer we are to an optimum size for the ATF, the more competitive these goods and services will become at home - and the higher our comparative advantage on world markets.

Therefore, what appears to be crucial in every approach to define an aggregate function is the determination of all resources (capital, labour and rent) that are allocated to the provision of that function. In this case, the ATF in the Canadian economy must also account for every resource devoted to fulfilling the transportation need in the economy. Put differently, we are asking ourselves the following question:

what would have been the "savings" in terms of resources had there not been a transportation need?

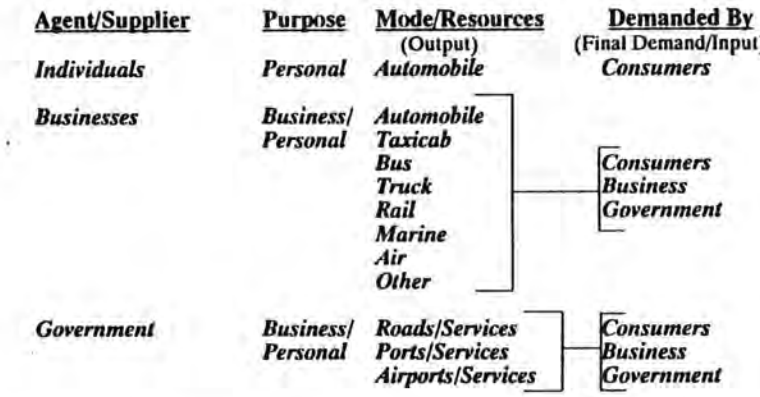
For these reasons, then, it is essential that the ATF be properly defined (its sphere of activity circumscribed) and its importance in the Canadian economy be reasonably determined. In essence, such is what this paper will endeavour to do.

2. Defining an Aggreagate Transportation Function

Almost every activity, be it for pleasure or business, depends on transportation in one way or another. It is therefore important to determine an ATF in terms of resources allocated to it. In other words, this function takes into account new additions to transportation capital stock, as well as flows of services derived from the use of that stock. This function is made up of goods, such as new cars, trucks and highways; that is, capital, as well as gasoline and other goods including services related to transportation such as insurance, licence fees, etc. Most important however, *transportation services* per se (capital, labour and rent) derived from the combination of all these resources must also be allocated to the transportation function. These services are supplied by various agents using various modes/resources and for one or more users. As shown in Figure 1 (below), each of these agents' contribution is part of the Aggregate Transportation Function.

Figure 1 illustrates that individuals use cars to partly fill their transportation needs; they are the ones that supply and demand automobile transportation services. The output, in this case, is the service rendered by an automobile as transportation equipment. It includes all the automobile-related expenditures and, in that sense is considered to be a final demand component since it is not used as input to the production of any other goods or services. Business is also a supplier of transportation services for both its own and private use. In this case, the output includes all resources (rent, capital, labour) asssociated with the production of output which covers transportation services as well as equipment. This output may, in and of itself, also be an input to the production of other goods and services; conversely, it may be a final demand component if used by consumers or government since, by definition, they are final users of this output.

Figure 1. The Aggregate Transportation Function in the Economy



Finally, Figure 1 also shows that government is a supplier of transportation output in terms of infrastructure as well as services associated with its infrastructure (viz. air traffic control, Coast Guard etc.). Again, this output is used by consumers and government and, in such cases, is a final demand component (but when used by business, it is an input to the production of other goods and services).

It should be noted that the criteria for selecting the agent/supplier is not based on ***marketability*** of the transportation output; in other words, it does not matter if this output is the result of a market transaction (purchased for money on the market or not). What counts, however, is that an agent has generated or, at least, put to work the resources to provide a transportation service or goods. It is the sum of these resources we are trying to evaluate.

Agents generate transport-related goods and services, such as the manufacture of automobiles, trucking services or construction highways (output) as demanded by consumers and government (final demand) or businesses (input). Since business uses transportation as an input for the production of goods and services that it eventually sells to final users (government and consumers), the latter end up by buying all transportation services/goods produced either directly or indirectly (the purchase of goods/services that include transportation as a part of the

cost). Again, our aim is to account for are all resources allocated for the provision of all transportation services in Canada[1].

This **ATF** approach shows that ***Individuals***, for example, use cars for both urban and for intercity travel. For this group of agents, the supply of and demand for transportation services using private automobiles is one and the same: that is, individuals create their own supply and demand. This group of agents (consumers) also allocates scarce resources (purchasing power as derived from income) for the provision of transportation services. In this case, however, we have only counted the outlay (automobile) which we have assimilated into the service. We have not accounted for the service rendered by the driver; in other words, when a person drives from A to B, we have not evaluated that transportation service as we would have, for instance, when a person was driven in taxi where not only all automobile-related expenditures are accounted for, but also the wage/profit of the driver.

Inasmuch as the private automobile is also a substitute for a marketable transportation service, it seems more appropriate to associate the service it renders to the business transportation sector. That is, for some types of travel (urban) the automobile is a substitute for taxis and, to a great extent, an urban transit system. For shorter intercity distances, they compete against intercity buses and rail. Similarly, with respect to medium intercity distances, they compete against air, bus and rail modes, whereas for longer distances, air rarely competes with another mode. Services rendered by the private automobile are restricted to consumers (final demand); in short, it fills an important transportation need and is, therefore, an integral part of the **ATF**.

Most marketable transportation services/goods are generated by the ***Business*** sector. Services are derived from the *use* of company cars, taxis, buses, airlines, railways, trucks and ships. In addition, the manufacture of the transportation goods ("the moving parts") within the transportation function, including automobiles, buses, railways, ships and aircraft is almost entirely generated in the business sector.

The services/goods originating in that sector are destined to busi-

1 To conform with this methodology, transactions with non-residents must be taken into account for both travel and freight and shipping but have been dropped from this study for the sake of simplicity. Since receipts and payments for these services are about equal even if accounted for, they would have cancelled one another.

ness (input to the production of goods and services) as well as individuals and goverment (final demand). Most of the demand for and supply of transportation services in this sector are made by different agents; indeed, some businesses exist or have made it their specialization to supply transportation services to others.

As for transportation infrastructure and facilities, they are, to a large extent, supplied by ***government*** . Included are roads, highways, ports, airports and other similar facilities. This infrastructure is used by individuals (as consumers), business and government. Resources allocated by government are not only limited to building these infrastructures, but also for their ongoing administration and maintenance (service). Thus servicing this infrastructure is an integral part of the **ATF**.

3. Evaluating the Transportation Function

The measurement of magnitude in the Aggregate Transportation Function of the Canadian economy may be evaluated by either the "Output" or "Final Demand" approach. While both would yield the same results, we have chosen to combine the two approaches, given the availability of data,

The ***Output*** approach deals with the production of transportation services, (air, bus, truck, etc.) transportation services, as well as the production of all other goods and services making up the transportation function. However, since output is only available by industry, one is faced with the task of specifying, for every industry, all resources allocated to the transportation function.

On the other hand, the ***Final Demand*** approach examines the *use* of all goods and services that are transport-related.

The remainder of this paper will endeavour to measure the importance of **ATF** in the Canadian economy in terms of total resources allocated to it by consumers, business and government with reference to Figure 2.

Figure 2. Final Demand/Input Components of the Transportation Function in the Canadian Economy

Agent	Resources Allocated For:
A) Consumers	*1) Automobile-related expenditures* *2) Purchased transportation services* *3) Cost of transportation embodied in the cost of goods and services*
B) Business	*1) Investment in transportation* *a) Construction* *b) Machinery and equipment* *2) Purchased transportation services* *3) Own-account transportation*
C) Government	*1) Expenditures on transportation* *-Current expenditures (excluding subsidies)* *- Investment in transportation* *a) Construction* *b) Machinery and equipment* *2) Purchased transportation services* *3) Own-account transportation*

A) Consumers

Resources allocated to **ATF** by consumers include the following:

1) *Automobile-related expenditures* such as the purchase of new automobiles, (net) used automobiles, repair, maintenance and fuel as well as other related expenditures such as insurance, licence fees etc. This is a final demand component.

2) *Purchased transportation* such, such as taxis, urban transit and inter-city bus, rail and air travel. For consumers, this is a final demand component although it may be considered as output of the transportation service firms.

3) *Cost of transportation embodied in the total cost* of goods and services that consumers purchase.

B) Business

Resources allocated to **ATF** by business include the following:

1) *Investment in transportation infrastructure and machinery and equipment. This is a final demand component.*

a) Infrastructure includes construction investments such as, for example, buildings used by a head office of a transportation company or the construction of a roadbed (engineering) by a railway firm.

b) Machinery and equipment including such investments as vehicles, rolling stock or other machinery used directly or indirectly in the provision of transportation services.

2) *Purchased transportation* equivalent to transportation services as purchased by consumers, but used on account of business travel as opposed to pleasure travel; also included are transportation services purchased for moving goods. This may also be considered as part of the output of transportation service firms.

3) *Own-account transportation* is in all ways equivalent to purchased transportation, except there is no out-of-pocket payment for such service. In this case, firms use their own transportation modes to move personnel and goods; for example, the retailer who uses his own vehicle to deliver merchandise. The valuation of this service must be at least equivalent to the operating cost related to that service (wages, fuel, insurances etc.). However, since this is not supported by any substantiated data, we have chosen to ignore it.

C) Government

Resources allocated to **ATF** government include the following:

1) *Current Expenditures* on transportation (excluding subsidies) as well as Investment in transportation *infrastructure and machinery and equipment. This is a final demand component.*

a) Current expenditures include transportation service expenditures of the federal, provincial/territorial and local governments and agencies as well as subsidies paid to transportation firms.

b) Infrastructure includes construction investments, such as a passenger air terminal, aircraft hanger (building construction) or the construction of a highway (engineering construction).

c) Machinery and equipment includes investments such as Coast Guard ships or any other form of machinery used directly or indirectly in the provision of transportation services/facilities.

2) *Purchased transportation* equivalent to transportation services as purchased by consumers and businesses, but used here on account of government travel as opposed to pleasure; also included are transportation services purchased for the moving of goods. This may also be considered part of the output of transportation services firms.

3) *Own-account transportation* by government corresponds to government use of its own capabilities involving no out-of-pocket payment for such a service. In this case, government uses its own transportation modes to move its personnel and goods, such as army aircraft to transport employees from one place of work to another. The valuation of this service must at least be equivalent to operating costs related to that service (wages, fuel, insurances, etc.)

No estimates for the Own-account component of the Aggregate Transportation Function are known to exist, although it is estimated at 5% of total transportation services used by each specified sector. However, since this is not supported by any substantiated data, we have chosen to ignore it.

3. Estimating Purchased Transportation

Estimates for Purchased Transportation are readily available for the consumer portion of **ATF** but not for business nor government sectors. Therefore, we have chosen **Total Revenues of Transportation Services firms** (including subsidies) as a proxy for all purchased transportation services (consumers, business and government). These total revenues are generated from the sale of transportation services to consumers, business and government. Since government subsidies/transfers (which reflect the difference in price for and cost of producing such services) are included in the revenues of transport services firms, they must be excluded from government total transport outlays. These changes transform elements of Figure 2 into the items shown in Table 1 below (with detailed references to tables in the Appendix):

- Automobile-related expenditures; (Appendix, Table 1A);
- Business investment in transportation; (Appendix, Table 2A);
- Total revenues of transportation firms (Appendix, Table 3A);
- Government current and capital expenditures (excl. subsidies/ transfers) on transportation (Appendix, Table 4A).

Table 1. Aggregate Transportation Function, Components, 1985-1988
Millions of current dollars

	1985	*1986*	*1987*	*1988*
1) Automobile-related expenditures	32,953	34,566	38,129	41,605
2) Business fixed investment in transportation	3,335	2,816	2,774	3,858
3) Government total transport outlays (excluding subsidies)	11,201	11,367	11,547	12,083
4) Total operating revenues of transportation firms (including subsidies)	30,415	31,652	34,013	35,008
7) TOTAL (ATF)	77,904	80,401	86,463	92,554
8) Total GDP	477,988	505,666	551,336	603,356
9) Transportation Share..(%)	16.3%	15.9%	15.7%	15.3%

Source: Statistics Canada, Transport Canada

4. Analysis of Results

The bottom line entry of Table 1 reveals the relative importance of the Aggregate Transportation Function in the Canadian economy. Every year, over 16% of all the available resources (evaluated in nominal dollars) are allocated for private and public transportation services for consumers, business and government.

Not only is this estimate more than three times greater than what the transportation business sector generates in terms of strict economic activity (transportation value added), it also exposes the prominence of consumer automobile-related expenditures accounting for about 42% of the Aggregate Transportation Function, followed by the product of transportation services by firms with about 40% of the ATF. Total government transportation outlays and business fixed investments in transportation share the rest.

To conduct both economic and leisure activities, Canadians commit approximately 16 cents per dollar earned for the purchase of transportation services and investment in transport-related equipment or structures in support of these services.

Moreover, since transportation prices have increased at a slower pace than prices in the economy in general, resources allocated to transportation represent an even higher proportion of total economic activity when expressed in constant dollars.

Table 2 (below), shows that, on average, transportation's share of total economic activity is stable and about one-half of a percentage point higher than in Table 1. In addition, revenues of transportation firms are almost equivalent to automobile related expenditures when expressed in constant dollars (and since 1986). This reflects the lower price increases of transportation services. While prices in the economy from 1984 to 1988 grew at the rate of 3.5% a year, prices of automobile-related expenditures increased by 4.0% and those of transportation services by only 0.9%. Prices of business fixed investment and government outlays in transportation increased, on average, by about 1.2% a year.

Table 2. Aggregate Transportation Function, Components, 1985-1988
Millions of 1981 dollars

	1985	*1986*	*1987*	*1988*
1) Automobile-related expenditures	28,084	27,662	29,912	31,380
2) Business fixed investment in transportation	2,754	2,260	2,243	3,160
3) Government total transport outlays (excluding subsidies)	9,251	9,116	9,330	9,560
4) Total operating revenues of transportation firms (including subsidies)	25,907	27,216	29,372	30,231
7) TOTAL (ATF)	65,996	66,254	70,857	74,331
8) Total GDP	396,342	409,115	425,742	444,931
9) Transportation Share..(%)	16.7%	16.2%	16.6%	16.7%

Source: Statistics Canada, Transport Canada

APPENDIX

TABLE 1A. CONSUMER EXPENDITURES ON MOTOR VEHICLES AND OTHER RELATED EXPENDITURES, MILLIONS OF DOLLARS,1985-88

	1985	*1986*	*1987*	*1988*
NEW AND (NET) USED VEHICLES	15,225	16,606	17,989	19,459
MOTOR VEHICLE REPAIRS AND PARTS	5,525	6,173	7,167	8,164
MOTOR FUELS AND LUBRICANTS	10,413	9,532	10,332	10,675
OTHER AUTO-RELATED EXPENSES	1,791	2,255	2,641	3,307
TOTAL	**32,953**	**34,566**	**38,129**	**41,605**
TOTAL CONSUMER EXPENDITURES ON GOODS & SERVICES	274,503	296,810	323,777	350,256

Source: Statistics Canada, *National Income and Expenditure Accounts, Annual Estimates* (13-201)

Table 2A. Business Fixed Investment (Construction and Machinery & Equipment) in Transportation
Millions of Current Dollars, 1985-1988

	1985	*1986*	*1987*	*1988*
Mode				
Air	423	513	702	1,682
Rail	1,467	997	824	857
Water	201	180	145	210
Motor	453	504	471	487
Urban Transit	791	622	632	622
TOTAL	**3,335**	**2,816**	**2,774**	**3,858**

Source: Statistics Canada, *Public and Private Investment in Canada* (61-201)

TABLE 3A. OPERATING REVENUES OF THE TRANSPORTATION SERVICES SECTOR BY REVENUE SOURCE, 1985-88
Millions of Current Dollars

	1985	*1986*	*1987*	*1988*
RAILWAYS	**7,669**	**7,571**	**7,899**	**8,003**
FREIGHT[1]	6,901	6,859	7,137	7,200
PASSENGER	768	712	762	803
AIRLINES	**5,535**	**5,887**	**6,274**	**7,136**
FREIGHT	766	745	687	770
PASSENGER[2]	4,769	5,142	5,587	6,366
TRUCKING[3]	**8,210**	**8,628**	**9,345**	**9,612**
MARINE SHIPPING	**2,344**	**2,140**	**2,177**	**2,274**
FREIGHT[1]	2,254	2,028	2,067	2,155
PASSENGER	90	111	110	119
BUS INDUSTRY[4]	**2,994**	**3,413**	**3,671**	**3,783**
OTHER	**3,663**	**4,013**	**4,647**	**4,200**
FREIGHT[5]	2,559	2,808	3,274	2,945
PASSENGER[5]	1,104	1,205	1,373	1,255
GRAND TOTAL	**30,415**	**31,652**	**34,013**	**35,008**
FREIGHT	**20,690**	**21,068**	**22,510**	**22,682**
PASSENGER	**9, 725**	**10,584**	**11,503**	**12,326**

Notes:
1 Defined residually as total less passenger revenues
2 Defined residually as total less freight revenues
3 Freight revenues only
4 Passenger revenues only
5 Estimated

Source: Statistics Canada

For airlines: *Air Carrier Financial Statements* (51-206)
For bus: *Passenger Bus and Urban Transit Statistics* (53-215)
For marine: *Water Transportation* (54-215)
For rail: *Railway Transport in Canada, General Statistics* (52-215)
For trucking: *Motor Carriers:Freight & Household Goods Movers* (53-222)
For other: *Corporation Financial Statistics* (61-207)

TABLE 4A. GOVERNMENT TOTAL EXPENDITURE ON TRANSPORTATION MILLIONS OF CURRENT DOLLARS, 1985-88

	1985	*1986*	*1987*	*1988*
Federal				
TC/NTA	4,091	4,198	4,390	4,413
Other	217	187	240	314
Sub-total	4,309	4,386	4,632	4,728
Provincial/Local	10,359	10,491	10,663	10,987
TOTAL	**14,668**	**14,877**	**15,295**	**15,715**
(Of which: Subsidies/ Transfers)	(3,467)	(3,510)	(3,748)	(3,632)

Source: Statistics Canada, *Local Government Finance*, (68-204)
Statistics Canada, *Provincial Government Finance*, (68-207)
Tranport Canada, *Government Expenditures on Transportation by Province*, (TP 7064)

References

Statistics Canada

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-*Corporation Financial Statistics* (61-207)
-*Local Government Finance*, (68-204)
-*Provincial Government Finance*, (68-207)

Transport Canada

-*Government Expenditures on Transportation by Province*, (TP 7064)

"Productivity Trends in Canadian and U.S. Railroads"

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I. Introduction

There have been a number of studies over the years which measure productivity growth in the railroad sector. Comparisons of Canadian and U.S. rail productivity growth during the 1960s and 1970s revealed substantial productivity gains in Canada following the partial deregulation of the Canadian railways in the 1967 National Transportation Act (Caves, Christensen and Swanson, 1981b; Caves, Christensen, Swanson and Tretheway, 1982). The lagging productivity of regulated American railroads in comparison with Canadian counterparts was part of the evidence in support of economic deregulation in the U.S. (e.g., Caves, Christensen and Swanson (1981a).

Surprisingly, there have not been many studies of rail productivity performance in the post-Staggers (1980s) era. Partly this is due to data problems. Simple partial productivity measures have been calculated, e.g., labour productivity or various performance ratios such as gross ton miles per train or train-hour. This paper will present some of these partial productivity measures for U.S. and Canadian railroads. But partial productivity measures are not necessarily a guide to more comprehensive performance measures such as total factor productivity (TFP). TFP compares the growth rate of total output to the growth rate of total input. TFP studies generally require substantial data bases. For example, measuring total rail inputs requires detailed data on all input categories including capital inputs. Accurate measurement of capital inputs requires current dollar valuations of capital stocks.

Recently, a simpler measure of TFP has been developed using a highly simplified approach to input measurement. Inputs are measured by deflating total current expenditures by an input price index. The approach was introduced by Caves and Christensen (1982); this "deflated expenditure approach" to TFP measurement has been adopted by the U.S. ICC (Ex Parte 290 Sub-No. 4 decision). This method of TFP measurement has been applied to Canadian railways by Cairns (1990). This paper will show that TFP estimates produced by this newer simplified approach are not consistent with the traditional more detailed calculation of TFP. This will be shown for both U.S. and Canadian railroads. This newer deflated expenditure approach to input measurement understates input use and thus overstates productivity. It appears that there is no shortcut to accurate measurement of TFP.

This paper presents a few general trends and simple productivity measures comparing Canadian and U.S. railways in the 1980s, along with a discussion of the few measures of TFP which have been done in recent years. First is a brief review of the concept of productivity and its measurement. This is followed by a description of some important trends in Canadian and U.S. rail operations along with a number of performance ratios or partial productivity measures. The remainder of the paper reviews recent estimates of total factor productivity

for the North American rail industry.

II. Productivity Measurement

We begin with a brief review of concepts of productivity measurement. Stated simply, productivity generally is measured as a comparison of output growth with associated growth in inputs. Different concepts and measures of output and inputs can be identified, hence a variety of specific productivity measures can be devised. Productivity measures can be devised for monitoring specific operations in a firm, e.g., rail yard performance might be monitored by comparing number of cars switched with the number of switch engine kilometres. (Tretheway and Waters, 1990, discuss a number of rail productivity measures). Productivity measures can be disaggregate or aggregative in nature. An example of an aggregate measure is the familiar concept of labour productivity: changes in output (e.g., tonne-kilometres) are compared with changes in labour inputs (number of employees or employee-hours) as a guide to productivity advances. Labour productivity is widely monitored, but it suffers from the defect that it is a partial measure. Gains in labour productivity may be due to investment in expensive capital, and thus do not reflect overall efficiency. A more general measure of productivity would compare output growth with the growth in all inputs. This is the concept of total factor productivity (TFP).[1]

This paper reports on some recent measures of TFP for Canadian and U.S. railways. But first, a few partial productivity measures are discussed.

III. Selected Trends and Partial Productivity Measures for Canadian and U.S. Class I Railways

Exhibit 1 presents an indicator of North American rail activity. Revenue tonne-kms. of traffic for 1972-1989 are shown for CP and CN along with the aggregate figures for the U.S. Class I rail industry.[2] There is an upward trend albeit with some fluctuations. The fluctuations in traffic appear larger in the 1980s. The only noticeable differences among the railroads are CP's avoidance of the downturn in traffic affecting other railroads in 1982, and the sharp drop in Canadian rail traffic in 1989 in contrast to the continued growth in traffic in the U.S.

The total number of employees for CP, CN and the U.S. Class I carriers is shown in **Exhibit 2**. All three show a steady downward trend, with what appears to be a major shift downward in the early 1980s. In the eight years prior to 1980, U.S. rail employment fell at an annual rate of 1.7%. In the eight years following the Staggers Act, employment fell by 8.3% per year. In Canada, the drop in employment accelerated as well after 1980, from -2.3% to -4.3% per year for CP in the two eight-year periods, and from -1.5% to -7.4% per year for CN.

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[1] This discussion of TFP refers to a comparison of an output index with an input index. There are other approaches to TFP measurement which focus on estimation of cost or production functions. For a discussion of alternate approaches to TFP specification and measurement, see Oum, Tretheway and Waters (forthcoming).

[2] Another source of graphical comparisons of Canadian and U.S. rail activity is Government of Alberta, 1990.

As mentioned at the outset, it is possible to construct a great many "performance ratios" to illustrate productivity changes. **Exhibit 3** plots the popular simple measure of labour productivity, revenue ton-miles (kms.) per employee. The Canadian and U.S. Class I railroads show very similar upward trends over the 1970s, with some indication of accelerated improvement over the 1980s, especially for the U.S. railways. CN figures follow the U.S. pattern more closely than does CP.[3]

Another popular overall performance measure in the rail industry is tonne-kms. per freight train hour (gross tonne-kms. are often used; we employ revenue tonne-kms. as this is a better measure of actual output). This is shown in **Exhibit 4**. The upward trend is particularly strong for the U.S. railroads; the growth rate for CN exceeds that of CP.

These simple performance ratios show apparent productivity improvements in both the U.S. Class I rail industry as well as in Canada, but with some sign that the U.S. railroads show slightly more noticeable improvements in the post-Staggers (1980) years.

However, as noted earlier, simplistic performance ratios are not necessarily a reliable guide to more comprehensive measures of performance. Increases in labour productivity must be compared with changes in other inputs including capital, fuel and materials. It is desirable to measure total factor productivity (TFP) to obtain more reliable performance comparisons. Unfortunately, there have been very few studies of North American rail TFP in recent years. The balance of the paper focuses on the few recent TFP estimates for Canadian and U.S. railways.

IV. The Concept and Measurement of Total Factor Productivity

The simplest measure of TFP is a ratio of indexes of total output and total input. While total output might be represented by a crude measure such as revenue ton kilometers, combining labour, fuel, capital and materials into a single measure of input poses a major challenge. This "aggregation" problem will be discussed shortly. Another issue is that the ratio of total output to total input is a "gross" measure of productivity. It does not distinguish sources of productivity gains. For example, if economies of scale are important in an industry, then there will be productivity gains simply from market growth as distinct from productivity gains associated with new technologies and innovations. There are alternate approaches to TFP measurement which distinguish the sources of TFP and these will be discussed shortly.

A complication in measuring productivity in transportation is that multiple outputs and inputs are involved. In general, the more detailed the components of the indexes, the more accurate is the resulting measure of productivity. As is well known, the most common measure of aggregate transportation output is the ton-mile (tonne-kilometre). This reflects the volume-distance elements of transportation output, but has the recognized shortcoming of treating all tons and miles as homogeneous. Different amounts of tons going different miles entail different input requirements; thus one observes different output/input relationships

[3] For an analysis of labour productivity differences between Canadian and U.S. railways and their causes see Jones, et al. (1990).

across firms or markets which may simply reflect differences in traffic mix rather than revealing differences in underlying technical efficiency.

Historically, scarcity of data generally has prevented extensive disaggregation when developing output and input indexes. On the output side, TFP studies generally have been able to separate freight from passenger outputs, e.g., Caves-Christensen (1980). Another modification to output measures is to incorporate differences in length of haul. There are economies of distance in transportation hence firms with a higher proportion of longhaul traffic will appear more efficient than firms supplying shorthaul markets. Again, differences in output/input ratios may reflect differences in traffic mix and not necessarily technical performance or innovation.

A significant improvement in constructing a railroad output index emerged in recent U.S. ICC proceedings (Ex Parte 290 Sub-No.4 regarding incorporating a productivity adjustment to the index of rail costs, the Rail Cost Adjustment Factor or RCAF).[4] Caves and Christensen (1982) proposed an output index based on 50 commodity classifications, four lengths of haul and whether cars were shipper- or carrier-owned (for a total of 400 output categories). At the request of the ICC, Reebie Associates (1988) reviewed this procedure and explored alternatives. They determined that it was not necessary to identify commodity type per se. They based their index on the type of equipment (rail car). Reebie Associates recommended an output index consisting of seven car types, three shipment weight categories, three lengths of haul, and three service types (defined as number of cars per waybill). This output index was accepted by the ICC. The weights for the output categories are the revenues reported on the waybill sample. While not devoid of controversy, it is generally agreed that this disaggregate index is a much improved measure of rail output. It reduces the extent to which shifts in traffic mix requiring fewer inputs is mistaken as productivity improvements. To our knowledge, such an output index has not been constructed in Canada.

Disaggregation on the input side is feasible for some input categories. Generally it has been possible to subdivide some input categories such as labour. (These data are public in the U.S.; they are filed in Canada but are not accessible to the public.[5]) Thus it is possible to construct indexes of labour inputs based on several labour categories. Similarly, fuel and energy inputs are reported in some detail.

It is much more difficult to develop measures of capital inputs. This is a problem for all industries. Conventional accounting treatment of capital inputs can differ substantially from that indicated by economic theory. To measure capital inputs accurately, one needs to have capital stock estimates expressed in current dollars and be able to specify a measure of the flow of capital services from that stock.[6] Ideally, one would distinguish between various types of capital inputs. For rail productivity studies, disaggregation has been limited to distinguishing between way and structures capital from equipment capital (Caves, Christensen,

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[4] A discussion of the issues in Ex Parte 290 is in Waters and Tretheway, 1990.

[5] Nonetheless, we found CP and CN to be cooperative in providing limited access to the reports which they file reporting operating and financial statistics.

[6] An explanation of the Christensen-Jorgenson (1969) perpetual inventory method of measuring a capital stock and its flow of services is in Appendix A of Freeman, et al. (1987).

et al.; Freeman, et al., 1987; Tretheway, Diewert and Waters, 1988). Some studies were forced to rely on crude proxies for capital stocks, such as miles of track, number of locomotives and/or car fleet, etc. (e.g., Cofsky and Roy 1985).

Estimating inputs of materials and miscellaneous services also face major measurement problems. There the traditional approach has been to estimate a quantity index of these inputs by deflating the expenditures by a price index thought to reflect the mix of materials and miscellaneous inputs used in producing transportation services.

The above discussion of labour, fuel and capital inputs describes techniques to construct physical measures of the quantity of inputs being used in producing transportation, a so-called physical input approach. Ultimately, it is an index constructed by physical measures of inputs, each weighted by the relative expenditures on that input. The total input index is the difference in input use by category (across firms and/or over time) weighted by their respective expenditure shares. In a simple form, the index of the growth in aggregate inputs would be:

$$(1) \qquad I = \Sigma_i \, e_i \, (\Delta x_i / x_i)$$

where e_i represents the share in total expenditures, and $\Delta x_i/x_i$ is the proportional change in input i between firms and/or years.[7]

Recently, a simpler approach to measurement of total input has been proposed, along the lines of the approach used to measure inputs of materials. It divides total expenditures by an input price index. If the input price index is constructed properly, this approach will produce the same measure of input quantity changes as in (1). This is called a "deflated expenditure approach" to estimating an input quantity index. One of the purposes of this paper is to examine whether or not this deflated expenditure approach to input measurement produces similar measures of TFP as those obtained by the more laborious physical input approach.

There are some other approaches to TFP measurement which involve statistical estimation of production or cost functions. These parametric approaches produce a different interpretation of TFP in that they attempt to isolate shifts in production efficiency from endogenous changes in productivity brought about by exploitation of economies of scale or traffic density. It is the shift in technical abilities which most economists (and most people) think of as productivity gains. This paper is confined to the non-parametric or "all sources" approach to TFP measurement.

V. Recent TFP Estimates for Canadian and U.S. Railroads

As noted in the introduction, productivity comparisons between Canadian and U.S. railroads was an important influence in the move to deregulate U.S. railroads. Unfortunately, the cost and non-availability of data have constrained productivity studies in recent years.

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[7] This simple formula abstracts from the appropriate indexing procedure for measuring the expenditure weights, i.e., the familiar problem of choosing "before" or "after" input prices and shares. This is a choice between Paache, Laspeyres or other index (e.g., the Tornqvist or Divisia index).

Nonetheless, a few estimates of rail TFP have emerged in the two countries. We examine these recent estimates but conclude that more precise calculations will be necessary to make reliable comparisons of rail TFP in the two countries.

TFP Estimates for U.S. Railroads Since the Staggers Act (1980)

Because lagging productivity and poor financial health of the U.S. rail industry was an important consideration leading to deregulation, it is surprising that there has not been more work measuring rail productivity in the post-Staggers era. Part of the explanation may be the significant accounting changes which took place in the late 1970s which made it difficult to link earlier data sets with data for the 1980s. The primary TFP estimates which have emerged are those connected with the ICC's Ex Parte 290 proceedings on applying a productivity adjustment to the allowed automatic increase in those rail rates which are subject to maximum rate limits. The regulatory controversy is not of interest here, only the estimates of TFP which have emerged.[1]

The TFP estimates adopted by the ICC in the Ex Parte 290 Sub-No. 4 proceedings use an index number (non-parametric) approach to productivity measurement but, as noted earlier, the construction of both the output and input indexes differ from procedures used in previous TFP studies. Instead of using the relatively simple ton-mile and passenger-mile output index of previous studies (e.g., Caves, Christensen, et al. and Freeman, et al. 1987), the much more disaggregate output quantity index discussed earlier was employed. The more comprehensive output index reduces the problem that apparent productivity gains can come about by shifting among outputs to those which require fewer inputs, which is not the same as real shifts in productivity. This can be seen in **Exhibit 5** which plots two output indexes for the U.S. Class I railroads during the 1980s. One is a simple freight ton-mile index and the second is the more detailed output index adopted by the ICC. For a given input measure, a lower output index results in lower estimates of productivity. That is, an output index based only on ton-miles overstates productivity by not separating out shifts to less input-using traffic as distinct from shifts in production efficiency.

In contrast to the ambitious approach to output measurement, the Ex Parte 290 proceedings adopted the much simpler deflated expenditure approach to input measurement. It calculates the total input quantity index simply as total expenses divided by an input price index; the latter is the Rail Cost Adjustment Factor or RCAF. This is a valid approach in theory, providing the measure of total costs is correct as well as the input price index. However, the measure of costs being used is total rail operating expenses plus fixed charges (interest). This adopts conventional accounting treatment of capital costs. The shortcoming is that it understates the measurement of capital inputs because interest charges and book depreciation are the only capital inputs considered. (Further, the RCAF is not identical to an input price index which incorporates the true service price of capital).

To contrast the change in input quantity measurement, we worked with the Association of American Railroads to update the capital stock estimates for the Class I rail industry using the physical input approach including the Christensen-Jorgenson framework for measuring true economic cost of capital inputs. We used the detailed output index adopted by the ICC.

[1] See Waters and Tretheway, 1990 for a brief summary of some of the issues.

Exhibit 6 lists three TFP indexes, their year to year changes as well as the overall average for the years 1981 to 1987 or 1988 (the ICC has announced its 1988 findings but the calculations have not been done using the AAR data base and procedures). The first TFP column are the figures produced by the ICC, i.e., the Reebie modification of Caves-Christensen's (1982) output index and Caves-Christensen's input index deflating total industry (accounting) costs. It shows an average annual growth rate of 4.3 percent through 1987, and 4.5 percent through 1988.[9]

The data base employed by the ICC contains differences from the AAR data base. In order to compare the two approaches to input measurement, it is necessary to employ a consistent data base. The second TFP index (column 7 in Exhibit 6) applies the deflated expenditure approach to the same data base used to construct the physical input index of total inputs. The two input indexes are shown in columns three and four of Exhibit 6. The corresponding TFP indexes are in the right-most columns. The deflated expenditure approach of the first column to input measurement understates total input use because it understates capital inputs. Using the ICC's output index and the two input indexes compiled from the AAR data base shows that the deflated expenditure approach overstates productivity by 1.5 percentage points through 1986, and by over 2.0 percent through 1988. The three TFP indexes are graphed in **Exhibit 7**. Of course, all show a consistent pattern, but the levels and growth rates differ because of the different input indexes employed. All three show productivity gains in the post-Staggers' period.

Unfortunately, it is not possible to make precise comparisons between these post-Staggers estimates of TFP with those of the pre-Staggers era. The post-Staggers data make use of the improved output index. But it is accurate to say that adoption of a simpler ton-mile type of output index would have shown even higher figures because it would not exclude the productivity gains brought about by shifts in traffic types. That is, had the new output index been available for earlier years (the data did not exist), it is almost certain that rail productivity during the 1960s and 1970s would have been even lower than that calculated in the various studies cited.

There are a couple additional caveats which should be noted about these productivity measures. The TFP figures appears to be higher for the post-Staggers' years than that experienced during the regulated era, but this cannot be stated with certainty. The recent TFP measures do not distinguish between productivity gains resulting from economies of scale or density in contrast to pure shifts in production efficiency (as did the Caves-Christensen, et al. estimates for the 1960s and 1970s). Given the shrinkage in miles of track being operated by the rail industry since Staggers, it is likely that part of the rail productivity gains might be explained by economies of traffic density.

Another complicating factor is the state of the economy during the 1980s. Although there was a brief slowdown in the economy and reduction in rail traffic in 1982, the 1980s is basically an expansionary phase of the business cycle. Past studies of productivity reveal that TFP estimates during the expansion phase of the business cycle overstate the growth rate over an entire cycle. Thus the TFP calculations in Exhibits 6 and 7 probably are an

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[9] The average annual growth rates in Exhibit 6 are arithematic averages. Geometric means are more appropriate for averaging growth rates. Use of geometric averages would reduce the growth rates slightly. (Tretheway and Waters, 1989 V.S.)

overstatement of what can be expected over a full business cycle. This could be significant. We calculated the difference in TFP growth rates during expansion and contraction phases of the business cycle in contrast to growth rates over a complete cycle using Caves, Christensen and Swanson's (1981a) figures. The differences vary, but we estimate the average overstatement of TFP growth during expansion relative to full cycle growth rates to be 30 per cent (Tretheway and Waters, 1989).

TFP Estimates for Canadian Railways

The first study of TFP for Canadian railways was carried out by Caves and Christensen (1978) with follow-up studies by Caves, Christensen and Swanson (1981) and Caves, Christensen, Swanson and Tretheway (1982). The latter studies are particularly interesting because they estimated TFP from data incorporating railways from both countries. It was these studies which received substantial attention in the U.S. as they revealed substantial productivity gains in Canada accompanying the effective deregulation of Canadian railways with the 1967 National Transportation Act. The studies also attracted attention because they showed CN's rate of productivity growth exceeding that of CP.

Subsequent, TFP estimates for Canadian railways were carried out by Cofsky and Roy (1985) as well as by Freeman, et al. (1985, 1987) for the period 1956-1981. Cofsky and Roy employed simple proxies for rail capital inputs. Miles of track were used as an index of way and structure capital, and freight and passenger car capacity (weighted by revenue shares) were used as a proxy for equipment capital. In contrast, Freeman et al. employed the physical input approach and, in fact, built on the data set originally developed by Caves, Christensen, et al. Cofsky and Roy reported TFP growth rates of 3.1 and 3.25 percent for CP and CN, respectively. However, Freeman et al. (1987), employing the more costly and detailed capital stock measures, pointed out that the proxies Cofsky and Roy had to use proved to be poor guides to capital inputs. The growth rates of TFP for CP and CN over the period 1956-1981 were 3.5 and 3.1 percent, respectively. (Errors in Caves' and Christensen's data entry caused an error which understated CN input growth hence had overstated CN's TFP in Caves, Christensen's earlier studies). Correcting for the larger amount of low density track in CN's capital stock (arguably a legacy of public service obligations arising from CN's origins) showed the growth rates of TFP to be very similar for the two railways.

The only TFP estimates for the Canadian railways during the 1980s were produced by Cairns (1990). He estimated TFP using the deflated expenditure approach described above. His data cover the period 1972 to 1988 and his graphs of TFP are reproduced in **Exhibit 8**. His data show TFP growing during the 1970s, accelerating in the early 1980s but flattening out thereafter. His output index is based on ton-miles and therefore will differ little from that used by Freeman, et al. (1987). But the input indexes are constructed quite differently. Cairns constructed an input price index based on confidential data. (Unlike the RCAF in the U.S., there is no equivalent published rail input price index in Canada). Therefore we are not able to comment or work with his input data. However, we can compare the output and input indexes (and TFP) from Freeman et al. and Cairns for the years which overlap (1972-1981). This is shown in **Exhibit 9**.

The trends in the two TFP estimates are quite different. Freeman et al. show substantial growth in TFP in the 1970s but a tendency to flatten after 1979. As noted in the

discussion above, the deflated expenditure approach uses standard accounting information as a measure of total costs (to be deflated by the input price index to yield the input quantity index). Total costs are measured as total operating expenses including depreciation and fixed charges. That is, the measure of capital input expenditures consists of book depreciation and imbedded interest costs. These are not a reliable guide to economic measure of capital inputs. In calculations of TFP for both the U.S. and Canadian railways, we find that way and structure capital inputs were growing in recent years; further, the service price of capital has changed markedly, declining circa late 1970s and rising sharply in the early 1980s. The deflated expenditure approach to input measurement tends to understate the growth of capital inputs and assigns too low of a weight to the real importance of capital inputs, i.e., an accounting measure of capital expenditures is much less than a measure based on current opportunity costs of capital. As a result, the deflated expenditure approach understates total input use and thus overstates TFP. Hence, we distrust his TFP estimates for the Canadian railways. This is unfortunate because the deflated expenditure approach offers a relatively simple procedure for calculating TFP. But it appears this approach is not a satisfactory substitute for the more detailed physical input approach to measuring TFP.

VI. Conclusion

Although some broad trends are apparent, we cannot make strong productivity comparisons between Canadian and U.S. railroads. There are only a few TFP estimates and they are not done on an identical basis. This paper has looked at these various estimates supplemented with a few simpler performance ratios.

The broad trends suggest that productivity gains in U.S. railroads are exceeding those of Canadian railways. The U.S. TFP estimates show gains whichever method of measurement is used. The only TFP estimates for CP and CN during the 1980s (Cairns, 1990) uses a simpler output index than that now employed in the U.S. This will tend to overstate productivity gains because it does not separate out gains by shifts in traffic mix to those requiring fewer inputs. Cairns (1990) does use the same approach to input estimation that is now used by the ICC. We believe that this deflated expenditure approach to input measurement understates input use in recent years (because of inaccurate treatment of capital inputs) and hence overstates productivity. Thus we think that Cairns' TFP estimates for Canadian railways probably are an overstatement. His estimates of productivity growth are lower than those being calculated for the U.S. rail industry. Therefore, although we cannot strictly compare the numerical estimates of TFP between the U.S. and Canada, it appears likely that the Canadian railways are lagging the U.S. Class I carriers in productivity gains.

What explains the difference? TFP generally is conceded to be the best approach to productivity measurement, but without further analysis it is not revealing about the causes of productivity gains. We can only speculate, and there are many possible explanations. One may be that U.S. railroads have been catching up with productivity gains realized earlier by the Canadian railways. The more intriguing possibility is that differences in the regulatory regime in the two countries may offer part of the explanation. Both countries are nominally deregulated, although various regulatory and public policy restrictions still persist. The Canadian railways maintain that they face restrictions on cost-cutting and shedding assets and other inputs. This is plausible. It is well known that the U.S. Staggers Act did give substantial freedom to railroads to reduce services, abandon lines and take cost-cutting measures in a variety of ways. Both Canadian and U.S. railroads face similar market prospects: they are mature industries with many traffic categories growing slowly or not at

all (and U.S. Class I railroads in particular have been active at shedding traffic). Productivity gains are easier in growing markets. Where traffic growth has slowed, productivity gains come about primarily by reducing input use. This requires hard decisions both by management and public policy makers. The existing statistics are not sufficient to settle this question, but further examination of the abilities and freedoms of rail management to reduce input usage looks like an important topic for research.

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Exhibit 1: Trends in Total Output

(Revenue Tonne-kilometers, 1972 = 1.0)

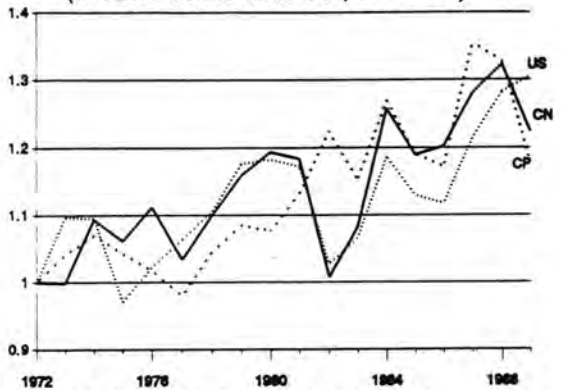


Exhibit 2: Employment trends

(1972 = 1.00)

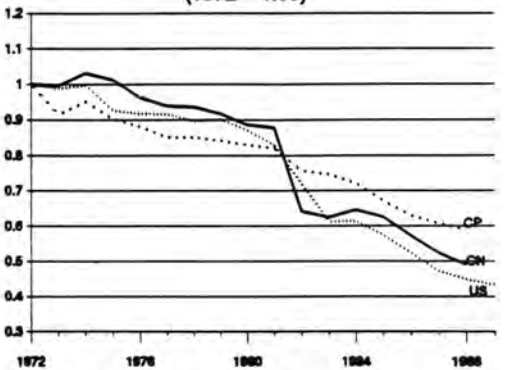


Exhibit 3: Labour Productivity

RTK/Employee (1972=1.0)

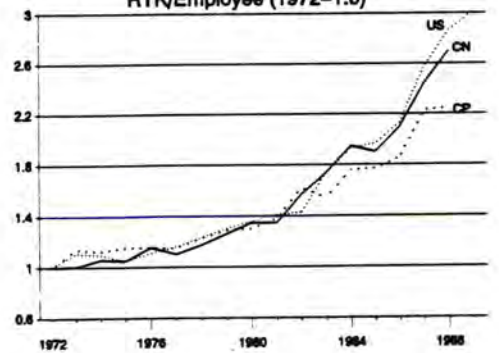


Exhibit 4: RTK per Train Hour

(1977=1.0)

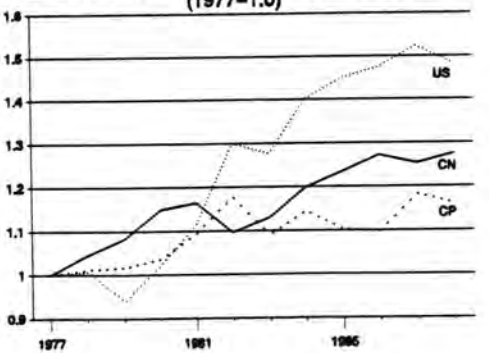
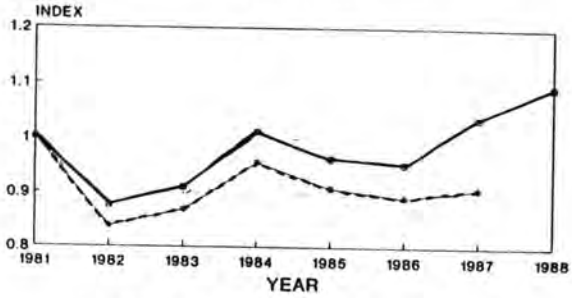


EXHIBIT 5
COMPARISON OF OUTPUT INDEXES
1981-1987



ICC OUTPUT INDEX - - - TON-MILE INDEX ——

EXHIBIT 7
ALTERNATE TFP MEASURES
U.S. Class I Rail, 1981-1988

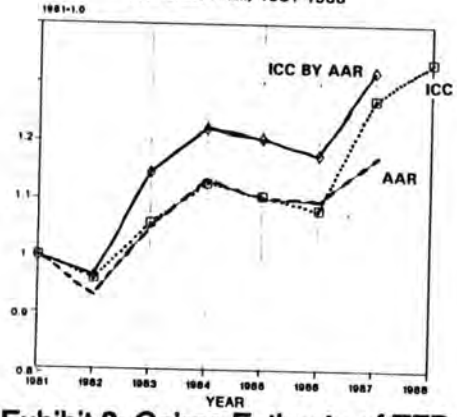


Exhibit 8: Cairns Estimate of TFP
(1972-1999)

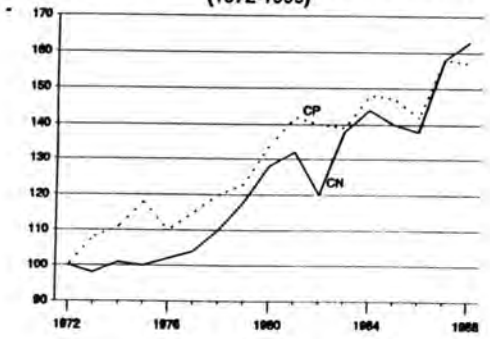


EXHIBIT 6

RECENT PRODUCTIVITY GROWTH FOR AMERICAN CLASS I RAILROADS							
	Output Index (ICC - Reebie	ICC Input Index (deflated exp.)	ICC-Type Index (by AAR)	AAR Input Index (phys. input)	TFP (ICC)	TFP Index (ICC by AAR)	TFP (AAR)
1981	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1982	.838	.873	.869	.901	.96	0.964	0.930
1983	.869	.821	.759	.827	1.058	1.145	1.051
1984	.956	.849	.783	.844	1.126	1.221	1.133
1985	.909	.823	.755	.822	1.105	1.204	1.101
1986	.892	.825	.758	.813	1.081	1.177	1.097
1987	.908	.714	.688	.776	1.271	1.320	1.170
1988			---	---	1.336		---
YEAR TO YEAR CHANGES							
1982	.838	.873	.869	.901	.96	.964	.930
1983	1.037	.940	.873	.918	1.102	1.188	1.130
1984	1.100	1.034	1.031	1.021	1.064	1.066	1.078
1985	.951	.969	.965	.974	.981	.986	.972
1986	.981	1.002	1.004	.989	.978	.978	.996
1987	1.018	.865	.908	.9546	1.176	1.121	1.067
1988			---	---	1.051	---	---
1982-86 avg. (arithmetic)					1.017	1.036	1.021
1982-87 avg.					1.043	1.051	1.029
1982-88 avg.					1.045	---	----

EXHIBIT 9
COMPARISON OF TFP USING TWO APPROACHES
CP RAIL, 1972-1988

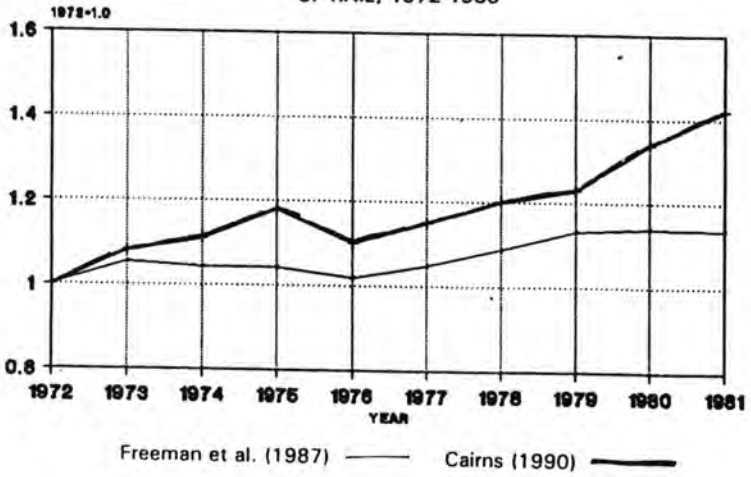
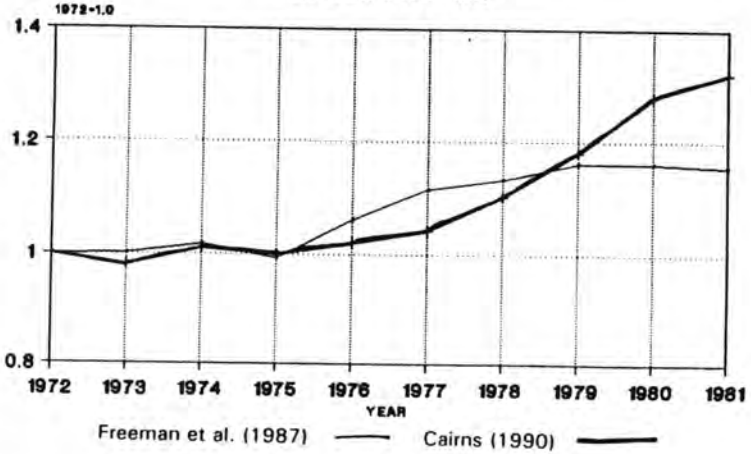


EXHIBIT 10
COMPARISON OF TFP USING TWO APPROACHES
CN RAIL, 1972-1988



All Roads Lead To Rome? A Comparison of For-Hire Trucking Productivity in Canada and the United States, 1978-1988.

by Joseph Jones
Research Associate
Canadian Institute of Guided Ground Transport

INTRODUCTION

Competition between the Canadian and American for-hire trucking industries has been one of the major transportation issues of the post-deregulation era. This paper presents some preliminary conclusions and outstanding research issues concerning the productivity performance of the Canadian and U.S. for-hire trucking industries in the period following deregulation in the United States and ending with the first year following the passage of the Motor Vehicle Transportation Act (1988). The paper is based on research undertaken for Transport Canada's Economic Analysis directorate[1]. It drew on data from *Trucking in Canada*, the American Trucking Associations' *Motor Carriers Annual Report* and material from the U.S. Bureau of Labor Productivity. It represents a preliminary analysis as a prelude to more disaggregate studies. The results are presented as partial productivity indicators; the data were not of sufficient quality for a total factor productivity analysis. Among the issues encountered in the course of the research were differences between Canada and the United States in the reporting of broker activities, differences in carrier classification, and the lack of a single all-encompassing measure of trucking productivity which is adequate for all segments of the industry, in particular the limited value of weight-based productivity measures in a period of changing commodity densities. Steps have been taken to address some of these issues; at this point others could only be noted.

COMPARISON OF PERFORMANCE

Over the study period, the for-hire trucking industries of Canada and the United States have followed somewhat different paths, in terms of policy environment, output performance, input quantity and cost trends and productivity achievements.

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[1] J. Jones, *A Comparison of Trucking Productivity in Canada and the United States, 1978-1988* (CIGGT Report No. 90-7, October 1990). The views expressed in this paper and the report are, however, those of the author, and do not necessarily have the endorsement of the sponsor.

Despite these differences, revenue per tonne-kilometre, an indicator of overall industry competitiveness, followed a similar downward trend.

Policy Environment and Market Entry

The U.S. trucking industry operated in the context of federal deregulation, affecting both motor carriers and railways. The main effect of the Motor Carriers Act (MCA) was to facilitate entry to the industry. From 1968 to 1978, the number of ICC-regulated carriers increased by less than 12 percent; from 1980 to 1988, it increased by 135 percent. The number of smaller (Class III) carriers almost tripled[2]. The number of Class I and II carriers has remained fairly constant since the 1980 revision of carrier classifications.

A second key policy initiative of the period was the passage of the Surface Transportation Assistance Act in 1982 which required states to provide 'reasonable' access by 48' long and 8'6" wide vehicles to and from the interstate highway network.

The Canadian trucking industry embarked upon deregulation towards the end of the study period, through the enactment of the Motor Vehicle Transport Act (MVTA) of 1987. The pre-MVTA environment was significantly more supportive of entry to the industry than the pre-MCA environment in the U.S.: the number of Class I-III carriers reporting to the Motor Carriers of Freight (MCF) survey increased by 87 percent from 1978 to 1987[3].

In certain respects, the Canadian policy environment was more conducive to higher trucking productivity. Weights and dimensions regulations were generally more liberal, longer hours of work were allowed, and the speed limit on major highways was slightly higher.

Output

Output for the U.S. for-hire trucking industry is estimated to have grown by 15 to 20 percent over the study period. Intercity trucking tonne-kilometres increased from 874 billion in 1978 to 1,026 billion in 1988. The intercity market share held by trucks advanced slightly from 24 to 25 percent. Within the trucking industry, a

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[2] This was primarily the result of new entrants to the industry. In addition, carrier classifications were revised upwards in 1980, so that the upper limit for Class III became annual gross operating revenues of $1 million, instead of $500,000.

[3] In 1974, when Canadian carrier classifications were revised, the MCF survey reported on 1892 carriers; the number rose to 3,589 by 1978 and 6,729 by 1988. An unknown part of the increase in the number of carriers in both countries was caused by inflation, which eroded the value of the classification thresholds.

growing share of traffic was carried by Class III carriers. Intercity output of Class I and II carriers, measured in tonne-kilometres, increased by barely 5 percent from 1980, when carrier classifications were revised, to 1988; for Class I and II carriers of General Freight, the growth in output was only 1.4 percent[4].

The output of the Canadian for-hire trucking industry grew at a considerably faster rate, as illustrated in Figure 1.

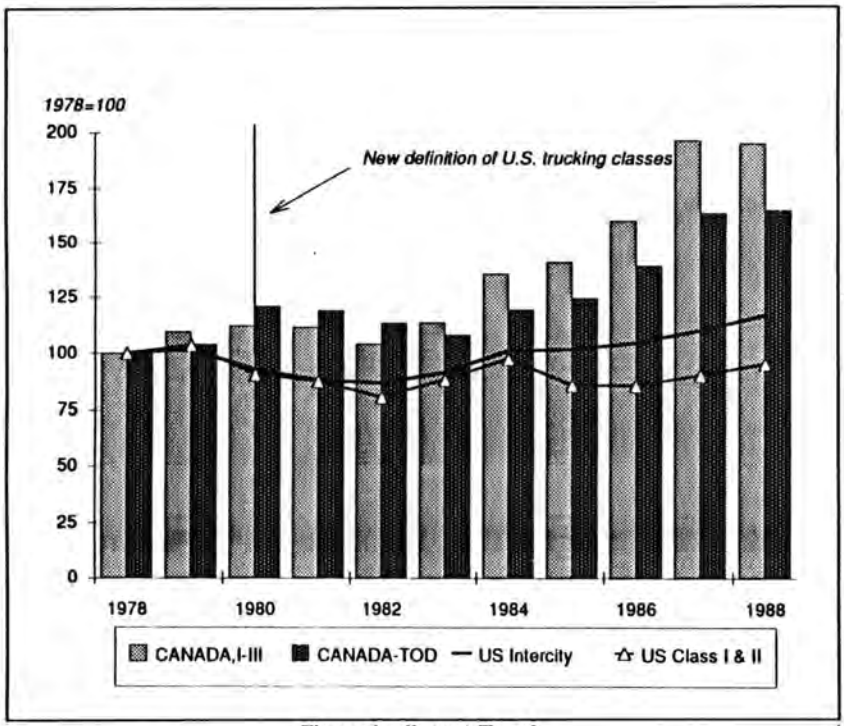


Figure 1: Output Trends

Our estimates of *total* industry output — Classes I to III, domestic and transborder — suggest that tonne-kilometres increased by 95 percent during the study period (74 percent from 1980-1988). Statistics Canada's estimate of the growth in *domestic intercity* traffic carried by Class I and II carriers is 65 percent (about 30 percent since 1980). *Transborder* traffic is estimated to have tripled from 1978 to

[4] American Trucking Associations, *Motor Carrier Annual Report*, summary statistics, 1980, 1988.

1988. In the same period, total traffic carried by Class I-III rail carriers increased by about 30 percent. Consequently, the trucking industry gained market share against rail in the 1980s, in intraprovincial, interprovincial and transborder markets.

Inputs

Overall, input costs increased faster in Canada than in the United States, when measured in domestic 1988 dollars (see Figure 2). During the early 1980s, this trend was masked by the decrease in value of the Canadian dollar; in 1987-88, the Canadian dollar appreciated, and the U.S. cost advantage in areas such as fuel prices was highlighted.

Real labour costs declined significantly in the United States during the early and mid-1980s, after a decade of relatively rapid growth. This decrease was part of a broader trend in industrial labour costs in the early 1980s. In addition, trucking firms faced pressures to cut costs following the enactment of both the MCA and rail deregulation, as freight rates fell. One of the key factors in the fall of labour costs in larger firms was the demise of the Teamsters, which now retains a foothold primarily in the Less-Than-Truckload (LTL) sector. In recent years, possibly because of a shortage of drivers, labour costs have stabilized. In addition, employment decreased by 11 percent for the Class I and II carriers from 1981, following the change in industry classification, to 1988.

In contrast, despite sizable year to year fluctuations, Canadian labour costs in 1988 were close to their 1978 levels in constant dollars, both for company employees and owner-operators. Real labour costs increased substantially from 1978 to 1981, dropped significantly during the 1982 recession, and have since failed to recover to pre-recession levels. It is estimated that employment — including owner-operators — increased by almost 20 percent. About half of that increase is probably attributable to increased utilization of owner-operators — in contrast to the United States, where the use of owner-operators has been declining for a number of years.

Fuel costs followed a broadly similar trajectory in Canada and the United States, although the timing was affected by national government policies. In particular, Canadian truckers were somewhat sheltered from the full effects of the price shock of 1979 to 1981; however, American truckers were quicker to benefit from the collapse in world oil prices of 1985-1986. By 1988, the average real cost per litre of fuel consumed by Canadian for-hire truckers, as reported in the MCF survey, was 20 percent higher than in 1978; U.S. truckers paid on average 11 percent more for diesel, while U.S. gasoline had dropped in price by 2 percent in real terms.

The cost of the standard intercity trucking vehicle, a five-axle tractor-trailer, increased by a comparable amount in both countries, approximately 30 percent in real terms. In contrast, the cost of financing vehicles grew more rapidly in Canada than in the United States: from 1984 on, real interest rates were consistently higher

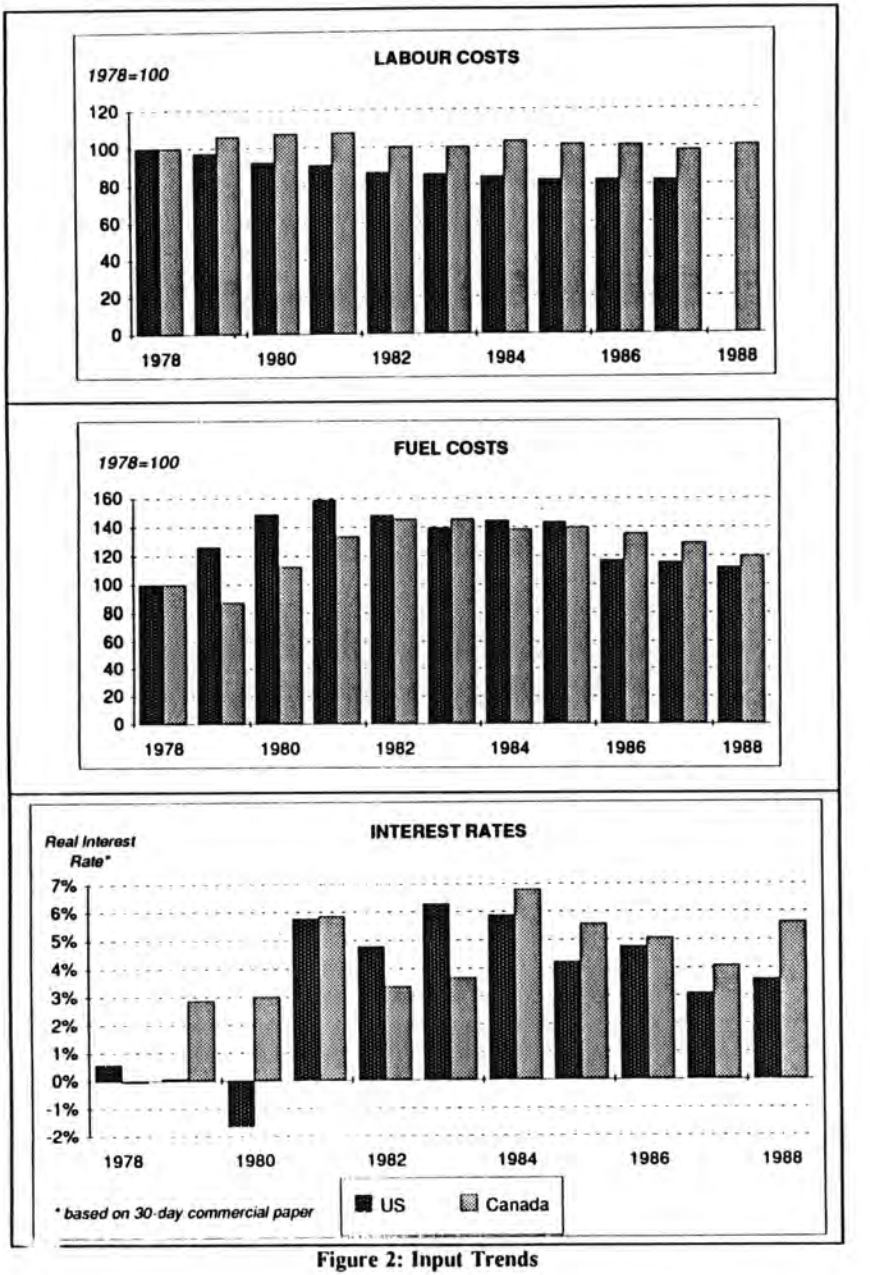


Figure 2: Input Trends

in Canada than in the United States. In 1988, the interest rate gap grew appreciably.

Productivity Indicators

Comparisons of productivity between the Canadian and American trucking industries are complicated because of:

- differences in definition of the industry structure, and consequently in the extent of coverage of the 'total industry'. The American data covers primarily firms earning over US$1 million per annum, while the Canadian data includes firms earning over C$100,000;
- differences in the available data: for example, the American data on owner-operators and on industry segments is more complete; and
- differences in the structure of the economy in the two countries, notably the greater importance of the natural resource sector in Canada, which affect the mix of trucking services which exists in each country.

Table 1 summarizes four measures of partial productivity[5] for the two countries. Tonne-kilometres (tkm) per employee and revenue per employee are measures of labour productivity, while tonne-kilometres per power-unit and revenue per power-unit measure equipment productivity.

The most noteworthy points about Table 1 are:

- Labour productivity is estimated to have grown much faster in Canada than in the U.S. during the study period, whether measured in terms of tonne-kilometres or revenue per employee. By 1988, the level of labour productivity in Canada and the U.S. was broadly comparable. Revenue per employee was roughly 20 percent higher in the U.S., probably because, as discussed below, rates are generally higher. (In 1978 the gap had been 28 percent, measured in 1988 Canadian dollars.) Canadian truckers hauled about 6 percent more tonne-kilometres

[5] The data were not sufficient to allow the estimation of total factor productivity, that is the ratio of all outputs to all inputs.

Table 1: Summary Comparison of Canadian and U.S. Performance (Canadian dollars)

	Tkm/ employee		Revenue/ employee		Tkm/ power unit		Revenue power unit	
	Growth		Growth		Growth		Growth	
	1988	p.a.	1988	p.a.	1988	p.a.	1988	p.a.
US Class I and II	795	2.39%	98.4	0.06%	1,370	1.56%	137.5	-0.30%
US General Freight	563	2.39%	88.8	0.08%	1,195	1.72%	188.3	-0.39%
US Specialized	1,373	0.47%	122.5	-0.88%	1,613	1.32%	143.8	-0.03%
Canada Class I-III	842	5.00%	81.4	0.61%	1,334	5.39%	130.3	0.98%
Canada General Freight	na	nc	97.0	2.86%	na	nc	184.0	2.58%
Canada Specialized	na	nc	99.2	-0.36%	na	nc	151.1	0.98%

1. *Exchange rate = US$1=C$1.23*
2. *"na" = not available; "nc" = not calculated.*
3. *Employees in Canada Class I-III includes estimate of owner-operators and their equipment. No such estimate could be developed for Canada General Freight and Specialized.*

per employee than their American counterparts, in contrast to the late 1970s, when the Americans hauled about 20 percent more.

- The trends in equipment productivity were broadly similar: higher Canadian growth rates enabling the industry to approach U.S. levels of productivity by 1988. A closer look at the components of equipment productivity suggests that while the rate of increase in the annual distance travelled per power unit was comparable (close to 2 percent per annum) the average load increased much faster in Canada than in the U.S. This difference probably stems in part from the more liberal weights and dimensions regulations prevailing in Canada. It may also be a function of the differences in traffic: a weight-based performance measure highlights improvements by bulk carriers, but is an inadequate gauge of the performance of carriers of manufactured products during a period when the use of new materials and packaging has tended to reduce freight density[6].

[6] Our findings agree with those of a recent study of U.S. "Motor Carrier Fuel Efficiency and Equipment Utilization: Effects of Deregulation". Authors John Ozment, William A. Cunningham and Grant M. Davis concluded that the Motor Carrier Act had not led to improvements in these areas, based on a review of MCAR data. *Transportation Research Forum*, Vol. XXX (2), 1990.

- Within both countries, it appears that the General Freight sector has improved productivity more rapidly than specialized carriers, whether measured in terms of physical or financial indicators. In the U.S., this performance is particularly striking in that the output of General Freight carriers decreased by 14 percent over the study period.

Competitiveness

Given the high operating ratios (operating expenses:operating revenues) which have traditionally prevailed in the for-hire trucking industry, revenue per tonne-kilometre is a reasonable proxy for the cost of providing trucking services. In both countries, for-hire truckers faced pressure to reduce rates in response to competition from other carriers and other modes. Figure 3 indicates that trucking rates followed a similar downward trend in real terms throughout the North American continent. Hence, the superior growth in revenue per employee achieved by Canadian for-hire truckers cannot be explained by differences in rate trends.

A comparison of truck and rail revenue per tonne-kilometre indicates that the for-hire trucking industry was able in both countries to reduce rates more rapidly than rail carriers in the first half of the 1980s. This was particularly true for U.S. contract carriers, who were the most affected by deregulation. Canadian for-hire truckers and the U.S. railways had greater success in pushing down rates in the mid- to late-1980s, and by 1987-88 appear to have caught up with the U.S. contract carriers. The reductions in revenue per tonne-kilometre were smaller for the Canadian Class I-III railways and the U.S. common carriers. In the case of the Canadian railways, the reduction in revenue per tonne-kilometre understates the reduction in costs because the operating ratio improved from 0.95 to 0.87[7].

IMPLICATIONS

The productivity comparisons in this report concern the *national* for-hire trucking industries of Canada and the United States. As such, they reflect primarily the domestic productivity of the two industries. Inferences about the competitiveness of Canadian for-hire truckers in transborder markets are premature, for several reasons:

- The productivity of international carriers is likely to be higher than the industry average, based on the available data concerning Canadian international carriers.

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[7] *Rail in Canada: 1987*, figure 1.2.

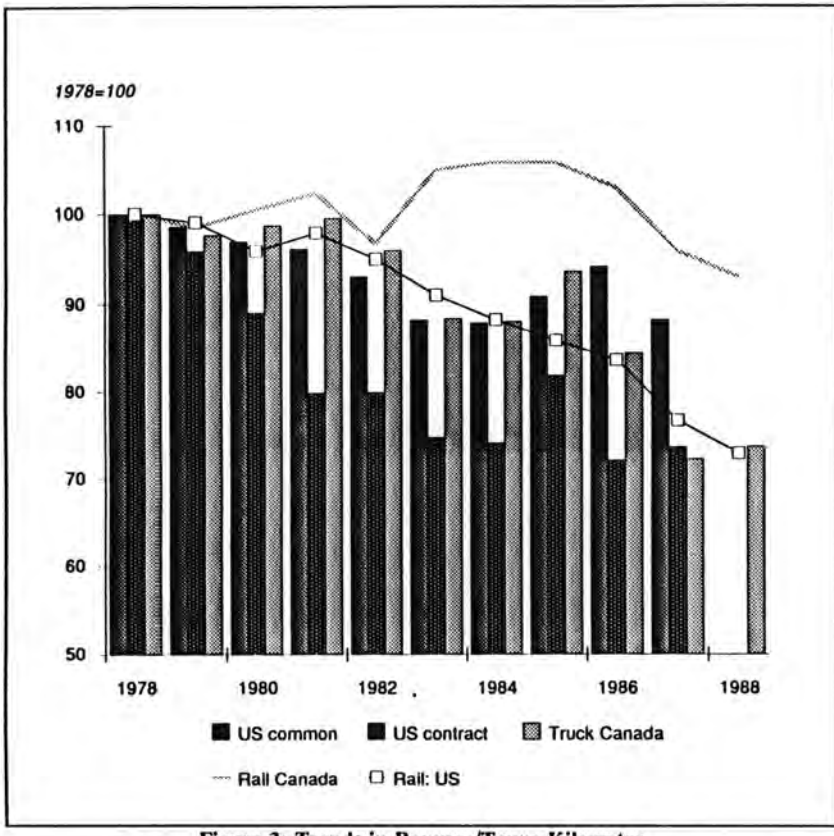


Figure 3: Trends in Revenue/Tonne-Kilometre

- U.S. carriers are not classified as "international" in the main data sources. Data concerning these sectors would need to be developed 'from the bottom up', for example from the *Motor Carriers Annual Report*.

- For certain types of movements, for example, the hauling of dense commodities from Canada to the United States, carriers are constrained in their choice of equipment: the lowest limits of either country govern the size of trucks used on transborder lanes. Consequently, it may be possible for Canadian bulk carriers to achieve higher equipment productivity in domestic markets than in transborder markets.

Our two preliminary conclusions concerning the implications of this study for transborder competition are:

- National productivity levels are roughly comparable. Unless international carriers diverge from these national levels to a significantly greater extent on one side of the border than the other, it appears that neither country has a productivity advantage in transborder markets.

- A more important factor in transborder competition appears to be exchange rates. Figure 4 shows that for most of the study period, the decline in the value of the Canadian dollar worked to the advantage of Canadian carriers. Since 1987, the situation has reversed itself.

Future Productivity Trends

The study considered a number of factors which may affect the productivity of either the domestic and/or transborder trucking industries. These were truck weight and dimension regulations, economic regulation, cabotage rules, truck regulations (safety, emissions), trucking regulations (dangerous goods), other regulations (highway, labour), truck technology, and freight flows. In particular, we attempted to identify factors which might give an advantage to either Canada or the United States.

While most of these factors clearly affect domestic productivity, our assessment is that in general the impact will be comparable on both sides of the border. One possible exception is trucking weight and dimension regulations, where it is probable, depending on the decisions of American legislators, that the increases in limits will be greater in the U.S. However, the effects of the RTAC weights and dimensions regulations are still working their way through the Canadian for-hire fleet. In addition, the impact of liberalized American regulations on transborder competition are by no means evident.

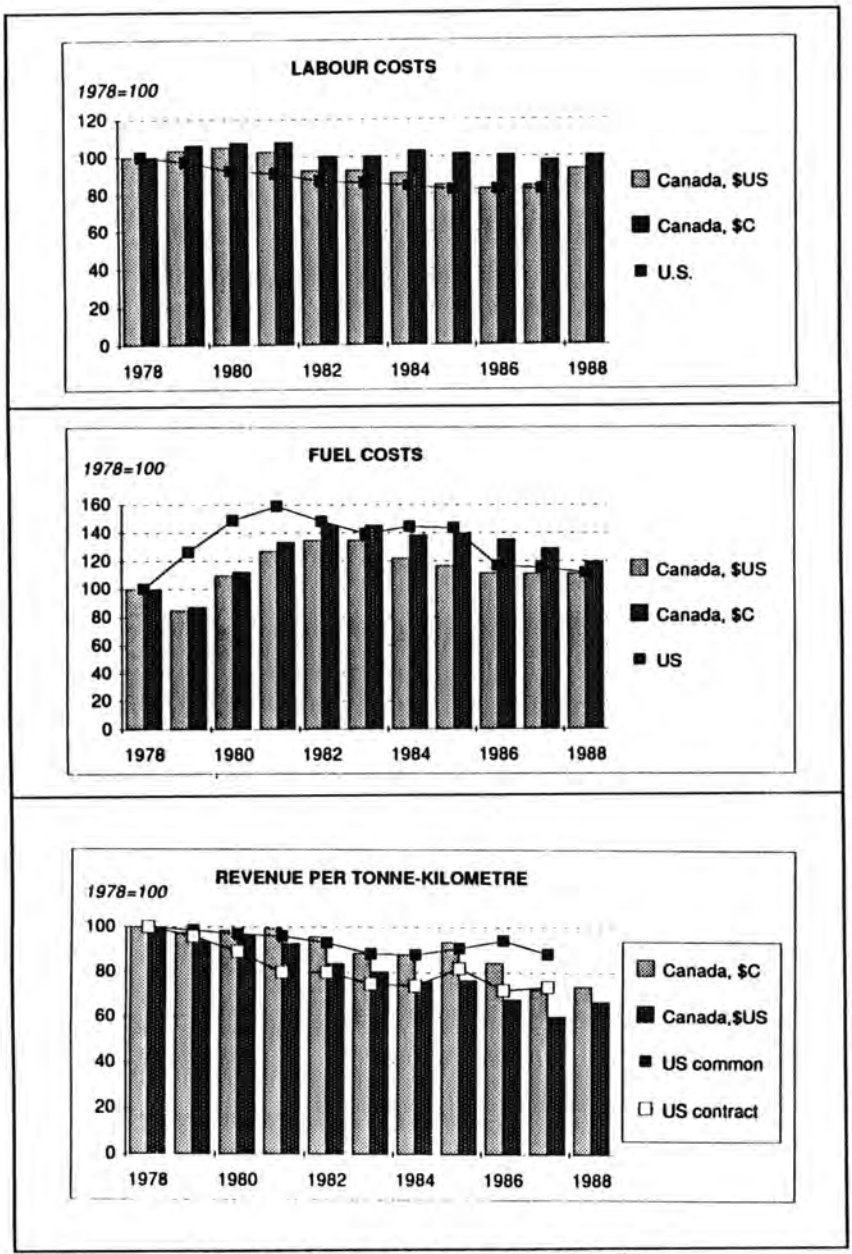


Figure 4: Impact of Exchange Rate Fluctations

Appendix: A Note on Canadian Input & Output Estimates

Two major hurdles had to be overcome to obtain Canadian input/output data for use in this study. The employment and equipment data from the Motor Carriers of Freight survey had to be adjusted to include owner/operator activity and the input (MCF) and output (TOD) surveys had to be reconciled. The universe for the MCF survey is considerably larger than that of the TOD survey; hence it is not possible to relate the unadjusted input and output estimates to develop productivity estimates.

The number of for-hire owner-operators was calculated as follows:

$$O/O\ employment = \frac{annual\ expenditure\ on\ O/Os}{(payment\ per\ vehicle\text{-}km * annual\ distance\ travelled)} \quad (1)$$

Expenditures on O/Os were obtained from the MCF survey; the estimates of payments per vehicle-km and annual distance travelled were obtained from a recent study by G. Davies, which extensively surveyed the literature. In translating employment estimates into fleet estimates, an average of one power-unit per owner-operator was assumed.

The output, defined as total tonne-kms, of Class I-III carriers was estimated using the following steps:

[1] Estimate Class I & II intercity yield (revenue per tonne-km) as weighted average of domestic and transborder yields reported in TOD surveys[8].

[2] Estimate local yield by extrapolating the distance-based yield estimates reported from the TOD survey.

[3] Estimate intercity and local freight revenues, using the ratio of freight revenue/total revenue (typically around 98 percent) reported in the MCF survey.

[4] Estimate intercity and local output by applying the yield calculations from [1] and [2] to the freight revenues derived from [3].

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[8] Transborder yield data is only available for 1987 and 1988. For previous years, it was assumed that the ratio between domestic and transborder yield was the same as in 1987.

A summary of the main estimates used to calculate Canadian partial productivity indicators is shown in Table 2. Further details can be found in Appendix B of CIGGT Report #90-7.

Table 2: Summary of Estimates of Canadian For-Hire Trucking Productivity, 1978-1988
(Current Dollars)

	Spending on O/Os ($MM)	Payment per km ($)	Owner Operators *	Company Employees	Total 'Employees'	Power Units Company	Power Units Total
1978	550	0.426	8,722	89,751	98,473	55,069	63,791
1979	711	0.487	9,852	102,684	112,536	56,332	66,184
1980	835	0.529	10,650	105,629	116,279	57,413	68,063
1981	911	0.609	10,106	105,579	115,685	53,980	64,086
1982	926	0.634	9,871	99,716	109,587	50,562	60,433
1983	982	0.649	10,220	92,608	102,828	48,777	58,997
1984	1,240	0.672	12,467	88,182	100,649	56,984	69,451
1985	1,543	0.854	12,195	102,094	114,289	57,987	70,182
1986	1,672	0.795	14,201	99,697	113,898	56,377	70,578
1987	1,920	0.730	17,758	104,450	122,208	57,337	75,095
1988	2,107	0.760	18,729	99,597	118,326	55,034	73,763

* Assuming average distance travelled of 148,000 km/yr.

	Freight Revenue ($MM)	Rev/ tkm ($)	Tonne-kms (MM)	Tonne-kilometres per 'Employee' ('000s)	Tonne-kilometres per Power unit ('000s)
1978	4,015	0.079	50,897	516.9	797.9
1979	4,650	0.083	55,878	496.5	844.3
1980	5,261	0.092	57,261	492.4	841.3
1981	5,757	0.101	56,953	492.3	888.7
1982	5,662	0.107	53,117	484.7	878.9
1983	5,844	0.101	58,002	564.1	983.1
1984	7,001	0.101	69,170	687.2	996.0
1985	8,029	0.112	71,952	629.6	1,025.2
1986	8,456	0.104	81,575	716.2	1,155.8
1987	9,167	0.092	100,188	819.8	1,334.1
1988	9,419	0.095	99,470	840.6	1,348.5

A BREAKTHROUGH IN AIRLINE CREW SCHEDULING

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INTRODUCTION

The Airline Crew Scheduling Problem is one of the most difficult applications of the general crew scheduling problem. It can be stated as the problem of assigning crews to a set of flight legs (non-stop flights) at minimum cost. The solution process is complicated by the presence of collective agreement constraints.

A rotation (also called a pairing) is a succession of activities (flight legs, deadheads, breaks and nighttime rests) that starts at a given crew base and finishes at the same crew base. A deadhead is a leg where a crew member is assigned to travel as a passenger. A rotation is said to be feasible if it respects all the norms of the collective agreement. The Airline Crew Scheduling Problem, also called the Crew Pairing Problem, can thus be defined as the problem of finding a set of feasible rotations so that the total cost is minimum and all the flight legs are assigned exactly once.

The classical mathematical approach is to solve a set partitioning formulation of the Airline Crew Scheduling Problem. Each row of the set partitioning problem corresponds to a flight leg, while each column corresponds to a feasible rotation. We present in this paper the general philosophy of a column generation approach. The major drawback of the classical optimization approach to crew scheduling, the huge number of feasible rotations (sometimes many billions!), does not apply anymore.

The basic idea of the column generation approach is the following. The master problem (which is essentially the set partitioning problem) must contain the restrictions ensuring that all flight legs are assigned exactly once. On the other hand, the different types of rotations are *only generated as needed* by several subproblems. The solution of a subproblem is a shortest path, from a crew base to the same crew base, on a special network constrained by the collective agreement rules. For example, many rules are related to time. The network can be designed so that time resources are consumed on the arcs while restrictions are imposed at the nodes. In practice, a relatively small number of rotations (columns) needs to be generated in order to find the optimal crew schedule.

1 - COLUMN GENERATION: FROM THEORY TO PRACTICE

Our group has been developing advanced optimization approaches for vehicle routing and crew scheduling at GERAD and CRT (Groupe d'Études et de Recherche en Analyse des Décisions and Centre de Recherche sur les Transports, two university research centers) in Montréal for the past ten years. In 1983, we presented the first numerical results on the optimal column generation approach applied to school bus routing and scheduling. It was awarded the first prize for the best contribution at the international EURO congress held in Vienna [1]. Since then seven master theses and two doctoral dissertations have permitted the development and the testing of prototypes of the current software systems. These upgraded versions are being used commercially to solve problems in such areas as school busing, transportation of the handicapped, urban transit crew scheduling, truck dispatching, as well as airline crew scheduling. A major achievement of the group has been the development of GENCOL, a column generation based software whose specialization in different areas has enabled us to optimally solve large instances of these problems. The following are some of the contexts in which GENCOL is currently being used or developed:

- *As the optimization module in ICARE, Air France's crew scheduling system.* Members of our group have been involved in airline crew scheduling since 1984 when they participated in the development of ICARE for Air France [2]. They have worked on enhancements to ICARE and since 1989 have participated in the development of the newest version of ICARE which incorporates GENCOL. When solving the problem of designing rotations, the column generation approach allows for substantial economies. The reduction is approximately 5% with respect to manual solutions provided by experienced schedulers. These results, obtained over a large number of runs, are for medium and long haul, and schedules of one and two weeks. The majority of these runs involved 300 to 500 flight legs but several runs of over 1000 flight legs were executed.

- *In an integrated crew scheduling and crew rostering system.* GENCOL will be used in a system that generates optimal rotations, and then proceeds to assemble these rotations into montly crew schedules which respect labor conventions. This system is developed by GERAD and AD OPT Inc. with the financial support of the National Research Council Canada (NRCC) and the Ministère du Transport du Québec (MTQ) in cooperation with Intair and Air Alliance.

- *To produce bus driver schedules.* The GENCOL based system CREW-OPT is being used in Lyon and is being implemented in Toulouse. The CREW-OPT software is an adaptation of GENCOL to the Urban Crew Scheduling Problem. It is a product of GIRO Inc. and constitutes a new module in the HASTUS family of scheduling software packages [3,4,5]. Two other packages were developed in a two year partnership project (1989-90) between GERAD and CRT university research centers and GIRO Inc.: BUS-OPT in the school busing area and DARSY, a Dial-a-Ride System for the transportation of handicapped and elderly people. These projects were financially supported by the Natural Sciences and Engineering Research Council of Canada (NSERC) and the National Research Council Canada (NRCC).

- *To route helicopters for the World Health Organization* (WHO). GENCOL is being developed to identify the minimum cost helicopter routes in the Onchocerciasis Control Program (OCP) [6] to exterminate black flies in Western Africa. The helicopters are used to spray larvicides along the rivers in these countries.

- *As a truck dispatching software.* The GENCOL based system being developed can optimally handle pickup and/or delivery at customer sites, full and partial loads, multiple depots and vehicle types, backhaulings and time constraints [7,8]. This undergoing project is financed by the Québec program Fonds pour la Formation de Chercheurs et l'Aide à la Recherche (FCAR).

2 - THE CLASSICAL OPTIMIZATION APPROACH

The objective of the airline crew scheduling problem is to minimize the costs associated with assigning crews to flight legs subject to collective agreement constraints. Each flight leg of a given schedule must be covered by exactly one crew. Flight legs and deadheads must be combined to yield rotations - round trips originating and terminating at a particular crew base. The optimization approach generally used for airline crew scheduling consists of two distinct phases:

1) generation of rotations;
2) selection of rotations comprising the minimum cost crew schedule.

Generation of rotations requires careful analysis of complex rules and regulations to ensure that legal rotations result from this first phase. The crew schedule solution results from the second phase where the following set partitioning problem (SPP) is solved:

$$(SPP) \qquad \textit{Minimize} \quad \sum_j c_j x_j$$

subject to

$$\sum_j a_{ij} x_j = 1 \qquad i = 1,\ldots,m$$
$$x_j \in (0,1) \qquad j = 1,\ldots,n$$

where
- m = number of flight legs
- n = number of rotations
- a_{ij} = 1, if flight leg i is a component of rotation j
  0, otherwise
- c_j = cost of rotation j
- x_j = 1, if rotation j is selected in the current solution
  0, otherwise.

The constants c_j and a_{ij} are fixed in the generation of rotations step. The values of the variables x_j are determined in solving (SPP) and will identify the minimum cost crew schedule.

The size of the set partitioning problem depends on the number of rotations generated in the first phase. Unfortunately, for even small to medium sized crew scheduling applications, an extremely large number of rotations is generated, making it difficult to solve the set partitioning problem. In a recent SIAM News article [9], the authors demonstrated the rapid increase in the number of rotations: more than 100 000 rotations are generated for problems of less then 100 flight legs. In the case of the Air Canada DC-9 fleet that we dealt with, 1200 flight legs yield 300 000 legal duties (sequence of flight legs and deadheads of at most 24 hours). Combining these duties into rotations of up to five days results in more than 10^{13} legal rotations for the weekly problem.

Systems that can solve small set partitioning problems in thousands of iterations are commercially available. Larger problems having no special structure cannot be solved directly. In order to solve realistic problems it is necessary to employ such tricks as selecting only the best rotations in the generation process, splitting the problem into smaller problems, or solving a daily problem and then extending these results to weeks and month. The extension of results is not easy and does not work very well. The SIAM News article mentioned earlier concludes with the observation that the rapid increase in the number of rotations is the bottleneck of the classical optimization approach to crew scheduling.

3 - THE GENCOL SOFTWARE FOR AIRLINE CREW SCHEDULING

In our column generation approach to the airline crew scheduling problem, the master problem is formulated as the linear relaxation of the set partitioning problem (LSPP) in which each row (constraint) corresponds to a flight leg and each variable (column) corresponds to a feasible rotation. The master problem can also include additional constraints, e.g. the number of rotations from a given base. Columns are generated by solving a subproblem.

GENCOL first solves (LSPP) using only a small subset of rotations $\{1,\ldots,n'\}$ with $n' << n$. Next, in a column generation step, a subproblem is solved to produce rotations that will improve this solution. The subproblem is formulated as a shortest path problem in a network corresponding to the flight schedule, but is subject in addition to labor constraints. (LSPP) is reoptimized with the new rotations to yield an improved solution. The minimum cost crew schedule is determined by alternating between column generation and (LSPP) reoptimization. This column generation approach has been shown to converge to optimality using Generalized Linear Programming theory. This alternating procedure is embedded into a specialized branch-and-bound tree [1,3,8] which produces integer solutions to (SPP) within one percent of the optimality. However, in more than 90% of the cases, an optimal integer solution is found with very few branchings. The XMP [10] linear programming code is currently used in GENCOL, but we will soon initiate testing of CPLEX which is reported to perform more efficiently. In any case, GENCOL can use any linear programming solver. The developers of GENCOL have programmed their own specialized algorithms to solve the constrained shortest path problems of the column generation step [11,12].

There are several types of problems in airline crew scheduling: short, medium, and long haul crew scheduling problems. The main difference between the approaches used to solve the various problems is the subproblem modeling. Modeling the subproblem requires care since the corresponding formulation must be able to generate all feasible rotations without being so complex that it cannot be solved efficiently. We have modeled the subproblem as a shortest path problem with resource constraints. For example, in the medium haul scheduling subproblem, the network consists of nodes representing flight leg departures and arrivals and of arcs corresponding to feasible duties or night rest periods. All of the paths in the graph have the same structure: a departure node, a duty arc, a rest arc, ..., a duty arc and an arrival node. The resource constraints serve two purposes: to check feasibility of a partial path or to keep some information to compute the cost of a partial path.

The constraints on connections and duties are dealt with during the graph construction. In this phase all feasible duties are enumerated in order to generate the subproblem network. The duty enumeration program begins by constructing blocks which are composed of two or three legs of which exactly one is a deadhead leg. The deadhead legs may include the flight legs of other airlines. When there are many candidate deadhead legs, only the best one is considered in order to reduce the number of blocks retained. Once all of the blocks have been generated, they can be considered as duties or feasible series of legs and blocks can be enumerated in order to obtain longer duties.

In the case of the long haul problem, the number of legs per duty is also small (three or less) but new considerations can become important such as handling correctly deadheading, longer night rests, etc. In the case of a shorthaul problem, there can be many legs per day and the number of feasible duties (one day of work) can be very large. This precludes complete enumeration of the duties. The subproblem network must be defined in terms of flight and deadhead legs and feasible connections between legs.

4 - THE NETWORK DESIGN

The following simplified example is adapted from the "GENCOL User Guide" [13]. It is intended to introduce some aspects of the network design. Suppose an airline has to find the optimal rotations so that the following simple collective agreement conditions are respected:

1.- Maximum of 8 hours of flying time per day.
2.- Minimum connection of 30 minutes.
3.- At least 11 hours of rest between two duties.
4.- Three days is the maximum rotation length allowed.
5.- Maximum of 36 hours of on-duty elapsed time for every rotation.
6.- Costs are linear functions of arc duration.

In the networks presented in Figures 1, 2 and 3, a flight leg is represented by a vertical arc. The waiting arcs are the horizontal ones. A waiting arc between two flight legs is feasible if the first flight leg finishes at the airport where the second flight leg starts and if there is enough waiting time (30 minutes).

Next, the partial network presented in Figure 1 is restricted to the first three days of the week. It is in fact a group of three subproblems. Each level represents a day duty. In other words, at each level we present the network of all the flight legs for that

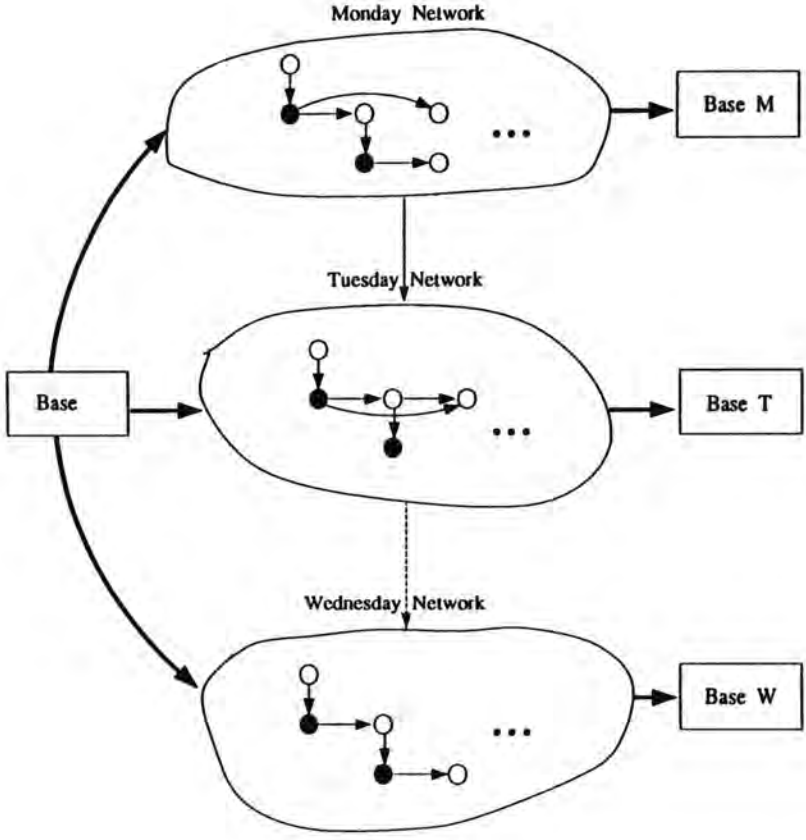


Figure 1: A three day rotation network

day and all the feasible connections respecting the minimum waiting time constraint. The dashed arcs that link one level of a network with another level are the nighttime rest arcs. A nighttime rest arc is feasible if its duration is at least 11 hours. There is also an arc from the base to all the flights starting at the base, for each of the three days considered. The node Base represents the physical crew base at departure time. As you can see, there are also three nodes representing the arrival base: one for the arrival on Monday, one for Tuesday, and one for Wednesday. They have been named Base M, Base T and Base W respectively.

Thus we can generate a rotation which starts at the base, does a Monday duty and finishes at Base M (that is, finishes the same day). The same can be done on Tuesday or Wednesday. We could also have a rotation starting on Monday, doing a Monday and a Tuesday duty and ending on Base T (finishing on Tuesday). Of course, we can also have a two-day rotation starting on Tuesday and finishing on Wednesday. Finally, since three-day rotations are allowed, a rotation starting on Monday and finishing on Base W should also be considered. To find the solution of a weekly schedule, we must finally consider six other partial networks, that is, a group of three subproblems for each day of the week. The resulting network, therefore, has seven groups and a total of 21 subproblems. It is up to GENCOL to choose the best rotations given the constraints. Now comes the tricky part: the resource and cost allocation on arcs, and the node restrictions.

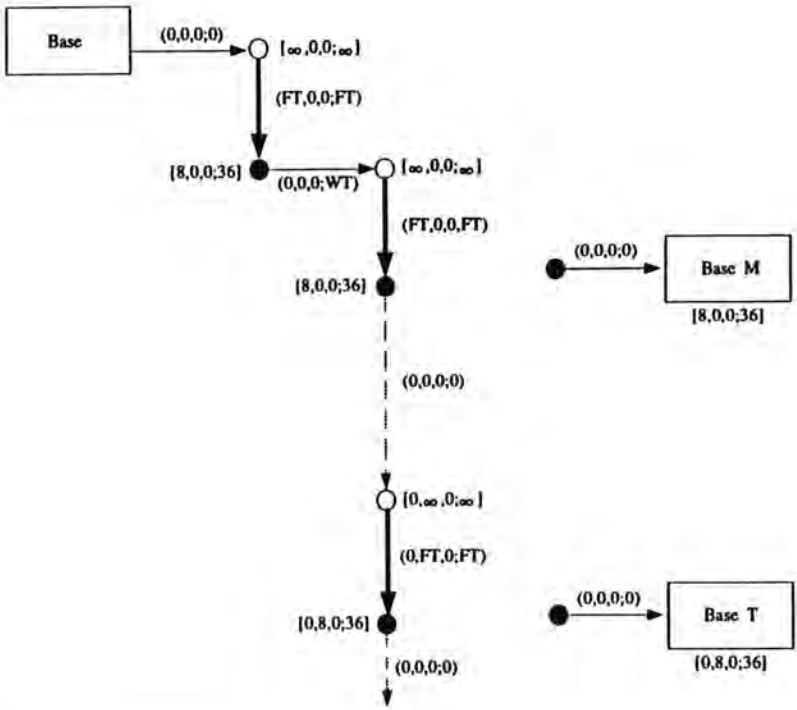
5 - A FOUR RESOURCE NETWORK DESIGN

How do we model the resources and constraints on the network so that they can be entered in GENCOL? Let's have a look at Figure 2. In this figure, we only show the arcs that are the most important in the network modeling: the arcs connecting the departing base with the beginning of a flight leg, some flight leg arcs, some waiting arcs and two nighttime rest arcs.

The only constraints that are not already covered from the way the network was created are the constraints on the maximum duty length (8 hours of flying time) and the maximum rotation length (36 hours on-duty elapsed time in three days). Therefore we need four different resources. The first three resources correspond to the constraint on the maximum duty length. The time spent on every flight leg is accumulated so that, at the end of the day, the 8 hour restriction is respected. We need three resources because we have three days, in the same way that we have three constraints, one for every day considered. The fourth resource is the one related to the time allowed for the rotation duration (36 hours). Somehow we have to accumulate the time spent on every on-duty activity and verify that the total elapsed time is within the 36 hour limit allowed by the constraint.

The cost of an arc is a function of the time spent on the arc, regardless of whether the arc is a flight leg, a waiting arc, or a nighttime arc.

With respect to resources, we have to specify the resource consumption on the arcs as well as the resource restrictions on the nodes. In Figure 2, the resource consumption on the arcs is represented by parentheses "( )" whereas the resource restrictions are represented by brackets "[ ]". The resources are presented as an ordered quadruple where the first three elements, separated by commas, represent the resources for Monday, Tuesday, and Wednesday respectively. The fourth element, separated by a semi-colon, represents the resource related to the total time spent on a rotation.



Legend: FT : Flying time
WT : Waiting time
( ) : arc resource consumption
[ ] : node resource restriction

Figure 2: A four resource network design

Let's see how the node resource restrictions are assigned. For every flight leg, there are two nodes, the beginning and the end of the flight leg. The hard restriction has been arbitrarily put on the end node that is represented as a dark node. The node at the beginning of the leg is unrestricted. Note that, for the Monday legs shown in Figure 2, the end node is shown with the following restriction: [8,0,0;36]. This means that, since we are on the Monday network, the first restriction is active so that the leg cannot last more than 8 hours. The second and third restrictions are not active, since they correspond to the time spent on Tuesday and Wednesday respectively. Finally, the 36 that appears after the semi-colon indicates that, no matter how many activities have been done before, the total time spent up to that flight leg end node cannot exceed 36 hours.

On the flight leg arcs for Monday, the resource consumption is an ordered quadruple of the form: (Flying time,0,0; Flying time). This means that the flying time has to be accounted for and cumulated so that we can be sure that the constraint on the length of the duty is respected. The second and third elements are 0 since on Monday we do not consume any "Tuesday time" or "Wednesday time". Finally, the flight duration has to be accounted for in order to verify the constraint on the total on-duty time of the rotation.

The arcs either leaving the departure base or entering the arrival base have the following resource consumption label: (0,0,0;0). In fact, since those arcs are only feasible if the flight leg starts at the base or ends at the base, respectively, there is no time spent on those arcs (they cost zero) and the consumption of all resources can be set to zero as well.

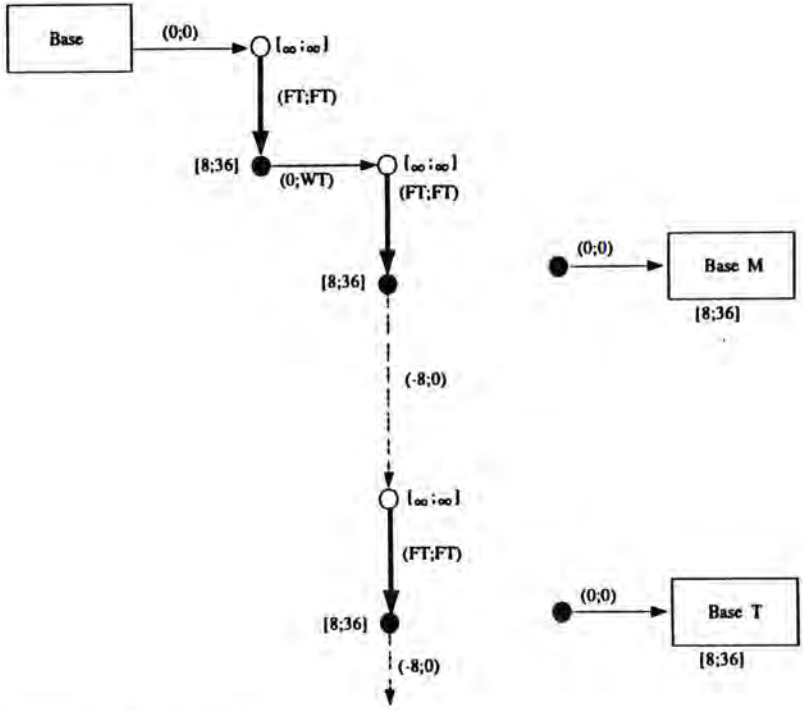
The waiting arcs have the following label: (0,0,0;Waiting time). This means that the first three resources are not consumed on those arcs. In fact, the 8-hour duty restrictions are related to the total flying time but not to the total time. However, since the fourth restriction, the rotation length, is on the total duty time, including waitings, a resource consumption equivalent to the waiting time has to be specified for this fourth resource.

With respect to the nighttime rest arcs, we already know that such arcs are possible only if the 11 hour duration constraint is respected. The resource consumption on those arcs is specified by (0,0,0;0) since there is no flying time during the rest period and since the 36 hour rotation length constraint does not include the rest time.

Finally, we show just one flight leg on the Tuesday network so that the transition between the Monday and Tuesday duties can be appreciated.

6 - MORE EFFICIENT AND REALISTIC NETWORK DESIGNS

Resources are costly in terms of resolution time, and we therefore are often interested in reducing their number. In our example, we can reduce the number of resources from four to two. The idea is to reinitialize the variable that represents the cumulated flying time once a duty has been completed. Another term used for reinitializing a resource is *reset to zero*. Figure 3 shows some of the changes that are implicit in this new design. The label put at the end node of any leg is [8;36] meaning that the duty resource consumption cannot be more than 8 hours up to that node and that the rotation consumption cannot be more than 36 hours. On the nighttime rest arc the resource consumption is specified as (-8;0). By using that negative value for the duty resource consumption, we are resetting the consumption to be less than or equal to zero. In fact, GENCOL assumes that the default lower bound for a resource restriction is zero. This is exactly what allows us to use the same resource for three days.



Legend: FT : Flying time
WT : Waiting time
( ) : arc resource consumption
[ ] : node resource restriction

Figure 3: A two resource network design

We now would like to mention another type of design needing only one resource. When one formulates the problem in terms of duties instead of flight legs, one is implicitly considering the 8 hour duty restriction. In this case the only resource considered is the total on-duty elapsed time consumed for the rotation. Note that with this network design, a particular flight leg can appear in several duties.

The example presented was simplified intentionally for illustrative purposes. No airline operates in such a simple environment. An Airline Crew Scheduling System must handle much more complex rules. In addition, it must have the flexibility to face rules specific to each carrier. Here are some of the constraints that GENCOL is dealing with:

- *Duty constraints*
  - . maximum duration according to report time
  - . briefing and debriefing parameters
  - . minimum and maximum connection time
  - . co-terminal rules
  - . minimum ground time for hotel room
  - . maximum number of aircraft changes
  - . maximum number of takeoffs and landings
  - . red eye duties

- *Rotation constraints*
  - . maximum duration
  - . duty break parameters
  - . 8-in-24 hours rule on breaks
  - . station discretionary parameters
  - . flying time limitations (weekly, monthly)

- *General constraints and cost function*
  - . number of hours credited per base
  - . nonlinear cost structure

7 - FEATURES OF THE AIRLINE CREW SCHEDULING SYSTEM

When investing in a crew scheduling system, the two most important considerations are: the quality of the schedules produced, and the functionality of the system.

An optimal crew schedule is a minimum cost crew schedule. The relative quality of schedules can be gauged by their relative costs. The cost difference between a "good" schedule, one that an experienced scheduler is unable to improve, and the optimal schedule can easily be 5%. Quoting the SIAM News article [9, page 19]: *"Given the high average crew costs, a minor improvement - say 1%, a reasonable expectation even over the results obtained with more advanced systems - could represent a $10 million saving for an airline of Northwest's size and structure"*.

The functionality of a crew scheduling system refers to the ease with which optimal schedules are implemented. A highly functional system is one in which optimal schedules are implemented automatically with little or no user intervention. The following questions should be asked in order to assess the functionality of a system:

- Must an initial schedule (determined manually) be input into the system?
- Does the system produce daily, weekly or monthly schedules?
- Does the system take into account such special events as cancellations and holidays?
- Are deadheads automatically generated?
- How general is the system? Can it handle a variety of fleet types? A variety of fleet sizes?

The airline crew scheduling system based on the GENCOL software and under development at AD OPT Inc. features:

A - *a state of the art crew schedule optimizer*:

- At Air France, this optimizer produces savings in the region of 5% of the rotation cost with respect to manual solutions provided by experienced schedulers.
- At Northwest Airlines, the preliminary results we have obtained are very encouraging. Tests are currently being conducted on two December 90 problems. For the A-320 case (a 313 flight leg problem), the GENCOL schedule shows, on the ratio of credited hours to block hours, an improvement of at least 2.7 % over the Unisys' ALPPS schedule. For the MD-80 case (a 282 flight leg problem), the results are more striking. Here the GENCOL schedule shows an 9.1% improvement. These results are even more significant when considered in terms of the annual dollar savings they represent. In both cases, the number of columns generated by the GENCOL software is less than 7000.

B - *a system that is highly functional*:

- Initial schedules are generated automatically by the system.
- The system requires little user intervention. GENCOL is unlike other systems in which the quality of the final solution is heavily dependent on a host of user input parameters.
- A variable optimization time interval that permits daily, weekly, monthly or user specified time frame crew schedules to be produced by the system.
- The system automatically accounts for the special events falling within the schedule time frame.
- The system is seamless: it accounts for the repercussions of the previous time frame schedule on the current schedule.
- Deadheads are automatically considered by the system, including flight legs from other airlines.
- The system handles short, medium or long haul rotations as well as domestic or international flights.
- The optimal crew schedule produced by the system minimizes the cost of credited hours as well as those of hotel stays, limousine service, meals and penalties. The latter are artificial costs imposed by the user to penalize rotations that are legal but undesirable.

9 - CONCLUSION

In the last decade, several groups in the research centers GERAD and CRT have demonstrated that it is possible to apply the scientific theories developed within the university ivory towers to problems arising in various areas of the business sector. Adapting the most advanced methods in computer science and optimization to treat real life problems has permitted the emergence of a generation of better performing software systems. These developments have been made possible thanks to the excellent collaboration of the research centers with several private enterprises. There have been regular contacts with client users such as Air Canada, Air France, Northwest, Intair, Société de Transport de la Communauté Urbaine de Montréal, Toronto Wheel-Trans Service, Winnipeg City, to name a few. There has also been direct contact with high-tech enterprises such as AD OPT, GIRO, INRO, which have emerged from certain university groups. These high-tech enterprises commercialize software systems which are already developed, and they participate in the financing of research work that is currently underway. Finally, important financial support is provided by government programmes promoting university/industry cooperative R & D activies. This combined collaboration and support has helped create in Montréal a dynamic community of computer scientists and operations researchers, perhaps one of the largest such communities in the world, who have been able to realize projects that at first appeared very ambitious. It is within this context that our research team has addressed the problems of vehicle routing and crew scheduling, and has developed our software system GENCOL.

With regard to airline crew scheduling, we have made a breakthrough: GENCOL is the first software capable of producing optimal solutions to large scale problems. This breakthrough will raise the standard of solution quality expected by airline companies. Our results also demonstrate that mathematical theories and computer power have already reached a level of development which permits software systems to reach optimal solutions to large real life problems. Thus the tools used for solving other airline problems should be reconsidered in light of this new quality standard.

Before ending, we would like to propose two visionary systems which we think should be developed in the near future:

- *An integrated Aircraft assignment/Crew scheduling/Monthly rostering system.* This would enable planners to have the three problems within a single environment. The transfers between systems, always painful and time consuming, would be reduced to nil. It would also favour a parallel resolution of the three problems, with feedback loops. Current solution processes use a sequential pattern where successive phases may suffer from the decisions taken in previous phases. Also, it is important to take into account the potential impact of decisions taken at the planning stages on the real time operations, e.g. the impact of short connections on aircraft routing, on crew scheduling, on maintenance system checks, on gate assignments, etc.

- *A real time decision support system for dispatching personnel and equipment.* Airline schedules are frequently affected by equipment shortage situations due to severe weather conditions, mechanical problems, etc. Likewise, gate assignment must handle problems that develop during daily operations. To recover from disruptions in the airline schedule, one is confronted with the task of making quick decisions. Unfortunately, airlines are currently suffering from insufficient tools available for real time operation decisions. Whereas planners have the power of computer software at their disposal, real-time operaters must rely on paper and pencil. Therefore, there exists a need for a system which is similar to the one used since 1986 for truck dispatching in open pit mines [14], which incorporates automatic localization and real time optimization.

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ECONOMETRIC ISSUES IN TRANSPORTATION DEMAND FORECASTING MODELS:THE CASE OF PIVOT POINT MODELING PROCEDURE AND THE PODM MODEL

by
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1 INTRODUCTION

In this paper, we show how computed residuals from regression are introduced into forecasting models and discuss the econometric implications. We give two examples of such models: the first one is the PODM model and the second one is the incremental or pivot logit model.

Forecasts of the air travel demand made by Transport Canada are partly based on the PODM model. We show how this model can be rewritten in order to explicit the role of the computed residuals into the forecasting model. We argue that computed residuals should not be included into the forecasting model since it increases unduely the variance of the forecast. This is the case wether the estimated model is well specified or misspecified.

Kumar (1980) has presented an incremental or pivot logit model. We show that this share model owns the same restrictions than those of the PODM model since it uses the computed residuals of the regression to do the forecastings.

2 THE PODM MODEL

2.1 WELL SPECIFIED MODEL

The PODM forecast model is defined as follows:

$$\frac{\hat{T}_{ij,f}}{T_{ij,b}} = \left(\frac{POP_{i,f}}{POP_{i,b}}\right)^{\beta_1} \left(\frac{EMP_{j,f}}{EMP_{j,b}}\right)^{\beta_2} \left(\frac{DIS_{ij,f}}{DIS_{ij,b}}\right)^{\beta_3}, \tag{1}$$

where $T_{ij,b}$ is the observed total trips in the market ij during the base period; POP, EMP and DIJ stand for population, employment and distance, respectively; the subscripts b and f designate base and forecast period, respectively; β's are parameters and lastly, the "^" means that the variable or the parameter is an estimate. The estimation of the β's parameters come from the following model:

$$T_{ij,b} = e^{\beta_0} \; POP_{i,b}^{\beta_1} \; EMP_{j,b}^{\beta_2} \; DIS_{ij,b}^{\beta_3} \; e^{\varepsilon_{ij}}. \tag{2}$$

The estimation of (2) requires linearization and is presented in (3).

$$\ln(T_{ij,b}) = \beta_0 + \beta_1 \ln(POP_{i,b}) + \beta_2 \ln(EMP_{j,b}) + \beta_3 \ln(DIS_{ij,b}) + \hat{\varepsilon}_{ij} \tag{3}$$

Let us now rewrite the PODM model as presented in (1) by using the logarithmic transformation and then by substituting $\ln(T_{ij,b})$ with its expression given in (3).

$$\ln(\hat{T}_{ij,f}) = \beta_1 \ln(POP_{i,f}) + \beta_2 \ln(EMP_{j,f}) + \beta_3 \ln(DIS_{ij,f}) + \ln(T_{ij,b}) - \beta_1 \ln(POP_{i,b}) - \beta_2 \ln(EMP_{j,b}) - \beta_3 \ln(DIS_{ij,b})$$

$$= \beta_1 \ln(POP_{i,f}) + \beta_2 \ln(EMP_{j,f}) + \beta_3 \ln(DIS_{ij,f}) + \beta_0 + \hat{\varepsilon}_{ij} \quad (4)$$

The last equation reveals that the PODM model includes the computed residual ($\hat{\varepsilon}_{ij}$) from the base period to forecast period f. We will now compare econometrically the PODM forecast with a model which omits the computed residuals in the forecasting. Hereafter it is referred as the best unbiased predictor (BUP) and defined as

$$\ln(\hat{T}^*_{ij,f}) = \beta_1 \ln(POP_{i,f}) + \beta_2 \ln(EMP_{j,f}) + \beta_3 \ln(DIS_{ij,f}) + \beta_0 . \quad (5)$$

The comparison is based on three criteria: point estimate, expected estimate, and variance of the estimate.

POINT ESTIMATES

For clarity purposes, the matrix notation is used in the proofs. Let's define N as the number of observations or number of markets in the sample, X a matrix with N rows and 4 columns: the first one being a constant, POP is the second, EMP and DIS are the others. The subscripts b and f will be defined as one specific market corresponding to the base period and the forecast period, respectively.

Let's start by comparing the forecast error implied in both procedures, the PODM (6), and the BUP (7).

$$\ln(T_f) - \ln(\hat{T}_f) = X_f(\beta - \hat{\beta}) + \varepsilon_f - \hat{\varepsilon}_b \quad (6)$$

$$\ln(T_f) - \ln(\hat{T}^*_f) = X_f(\beta - \hat{\beta}) + \varepsilon_f \quad (7)$$

The PODM approach compensates BUP forecast by adding the computed residual term ($\hat{\varepsilon}_b$). This means that if the calibrated model overestimates trips for some origin-destination pairs ($\hat{\varepsilon}_b < 0$), then the PODM forecast is smaller than the one of BUP.

The PODM forecast could be justified if random terms of the base period are autoregressive of order 1 with the random terms of the forecast period and the correlation is 1. This last assumption however violates the stationary assumption which states that the absolute value of the correlation coefficient must strictly be smaller than 1 in order not to have exploding series.

EXPECTED ESTIMATES

It is straightforward to prove that forecasting errors for both approaches are not biased, i.e. the expected value of (6) and (7) are both equal to zero. Therefore, even when comparing point estimates we identify systematic differences between the two approaches, both on average yield the same outcome.

VARIANCE ESTIMATES

Since both forecasting errors are unbiased, then the one with the smallest variance should be the privileged one. Below, we derive their respective variances. Before doing so, let us rewrite $\hat{T}_f$ and $\hat{T}_f^*$ as

$$\hat{T}_f = (X_f M + (B - X_b M))T$$

$$= (X_f M + C)T$$

$$\hat{T}_f^* = X_f MT$$

where $M = (X'X)^{-1}X'$

and B is a (1xN) vector equal to 0, except for the base period b which is equal to 1. The variance of the forecasting errors are equal to

$$V\{\ln(T_f) - \ln(\hat{T}_f)\} = E\{\varepsilon_f - (X_f M + C)\varepsilon\}^2$$

$$= \sigma^2(1 + X_f (X'X)^{-1}X'_f + C'C) \quad (8)$$

$$V\{\ln(T_f) - \ln(\hat{T}_f^*)\} = E\{\varepsilon_f - X_f M\varepsilon\}^2$$

$$= \sigma^2(1 + X_f (X'X)^{-1}X'_f) \quad (9)$$

Even though the PODM forecast is unbiased, it has a greater variance than that of the BUP. Thus, the inclusion of the computed residuals into the forecast computation is unsound since it unduely increases the variance.

The results presented so far would not surprise any econometrician since it is a well-known result that $\hat{T}^*_{ij,f}$, as defined in (2), is the best unbiased predictor.

2.2 MISSPECIFIED MODEL

One argument to justify the PODM forecast might be the presence of a systematic bias from the BUP forecast which could be related to the omission of relevant factors in the regression. Then forecasts may be improved with the inclusion of the computed residuals and therefore the missing variables. In Canada, for instance, omission to measure adequately cultural differences into a regression model induce overestimation of the number of trips between francophone and anglophone cities. By using this argument, it is redundant to say that the model is misspecified. A discussion on this issue is presented below.

POINT ESTIMATES

Let us define the "real" model as:

$$T = X_0\beta_0 + X_1\beta_1 + \varepsilon. \quad (10)$$

Now let us assume that the relevant X_2 variables are not included into the regression model for some reason. The forecast errors in this case are given below.

$$T_f - \hat{T}_f = X_{0,f}\beta_0 + X_{1,f}\beta_1 + \varepsilon_f - (X_{0,f}\hat{\beta}_0 + \hat{\varepsilon}_b)$$

$$= (X_{0,f} - X_{0,b})(\beta_0 - \hat{\beta}_0) + (X_{1,f} - X_{1,b})\beta_1 + \varepsilon_f - \varepsilon_b \quad (11)$$

since $\hat{\varepsilon}_b = T_b - X_{0,b}\hat{\beta}_0$

$$= X_{0,b}(\beta_0 - \hat{\beta}_0) + X_{1,b}\beta_1 + \varepsilon_b \quad (12)$$

$$T_f - \hat{T}_f^* = X_{0,f}(\beta_0 - \hat{\beta}_0) + X_{1,f}\beta_1 + \varepsilon_f . \quad (13)$$

If explicative variables are constant ($X_{0,b} = X_{0,f}$, $X_{1,b} = X_{1,f}$) then the variation in the number of trips, according to (11), is solely produced by random variables ($\varepsilon_f - \varepsilon b$) as expected. However, (13) implies that change in the dependent variable, in this case, would be ($\varepsilon_f - \varepsilon_b + \hat{\varepsilon}_b$), which is different from the real change.

But one should keep in mind that, in general, when explicative variables do change from base period to forecast period, point estimates cannot suggest in any way to include or to exclude computed residuals from the forecast.

EXPECTED ESTIMATES

It is a well-known result that the least squares estimates of the β's parameters are biased when relevant variables are omitted

$$\hat{\beta}_0 = (X'_0X_0)^{-1}X'_0T$$

$$= \beta_0 + (X'_0X_0)^{-1}X'_0X'_1\beta_1 + (X'_0X_0)^{-1}X'_0\varepsilon . \quad (14)$$

Let us now examine the expected estimates of the PODM and BUP forecasts in the case of a misspecified model. To do this, we take the expected value of (11) and (13).

$$E(T_f - \hat{T}_f) = (X_{0,f} - X_{0,b})(-(X'_0X_0)^{-1}X'_0X'_1\beta_1) + (X_{1,f} - X_{1,b})\beta_1 \quad (15)$$

$$E(T_f - \hat{T}_f^*) = (X_{0,f}) \quad (-(X'_0X_0)^{-1}X'_0X'_1\beta_1) + X_{1,f}\beta_1 \quad (16)$$

The only justification for the PODM forecasting may be found in (15). If one assumes that included variables are orthogonal to the missing variables ($X'_0X_1 = 0$) and that excluded variables are the same in the base period and the forecasting period ($X_{f,1} = X_{b,1}$) then the PODM forecast is unbiased. Otherwise, it is inconclusive whether one approach should be preferred.

VARIANCE ESTIMATES

Since point estimates and expected estimates do not lead to any support to either PODM forecasting or BUP forecasting then one might be inclined to choose the procedure that would yield the smallest variance. Below, we derive the variances of the two forecasting procedures. Before to do so let's rewrite $\hat{T}_f$ and $\hat{T}_f^*$ as

$$\hat{T}_f = X_{0,f}\beta_0 + T_b - X_{0,f}\beta_0 = (X_{0,f}M_0 + (B - X_{0,b}M_0))T$$

$$= (X_{0,f}M_0 + C_0)T \tag{17}$$

$$\hat{T}_f^* = X_{0,f}\beta_0 = (X_{0,f}M_0)T \tag{18}$$

The variance of the forecasting errors are equal to

$$V\{\ln(T_f) - \ln(\hat{T}_f)\} = E\{\varepsilon_f - (X_{0,f}M_0 + C_0)\varepsilon\}^2$$

$$= \sigma^2(1 + X_{0,f}(X'X)^{-1}X'_{0,f} + C_0'C_0) \tag{19}$$

$$V\{\ln(T_f) - \ln(\hat{T}_f^*)\} = E\{\varepsilon_f - X_{0,f}M_0\varepsilon\}^2$$

$$= \sigma^2(1 + X_{0,f}(X'X)^{-1}X'_{0,f}) \tag{20}$$

As the well specified model the variance of the PODM forecast error is greater than the BUP one. Thus the inclusion of the computed residuals into the forecast computation is an unsound practice even if relevant variable are omitted from the model.

3 THE PIVOT MODEL

The forecast pivot model is defined as follows

$$\hat{p}_{ij,f}^m = \frac{p_{ij,b}^m \exp(\hat{V}_{ij,f}^m - \hat{V}_{ij,b}^m)}{\sum_l p_{ij,b}^l \exp(\hat{V}_{ij,f}^l - \hat{V}_{ij,b}^l)}, \tag{21}$$

where $\hat{p}_{ij,f}^m$ is the forecasted share of the mode m for the period f, $p_{ij,b}^m$ is the observed share of the mode m during the period b, $\hat{V}_{ij,b}^m$ and $\hat{V}_{ij,b}^m$ are, respectively, the computed service level of the mode m during the base and forecast period.

The estimated logit can be represented as follows

$$p_{ij,b}^m = \frac{\exp(\hat{V}_{ij,b}^m + \hat{\varepsilon}_{ij,b}^m)}{\sum_l \exp(\hat{V}_{ij,b}^r + \hat{\varepsilon}_{ij,b}^l)}, \tag{22}$$

where $\hat{\varepsilon}_{ij,b}^m$ is the computed residual from the base period.

We now rewrite the pivot model by using the logarithmic transformation and then by substituting $p^m_{ij,b}$ with its expression given in (22).

$$\ln\left(\frac{\hat{p}^m_{ij,J}}{\hat{p}^l_{ij,J}}\right) = \ln\left(\frac{p^m_{ij,b}\ \exp(\hat{V}^m_{ij,J}-\hat{V}^m_{ij,b})}{p^l_{ij,b}\ \exp(\hat{V}^l_{ij,J}-\hat{V}^l_{ij,b})}\right)$$

$$= \ln(p^m_{ij,b})+\hat{V}^m_{ij,J}-\hat{V}^m_{ij,b}-\ln(p^l_{ij,b})-\hat{V}^l_{ij,J}+\hat{V}^l_{ij,b}$$

$$= \hat{V}^m_{ij,J}-\hat{V}^l_{ij,J}+\hat{\varepsilon}^m_{ij,b}-\hat{\varepsilon}^l_{ij,b}\,, \qquad (23)$$

It is obvious now that the forecast done by the pivot model such as presented in (23) has the same restrictions than those of the PODM. Indeed the model (23) has the same linear form (24) that was discussed in the preceding section.

$$\ln(\hat{T}_J) = X_J\beta+\hat{\varepsilon}_b\,, \qquad (21)$$

where $\hat{T}_J = \ln\left(\frac{\hat{p}^m_{ij,J}}{\hat{p}^l_{ij,J}}\right)$

$$X_J\beta = \hat{V}^m_{ij,J}-\hat{V}^l_{ij,J}$$

$$\hat{\varepsilon}_b = \hat{\varepsilon}^m_{ij,b}-\hat{\varepsilon}^l_{ij,b}$$

Therefore the pivot model applied to aggregate share yields unbiased forecast as the logit model but with a greater variance.

4 CONCLUSION

In this paper we have shown that the two forecasting models, namely the PODM and the pivot model, differ from the traditional one by using the computed residuals from the regression. This increases unduely the variance of the forecast produced by these two models.

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The Impact of Canada-U.S. Trade Agreement on the Canadian Refrigerated Trucking Industry

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1.0 INTRODUCTION

Refrigerated trucks constitute between 5 and 10 percent of the entire Canadian truck fleet. Specializing primarily on highly perishable commodities, refrigerated trucks have been important in reducing trade imbalances. Within Canada, more general freight is carried from east to west by truck than is available for return hauls. In order to balance east-west loads, some general freight carriers use refrigerated trucks to haul dry freight west, where agricultural products can be transported on the return movement east. Trucking carriers thus enhance their flexibility by utilizing refrigerated vehicles as a strategic part of their operations.

The Canada-U.S. Trade Agreement (CUSTA), activated in 1989, presents new challenges and opportunities for the Canadian refrigerated trucking industry. To the extent that CUSTA alters the profile of east-west and north-south trade, the role of the refrigerated trucking segment will likely alter as well. The fundamental impact of the free-trade agreement is impossible to predict even two years after implementation. As the argument was made, however, the overall effect should be an increase in economic growth. For Canadian interests, particularly those in the agriculture and trucking industries, the uncertainty is predicting the directional change in product flows and the resulting impact such changes imply for employment and investment.

The purpose of this paper is to attempt to clarify several uncertainties and to allow an objective assessment of the consequences of CUSTA upon the refrigerated trucking segment.[1] With this objective in mind, the paper addresses the following issues:

1. Evaluation of the trends in east-west and transborder refrigerated truck movements;
2. Assessment of the probable consequences of CUSTA on agricultural trade; and
3. Identify other issues of consequence to the refrigerated segment of the Canadian trucking industry.

The paper is organized in the following manner. After the introduction to the study, attention is focused on the identification of patterns of east-west and north-south refrigerated trucking movements that are important to Canadian domiciled carriers. Following this overview, terms of the CUSTA are discussed with respect to possible impacts upon refrigerated trucking interests. The final section discusses the related economic/regulatory issues that are pertinent to the Canadian trucking industry and particularly the refrigerated trucking segment.

2.0 REFRIGERATED FREIGHT MOVEMENTS

2.1 Data Sources

The sheer volume of statistical detail on for-hire refrigerated truck movements within Canada and between Canada and the U.S. can be overwhelming. To assist in the presentation of the material, key points are illustrated graphically. Tabular and more disaggregated statistical data are available from the authors upon request.[2] Statistics Canada conducts three surveys of the trucking industry each year to estimate east-west and, more recently (1987), north-south goods movements. The survey set consists of all shipments transported by for-hire trucking firms with gross operating revenues of $100,000 or more. Couriers and other specialized small shipment carriers are excluded from the survey.

Carriers are stratified into three classes based on gross operating revenues for sampling purposes: Class I - carriers with domestic gross revenues of $3 million and over; Class II - carriers with domestic gross revenues of $350,000 to $2,999,999; and Class III - carriers with domestic gross revenues of $100,000 to $349,999. The sample frame used by Statistics Canada is composed of all Class I carriers and a random sample of Classes II and III. A systematic second stage of sampling is then conducted of shipments from Class I and II carriers.

Data from Statistics Canada, International Trade Division, were employed to analyze transborder refrigerated freight movements for the years 1984-1989. The commodities included were: fresh and frozen meat, fresh and frozen fish, fresh and frozen vegetables, dairy products, and fresh fruits. While these categories encompass the main food products moved by refrigerated trucks, numerous additional commodities (food and non-food) are transported in refrigerated trailers. As a result, totals for refrigerated freight shipments tend to under-estimate the importance of refrigerated trucks. Transborder trade data include movements by American and Canadian domiciled carriers. Trade data are obtained through Canada Customs collections on shipments to and from the U.S. While import data reporting is mandatory, export data are voluntarily submitted as trucks pass Canadian points. The procedure is generally thought to underestimate the total volume of exports because of the incomplete compliance.

Domestic freight movements by refrigerated truck were obtained from Statistics Canada's annual "For-hire Trucking Survey." Several limitations are evident in these data, as well. First, a significant proportion of freight movements in Canada are carried in privately owned trucks that are not reported in the goods movement data, and therefore are not represented in the sample frame. Second, the data obtained from the survey may differ from actual trade data because of sampling and non-sampling error. Sampling errors can be effectively addressed with increased sample size; however, non-sampling errors are not so easily remedied and are an inherent problem. Third, the data are not timely since the most current information on for-hire truck movements within Canada was for 1987.

2.2 Canadian Domestic East-West Refrigerated Freight Movements

Total interprovincial movements of refrigerated freight by province of origin and destination, are presented in Figure 2.1 for the years 1984-1987. The Atlantic provinces, Quebec, Ontario, Manitoba, and Alberta are all important origin points for refrigerated freight. A distinct trend is evident in the figure as origin volumes increased from 1984 through 1986, then fell in 1987. The exceptions are Ontario, whose largest volumes are reported in 1984, and Alberta, with peak output in 1987. The destination data for refrigerated freight parallels market demand and population patterns, and consequently Ontario and Quebec account for the preponderance of destination points. The remaining provinces tend to be relatively uniform with respect to the

distribution of destinations, thus dramatizing the asymmetry in the distribution of Canadian population.

Net interprovincial movements (shipments minus receipts) for refrigerated freight are given in Figure 2.2 for the period 1984-1987. Atlantic provinces, Manitoba, and Alberta tend to be net exporters of refrigerated freight while Quebec, Ontario, Saskatchewan, and British Columbia reflect net import positions. Refrigerated freight imbalances favour freight destined for Quebec and Ontario, and originating in the Prairie provinces (115,721 tonnes), the Atlantic provinces (57,900 tonnes) and British Columbia (5,737 tonnes). The table also identifies an imbalance of refrigerated freight originating in B.C. destined for the prairies (23,799 tonnes). The imbalance of refrigerated freight is due in large part to the fact that most Canadian demand is located in the eastern provinces, whereas raw materials and food production dominate the economies of the western provinces. As a result, more refrigerated freight per capita is originated in the Prairie provinces than in eastern Canada, even though Quebec and Ontario originate more total freight per capita than either western Canada or the Atlantic provinces.[3]

Figure 2.1: **Refrigerated Interprovincial For-Hire Domestic Freight Volume by Origin and Destination, 1984-1987.**

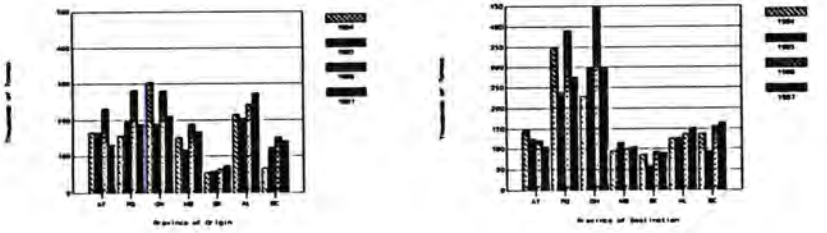
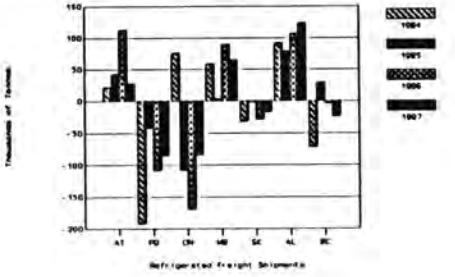


Figure 2.2: **Net Interprovincial Total and Refrigerated Freight Volume, Shipments minus Receipts, 1984-1987.**



2.3 North-South Refrigerated Freight Movements

Figures 2.3 through 2.6 present the total tonnes of exported and imported refrigerated truck freight to and from the U.S. for 1984-1989. Import data reflect the port of entry, however, rather than the ultimate destination of freight. For example, freight imported through the Windsor, Ontario, port would be classified as an import into Ontario. The shipment, however, may be destined for another province. Therefore, given the location of Canadian ports of entry, data are grouped into four categories: 1) Atlantic provinces, 2) Quebec and Ontario, 3) Prairie provinces, and 4) British Columbia. Export data by province are more precise than import data. Since April 1984, Statistics Canada has reported export data by province of origin, rather than by province of lading (export port). For purposes of comparison, however, exports are grouped into the same regional categories as the import data.

Figure 2.3 presents the total refrigerated truck freight exported and imported from the northeastern U.S. for the study period. Virtually all of the refrigerated exports into northeastern U.S. from Canada originate in the Atlantic provinces (394 thousand tonnes) and Quebec/Ontario (223 thousand tonnes). Exports from the Atlantic provinces reflect the large volumes of fresh and frozen seafood and potatoes that are shipped into the U.S. region. The Atlantic provinces also show an increasing export trend (roughly 50 percent from over the period). About 98 percent of all imports from northeastern U.S. are destined for eastern Canada, with approximately 80 percent shipped to Quebec/Ontario, the major population and demand areas.

Figure 2.4 presents the refrigerated exports by truck from Canada to northern U.S. for the years 1984-1989. As expected, most Canadian refrigerated exports by truck originate in Quebec and Ontario (about 75 thousand tonnes), and the Prairie provinces (roughly 24 thousand tonnes). These exports, which are largely meat products, tend to follow changes in the Canada-U.S. exchange rate. Total refrigerated exports to the Northern U.S. increased from about 115 to 170 thousand tonnes from 1984-1986, but indicate a decline from 170 to 117 thousand tonnes from 1986-1989. The changes parallel decreases in the average annual exchange rate (U.S. dollars per Canadian dollars) from 1984 (0.76) to 1986 (0.72) and a steady increase from 1987 (0.75) to 1989 (0.86).

Figure 2.3: Refrigerated Truck Movements, Canadian Exports and Imports with Northeastern United States, 1984-1989.

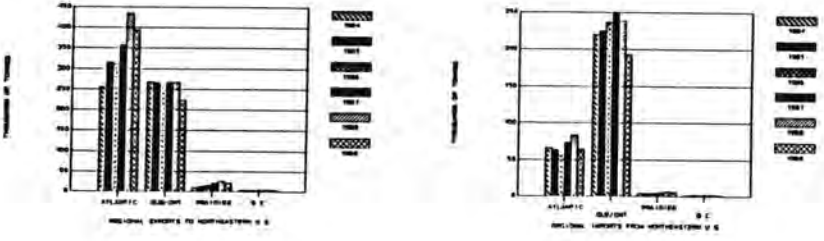
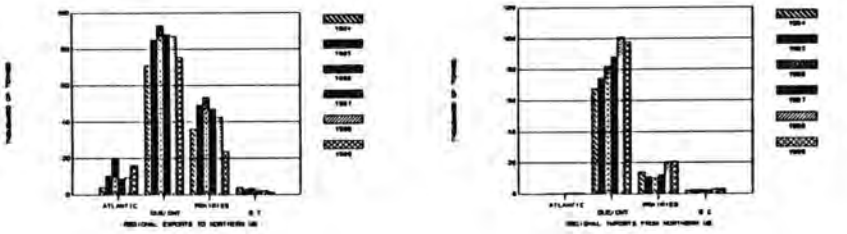


Figure 2.4: **Refrigerated Truck Movements, Canadian Exports and Imports with Northern United States, 1984-1989.**



Total refrigerated freight exported to and imported from the southern region of the U.S. for years 1984-1989 are depicted in Figure 2.5. Total refrigerated exports are generally stable at between 81 and 86 thousand tonnes. Shipments originating in eastern Canada (Atlantic provinces, Quebec and Ontario) account for over 90 percent of exports to southern U.S. states. Closer scrutiny of the data indicates that over the study period the proportion of exports originating in Atlantic provinces has increased relative to those from Quebec and Ontario. In fact, by 1989 Atlantic provinces dominated exports to the southern region. Total refrigerated imports from the southern states increased almost 50 percent over the six year period.

Figure 2.5: **Refrigerated Truck Movements, Canadian Exports and Imports with Southern United States, 1984-1989.**

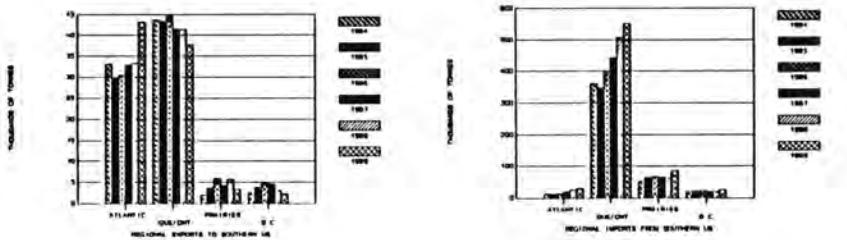
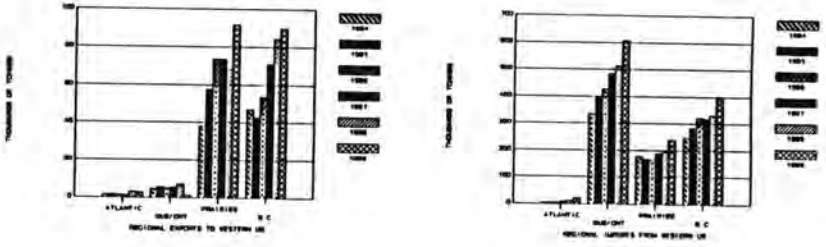


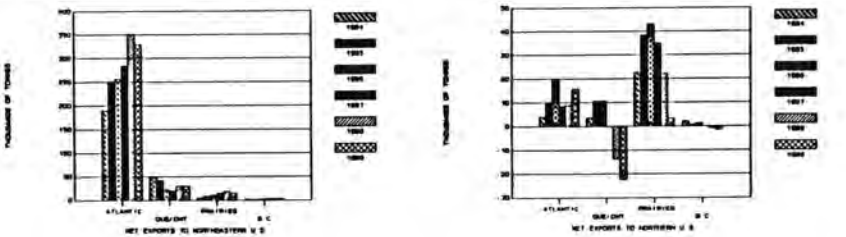
Figure 2.6 reports total refrigerated exports to and imports from western U.S. for the study period. Exports originate mainly in the Prairie provinces and B.C. and indicate a health increase in trend over the study period. Similar to southern U.S., refrigerated imports into Canada from the western states are largely fresh fruits and vegetables originating in California. These imports can be divided almost evenly between eastern Canada and western Canada.

Figure 2.6: **Refrigerated Truck Movements, Canadian Exports and Imports with Western United States, 1984-1989.**



Net refrigerated truck movements for Canada-U.S. origins and destinations are given in Figure 2.7. The Atlantic provinces are the only region that is a total net exporter of refrigerated freight. Ontario and Quebec are increasing net importers, as is true of western Canada although to a lesser extent.

Figure 2.7: **Net Refrigerated Truck Movements, Canadian Exports Minus Imports with Northeast and North United States, 1984-1989.**



Figures 2.8 and 2.9 present a summary of the destination of refrigerated truck shipments to the U.S. (1984-1989) and to other parts of Canada (1984-1987) from each region. Refrigerated shipments originating in the Atlantic provinces (Figure 2.8) consist largely of shipments to Quebec and Ontario (50 percent) and to the northeastern U.S. (40 percent). Less than 5 percent of refrigerated freight originating in the Atlantic provinces is shipped west of Ontario. The major destinations for Quebec and Ontario refrigerated freight (Figure 2.8) are the Atlantic provinces (33 percent), and northeastern U.S. (32 percent). Shipments to the Prairies (18 percent) and B.C. (5.8 percent) constitute less than 25 percent of all shipments originating in Quebec and Ontario. The data reveal the importance of refrigerated trade in Ontario, Quebec, and Atlantic provinces with the United States.

Refrigerated freight shipments originating in the Prairie provinces (Figure 2.9) are largely east-west oriented. About 80 percent of total refrigerated shipments originating in the Prairies are to B.C., Quebec, or Ontario, with much of the remainder transported to western and northern United States. B.C. is also highly dependent on east-west trade. On average, 64.4 percent of refrigerated freight originating in B.C. is shipped to Prairie provinces, and about 11.5 percent to Quebec and Ontario. Approximately 20.5 percent of B.C. originated freight flows to destinations in western U.S.

Figure 2.8: **Net Refrigerated Truck Movements, Canadian Exports minus U.S. Imports, 1984-1989.**

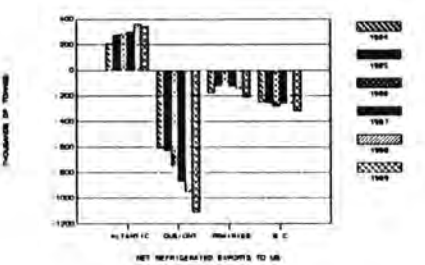
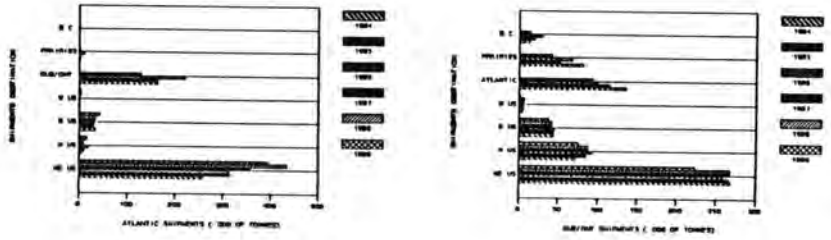


Figure 2.9: **Atlantic and Quebec/Ontario Refrigerated Freight Shipments to the U.S. and other parts of Canada, 1984-1989.**



2.4 Canadian Domiciled Carriers

Figures 2.10 and 2.11 summarize refrigerated shipments by Canadian domiciled carriers for 1987. British Columbia exported 23 percent of refrigerated tonnage to the U.S., 42 percent to Alberta, and 12 and 14 percent to Saskatchewan and Manitoba, respectively, in 1987. The Prairie provinces are highly dependent on east-west trade, with less than 15 percent of the refrigerated freight hauled by Canadian domiciled carriers exported into the United States. The information presented in Figure 2.11, however, confirms the nature of Quebec's, Ontario's, and the Atlantic provinces' dependence upon markets in the U.S., as insubstantial amounts are exported to western provinces. Ontario is the only significant link to the west with about 10 percent of its refrigerated shipments destined in that direction.

In general, the data correspond to economic logic. As distances increase, rising transportation costs inflate the prices of goods, which in turn decrease quantity demanded. There are some exceptions, however, as in the case of the Prairie provinces. Manitoba ships 27 percent of all refrigerated freight to Ontario, 7.6 percent to Quebec, and 3.7 percent to the Atlantic provinces, with average shipment distances of 1,327, 2,409, and 3,781 kilometres, respectively. The percentage of refrigerated freight tonnage is generally higher to eastern Canada than to U.S. regions, while average distances are lower to U.S. regions. Many factors may contribute to this paradox; tariff barriers, currency valuations, non-tariff barriers, different grading systems to fit tastes and preferences, and the strength of the goods producing industries.

Figure 2.10: **Western Canadian Refrigerated Freight shipments to the U.S. and other parts of Canada, 1984-1989.**

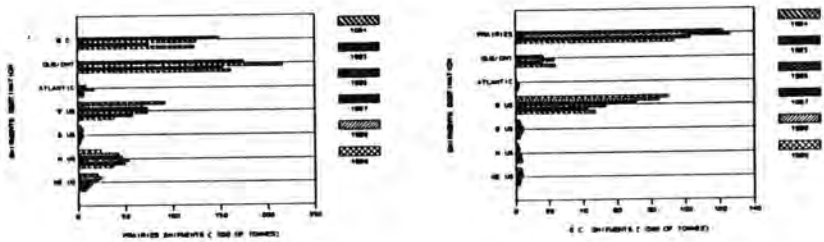
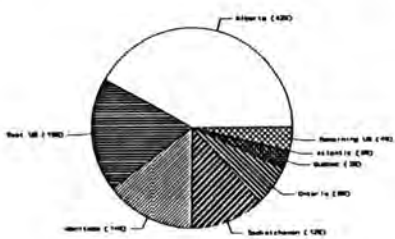
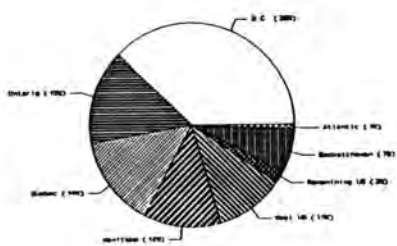


Figure 2.11: Canadian For-Hire Trucking 1987, Refrigerated Exports by Province of Origin

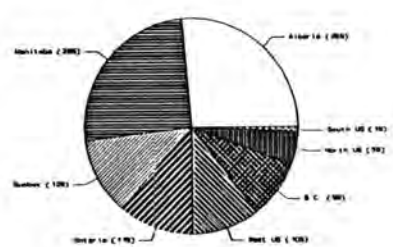
British Columbia



Alberta



Saskatchewan



Manitoba

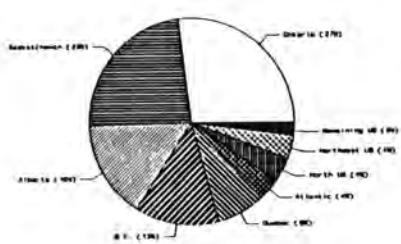
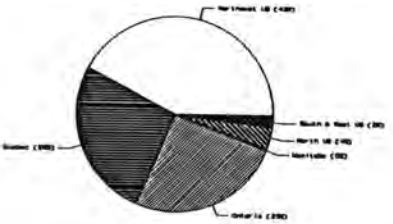
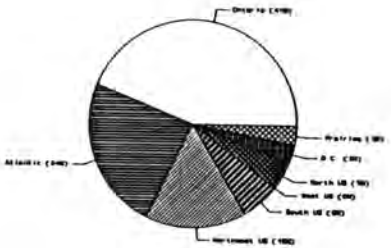


Figure 2.11: (continued)

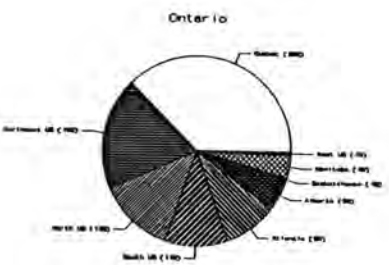
Atlantic Provinces



Quebec



Ontario



3.0 CANADA-UNITED STATES TRADE AGREEMENT (CUSTA)

CUSTA, which took effect on January 1, 1989, is designed to liberalize trade between Canada and the United States. Under this agreement, most tariffs on agricultural goods are scheduled to be eliminated within ten years. In addition, some important inspection and regulatory practices that have obstructed agricultural trade between Canada and the U.S. have been harmonized.

3.1 Goods Included

CUSTA provides for the reduction of trade barriers on domestic goods only. In order to be considered a domestic good, and thereby be subject to treatment under CUSTA, the item must be a product of either the U.S. or Canada. Technically, the good must originate from either Canada or the U.S., or it must be significantly changed from its original form in Canada or the U.S. This provision of CUSTA prevents the transshipment of foreign bulk agricultural products from American ports to Canada as "American exports" and vice versa. Accordingly, a truck driver

at the border must provide documentation that meets, or in some cases exceeds, the pre-CUSTA requirements for country of origin.

3.2 Reduction of Tariffs Under CUSTA

Tariffs for most goods are reduced by one of three schedules under CUSTA: 1) immediate removal, 2) removal over five years, or 3) elimination over a ten year period. Tariffs are phased out at equal percentages each year. For example, under the ten year schedule, tariffs are reduced at ten percent of the pre-CUSTA level per year. Other import taxes, such as customs user fees, are to be phased out over five years and are banned from future re-introduction. Export taxes have been removed and/or banned unless such tax is also assessed for domestic consumption.

Most agricultural products are subject to the ten year schedule. The exception is fresh fruit and vegetable tariffs, which have been given special status. Both governments reserve the right to re-initiate their tariffs during a twenty year phase-out period, if the price of fresh fruits and vegetables becomes depressed, in order to protect domestic producers.

3.3 Reductions in Non-Tariff Barriers for Meat Under CUSTA

CUSTA contains a commitment to reduce non-tariff barriers to agricultural trade. Canadian import quotas on American poultry have been altered to reflect the previous quota plus the special import quota of 3.5 percent on turkey and 7.5 percent on chicken. Also, certain poultry products, such as prepared Chicken Kiev and chicken and turkey "TV" dinners, are exempt from import quotas.

The inspection procedures for meat and poultry, as well as for fresh fruits and vegetables, will be harmonized under CUSTA. Prior to CUSTA, each country's packing plants were subject to inspection by officials of the other country. The U.S. required every load of meat imported from Canada to undergo a physical inspection. Shipments could be refused because of poor quality or unsatisfactory packing. Kerr, Cullen, and Sommerville (1985) estimated that for Canadian beef exports, the cost of these inspections was approximately 20 percent of the U.S. import tariff level on beef.

In addition to the costs involved, the transportation of meat was delayed by inspection. Truck drivers were detained three hours for a skip lot (partial inspection) and six hours for a full lot. Prentice and Hildebrand (1988) suggest that the delay could take a full day if "the carriers are required to await lab results before proceeding on their trip." Moreover, loads that failed to pass the inspection had to be returned to the plant of origin. These inspections and the potential for delay caused carriers to either increase their rates to compensate for the lost time, or to decline to take meat loads.

As of January 1, 1989, the U.S. moved all meat inspections to border crossings, instead of previous practice of inspecting at the destination, and licensed private firms to construct and operate the facilities. U.S. Customs no longer conducts meat inspections, but may detain drivers to ensure compliance with other federal regulations. Meat inspectors, working under the umbrella of the U.S. Department of Agriculture (USDA), operate at eight entry points on the Canada-U.S. border.

Under the provisions in CUSTA, border inspection of Canadian meat is allowed only as often as U.S. domestic inspections. As a result of CUSTA, the privately owned meat inspection

stations became unprofitable. In response, the U.S. government raised inspection fees from $100 to $600. In addition, Canadian shippers allege that the frequency of inspections, and subsequent rejects of meat loads have actually increased since CUSTA (Manitoba Co-operator, January 4, 1990).[4]

On February 26, 1990, U.S. Secretary of Agriculture, Clayton Yeutter and Canadian Minister of Agriculture, Don Mazankowski, issued a joint statement that announced their agreement to conduct a 1-year experiment which would eliminate re-inspection of meat and poultry products. On June 28, the U.S. Food Safety and Inspection Service published a proposed amendment in the Federal Register that would implement the Yeutter-Mazankowski agreement. The 30 day comment period that follows publication was extended a further 30 days because of the number of submissions received. As of February, 1991, the comments have been assessed, but no decision on the 1-year experiment has been announced by the U.S. government.

3.4 Changes in Freight Movements

Tariff reductions may stimulate north-south movements of freight to the detriment of east-west movements which involve greater distances between origins and destinations. CUSTA is expected to lead to an increase of Canadian beef and pork exports to the U.S. (Agriculture Canada, 1988), and some increase in the volume of poultry imports from the U.S. The trade of fresh fruit and vegetables is expected to become more specialized. Canada is projected to have expanded export opportunities for storable vegetables, e.g., potatoes and onions, while the U.S. will expand its exports of horticultural products during the summer season.

Relative prices in Canada-U.S. trade are also affected by the Canada-U.S. dollar exchange rate. Coleman and Meilke (1988) show that, on average, a 10 percent devaluation of the Canadian dollar led to a 15.5 percent increase in beef exports and 1.9 percent increase in pork exports to the U.S. between 1972 and 1982. Since 1986, the appreciation of the Canadian dollar has reduced the immediate impact of reduced tariff and non-tariff changes under CUSTA (Prentice et. al. 1990).

4.0 FACTORS THAT AFFECT THE CANADIAN TRUCKING INDUSTRY

Prentice et.al. (1990) conducted personal interviews with 27 trucking companies based in Minneapolis-St. Paul, Toronto, Montreal, Calgary, and Winnipeg to determine attitudes regarding CUSTA and other regulatory/economic policy changes occurring in North America since 1980. The convenience sampling and small number of respondents preclude generalizations to the broad population of trucking companies; however, the continuity of results implies a significant degree of internal consistency.

4.1 Effects of CUSTA on Canadian Trucking Industry

Clearly, the exclusion of transportation services from CUSTA reduces the potential benefits that could flow from the agreement. Canadian trucking firms face numerous economic and regulatory obstacles that their U.S. counterparts do not confront, or have been able to avoid through legislative enactments during the 1980s.

Trucking firms, including refrigerated freight carriers, reported no change in domestic east-west movements since CUSTA. A modest increase in general freight, but not refrigerated freight, was the only transborder freight lane increase mentioned. Most carriers anticipate

decreased east-west trade and increased north-south trade as trade barriers are lowered. In the short run, however, carriers felt that trade would parallel changes in currency values.

An increase of interchange between the U.S. and Prairie provinces could have a significant effect on the Canadian domestic east-west load imbalance. First, CUSTA is likely to divert the origin of some manufactured goods to the U.S. Although no changes were evident so far, trucking firms anticipated these composition changes as well. If this occurs, it would accentuate the current imbalance of LTL loads northbound from the U.S., while alleviating the east-west domestic imbalance.

Reduced tariffs could lead to longer hauls and a marginal increase in the number of trucks. It is not clear, however, whether longer hauls per se will lead to increased profitability. The effect of CUSTA on freight rates and operating efficiencies is quite uncertain. Greater competition should lead to lower rates in a freely competitive market. It remains to be seen whether firms are willing to invest in equipment and streamline local operations sufficiently to incur lower operating costs that can be passed along to shippers.

The harmonization of meat inspections between Canada and the U.S. has the potential to increase firm-level efficiencies in the transborder movement of refrigerated meat. Evidence is mixed, however, as to the net positive impact such harmonization will provide to Canadian refrigerated truck operations.

For those trucking firms which operate in the transborder market, cabotage regulations are an economic barrier that reduces their efficiency and provide a competitive disadvantage vis a vis U.S. carriers. Because cabotage rules preclude Canadian trucks from traffic lanes solely within the U.S., (vice versa for U.S. firms operating in Canada), opportunities for movements further into the interior of the U.S. market are limited to carriers originating at a Canadian point. The problem is that U.S. carriers do not experience the same difficulties in organizing profitable loads from the U.S. into Canada due to the large number of potential points served enroute. Canadian carriers, on the other hand, are at a disadvantage because of the small population and economic base from which to operate. Canadian cities are often either too small or too far apart to generate profitable transshipment traffic. Cabotage restrictions do not have as great an impact in Alberta or Saskatchewan as their population centres are about 200 miles or more from the border. Moreover, there are no major U.S. centres closer than 600 miles directly south of these provinces.

The advantages to Canadian freight carriers of locating their transborder operations in the U.S. presents a significant problem. At present, the Canadian international trucking industry earns over $1.49 billion, and supports 16,000 person-years of work in Canada (Statistics Canada, Trucking in Canada, 1987). In the short term, many carriers are depending upon their ability to provide exceptional service in competing with lower rate offerings in the U.S. This strategy, however, may not be sufficient in the long term, which will require the industry to pay careful attention to efficiency, innovation, and to develop a marketing strategy which emphasizes superior service and customer dedication.

5.0 CONCLUDING REMARKS

The major contribution of this paper lies in highlighting the trends in east-west and north-south refrigerated truck movements and, therefore, in establishing a benchmark to assess future economic and legislative impacts. We have indicated that the imbalances are significant, although east-west movements are less important than generally assumed. Only for contiguous provinces are volumes sufficiently high.

An important question is whether the present pattern for Canadian refrigerated truck movements is a function of the previous lack of liberal trade, and thus a result of artificial stimulation through collusive private and governmental actions, or primarily a result of competitive advantage with respect to commodities economically transported. To the extent that patterns are reflective of underlying natural economic processes, the movement to a liberal trade regime for North American businesses will likely not disturb the observed flows. Each province will continue to produce and transport those commodities that bring producers the greatest return. On the other hand, if the pattern of trade and transport has evolved because of significant protective measures, either through support of transportation rate structures, entry barriers, or through subsidy allocations to specific economic sectors within Canada, then it is likely that trade liberalization will change the observed relationships. To what extent has protectionism and/or subsidy allocations led to the development of east-west and north-south linkages? More importantly, to what extent is protectionism or subsidy programs necessary to maintain existing trade and transport flows? Answers to these questions will shed light on the issue of whether trade and transport patterns are sustainable over time as markets become more liberalized.

A related issue addresses the linkage between trade liberalization and transport deregulation. Canadian and U.S. negotiators purposely omitted transportation services from provisions of the Free-Trade Agreement signed in 1989. In light of the importance of north-south trade to Canadian provinces, does it make sense to have in place a process which liberalizes trade in commodities, but ignores the necessity to be competitive in transporting and distributing such commodities? Obviously, trade and transportation liberalization must be complementary goals.

The impact of transport deregulation has been ignored in this paper; however, it must be pointed out that the essence of competitive advantage lies in generating efficiencies in the provision of quality goods and services. This statement implies that free trade in goods is a necessary, but not sufficient condition for attaining competitive advantage. The Canadian-U.S. Free Trade Agreement may stimulate production efficiencies in both countries, in our case commodities requiring refrigerated transportation; however, without active competition in the transport sector some of the gains may be negated. Furthermore, the loss is likely to accrue largely to the partner with the least efficient transport sector.

Trucking deregulation in the U.S. has been in place for over a decade with significant gains noticeable in operating efficiencies. Canadian trucking has not experienced similar regulatory changes and tends to be more costly in relation to U.S. firms. The consequence for present refrigerated trucking flows, assuming no change in the nature of trucking regulation, is that Canadian producers must attain significant production advantages relative to U.S. producers to compensate for higher Canadian transport costs, or, alternatively, for Canadian producers to utilize less expensive U.S. domiciled refrigerated carriers to continue servicing demands in western, southern, and eastern U.S. markets. If the latter case evolves, we are likely to observe a significant exodus of Canadian domiciled carriers to the U.S. Both scenarios suggest the need for harmonizing transport policy with trade negotiations for the best interest of both partners.

ENDNOTES

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1. The ramifications of CUSTA are difficult to separate from other important issues facing the trucking industry. The progressive deregulation of extra-provincial trucking in Canada commenced one year prior to CUSTA with passage of the Motor Vehicle Transport Act (MVTA) in 1987. Deregulation of the trucking industry could have an impact on east-west/north-south movements independent of CUSTA. Coupled with changes in the laws governing transport activities that impact upon transport/commodity flows are real differences in taxation regimes and currency exchange rates between Canada and the U.S. Our concern is to focus on the impact CUSTA is likely to have on refrigerated transport flows while recognizing the interrelatedness that exists between the various factors impacting the industry.

2. For a thorough overview of the data and tabular results, the reader is urged to review Prentice, B.E.; Warkentine, G.E.; Benell, D; Lawrence, W.C.; and Shi, H. **Impacts of the Canada-U.S. Free Trade Agreement on East-West and North-South Movements by Refrigerated Truck.** Transport Canada, Economic Research Branch, Publication No. TP0753.

3. ibid, pp. 5-29.

4. The rules permit inspection stations to examine the next 15 loads from individual shippers after the initial violation. This creates a significant economic incentive for the inspection stations to be over-zealous in their enforcement of regulations.

This paper is based on background research carried out on behalf of Transport Canada. The opinions expressed herein are those of the authors and not Transport Canada.

THE DEVELOPMENT OF EAST-WEST EUROPEAN TRANSPORT IN THE 1990S

Kenneth Button*

Introduction

The Gorbachev era initiated a transformation of Eastern Europe. The political and economic changes - and especially *perestroika* - which are taking place in the post-socialist states are inevitably resulting in widespread economic ripple effects throughout the rest of the Continent. There has been a move away from state monopolisation of the means of production as privatization has been carried through and even within the state sector changes are taking place. Formerly, costs, price and interest rates, while often set down on paper, had little relevance in economic decision making which was geared to the 'hard' constraints of resource direction. The current changes may, therefore, be viewed as seeking to harden budget constraints and to increase the role of monetary variables in decision making (see Funck and Kowalski, 1989).

The changes are as pronounced in the transport sector as any other. Indeed, emphasis is being put on improving communications, in the widest sense, between the East and West as a key ingredient in a broader integration processes. The implications involve, however, not just immediate issues of handling changes in international freight flows across the Continent but also longer term matters which extend into issues of reinvestment in the transport infrastructure of most Eastern European countries, the containment of environmental degradation associated with the transport technology employed, the problems of redeploying many hundreds of thousands of currently unproductive workers and management questions concerning the efficient operations of transport systems.

Further, the changes in the East are taking place at a time when transport policy in Western Europe is itself becoming less interventionist. Not only have many countries liberalized their domestic transport policies and also bilateral arrangements with other states but, in the wider context of the European Communities' (EC) Common Transport Policy, there have been more general movements away from economic regulation (Banister and Button, 1991). Eastern Europe, if it is to successfully liberalize trade, must begin to compete in this larger and less controlled transport framework. Also, domestically, national transport policy makers will need to take cognizance of the inevitable demonstration effects which will materialise as travel and communications become freer.

The objective of this paper is initially to examine the differences in the transport systems of East and West Europe, both in terms of their physical composition and their management, and then to consider the implications of the on-going political changes in Europe for the future of these systems[1]. While passing references are made regarding most modes of transport, space constraints leads us to focus on land transport. By its nature such as exercise must be also be speculative especially given, first, the uncertainty surrounding larger political developments in Eastern Europe and, second, even if there were relative political certainty about the future, there are still difficulties of actually determining the macroeconomic outcomes of the current pattern of change. The derived nature of demand for transport services makes it particularly sensitive to these exogenous forces.

An important caveat must also be introduced at a very early stage of the discussion, namely that one must take care not to over generalising about transport in the East and West. There are quite significant differences between transport facilities and policies within the EC and CMEA which in many ways may be more substantive than the differences between the EC as a group and Eastern Europe as a block. The differences between the railways of the former German Democratic Republic (GDR) and those of some parts of the EC are, for instance, probably less than those between the rail systems of the Netherlands and Greece[2]. As a consequence of these diversities in Eastern European economies, and also because of space constraints, rather less is said concerning the USSR (in part because of its size and internal differences) and Yugoslavia (in part because of its particular form of self-management) than the other states in that region. But one should also say that these differences extend beyond the physical natures of the national transport systems and relate to priorities and objectives. Decision making in Eastern Europe was, until recently, almost entirely dominated by political criteria rather than the notions of economic efficiency which we are more familiar in the West. In consequence, dependent upon the particular political position of the team in power at any one time, so the policy of a particular state would change. This gives both variations across countries in terms of their starting positions regarding current reforms and variations in the ways these reforms are manifesting themselves.

There are, therefore, problems in divining the direction and nature of change in Eastern Europe, or, indeed, in the EC. A number of possible scenarios could be advanced. Here we are less concerned with details but assume that liberalization of markets will continue and that trade between East and West will become freer. It is also explicit in the discussion that this will over the next decade, albeit at variable speeds and in differing ways, lead to greater economic prosperity for Eastern European economies.

A further caveat relates to the reliability of data. Many Eastern European countries have traditional been rather sparing with the data that they have released regarding both transport systems themselves and the use made of them. Even where quantitative data is available, consistency is often difficult to determine especially with regard to qualitative attributes[3]. Further, the lack of convertibility of currencies makes it difficult to even determine the international trade of Council for Mutual Economic Assistance (CMEA) nations with outside countries.

Despite these reservations and caveats it is timely to look at developments in transport in Eastern Europe. At one level - that of self interest - there is likely to be a growing market for Western technology and expertise. At a higher level, there is a vested interest for all parties to have efficient transport systems both to lubricate the movement of goods across borders and to ensure maximum efficiency of production within borders.

Transport Policy Formulation in Europe

The development of transport policy in Western Europe, and especially, that within the EC, is well documented in readily available sources and no details are offered here[4]. In broad terms the EC Common Transport Policy leaves each member state to pursue its own domestic transport strategy within the broader framework of EC anti-trust policy, social policy, regional policy, etc. International transport within the EC is gradually being liberalized in line with the move to the Single Market concept while the EC as a whole is gradually becoming more involved in policy formulation relating to transport between member states and non-members. In particular, the 1980s saw significant changes in the way European transport policy is viewed and in the ways that policies are formulated and implemented. The decision to move towards the Single Market for the EC dominated much of this change, especially during the latter part of the decade. But equally there are questions concerning financial arrangements and the degree to which more centralized coordination of investment is desirable which still remain largely unresolved[5]. In many ways, therefore, the situation in Western Europe is

an evolving one although the real issues are rather more centred around the exact pace of change and its details rather than the underlying philosophy and fundamentals involved.

In contrast transport in Eastern Europe was, as a generalization, heavily regulated and controlled both at the national and international levels. Further, evolutionary changes towards greater liberalization have not been occurring gradually over time although there have - eg in the 1970s - been periods of reform. The underlying theory of transport policy was that transport is not a 'productive activity' in the material sense and hence planners aimed at a unified system with the minimum of duplication. The outcome was that almost any movement required a mix of modes.

At the international level CMEA has played a central role during the post-Second World War phase to coordinate international transport within Eastern Europe (Tarski, 1981). CMEA essentially had no independent power but relied upon consensus among the members states. Transport arrangements are, therefore, determined on a bilateral basis very much like those in EC prior to the integration taking place after 1992. Nevertheless, agencies within CMEA, such as the Permanent Transport Commission did plan integrated transport policies designed to ensure international transport would be available to meet the objectives of the macro-economic plans ('perspective production plans') of the different states. This extended to decisions regarding modal supply as well as overall considerations concerning aggregate capacity.

At the national level, the idea that transport is not in itself productive has in many cases led to excessive spread in the transport networks supplied. Essentially, transport was not a major consideration in the planning exercises of the 1950s through to the 1970s and led to the adoption of dispersed factory systems as part of nationwide industrialization in countries such as Poland (Potrykowski, 1985). In other countries military factors and efforts at establishing political cohesion dominated considerations of strict economic efficiency.

Nationally, Eastern European states have also tended to pursue somewhat independent lines in other ways. The USSR, for instance, has what the Soviet literature calls a 'unified transport system' in which the state owns all roads, railways, pipelines, etc so that the system can be planned as a unity. Ideals of eliminating waste and unnecessary competition predominate. Despite this the USSR has rarely given the highest priority to transport either in terms of resource allocation or developing specific administrative structures to meet its particular needs. Certainly, in practice the method of coordination has major problems. The 'branch' method of organization spreading from the centre, for example, with separate branch ministries for rail, roads, shipping, etc. has led to high levels of vertical integration but little coordination horizontally between the modes[6]. It should be pointed out that while some of the blame for lack of overall coordination can be explained simply in terms of bureaucratic ineptitude (or X-inefficiency, to adopted the jargon of managerial economics), the very inflexible nature of the system, which puts pressures on ministries to meet their designated plans, generally leads to high levels of allocative inefficiency.

In all Eastern European countries the main infrastructure is in state hands, a situation not unlike that in much of Western Europe, but also much of the mobile capital including road haulage is state owned. Indeed, the 4,500 trucks in the Bulgarian national transport cooperative, SOMAT, is the largest road haulage fleet in Europe. Such state ownership should not always, though, be linked with the strict command approach seen in the USSR and, indeed, SOMAT, because of intense competition from low cost suppliers from countries such as Turkey in the international markets in which it also operates, is more akin to firms in the West in its approach to management.

Some countries, and most especially Hungary following the setting up of a 'new economic mechanism' in 1968, have been less centralist in their approaches and have allowed a degree of private ownership of transport. .This mixed economic approach, however, is not without its difficulties in countries where market forces are given little sway. In particular, traffics from state enterprises tend to be directed to heavily subsidies

state owned transport and especially to the railways. On the factor input side obtaining spares, fuel, etc for private enterprise transport often encounters physical limitations which cannot be circumvent, as in a full market system, by offering higher prices.

The Problems

The very rapid developments in Eastern Europe over the past three years have added a particular dimension to the constraints on policy makers in Europe. At one level there is an inevitable long term increase in trade between East and West as the economies of the former move forward. But in addition to this a certain amount of trade diversion will occur as each state seeks to develop its own comparative advantage. This will put pressure on the existing transport systems in Europe and more investment will inevitably be needed. But in addition to this the enlargement of the market area of Europe in such a sudden way and with, at this time, relatively unclear long term consequences adds to the basic uncertainty involved in defining what any ultimate integrated European transport market may look like.

In very broad terms the transport systems of Eastern European countries tend to differ in two major respects from their Western counter parts. The basic infrastructure is different and the method of management is different. The many problems created can usefully be reviewed under a number of headings.

- *Balance of Trade*. In broad terms, the bulk of foreign trade involving Eastern European countries has been within the CMEA net with much less trade taking place with the rest of the world. In 1985, for example, Bulgaria exported (in $US terms) about five times as much to other CMEA countries as to the rest of the world combined and imported four times as much. In the case of Czechoslovakia the ratio was about 3.5:1 for both exports and imports and about 1.5:1 for the USSR and 2:1 for the GDR on a similar basis. From another perspective, East-West trade accounted for less than 2% of the trade of EC countries in the 1980s and less than 13% of trade involving CMEA members. Further, the share of manufactures and minerals in exports from Eastern European countries was 50% and 30% respectively compared with 73% and 13% for world-wide exports.

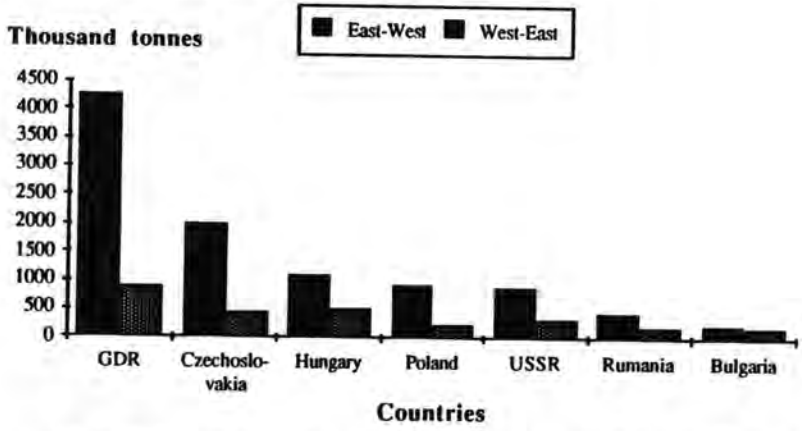
These features of trade patterns inevitably led to infrastructure being designed to cope with the particular form of internal and CMEA trade, which mainly involves movements of bulk raw materials and semi-finished products, and which bears little relation to world, market determined trade patterns[7]. Forecasts suggest that on the basis of even a relatively conservative scenario, by the early part of the next century this pattern of trading activity will be transformed and with this will come the need for a different form of transport provision (Seidenfus, 1990).

One must add to this that the trade which does exist between the CMEA countries and the EC, in particular, while relatively balanced in financial terms is heavily bias in favour of bulk movements from Eastern Europe in physical terms. According to the United Nations Commission for Europe (ECE), in terms of aggregate tonnage carried by rail, while 30 million tonnes of freight moved from East to West only 15 million tonnes moved in the reverse direction in 1987. The comparable figures for road transport are 9.8 million tonnes and 3 million tonnes respectively and by country are shown in Figure 1. These types of imbalance, brought about primarily through lack of appropriate market incentives, result in considerable amounts of empty running coupled with facilities ill-suited to the carriage of manufacturer products.

Further, within the CMEA imbalances in the nature of trade exist. In particular, the USSR fostered the establishment of a set of freight rates fixed without regard to mode employed or to prime costs and which effectively subsidised the exports of its raw materials to other Eastern European states. Other countries benefited in that their import costs for raw materials were thus kept down but they also had to introduce similar pricing structures for their own facilities which meant that for though traffic - eg from the USSR through Poland to the GDR - the transited country often suffered heavy losses.

Problems of this kind also extend to the cost side with differences, in this case, in rail gauge in Poland and the USSR resulting in vast amounts of resources being expended on building axle-changing and reloading facilities at border points (Alvstam *et al*,1985).

Figure 1 Volumes of traded goods transported by road between CMEA countries and the EC in 1986



• *Modal Split.* Some indication of the modal split for freight transport in EC and selected Eastern European countries can be seen in Table 1. It is clear that rail is a much more important form of freight transport in Eastern European countries than in the EC. The emphasis on rail freight transport in Eastern Europe also has knock-on effects for other transport activities. The problems of scheduling, for example, mean that most passenger inter-city services in Eastern Europe seldom average 80 kilometres per hour, except in Poland where a few fast trains per day average around about 100 kilometres per hour.

High quality road transport does not offer a substitute both because of the limitations of the available infrastructure and because of the relatively low level of automobile ownership. Table 2 indicates the level of car ownership to give some indication of the potential use made of that mode for passenger transport. Further, in general whereas a private cars averages some 12,000 or so kilometres per annum in Western Europe, the figure for Eastern European states is under 10,000.

• *Quality of Infrastructure.* The Eastern European states are heavily reliant upon rail for freight transport but their systems tend to be old and the efficiency of operations is highly questionable. If one considers Table 1, for instance, it is clear that the Eastern European economies have extensive rail networks but equally that, when compared to the EC states, a relatively small percentage of it is doubled tracked. Taking another parameter of the need for investment in the Eastern European rail transport system, it is clear that there is a need for more electrification. For example, of 27,284 kilometres of line, 11,669 are currently electrified in the states of the pre-1990 FRG but out of 14,024 kilometres in the old GDR only 3,475 kilometres were electrified and in Poland, of 26,545 kilometres only 6,296 are electrified. The rolling stock, especially that required for passenger services, of the Eastern European railways tends to be older than that in the EC and also much more uniform which makes it difficult to respond to changing economic conditions (Timar, 1990). Further, the facilities for maintaining both track and mobile capital is generally out-dated and inadequate. The costs of change are, thus,

likely to be high. German reunification alone, for instance, will inevitably mean substantial investments in new rail transport infrastructure[8]. One estimate, expressed in May 1990 by Dr. Reiner Gohlke, president of the Bundesbahn at a conference of the Community of European Railways, is that some DM100 billion is needed simply to get the old GDR rail system into a comparable condition to the network in the West.

Table 1 Mode split for freight carriage (thousand tonnes/kilometres in 1988)

Country	*Road*	*Rail*	*Inland Waterways*
European Community			
Belgium	26.00	7.00	6.35
Denmark	9.10	1.66	-
France	111.80	52.30	7.33
Germany	151.40	58.50	52.80
Greece	14.00	0.60	-
Ireland	5.00	0.55	-
Italy	169.00	19.60	0.14
Luxemburg	0.40	0.64	0.36
Netherlands	22.10	3.20	33.85
Portugal	9.00	1.56	-
Spain	133.00	12.00	-
United Kingdom	124.80	18.20	2.30
Eastern Europe			
Bulgaria	14.70	17.60	-
Czechoslovakia	13.10	69.40	5.20
GDR	16.40	59.40	2.50
Hungary	13.20	20.20	2.00
Poland	38.80	120.70	1.40
Yugoslavia	20.90*	25.40	4.60

* Public transport only

Source: Taken from United Nations, European Conference of Ministers of Transport, International Road Federation and International Union of Railways data sets.

The poor quality of automobiles is another problem as is that of the road networks. In a little more detail, as seen from Table 2, the high quality road transport systems of most Eastern European countries are comparatively sparse compared to the rest of Europe (Marcel, 1989). This is only partly a reflection of the relatively weak demand for road use stemming from the low levels of private car ownership in these countries and is more closely linked to the ideologies of the decision makers. Resources have tended to be channelled, albeit often in an inefficient manner, into the rail systems.

• *The Geography of the Infrastructure.* There is the difficulty that after decades of separation the investments which have taken place are not in sympathy with a more integrated European economic system. Some of the difficulties become clear simply by taking the German situation.Much of the GDR electrified rail network served a north-south axis rather than an east-west axis - ie it served the needs of the internal GDR market and its politically determined trade links. The same broad picture is also true for the Federal Republic. While there are points where links can be improved in this context the situation is somewhat worse in other Eastern European countries where the main

investments have been to link the economic centres of Bulgaria, Hungary, Poland etc. to the USSR (Turnock, 1989).

Table 2 Basic transport infrastructure of selected European countries (1988)[9]

Country	*Motorways (kms)*	*Rail Track (kms) (double tracked)*	*Car per Capita*
European Community			
Belgium	1570	3554 (74%)	0.364
Denmark	835	2476 (33%)	0.320
France	5300	34365 (45%)	0.400
Germany	8715	27278 (50%)	0.472
Greece	90	1565 (16%)	0.150
Ireland	8	1944 (27%)	0.208
Italy	6091	16015 (35%)	0.430
Luxemburg	75	272 (60%)	0.460
Netherlands	2060	2828 (63%)	0.356
Portugal	211	2850 (15%)	0.210
Spain	2344	12531 (21%)	0.276
United Kingdom	3100	16599 (69%)	0.349
Eastern Europe			
Bulgaria	258	4055 (23%)	0.132
Czechoslovakia	518	12856 (23%)	-
GDR	1855	14024 (30%)	0.225
Hungary	324	7403 (15%)	0.169
Poland	220	26545 (34%)	0.119
Yugoslavia	828	9349 (12%)	0.131

Source: Taken from United Nations, European Conference of Ministers of Transport, International Road Federation and International Union of Railways data sets.

The artificiality inherent in much of past industrial location policy in Eastern European also means that in the longer term as rationalization of production takes place there will be insufficient capacity on many links in the transport network but excess capacity on other corridors. If one takes the former GDR, for instance, while it has some 14,000 kilometres of railway track less than 4,000 kilometres would be required to interlink towns of over 100,000 population. The far flung nature of the railways also means that much of the data cited earlier regarding the quality of the system may well be distorted because there is no indication of the extent to which electrification or double tracking correlates to the use made of particular links in the network.

- *Latent Demand.* The economic systems of Eastern Europe have in the past relied heavily on physical rationing measures for the allocation of consumer goods (eg waiting lists for cars) coupled with a rather ineffectual pricing structure. Liberalization of markets is gradually resulting in increased demands for consumer goods as prices take a more central role in allocating production and consumption. This will inevitably lead to rising levels of car ownership and indeed in some areas, such as the former GDR, this is already occurring. The important consideration here is that car ownership tends, from both the experiences of Western economies (Tanner, 1983) and less developed countries (Button and Nboh, 1990), to follow a sigmoid growth curve. Consequently, once a certain critical level of ownership is reached there is a very rapid acceleration in the level of ownership over the following years. Many of the Eastern European countries are at or about this critical level of ownership and under freer market condition acceleration seems

almost inevitable. The pressures of the existing latent demand, which a more market orientated economic system would release, are also likely to be accompanied by additional pressures for car ownership and use as the macroeconomic efficiency of the Eastern European states leads to rising income levels.

- *Management Approach.* In terms of productive inputs, the transport systems of most Eastern European countries are much more labour intensive than found in Western Europe. For example, while the pre-unification FRG's rail system employed 240,806 people in 1987, the GDR's employed 249,964 and Poland's 360,015 but in terms of performance, the FRG system did over 40% more tonne kilometres than the GDR's system and only 20% less than Poland's. In the USSR, which has the world's busiest rail system, nearly four million people are employed on the network, although, for comparative purposes, it is interesting to note that the US system, which is a 240,000 kilometres network, while admittedly producing only half the tonnage and a quarter of the tonne kilometres, operates with only about 150,000 employees. Part of the problem must be attributed to the lack of power management has over recruitment and sacking but equally management operates under a confused objective/reward structure which does little to stimulate its efficiency or to motivate innovation (Ambler *et al*, 1985).

The management of transport systems by command and control instruments which, to varying degrees, has typified the approach in Eastern European economies, is particularly disadvantageous in a modern industrialized society where many movements are of non-bulk commodities, irregular in their nature and heavily dependent on service quality to achieve consumer satisfaction. Flexibility is essentially and local responsiveness normally desirable but these are the very features missing in a centrally planned transport system[10]. It also poses problems at a more micro level making it difficult to specify targets for management and to identify (and translate into quantitative terms) appropriate performance indicators.

The lack of a profit motive also removes both an internal measurement of efficiency and criteria upon which facilities may be allocated between users. Furthermore, the heavy subsidies traditionally given to transport in most Eastern European countries adds to this problem. In Poland, for example, where rail transport has been supplied well below cost, enterprises geared to rail transport tend to circumvent legal minimum distance requirements to employ road transport for short hauls by deliberately using distant suppliers - the costs of transport in overall production costs being so small that it does not stimulate rational use of resources (Turnock, 1989).

The differing management approaches of the Eastern European nations, coupled with the nature of the ownership of much the mobile capital, also leads to potential transitional problems as privatization takes place. Whereas the privatization of transport in Western Europe in the 1980s was into an economic system and a culture where risk management and enterprise were the norm, this is hardly the case for Eastern European states. The skills required are thin on the ground and the mechanisms for transferring assets to private ownership simply do not have a pedigree in systems where banks and financial institutions are not designed to channel private resources into investment activities.

- *Environmental Issues.* Transport is extremely intrusive on the environment but additionally, there is mounting evidence that the scale of the associated environmental degradation is at least as much due to governmental interventions in markets as to traditional notions of market failure (Barde and Button, 1990). While there are national differences, the environments of Eastern Europe are all heavily polluted and much of the problem must stem from intervention failure. Energy production, raw material extraction and heavy industry are the major culprits but transport is also a contributor (Turnock, 1989; Russell, 1990). Data on the exact state of the environments in Eastern Europe, let alone the factors causing their degradation, are sparse but some indications are available. Table 3, for instance, gives some calculations regarding Nitrogen Oxide (NO_X), an atmospheric pollutant associated with acid rain, which in the West is being countered by

the fitting of catalytic converters and is in most countries stable or falling (Linster, 1990). The vintage and technology of the vehicle park in Eastern Europe also means that the NO_X and similar atmospheric pollution problems are increasing and not abating. Growth in car ownership can only add to these effects.

Table 3 Estimates of NO_X emissions (10^3 tonnes per annum)

Country	*All Modes*	*Road Transport*	
	1980	*1980*	*Forecast 2000*
Bulgaria	89	88	185
Czechoslovakia	91	88	95
GDR	-	81	144
Hungary	100	75	142
Poland	190	185	201
Romania	-	85	105

Source: Laikin, *et al* (1987)

• *Mobility in the West.* While there will be development problems in Eastern Europe over the next decade, Western Europe will also be encountering increased transport difficulties albeit of a somewhat different kind. Traffic growth has been rapid since the 1970s and tended to exceed most official forecasts - in the FRG, for instance, traffic has already reached the 1985 forecasts for the year 2000. But coupled with this, infrastructure investment has tended to slow down and actually fell by 25% in the period 1975 to 1984 (Rathery, 1988). The result is that not only are there serious urban congestion problems in most major cities but that major bottle-necks and 'corridors of transport stress' have emerged at points along some of the main Western European lines of communication - see Figure 2 (see also European Roundtable of Industrialists, 1990).

Even without increased movement brought about by an opening of borders to the north, congestion will inevitably grow and traffics from Eastern Europe will add to this especially at major cross-roads. While formulating scenarios concerning patterns of trade are always enmeshed with problems, it seems almost certain that Hanover, Nuremberg, Vienna and Berlin will become major 'junctions' (de Waele, 1990). In most cases these cities do not possess suitable infrastructure to handle major flows of transit traffic. Berlin's post-war transport infrastructure, for example, was built on the premise of a divided city while Vienna is in a country already antagonised by high levels of through traffic and does not even have a ring motorway.

Policy Directions

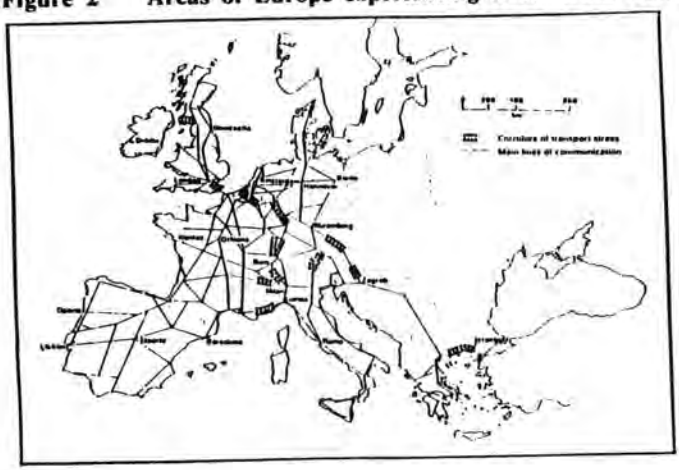
The transport policy options open to most Eastern European states, assuming that they do not wish to revert back to centralist planning doctrines, are relatively small in number. This is in part because of the time it takes to physically change any major transport system but also the resources available for major restructuring are very scarce. Conditions attached to outside monies, either from government sources, via bilateral agreements and through international agencies such as the World Bank, the European Investment Bank and the Bank for European Reconstruction and Development (BERD), or directly from private sector sources will also inevitably influence the patterns of change which is possible. Some general points can, however, be made.

One of the big advantages that the post-socialist states enjoy is that they have the opportunities to learn from the past mistakes of Western Europe as well as the pitfalls of their centralist planning history. The experiences of the CMEA countries and, indeed, the EC suggest that there is a danger in being excessively dogmatic and doctrinaire in drawing up long term transport policies. The demand for transport services is derived from the demands of passengers and freight shippers which in turn depend upon a

multiplicity of economic influences. The traditional CMEA and EC approach to transport policy was to focus heavily on supply side considerations and even within this framework to apply static notions of cost and technology. The EC has become more demand oriented in its thinking in recent years and inevitably the transport policy makers in post-socialist Eastern European countries will, albeit probably to a lesser degree, follow suit.

The shift towards more demand driven policy has, perhaps inevitably, also coincided with greater reliance on private sector funding for infrastructure together, in many cases, with privatization of the operation of transport systems. This does not mean that the public sector has not had a central role - indeed given externalities and property right difficulties it must retain an overall planning and coordinating function. Rather that its role has changed. In the context of Eastern Europe there are good reasons to suggest that private sector injections of money are desirable from outside of the country and that privatization of large parts of the existing transport system would also be advantageous. In terms of investment it would mean that resources would be directed at projects offering high commercial returns rather than, as in the past, dissipated across many variable schemes. Perhaps more important, however, is the management of assets, including the privatization of existing ones. There is a danger in a climate of transition, where existing control-and-command systems are breaking down, that existing management could both capture new investment and take command of existing transport capital for their personal gain. The reaction of workers to this, in an emergent market economy, is likely to be demands for higher pay. Besides macroeconomic implications for the rate of inflation, this will ultimately both reduce the efficiency of transport industries as they stand but will also deter further outside investments. Rapid measures to stimulate quite substantial programmes of privatization, even if they are far from any notion of the theoretical ideal, should act to circumvent this danger.

Figure 2 Areas of Europe experiencing stress from transport pressure.



Source: Whitelegg (1988)

One should also remember that Eastern European states have the chance to renew their aged infrastructure with modern and appropriate technology. It would be an error to try to bring the forty year old technologies of many Eastern European transport systems up to the standards of the 1970s or 1980s. Rather there is a need to think in

terms of the technology and operational systems of the 1990s and forward. Again this would seem to suggest a central role for the private sector which, as a generalisation, tends to be more innovative in its approach but equally, agencies such as the BERD can be proactive in ensuring that public sector investment are geared to economic development rather than captured by national bureaucrats whose interests are often somewhat different.

While it is inevitable that one tends to think in modal terms, and indeed we revert to this below, one of the important opportunities the East enjoys is to improve modal coordination especially in terms of infrastructure provision. The tendency to think beyond individual modes is only just changing in the West with high-speed rail and motorway systems tying in with airports in hub-and spoke configuration which allow maximum overall economies of density, scale and scope to be exploited. Indeed, operators are slowly thinking in these terms with increasing emphasis on integrated systems for express parcel services and airlines such as Lufthansa extending their interests into rail transport[11].

Turning to specific modes, a number of points can be made.

- *The Railways* Looking at the geography of the larger Europe, and in particular the distances between the main generators of traffic - ie the major centres of population - there are few long distance routes. It is, for instance, only 250 kilometres from Vienna to Budapest, just over 450 kilometres between Munich and Prague and less than 550 kilometres between Warsaw and Berlin[12]. These routes, from the experiences of high-speed trains in France and Japan, are often seen as to be best suited to tracked surface transport.

The rail systems of Eastern Europe are, however, not currently of a standard capable of taking high speed traffic and the incentive to invest may be lacking. There is, if anything, excess aggregate physical capacity at present on most Eastern European systems and, given the probable change in the nature of East-West trade in the near future, coupled with changes in the types of internal traffic which will accompany increased manufacturing output, this may well be seen as likely to persist into the next century[13]. Indeed, it has been argued that if the X-inefficiency endemic in most Eastern European rail systems were eliminated then output could be doubled with no expansion of capacity (Rothengatter and Kowalski, 1990). There is a danger, therefore, that in this type of environment insufficient investment will be made and that resources, instead, will be steered towards maintaining what is there[14]. This danger must be avoided.

User charges must also be more closely related to costs and the hidden subsidies common to most Eastern European railways need to be made explicit or removed. The introduction of private investment has been seen to stimulate efficiency improvements elsewhere as well as providing monies for investment and modernisation[15]. The situation is not so clear with regard to the use of public monies but hopefully the national and multi-national agencies involved will make economic pricing a condition of granting loans, etc.

- *The Road Network*. The option of developing the road haulage industries in Eastern Europe as a complement to industrial reform is extremely limited in the short run because of inadequacies in the basic infrastructure. These are as much qualitative constraints as to do with the extent of the networks. Indeed the view of the ECE is extremely depressing, eg, "The present road infrastructure in Central/Eastern European countries has deteriorated such that it is unlikely to be able to cope with increased road traffic volumes" (Lehmacher, 1990). Further, many of the links required to expand East-West traffic are of limited capacity and, in some cases, there are no convenient roads on the Eastern side. But against this constraint must be set the needs of modern industry for flexible transport systems together with a pent-up demand for additional car ownership. Indeed, in terms of the automobile even if the Eastern European states (excluding the USSR) were to increase the per capita automobile ownership to half the current level in

the USA or the pre-unified FRG, then an extra 11 million vehicles would be seeking road space.

Many Western European countries are currently encountering capacity problems on their road networks and private investment is seen as one way of injecting funds into the system (eg Organisation for Economic Cooperation and Development, 1987). Such an approach has obvious attractions for Eastern European economies although some caution would be needed. In particular, while tolled, privately financed roads may make users aware of the opportunity costs of their activities, the existing system of free, albeit poor quality, public roads may mean that the ultimate use of the entire network is far from optimal. There may be a case, therefore, to go beyond the Western European 'club system' of annual licences allowing access to the public road network and to introduce tolls for all major roads irrespective of ownership. Relatively low car ownership levels coupled with predictions of rapid rises in this figure would make it comparatively efficient to initiate such systems at this time before the problems of mass ownership and the emergence of powerful motoring lobbies of the type found in Western Europe become realities.

- *Combined Transport.* In the past relatively little use has been made of containerization in Eastern Europe[16] - in part because of the nature of the goods carried. This must inevitably change as the economic bases of countries change and as transport is modernised. Other forms of combined transport, such as piggy-back systems, have also been little used but have recently stirred interest among transport planners who, especially in the context of the doubtful quality of existing road infrastructure, see potential for them as a means of easing transport problems between the East and West. While there may be some scope for developing such systems, especially if this can be done without incurring very high investment costs, their relatively poor performance in EC countries to date makes it unlikely that they will prove to be a long term solution. Even in the short term, the Eastern European systems are not currently inter-connect with those in the West and, in any case the latter (with the exception of the London-Amsterdam/Brussels-Cologne and Paris-Manheim-Munich routes) run exclusively north-south giving little scope for the carriage of Eastern European goods.

The Role of the West

Western Europe has a vested interest in ensuring improved transport both between itself and the East and within Eastern Europe itself. Better transport is important to lubricate trade but within Poland, Rumania, Hungary, etc it is important as an element in the economic development of these countries. In the special case of Yugoslavia there is also the incentive to improve transit networks to link Greece with its EC partners[17]. Within Western Europe, the EC put increased emphasis on transport infrastructure development and standardisation throughout the 1980s (Button, 1990). This should be seen, however, as much in terms as a reaction to increasing problems of bottle-necks in the transport networks, and indeed to missing networks themselves, as to a pro-active programme of works designed to stimulate EC economic development.

To ensure that these efforts bear fruit there is a need to coordinate, in broad terms, the policies of the 1990s with those of Eastern Europe. This is most obviously the case with regard to infrastructure provision and there is already signs that international railway advisory bodies such as the the IUR and ECE are thinking in these terms although, equally, the proposals being produced tend to be rather vague about how Eastern European countries are to generate resources for modernisation. The key role the West in this context must be one of ensuring that scare resources are not wasted although equally it should avoid the potential pitfalls of rigid planning, especially in a uni-modal context.

The West is inevitably channelling funds into Eastern Europe. Private sources pose few problems but mechanisms must be found to ensure that institutional fundings are not swallowed up in established bureaucracies and that there exist mechanisms to

encourage technical and managerial innovation. While soft loans may be desirable, a tightening of terms over time may stimulate the necessary care in the use of scarce resources[18]. These resources are also likely to be needed as much to enhance the efficiency of management and to introduced state-of-the-art computerised management systems as to refurbish the hardware of the transport networks although there is often a danger in transport that these elements are less sexy to those in the industry and get neglected in policy making.

Conclusions

The changes which are taking place in Eastern Europe, albeit at variable paces in different countries and with some back-sliding, represent above everything else a movement away from a situation where every issue was viewed primarily as a political problem, or perhaps a military problem, to one where economic considerations are often seen to have a dominant role. This means that efficiency considerations are gradually permeating deeply into the decision making process. The long term pattern of change is difficult to forecast, though, and its implications for Western Europe are far from clear. That transport will need to change both within Eastern Europe and in the West seems unquestioned, the difficulty is to define policies which will, if not optimize the eventual outcome, at least leave the Continent with a transport system capable of meeting the demands of industry and travellers in the next century.

Endnotes

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1 While urban transport problems are often serious in eastern European countries and the growth of car ownership is adding to local environmental degradation (eg through noise generation, etc) these are given limited attention in the paper. The focus is primarily on inter-urban and international movements. For discussions of the types of urban traffic problems which are emerging in eastern European cities, and some of the policies being activated to deal with them, see Voigt (1988) and Saitz (1988) on the German Democratic Republic and Roe (1990) and Lesley (1989) on Hungary.

2 As an example of differing situations, while the USSR has a state owned road haulage fleet which is heavily subsidised and, for the most part seen as part of the defence industry, Hungary has 35,000 private hauliers and own account operators with a total fleet of over 165,000 vehicles.

3 A major problem is a different accountancy a convention employed in most eastern European countries - eg for national accounts they (with the exception of Poland and Hungary) use the material product system which does not include 'immaterial outputs' while most other countries use the more comprehensive UN System of National Accounts. At the more micro level, most eastern European countries have good data on the registration of new vehicles but little idea of scrappage rates which make estimates of national car parks extremely tentative.

4 The literature on this subject is extensive and the volume of official documentation massive but a brief, up-to-date review is contained in Button (1991)

5 In early 1991, for instance, an EC commissioned study (Smit-Kroes *et al*, 1991) stressed the need for increased investment in transport infrastructure, which would run into "billions of ECUs", aimed at discouraging the excessive use of private and commercial vehicles and to increase the use of public transport.

6 Shaw (1985) offers some interesting illustrations of these problems.

7 In particular, the trailing stock employed in eastern Europe does not met the requirements of western European railways, especially with regard to the technical specifications consistent with high speed rail passenger and freight operations.

8 Although some limited disinvestment is also likely in areas where subsidized transport has been provided in the FRG to compensate for pre-Second World War markets formerly lost to the East.

9 There are inevitably problems of definition when making comparisons between EC countries and eastern European states not least of which is that infrastructure quality may differ as does the quality of the national car parks.

10 For some discussion of an actual case study showing the the pros and cons of management in centrally planned economies see Vlachoutsicos and Lawrence (1990).

11 The actual degree of integration taking place with, for example, the EC is still very limited but given the levels of congestion which exist coupled with the increased opposition to many major new infrastructure projects their are pressures to ensure maximum productivity from transport networks.

12 Further over half the busiest thirty air routes in western Europe are over distances of less than 375 miles.

13 An interesting perspective on the likely industrial ambitions of Eastern European states is offered by Robinson (1991), "Ironically for countries which used to measures their economic performance exclusively by crude output figures, the effectiveness of their reform policies is now judged by the speed of production decline". In quantitative terms industrial production fell in this region by about 18% in the first three quarters of 1990 according to the ECE.

14 Modernisation also implies higher levels of productivity and an inevitable shedding of labour. The political and social problems this can cause have already been experienced in the former GDR where railway workers staged strikes in late 1990.

15 See, for example, Sumita (1989) on the Japanese situation. He is not convinced these experiences are directly transferable to Western Europe but they may well be to some corridors within a pan-European context.

16 In the GDR, for example, only about 1.5% of freight traffic (by volume) was containerized.

17 The EC is particularly conscious of this problem and transport investments in Yugoslavia have formed a significant element of its infrastructure budget (Commission of the European Communities, 1986)

18 The use of something akin to the (RPI-X) formula used in the UK to regulate prices charged by newly privatized utilities could be examined in this respect.

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Discount Air Fares in Canada: Price Competition and Product Differentiation

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If one examines the intercity passenger industry in Canada in the 1980's, the air mode has been characterized by discount air fares. While the public perception may be that deregulation had a much greater effect on air fares in the United States, the period of post economic regulatory reform in Canada has also been a period of significant growth in discounting. This paper examines the Canadian experience where over 60% of the passengers carried on major domestic scheduled services travel on a discounted ticket. Much of this paper is based on seven years of sample data of passenger counts, revenues and fare types used by Canada's major scheduled airlines.

While the use of discounted air fares has increased in the 80's, the carriers' motives for the increase in discounting are varied. The use of a discounted air fare as a competitive tool, especially amongst the major scheduled domestic carriers to gain or maintain market share, will be examined. In addition, the use of discounting to achieve product differentiation to appeal to different markets to stimulate travel will also be explored.

The study of discounting is complicated by the deliberate pricing and marketing approaches used in the commercial air transport industry. There is a conscious effort to link price and product. Many fares are offered in a market but with many different restrictions or "fences". The concept of a "fence" is to attempt to obtain the highest revenue possible from the customer. Common fences include an advance period before a flight for reservations, the inability to change flights or carriers, a fee or the inability to cancel reservations, minimum or maximum periods of stay.

The study is further complicated in that there is much to suggest that the elasticities of demand for air travel greatly differ for different markets. A business traveller's demand to be in a certain city for a certain time is usually more inelastic than someone retired going to visit a relative.

To measure the supply of tickets offered at different fare levels is very difficult. There is no publicly available data source for this information. An air carrier's reservation system is the only place where this information is to be found. Even there, the information is constantly changing as the carrier

alters the supply of tickets at the various fare levels as the flight departure time approaches. A true picture of the supply would be the reservation system at the time of the flight departure. A near proxy for the supply offered is the actual fares used by passengers on a flight. This exists for major Canadian air carriers in the Fare Basis Survey conducted by the Aviation Statistics Centre of Statistics Canada.

This survey, which was initiated in January 1983, represents a regular and comprehensive source of fare type-specific data on passengers and revenue. It covers the scheduled domestic and international operations of the Canadian Level I air carriers.[1] The Fare Basis Survey is designed to be conducted in accordance with a stratified random sample of 56 days per calendar year (or 14 days per quarter). Each day of the week is sampled twice per quarter. The sampling unit consists of all lifted flight coupons in a carrier's system applicable to scheduled services; reportable coupons are those which are lifted on one of the designated sample days.

Data reported from the reportable coupons are the coupon city-pair, the fare basis code, the number of passengers and the associated revenue. The coupon city-pair refers to the two locations between which the coupon was used for passage. The fare basis code is an alphanumeric code denoting the applicable service, restrictions on travel and any discount to which the passenger is entitled. The revenue reported is the allocated portion of the revenue from the ticket associated with a particular coupon. This revenue allocation is performed by the air carrier. Carriers report only on coupons lifted by them for carriage.

The Fare Basis Survey provides, on a quarterly and annual basis, direct estimates (passengers and revenue) and derived estimates (passenger-kilometres, average fares, yields). These data are produced for individual air services (i.e., specific company, specific city-pair, specific services associated with the flight, specific fares) or for specified domains (i.e., designated carrier, designated fare group (e.g., discount fare), designated geographical entity (e.g., market)).[2]

The use of fare discounting became very important in the Canadian domestic market in the 1980's. Between 1983 and 1989, the proportion of domestic scheduled passengers who flew on discount fares rose by more than 16 percentage points, from 44.5% to 60.7%. Shallow discount traffic (discounted less than 30% off the economy fare) accounted for 3.2 percentage points growth. Deep discount traffic (discounted 30% or more off the economy fare) accounted for 13.1 percentage points (see Table 1).

For the years 1984 to 1989, over 80% of discount passenger traffic travelled on deep discounts.

When the distribution is expressed in terms of passenger-kilometres, the proportion of shallow discount travel, increased by less than one percentage point from 1983 to 1989, while the proportion of deep discount travel jumped by 12.7 percentage points, to 58.4%.

Table 1: Discount Traffic in Canada, 1983-1989

Period	Fare Groups		
	All Discounts	Shallow Discounts	Deep Discounts[1]
A) Percentage of Passengers			
1983	44.5	8.5	35.9
1984	49.4	8.1	41.3
1985	53.4	11.4	41.9
1986	57.7	13.8	44.0
1987	54.6	8.4	46.2
1988	63.3	11.9	51.5
1989	60.7	11.7	49.0
B) Percentage of Passenger-kilometres			
1983	53.7	8.0	45.7
1984	57.8	6.5	51.3
1985	60.2	9.3	50.9
1986	63.7	10.5	53.2
1987	61.1	6.6	54.6
1988	68.5	7.9	60.6
1989	66.9	8.5	58.4

[1] Prior to 1985, deep discount fares were those discounted by 25% or more off the full economy fares. Since 1985, deep discount traffic has been that discounted by 30% or more off the full economy fares.
Source: Fare Basis Survey

On a year-to year basis, the major increases in discount traffic occurred in 1984 and 1988. In June 1984, there was a relaxation of fare regulations that allowed the airlines to offer shallow discounts on a route basis rather than on a system-wide basis. The implementation of new fare procedures in September 1984 allowed airlines more pricing flexibility and consumers easier access to cheaper fares. The new rules increased from 25% to 30% the discount airlines could offer on any portion of their network with only one day's notice. Also, the restrictions on booking and length of stay requirements for deep discount fares were loosened. These changes on the regulatory side made more price competition possible. The impetus in 1988 was different.

The intense competition between Air Canada, Canadian Airlines International Ltd. (CAIL) and Wardair for market share stimulated the amount of discounting in 1988. CAIL with its restructured schedule, and Wardair, with its enhanced schedule on high-density intercity routes, used price discounting to compete with each other and with Air Canada, in an attempt to acquire a larger share of the domestic passenger traffic. This competition was especially evident in the large number of discount fares offered on the long-haul transcontinental routes, such as Calgary-Toronto, Edmonton-Toronto, Montréal-Vancouver, Ottawa-Vancouver and Toronto-Vancouver. This competition will be examined more closely in the next section.

Price Competition

The basic product that an air carrier offers is transportation. If several prices were offered for travel between points A and B, consumers would opt for the lowest price if all else were equal. Therefore the first requirement for price competition is some method of price discrimination. This is possible for airline travel because the product cannot be stockpiled and resold.[3]

Where air fares are used in price competition, their purpose is to attract market share from a competitor or to preserve market share from a competitor. To do so the prices offered must be known by the target markets. If discriminatory pricing is used, such as offering a lower fare on particular flights, this is not done in secret. Prices "have to be promoted, to all 'eligible' customers, and passengers can and do compare notes on the fares paid".[4]

Recently, there have been three very apparent examples of firms attempting to use their pricing policies in a competitive manner. These were instances where carriers attempted to establish themselves in a market by taking away market share from existing operators. The three instances that will be examined here were those of Wardair, City Express and Intair.

Wardair, during the brief period from 1986 to 1989 when it attempted to break into the domestic scheduled service market, had a stated pricing policy: "our domestic economy fares were priced below the fares offered by existing carriers".[5] The impact that Wardair had on the market can be seen in Table 2 below.

During 1988, the degree of discounting offered on economy fares averaged about 36%, up from the 1987 level of 35% (see Table 2). The discount off the economy fares for shallow and deep discount segments of the domestic market averaged about 22% and 39% respectively in 1988.

In 1989, Wardair was taken over by the same parent corporation that owned CAIL. Not only did most air fares in Canada increase substantially, the major airlines reduced the degree of discounting they offered on economy fares by 6.3 percentage points for shallow discount fares and 3.5 percentage points for deep discount fares.

It appears that the major airlines moved to recover from the costly price competition of the previous year. Some of the pressures that produced the 'fare wars' of 1988 were removed when Air Canada regained the market share it lost during the December 1987 strike. Price competition also appears to have been affected by PWA Corporation's takeover of Wardair. There was a realignment of Wardair's lower price structure with CAIL resulting in increases in economy and business class fares.

Table 2: Percentage Discount Off the Economy Fare, Domestic Market, 1983, 1987-1989

Period	Fare Groups		
	All Discounts	Shallow Discounts	Deep Discounts[1]
	Discount Off Economy Fare %		
1983[2]	24.7	8.5	28.6
1987[2]	34.9	23.6	37.0
1988	35.9	21.5	39.3
1989	31.9	15.2	35.8

[1] See Table 1 Footnote 1.
[2] For 1983 and 1987, economy fare figures included business class fares.
Source: Fare Basis Survey

If the airlines do use discounting as a method of price competition, one would expect to find less discounting on routes where they do not face competition. This would mean that a passenger who travels on a route served by an air carrier with "monopoly" power would be subject to a certain form of price discrimination. This hypothesis was examined using the Fare Basis Survey. As Table 3 shows, the travellers on "monopolistic" routes[6] are less likely to have access to cheaper travel. However, on the routes where a major carrier has to compete with at least one other major carrier, the passengers are more likely to travel on discount fares. For example, in 1988, discount passengers accounted for 65.5% of passengers on routes with two carriers. This increased to 66.2% of total passengers on routes with three carriers, while on monopolistic routes this proportion decreased to 52.4%.

Table 3: Percentage of Passengers Travelling on Discounted Air Fares by Number of Major Carriers Serving the City-Pair, 1983, 1987-1989

Period	Number of Major Carriers Serving the City-Pair		
	Three or More	Two	One
	Percentage of Passengers on Discounted Fares		
1983	45.9	51.6	34.7
1987	56.3	56.1	48.8
1988	66.2	65.5	52.4
1989	61.9	62.6	52.5

Source: Fare Basis Survey

The policy of discriminatory pricing on non-competitive markets was seen to affect the amount of discounting of air fares, what was its impact on the degree of discounting? In 1988, the airlines offered shallow discounts on 34.3% of the monopolistic routes and on less than two per cent of the duopolistic routes. All domestic markets served by the three major airlines were deep discounted. Moreover, the passengers travelling on over 85% of the oligopolistic routes were granted a discount of 50% or more. Where only two major carriers competed, the proportion of routes discounted at that level decreased to 52.7%, while where a carrier did not have to share the market with another major carrier, this proportion dropped to only 25.5% (see Table 4).

Table 4: Amount of Discount Off the Economy Fare by Number of Major Carriers Serving the City-Pair, 1988

Amount of Discount Off the Economy Fare	Number of Major Carriers Serving the City-Pair		
	Three	Two	One
	Percentage of City-Pairs		
<30%	-	1.8	34.3
>= 30% and <40%	7.1	3.6	12.5
>= 40% and <50%	7.1	41.8	27.7
>= 50% and <60%	85.7	52.7	25.5

Source: Fare Basis Survey

The impact of competition between airlines can also be assessed through the cost of travel. An examination of Table 5, clearly shows that the vigourous competition between Air Canada, Canadian and Wardair in 1988 led to a substantial decline (-13.8%) in discount air fares on markets served by all three carriers. During that year, the discount air fares on monopolistic or duopolistic routes decreased slightly.

Table 5: Average Discount Air Fares by Number of Major Carriers Serving the City-Pair, 1983, 1987-1989

Period	Number of Major Carriers Serving the City-Pair		
	Three or More	Two	One
	Average Fare Paid $		
1983	87.5	130.3	84.1
1987	156.7	103.5	88.6
1988	135.0	104.2	85.9
1989	149.1	135.1	100.8

Source: Fare Basis Survey

While Wardair's attempt to break into the domestic passenger market was the largest use of fare discounting as a competitive tool, there have been other regional attempts. Two recent examples of carriers attempting to establish themselves in the Toronto-Ottawa-Montreal corridor using discounted fares were City Express and Intair, both independents not affiliated with either the Air Canada or the Canadian Airlines families. City Express had a policy of pricing their product below that of their competitors. Competition was not solely on price as they operated a service to downtown locations and included shuttle bus service to/from the city centre. Their print ads made it very clear, however, that price was an integral element of their attempt at getting market share.

Very recently, the carrier Intair has attempted to use price to compete and to establish themselves in the same Ottawa-Toronto-Montreal triangle. Although the standard economy fare for Ottawa-Toronto on the majors was $179, Intair widely advertised a fare of $69. Air Canada countered with a $69 fare. Interestingly, it was limited to five specific flights between Ottawa and Pearson International.[7] These five flights were those that were closest to the departure times of the Intair flights.[8] Air Canada met the competition on price but tried to minimize the impact of the price war on their revenue generation by not extending the lower prices to those travelling at times not offered by the price competitor.

Product Differentiation

Pricing policies can be used not just to obtain market share from a competitor but also to target certain consumers. Price discrimination is possible if the markets being targeted can be kept separate and if they have different demand characteristics.[9] This is done with air fares by the use of various "fences" or restrictions. These can be constraints on the actual travel or the travel arrangements. Common fences include minimum or maximum length of stay, constraints on when the reservation can be made or when payment is required, restrictions on cancellations or changes in itineraries.

The effect on consumers of the use of discount fares by the airlines to achieve product differentiation will be assessed through different factors such as the market segmentation by day of the week, the number of fares offered on selected markets and the stimulation of travel during the peak period.

The day of the week a person chooses to travel by air mode is dependent on a series of factors such as the purpose of travel (business versus personal), the availability of tickets, the frequency of the flights, the price. However, to what degree can the price influence that choice?

This issue will be examined through the analysis of one less discretionary market, the Toronto-Ottawa-Montreal corridor and one discretionary (or vacation) market, the U.S. southern market (selected destinations).

In 1989, the Sunday travellers in the Toronto-Ottawa-Montreal corridor paid, on average, almost 40% less than the travellers who flew on the Wednesdays. On these corridor routes with traditionally large components of business-oriented travel, nearly half of the passengers used discount fares. These discounted passengers were uniformly distributed throughout the week, the proportions ranging from 11.6% on Sundays to 16.4% on Mondays. Over 50% of the deep discount passengers travelled during the week-ends (defined as Saturday and Sunday) and on Mondays. The presence of Mondays in that group can be attributed to one of the common fences applicable to deep discount fares, that is, the passenger must stay until the first Sunday following departure.

As evidenced in Table 6, 70.1% of the passengers who travelled on Sundays used discount fares, of which 54.8% were discounted by 30% or more off the full economy fares. Less than two out of every ten passengers who flew on the Wednesdays benefitted from the deeply discounted low-price air fare products.

Table 6: Distribution of Discounted Passengers by Day of the Week - Selected Domestic and U.S. Southern Markets, 1989

Day of the Week	Fare Groups		
	All Discounts	Shallow Discounts	Deep Discounts
	Percentage of Passengers		
A) Selected Domestic Markets			
Sunday	70.1	15.3	54.8
Monday	63.8	17.8	46.1
Tuesday	50.0	22.3	27.7
Wednesday	39.9	23.6	16.4
Thursday	40.3	21.9	18.4
Friday	40.4	21.3	19.2
Saturday	50.3	19.3	31.0
B) Selected U.S. Southern Markets			
Sunday	81.8	19.2	62.6
Monday	78.9	15.3	63.7
Tuesday	78.4	11.3	67.1
Wednesday	75.6	11.9	63.6
Thursday	78.6	12.6	66.0
Friday	78.0	13.8	64.3
Saturday	76.8	14.2	62.6

Source: Fare Basis Survey

However, if more deep discounting prevailed on the Sundays, it is also on that day of the week that the average deep discount fares were highest (see Table 7).

Contrary to the situation observed in the 'golden' triangle, the proportion of discount carriage for services between Canada and the selected U.S. southern destinations has no direct relation to the day of the week, as it stood at approximately 80%, no matter what the day. Shallow discount traffic ranged from 11.3% (Tuesday) to 19.2% (Sunday) and deep discount traffic ranged from 62.6% (Sunday and Saturday) to 67.1% (Tuesday), respectively.

In these more discretionary markets, where the demand for air travel is higher on Sundays, the price-sensitive travellers (over three out of every five passengers travelled on deep discount fares) paid relatively higher discount fares on that day of the week.

Table 7: Average Discount Air Fares by Day of the Week - Selected Domestic and U.S. Southern Markets, 1989

Day of the Week	Fare Groups		
	All Discounts	Shallow Discounts	Deep Discounts
	Average Fare $		
A) Selected Domestic Markets			
Sunday	74.3	103.9	66.0
Monday	76.8	109.7	64.1
Tuesday	90.6	125.1	62.8
Wednesday	99.3	126.2	60.6
Thursday	96.3	125.1	61.9
Friday	94.1	124.6	60.2
Saturday	86.3	119.4	65.7
B) Selected U.S. Southern Markets			
Sunday	160.9	222.6	142.0
Monday	154.1	211.5	140.4
Tuesday	141.3	197.2	131.9
Wednesday	133.1	203.3	120.0
Thursday	141.8	215.7	127.7
Friday	137.4	205.0	123.0
Saturday	143.9	209.5	129.0

Source: Fare Basis Survey

While offering fares to counter those of a competing carrier or to attempt to gain more market share sounds justifiable, why would a carrier offer many fare types in a monopoly market? (We are using the term "monopoly" here only in reference to other major scheduled air services, it ignores the issue of competing modes.) Canadian Airlines was offering 16 different air fares between the points of Churchill and Gillam in January 1991. These ranged in cost from $122 to $288 return.[10] An examination of the fare types shows that the airline was attempting to segment and appeal to these markets. They offered a full economy fare for the passenger who required the maximum in flexibility with respect to booking, changing or even cancelling the flights. This maximum flexibility for the traveller with the most inelastic demand for the trip came with the highest price. Other fares were aimed at children, those over 55 years of age, groups of ten or more, those travelling around the Christmas period.

The number of fares offered differs from market to market. In January 1991, while Canadian Airlines offered 16 different fares on their Gillam-Churchill route as discussed above, they also offered 26 different fares on their Toronto-Vancouver route and 28 fares on their Montreal-Toronto route.[11] Determining the characteristics of a particular market, the elasticities of demand for potential travellers between two city-pairs, is expensive. It is reasonable to assume that a carriér would concentrate this process on their larger markets where the consequences of a proper range of price offerings could have the largest impact. The larger markets, however, are also those that are most likely to attract competition. Therefore, we would expect to find the most fare choice in a large volume market such as Montreal-Toronto. Not only is this the largest volume domestic market in Canada but it is one with many carriers competing.

One of the carriers' motives for the use of discounted fare is to stimulate new demand by diverting passengers from surface transport modes and by inducing people to travel more.[12]

The approach used by the airlines to stimulate travel can be best examined through the summer months, which is the high season for air travel in Canada.

During the peak travel period, we would expect that the airlines would offer less low-price air fare products than during the trough period. However, contrary to the expectations, the figures revealed that more passengers travel on discount fares during the summer months than during any other periods of the year. For example, in 1989, 28.8% of the discounted passengers travelled between July and September. During those months, when the demand for air travel is mostly discretionary, over 67% of passengers used discount fares.

In light of this, it seems appropriate to assume that a carrier offers a greater number of seats at low fares during the high season to attract more potential travellers or to stimulate price-sensitive passengers to travel by air rather than by a different mode of transportation.

A small study conducted by the Canadian Transport Commission during June 1983, indicated that 85% of the travellers would not have flown if they had been required to pay the full price and 22% of the passengers would have used a surface mode if they had no access to lower fares.[13]

Another reason that carriers offer the largest number of discounted seats during the high season is a function of the capacity offered. The third quarter is typically the quarter with the highest capacity.[14] If the discounted seats are a function of the number of available seats, this alone would result in large numbers of discounted seats in the third quarter. This is especially the case in that adding capacity is done by adding flights which are a "lumpy"[15] factor of production in terms of seats available.

Conclusion

There are many factors in the domestic environment which could affect the future discounting of domestic scheduled air fares and which were not examined in this paper. The affiliate feeder carrier's of the majors are increasing their fleets of jet aircraft. Will they be required to stimulate demand to finance their operations; could this result in fare competition between the feeders and their parents? Will there be further attempts by independents such as Intair and City Express or new entrants to carve out a market share that will affect the pricing policies of the major carriers? Will overcapacity in the charter market result in increasing competition from domestic charters which will require the majors to deeply discount their scheduled domestic fares? Will other modes such as bus and rail more closely target and compete with short-haul air carriers and will the air carriers use fares as a response? What will be the impact of any "Open Skies" agreement between the United States and Canada, especially if some form of cabotage rights are granted?

We examined the general trends in the use of discounted air fares in the Canadian domestic scheduled air passenger market in the 80's. During this period there was an increase in the use of discounting with the year 1988 being the key year. This peak coincided with Wardair's entry into the scheduled domestic market and their pricing policy. An examination of the data filed in the Fare Basis Survey suggests that the number of carriers operating in a market had a definite impact on the amount and degree of fare discounting. There continues to be regional and local responses to price competition. The data showed the carriers discount fares even on non-competitive routes. This was done in lower quantities and the level of discount was less. Given the fences used in these markets, there is evidence to suggest that the carriers also used discounting to achieve product differentiation to appeal to different markets to stimulate travel or to attract travellers who otherwise may not have flown.

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References and Notes

1. For the years 1983 to 1986, the participating carriers in the survey were: Air Canada, CP Air, Eastern Provincial Airways, Nordair and Pacific Western Airlines. For 1987 to 1989, Air Canada, Canadian Airlines International Ltd. and Wardair were included.

2. For additional information on this survey, refer to the CTRF paper (May 1985) The Fare Basis Survey and Discount Air Fare Utilization in the Domestic Market, John A. Greig and Emile Di Sanza.

3. H.E. Leland & R.A. Meyer, "Monopoly pricing structures with imperfect discrimination", The Bell Journal of Economics, Autumn '76, Vol. 7 No. 2, p. 449.

4. S.D. Trotter, "The Price-Discriminating Public Enterprise, With Special Reference to British Rail", Journal of Transport Economics and Policy, January 1985, Volume XIX no. 1, p. 53.

5. George Curley, President and Chief Operating Officer, Wardair, Wardair International Ltd. Annual Report 1986, p. 9.

6. Monopoly here is defined as a route where there is no scheduled service competition from another major Level I air carrier. There may be competition from third level, feeder or commuter carriers or from charters.

7. Airline Tariff Publishing Company (ATPCO) Passenger Tariff Set, The Official Canadian Passenger Tariff (No. 132), January 9, 1991, p. 503, p. R-85.

8. Official Airline Guide, December 1, 1990, p. 999.

9. S.D. Trotter, op cit, p. 43.

10. ATPCO Passenger Tariff Set, The Official Canadian Passenger Tariff (No. 132), January 9, 1991, p. 137.

11. ATPCO Passenger Tariff Set, The Official Canadian Passenger Tariff (No. 132), January 9, 1991.

12. R. Hakka, "B-767 Excursion Fare Survey", Canadian Transport Commission, Research Branch, Passengers Transport Studies, Working Paper No. 40-85-14, November 1985, p. 4.

13. Ibid pp. 31-32.

14. See Statistics Canada catalogue #51-002, Air Carrier Operations in Canada.

15. Jean Triole, The Theory of Industrial Organization, The MIT Press, Cambridge, Mass., 1989, p. 321.

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