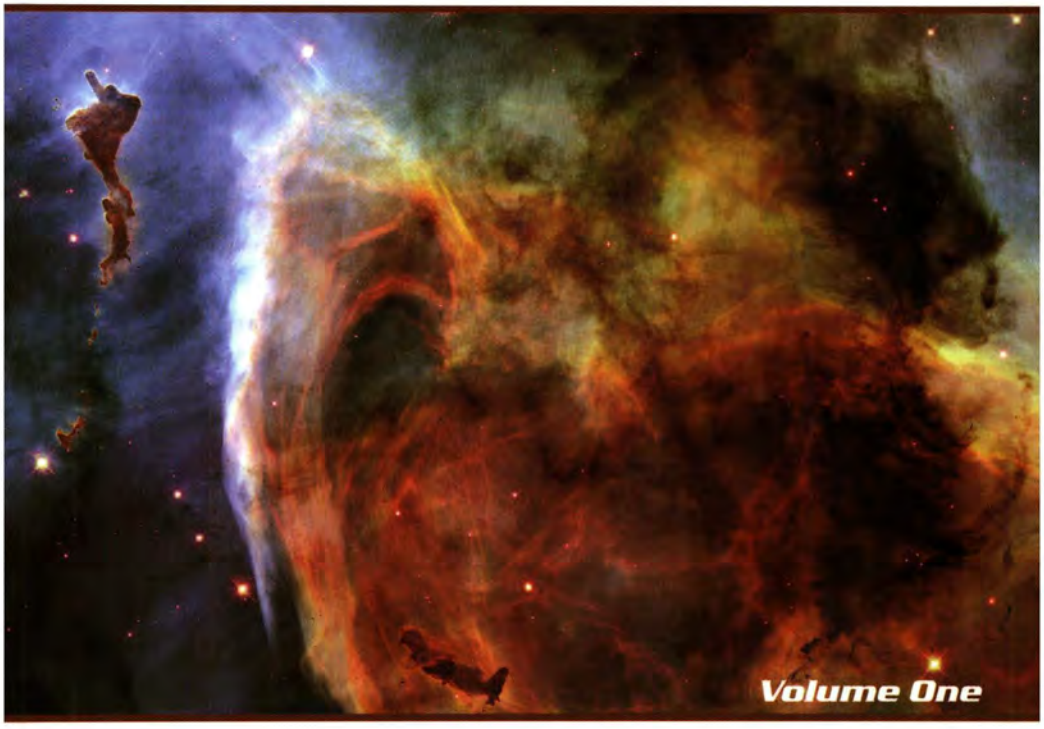
2001 A Transportation ODYSSEY

2001 Une odyssée en TRANSPORT



CANADIAN TRANSPORTATION RESEARCH FORUM

CTRF/GRTC

LE GROUPE DE RECHERCHES SUR LES TRANSPORTS AU CANADA

Vancouver, British Columbia • May 6-9 mai • 2001

Proceedings compiled by
W.G. Waters II, the University of British Columbia
Vice President Program & Publications, CTRF

PROCEEDINGS

of the 36th Annual Conference
de la 36è Conférence annuelle

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President's Message

Welcome to the 36th Annual Meeting of the Canadian Transportation Research Forum. This event promises to be *A Transportation Odyssey*. The conference organizers are to be commended for their efforts which culminate in this educational and enjoyable 3 to 4 days in Vancouver. Congratulations to Bill Waters, Paul Ouimet and their team.

It has been a great honour and pleasure for me to serve as CTRF President for the year 2000-2001. I hereby claim to have been president during the first year of the new millennium, whichever year you believe that to be.

I take this opportunity to recognize and acknowledge all those who have contributed to another successful year for CTRF. Thank you to all board members, sponsors, conference organizers, attenders, panelists, authors, presenters and volunteers.

These conference proceedings contain the results of research conducted by numerous transportation professionals over the past very interesting and exciting year for transportation in Canada.

I know you will find the 2001 Transportation Odyssey to be a worthwhile, informative, and memorable journey; by attending in Vancouver or by reading these proceedings at a later date, or both.

Sincerely,



Gordon E. Tufts, P. Eng.
el presidente

Message du Président

Bienvenue à la 36è Conférence annuelle du Groupe de recherches sur les transports au Canada. Cet événement promet d'être *Une odyssée et transport.* Les organisateurs de la conférence méritent tout un hommage pour leurs efforts qui ont abouti à ces 3 ou 4 jours aussi instructifs qu'agréables à Vancouver. Félicitations à Bill Waters, Paul Ouimet et leur équipe.

Cela a été un grand honneur et un plaisir pour moi de servir comme président pour l'année 2000-2001. Par la présente, je revendique le fait d'avoir été président durant la première année du nouveau millénaire, quelle que soit l'année qui vous convient.

Je profite de cette occasion pour souligner la contribution de tous ceux qui ont assuré une autre année de succès pour le GRTC. Merci à tous les membres du conseil d'administration, aux commanditaires, aux organisateurs de la conférence, aux congressistes, aux panélistes, aux auteurs, aux conférenciers et aux volontaires.

Les présents Actes contiennent les résultats de la recherche entreprise par de nombreux professionnels en transport durant l'année écoulée, laquelle a été des plus intéressantes et des plus passionnantes en matière de transport au Canada.

Je sais que vous trouverez que l'Odyssée en transport 2001 est un voyage utile, instructif et mémorable, que ce soit par votre participation à Vancouver même, ou en lisant ces Actes ou bien les deux.

Sincèrement,

Gordon E. Tufts, ing.
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Volume I

Session 1 Plenary Session
"Consolidation and Continentalization in North American Air and Rail Transportation"

Speakers to be announced

Session 2.1 Airport Policy

- One Size Does Not Fit All: A Critique of Canada's National Airport Policy. *John Brander and B.A . Cook.* 1
- Airport Privatization in Brazil : Questions and Answers. *Respicio A. Espirito Santo Jr., Fabio Cardoso Correia and Guilherme L. Palhares* 17

Session 2.2 Transportation and Supply Chain Efficiency

- The Internet-Enabled Supply Chain and Transportation. *Garland Chow and Michael Haughton* 32
- GIS Application in Transportation. *David Spearin.* 56
- The Japanese Takuhaibin System – Prototype for a Universal Solution of the Distribution Challenges in the Age of E-Business. *Claus Eberhard* 69

Session 2.3 Transportation Policy – Canada and Communities

- Canada Transportation Act : A Snapshot of Key Stakeholder Opinion. *A.J. Phillips and D.B. Duncan* 85
- Regulatory Reforms in Canadian Transportation since 1987. *Joseph Monteiro* 101
- Planning a Transportation and Technology Museum: Concept and Market Analysis. *Linda Christian* 121

Session 3.1 Evolution of Airline Industry and Performance

- The Evolution of Airlines in Canada with Emphasis on the Role of the Competition Bureau's Role in the Restructuring of the Airline Industry. *Joseph Monteiro and Richard Annan and Andrew Eckert* 136
- Adverse Effects of Mergers on Airline Performance – The Case of Canadian Airlines International, Ltd. *William Jordan* 156
- Assessment of Recent Performance of Canadian Carriers in Comparison with U.S. Carriers. *Tae H. Oum and Chunyan Yu* 173

Session 3.2 Trade and Transportation

- Mexico's Rail Privatization: Implications for Modal Competition in North American Grain Trade. *Mark Ojah and Barry E. Prentice* 174
- Trade and Transportation: The Impact of the 1995 Transborder Air Services Accord. *Gordon Baldwin and Michael W. Pustay* 189
- Economics of Congestion at a Border Gateway: The Case of Laredo. *Barry E. Prentice and Wanda Heron* 205

Session 3.3 Technology and Rail Transportation

- The Fight Between Technology and Survival: Heavy Cars versus Short Line Railroads. *Kenneth L. Casavant, Jerry Lenzi, and Denver Tolliver.* 221
- A Preliminary Feasibility Study about High-Speed Rail in Canada. *Masatoshi Hatoko* 235
- Oil Prices and Railway Electrification. *F.H. Howard* 251

Session 4.1 Air Cargo

- Innovative Air Cargo Transfer Flexibility at Ted Stevens Anchorage International Airport. *Darren Prokop* 262
- The Blurred Lines of Responsibility in Air Cargo Customer Service. *Meyer D. Lapkin and Michael A. Crockatt* 278

Session 4.2 Intermodal Transportation and International Linkages

- Vertical Integration in Liner Shipping: Strategy and Status. *Trevor D. Heaver* 292
- The Future for Canada-U.S. Container Port Rivalries. *Doug O'Keefe* 309
- An Assessment of North American Cabotage Laws: The Carriage of Goods in Containers. *Erica Vido and Jake Kosior* 325

Session 4.3 Transportation Safety

- Heads Up! Enhancing the Safety Audit. *Lennart Henriksson* 337
- Designing Programs for Reducing Aggressive Driving, Beyond Law Enforcement, *Richard A. Raub and Richard I. Wark* 347
- Allocating Emergency Response Facilities to Mitigate Risks of Dangerous Goods Transportation. *Ghada Hamouda, F. Saccomanno, and L. Fu.* 363

Session 5.1 Airline Alliances and Competition

- Global Alliance Airline Network: Traffic Routing Patterns and Impacts on Airports. *Tae H. Oum and Chunyan Yu* 377
- Simulating Airline Alliances in an International Context. *James Nolan, Pamela Ritchie and John Rowcroft,* 378
- Des alliances stratégiques à la desserte des Îles- de-la-Madeleine : les enjeux de la déréglementation du secteur aérien au Canada (From Global Alliances to Servicing Magdalene Islands: Issues of the Canadian Air Transportation Deregulation Policy). *Yann Alix* 380

Session 5.2 Motor Carriers

- Truck Safety and Safety Regulations. *Fred Nix* 396
- Evolution des conditions économiques des conducteurs – propriétaires, 1991-1998 (The Evolution of the Economic Conditions of Owner Operators 1991-1998). *Gilles Paré* 412
- Economic Impact of For-Hire and Private Trucking in Manitoba, 1998 Results and Methodology. *Darren R.Gorman, Barry E. Prentice, Scott J. Shurvell* 414

Session 6.1 Airport Management and Performance

- Private Airports and Public Needs: There is a Connecting Flight. *Michael Crockatt and Darren Prokop* 430
- Transport Canada's Delegation to New Commercialised Entities: the Cases of Montréal Airports and Port. *Michel Boucher* 446
- A Comparison Study of Medium Airport Management in Different Countries. *Guilherme Lohmann Palhares and Respicio A. Espírito Santo Jr.* 448

Session 6.2 Efficient Investment and Maintenance of Road Infrastructure

- Tender Evaluation – Quality-Price Trade-Off Method. *Gordon A. Sparks, Paul Christensen, Curtis F. Berthelot* 465
- The Impact of Transportation on Local Economies: Two Case Studies. *Tom Kearns.* 480
- Addressing Infrastructure Maintenance Issues Through Management Innovations. *Mohammad Tayyaran and Ata M. Khan.* 496

Session 6.3 Energy and Efficiency in Transportation

- Rail Freight Competition and Efficiency Gains in Australia. *Philip Laird* 512
- The Economic and Environmental Benefits from Vehicle Speed Reduction. *F.R. Wilson, A.M. Stevens and A. Ambo* 530
- Transportation Energy Demand Model: The Application of a Complete Decomposition Method. *Jason Randall and Mohamed Nouhi.* 549

Volume II

Session 7.1 Urban Transportation

- Exploring the Effectiveness of Land-Use Policy on Air Quality: A Simulation. *Terence Lam and Debbie Niemeier* 565
- A Model of Curb Rights in Private Urban Transit Markets. *André De Palma and Robin Lindsey* 581
- Trucking in Canadian Cities: Planning for The Future. *Clarence G. Woudsma.* 597

Session 7.2 Competition and Regulation

- Mediation and Regulatory Efficiency. *Arun Thangaraj, C. McClellan and G. Nera* 614
- Importance des modifications - la loi sur la concurrence portant sur les comportements d'eviction et les ordonnances provisoires relativement à un services aérien. (The Importance of Amendments to the Competition Act on Temporary Orders in Relation to a Domestic Airline Service in Canada). *Jacques Picard* 630
- The Use of Economic Analyses in Competition Cases (Part II) Analysis of a Conspiracy and a Merger in a Transportation Cases. *Joseph Monteiro and Andrew Eckert* 646

Session 7.3 Environment and Transportation: What Next?

- The Green Mile: Approaches and Attitudes toward Environment Sustainability among Canadian Transport Faculty. *Anthony Perl and Michael Bates.* 666
- Modern Roundabout, Global Warming, and Emissions Reductions: Status of Research, and Opportunities for North America. *Tony Redington.* 682

Session 8.1 Traffic Congestion and Transportation Planning

- A Time Series Analysis of Vessel Traffic Service Utilization. *Louis Le Blanc and Nicholas A. Beadles.* 698
- Economic Modelling of Congestion in Transportation Network. *Yuri Yevdokimov* 705
- The Foundation of a New Transportation Planning Model for the Manitoba Capital Region. *Kean Hoe Lew, Alan Clayton and Doug Hurl.* 721

Session 8.2 Rail Competition and Access

- Clearing the Track: Appraising Railway Perspectives on the Issues of Regulation and Competition in the North American Rail Industry. *William Drew and James Nolan* 732
- Railway Competition and Continental Consolidation. *Kells Boland.* 748
- Railway Reform in Australia: Access Regimes, Changes in Ownership, and Structural Change. *Derek Scrafton,* 761
- Rail Access Pricing for Freight : International Practice. *Malcolm Cairns.* 777

Session 9.1 Planning and Paying for Roads and Their Operation

- Modeling the Rationalization of Rural Road Networks: The Case of Saskatchewan. *Paul Christensen, James Nolan and Gordon Sparks.* 797
- Planning, Operations and Maintenance of Toll Road Systems. *Ata M. Khan and Mohammad R. Tayyaran,* 812
- User Charges and Cost Recovery: The State of Idaho/American Trucking Association Case. *James R. Jones and Selahattin Bekmez* 828

Session 9.2 Integrated Transportation and Economy Modeling (ITEM) : A Status Report

- Integrated Transportation and Economy Models: Version 0 *Marc Gaudry, et al.* 844
- A computable General Equilibrium Model for Transport in Canada. *Marc Gaudry, et al.* 845
- A Modal Accounting System for Transport with First National and Regional Results. *Marc Gaudry, et al.* 846
- Analysis: Some ITEM System Tools. *Marc Gaudry,et al.* 847

Session 10.1 Changing Policies and Practice in Grain Transport

- The Development of Western Grain Rates. *Jim Riegle* 848
- Regional Railway and Grain System Project. *Roy Atkinson, Javier Caceres, Gary Housch and Darrell Richards.* 862
- Grain Car Canada: Electronic Railcar Market Allocation System. *Barry E. Prentice and Tamara Thomson* 878

Session 10.2 Transportation Safety

- Identifying High-Hazard Locations for Pedestrian and Bicycle Crashes. *Richard A. Raub.* 895
- The Role of Inclement Weather in Heavy Truck Accident Causation: Implications for Driver Training, LCV's and Safety Programs. *J.M.Kosior and Shannon Summerfield.* 896
- Simulation of Heavy Trucks in Inclement Weather. *Shannon Summerfield and J.M. Kosior* 913

Student Prize-Winning Papers from the 1999-2000 CTRF Student Paper Competition

- The A to DC of Order Fulfillment in E-Tailing. *Ignatius V. Hsu, University of British Columbia, Mark Bunting Award for 1st Prize Undergraduate Category* 923
- The Civil Aviation Industry: A Discussion of Air Pollution Problems. *Samantha Sawyer, University of British Columbia, 2nd Prize Undergraduate Category* 939
- A Theoretical Analysis of Low-Cost Entry in the Air Transport Industry. *Bonnie-Lynn Robertson, Albert Stevens Award for 1st Prize Masters Category. Also won the Air Canada Award for the best Air Transport Paper* 951

ONE SIZE DOES NOT FIT ALL
A CRITIQUE OF CANADA'S NATIONAL AIRPORT POLICY

John Brander and B.A. Cook
Department of Economics, University of New Brunswick
Fredericton, N.B., E3B 5A3

Diversity is the term which best describes Canada's national airport system. Pearson is the largest, with a 1998 passenger volume of 25.6 million passengers. This volume was about 70 per cent larger than Vancouver which ranked second. The two Montreal airports ranked third, having about 60 per cent of Vancouver's passenger volume. Moncton ranked 20th at 0.1 per cent of Toronto. The remaining airports had even smaller volumes. Given this great variation in size, one must question whether a single nation-wide airport policy, and in particular one which treats airports as individual entities rather than as part of an airports system, is appropriate in the early part of the 21st century. This is especially true of the airport rents to be extracted by Transport Canada from the Local/Canadian Airports Authorities.

The current Transport Canada policy with regard to these airports is one of devolution, of handing off the operating responsibility to local authorities. What is not often understood is that the ownership of the airport, as well as the responsibility for system integrity and safety standards resides with the Minister of Transport. The obvious first step in assessing the policy is to put it in historical perspective. Then its strengths and weaknesses are probed with a view to enhancing both its effectiveness and its fiscal fairness. The basic question which the reader should keep in mind throughout is whether there is a system of interconnected airports or whether there is a set of spatially separated monopolies. The answer to the riddle depends on which philosophical position one adopts.

The approach of the paper is chronological. It begins with the

establishment of the Airports Revolving Fund in 1969 and. utilizes data from both the *Public Accounts* and *Reports of the Auditor General* to consider the record across the period 1969-70 through 1990-91. It seems apparent that over the period, shifting accounting practices masked some of the emerging financial difficulties. Closely related is the need to rework the data to simulate what the situation would have been had those collections of airports in the Fund , varying from 2 to 23 depending on the period, operated outside Transport Canada.

What emerges is a picture of a financial structure characterized by increasing deficits and an apparent inability to control escalating costs, particularly on the capital side. These financial problems led to the expansion of the Fund from 4 to 23 airports in 1979-80 and to the subsequent contraction to 9 airports in 1985-86. Initiatives were undertaken to determine if there was a more efficient organizational structure for the major airports. Two of these are considered here. The first is the *1979 Draft Report of the Task Force on Airport Management* . The data presented in the Report, while old, are complete at the level of the individual airport, providing a view of the cost structures in sufficient detail to permit analysis The Report is also of value in that it provides a perspective of the National Airports ***as a system of airports and not a collection of spatially separated monopolies***. The other is the National Airports Policy document (1994). We proceed in a chronological order and thus move back and forth between the available data and the reports. There was a second Task Force of Airports (1986) which is not considered as it contained no data useful to the analysis.

The paper then explores two policy issues. The first of these relates to the role of the Minister and of Transport Canada in the airports in future. It is clear that both have a significant role to play in both air safety and system integrity. What is less clear are the financial implications of separating these overall issues from the day-to-day operations of the airports in the system. The second policy issue is

the optimal level of financial inter-connectivity among the members of the National Airports System. The central issue is the determination of the rents to be charged to the local authorities for the airport land and facilities. Concern has been expressed already about their potential escalation in future years. Closely allied to the rent level question is the issue of equity in an airports system. Specifically, there is the question as to whether some of the rents should be negative, a concept akin to the negative income tax.

A final section of the paper will draw these threads together and present conclusions about the desirable direction of Canadian airports policy in the future.

1.0 THE REVOLVING FUND YEARS:

The Airports Revolving Fund was created by Parliament in 1969, and initially included only Pearson and Dorval. It was then expanded to include Mirabel and Vancouver as well as the Pickering project which was later abandoned. All operating expenses, capital expenditures and loan repayments (including interest) were to be charged to the Fund on the one hand, and all revenues earned and loans granted by Parliament were to be credited on the other. The discussion of the Fund is divided into three periods - the period of 4 airports, of 23 airports and of 9 airports.

1.1 The Four Airport Period:

Initially, the policy seemed to be on track. Every year from its inception to fiscal 1975-76, the Fund showed a profit. In constant (1986) dollars, these profits ranged from $21 million to $47 million. Over the next three fiscal years, real (1986) losses amounted to just over $125 million, more than half its accumulated profit from the earlier part of this period. Year to year comparisons of the data are shown in Table 1.

Table 1

Revolving Fund Revenues, Expenses and Profit 1970-1980
(Millions, 1986 $)

YEAR	REAL REVENUES	REAL EXPENSES	REAL PROFIT
1970	121434	73732	47702
1971	126979	86427	40552
1972	127564	97802	29763
1973	138874	107729	31144
1974	148020	126871	21149
1975	157538	122524	35014
1976	236296	214852	21444
1977	271591	314290	-42699
1978	262569	310754	-48186
1979	274560	308797	-34238

Source : Public Accounts of Canada, Various Years.

Up to 1976, cumulative profit amounted to about $227 million. In retrospect, it is fair to say that these profit figures were overstated. No account was taken of either terminal control costs or of the value of services received by the Fund's airports from other government departments, costs which were to become significant in later periods. Problems, however, lay on the horizon, in the form of the accounting convention of capitalizing interest payments on facilities which were not yet opened. The reference is to Mirabel and Pickering. During the period, costs rose by 4.2 times, but revenue increased only 2.3 times, both in constant (1986) dollar terms.

The Mirabel Airport opened Dec. 1, 1975, and between then and the end of the fiscal year experienced a loss of $18.4 million in nominal terms. In 1976-7 the nominal losses were $54.3 million and the

following year, $51.5 million. (Minister Lang, Hansard, 3rd Session, 30th Parliament, Volume II, Page 1686) In his 1977-78 Report, the Auditor General stated that "due to the magnitude of these losses, continued financial support by Parliament is essential to the survival of the Airports Revolving Fund".

While there was sufficient financial strength in the rest of the Fund to absorb this loss for 1975-6, it quickly fell into a loss situation in 1977 In passing, it should be noted that the revenues shown for the last two years include the airport share of the Air Transportation Tax. In 1977-78, this tax constituted 8.2 per cent of the revenues of the fund; in the following year, it constituted 8.3 per cent. If this tax revenue is removed from the Fund, the losses become $59,085 million and $46,612 million respectively.

The Federal Response to these significant losses was to create the Task Force on Airport Management which reported in 1979. This marks the beginning of the second phase of the Revolving Fund.

1.2 The Draft Report of the Task Force:
The Report recommended fundamental changes in the accounting procedures utilized by the Airports Revolving Fund. It began by assuming that both on site airport charges and the air transportation tax would be fully indexed for inflation. On site revenues would be credited to the airport earning them. The Air Transportation Tax would be allocated among airports according to formula. On the cost side, the Report argued that only cash expenditures which can be specifically identified as relating to the operation and maintenance of airports, or to such capital investment at them, should be considered when the financial viability of the principal airports is being evaluated.

Most of the changes involved radical departures from past practice. Interest charges on past loans were apparently no longer to be levied. Depreciation charges, which had previously been the source of funds

for the repayment of loans were apparently no longer to be charged. Air terminal control costs were apparently to remain outside the Revolving Fund against the advice of the Auditor General (AG Report, 1978, page 523). On the revenue side, the posture of the Report favors the internal cross-subsidization of airports both inside and outside the principal airports group.

The management system proposed by the Report (as its first choice) was the airport commission concept where each of the principal airports would be administered by a local airport commission. It saw a status quo scenario with regard to regulatory and administrative matters within Canadian Air Transportation Administration (CATA) which would presumably look after the smaller airports.

The individual airports would be administered by a local airport commission composed of members of the community familiar with the needs and priorities of the local community. These commissioners would be responsible for the day-to-day operation and management of the airport through an airport manager. A Canadian Airport Authority would be established in Ottawa to maintain the overall planning function and to direct and control airport development in Canada. The proposed system envisaged advisory committees at the local, regional and national levels.

The extent to which CATA was prepared to "let the birds out of the nest" is unclear. It appeared as though both system integrity and capital development were to remain with the headquarters group. The upshot of the management proposals was that CATA would remain firmly in control except for the day-to-day operations of the airports.. In essence, the proposed changes in structure were cosmetic - it would be business as usual dressed up in different jargon.

Equally interesting is the exercise which the Report describes with reference to the financial side of the individual airports. The objective here appears to have been to maximize the number of self-

sufficient airports. The initial step was to remove all non-cash items and overhead from the accounts of the principal airports group. On the basis of their analysis year, this reduced total expenses to $170.6 million, a reduction of about 45 per cent - all done with strokes of the pen. Still, the number of financially sufficient airports rose only to 6. Forgetting about the value of services provided by other departments increased this number to 7. Were terminal control costs to be ignored, the number of self sufficient airports would rise to 11, or to 16 if tax and fee increases were to be incorporated. It is interesting to note that in 1979, the costs which the Task Force sought to avoid amounted to almost 55 per cent of the costs associated with the four airports in the Revolving Fund at that time.

The last chapter in the exercise was the redistribution of the Air Transportation Tax. By adjusting the allocation formula, the Report was able to attain self-sufficiency in 22 of 23 airports. This strongly suggests the importance of thinking about a **system of airports** as opposed to a **collection of spatially separated monopolies.** The lesson from all of this may well be that internal cross-subsidization among the various national airports is virtually essential.

What was the Government response ? It ignored the structural recommendations of the Task Force. Instead, the national airports would continue to operate under the aegis of the Air Administrations both national and regional. It changed the name of the Airports Revolving Fund to the Self Sufficient Airports Group Revolving Fund expanding the number of included airports to 23.. And, it took some of the advice of the Task Force - it changed the nature of costs attributed to the Fund.

1.3 The Twenty-three Airport Period :
The Public Accounts 1978-79 reports that, effective April 1, 1979, three changes were made to the Revolving Fund. The first was the inclusion of 19 additional airports. Secondly, interest payments on the

outstanding balance of the loan fund were suspended as were repayments to the loan fund. Thirdly, there was the inclusion of a charge for essential air traffic control and other services formerly provided free of charge to Revolving Fund Airports. In essence, the Fund was recreated as the Self Supporting Airports Group (SSAG), and the slate was wiped clean.

The costs and revenues of the 23-airport SSAG for the fiscal years 1979-80 through 1984-85 are shown in Table 2. While there is

Table 2
Self-Supporting Airports Group Income and Expenses
1979-80 to 1984-85
(Thousands of 1986 dollars)

YEAR	REAL REVENUES	REAL EXPENSES	REAL PROFIT
1980	457264	478453	-21189
1981	465984	448989	16995
1982	465036	447463	7685
1983	438751	431762	16099
1984	441212	444161	-2949
1985	459018	453660	5359

Source: Public Accounts of Canada, Various Years.

considerable variability in the financial results, overall the Group did manage to earn an operating profit for the period as a whole. Overall, the profit amounted to almost $22 million. However, it is fair to say that this group of airports was not self-sufficient. The surplus was generated by the expedient of the federal government foregoing interest charges and debt repayment. Nor are the values of services

provided by other government departments included on the cost side. Operating costs , in other words, are artificially reduced below the levels which would be incurred by a different management and operations structure. Nor is there a sufficient amount of profit to finance necessary capital improvements.

In addition, the profitability is very much a consequence of the inflow of Air Transportation Tax revenues, a revenue source which would not be available to the local airport authorities which had been proposed in the 1979 Report. Without the ATT, the loss to the airports group over the six year period amounted to $1.02 billion, or $44.2 million per airport. We regard this as an important dimension of the problem, for this revenue source would not have been available to the not-for-profit local airport authorities envisaged by the Task Force.

Kenneth Dye, the Auditor General stated in October, 1985 that

> during the six years ended March 31,1985, the Fund has not met the objective of developing and operating its system of 23 airports in such a way in such a way as to recover their costs... (Public Accounts 1984-85, Page 27-25)

He adds that effective April 1, 1985, the number of airports was reduced to 9 "in an attempt to achieve financial viability".

1.4 The Nine Airport Period :

This represents the third attempt on the part of Transport Canada to operate a system of airports in a self-sustaining way. The airports remaining in the program were all classified as international airports, though it must be noted that there was still great variability in size. This experiment lasted until March 31, 1991. Financial data for the period appear as Table 3.

Table 3
Self-Supporting Airports Group Revenues and Expenses
1985-86 to 1990-91
(Thousands of 1986 dollars)

YEAR	REAL REVENUE	REAL EXPENSES	REAL PROFIT
1986	493797	435679	58117
1987	393142	420182	-27040
1988	408335	411075	-2740
1989	468858	439417	29440
1990	468804	460504	8300
1991	472089	480241	-8152

Source: Public Accounts of Canada, Various Years

On the expense side, it should be noted that this time the costs more fairly represent the true situation. Terminal control costs are included as are interest on contributed capital and depreciation. It should also be noted that for the period as a whole cost escalations were kept in check, the increase was limited to about 10 per cent in real terms. For the period as a whole, the real profit was about $58 million, about $6.4 million per airport in the Fund.

However, it is also noteworthy that the profitability depended in large measure on the allocation of the Air Transportation Tax to the Fund. That single revenue source contributed roughly 20 per cent of the Fund's real revenue over the period. Without this allocation, the cumulative deficit would have amounted to $597 million. Furthermore, the allocation was artificial, being based on factors other than, say, passengers originated. The Public Accounts 1986-87 reports that the allocation was "calculated to give a 6 per cent return on Canada's investment in the Fund" (Page 1-33) As noted earlier, this is an important consideration because this revenue source would

not have been available to not-for-profit local airport authorities. In addition, it should be noted that the operating profits for the period appear to be insufficient to finance large scale capital improvements at these airports. In this sense, the third version of the Fund was not different from earlier approaches.

1.5 An Overview 1969 through 1991

The Airports Revolving Fund was created effective April 1, 1969 and wound up March 31, 1991. During the first period, the Fund showed an operating surplus of $102 million (1986 dollars), but ended the period with a substantial debt to Canada. The real surplus of revenues over operating expenditures for the 23 airport period amounted to $22 million. The profitability depended on Air Transportation Tax allocation and the deletion of certain cost items. During the final period, the surplus was $58 million. Overall, from 1969-70 to 1990-91, the surplus was $182 million as measured in 1986 purchasing power.

This review of the period does not generate much confidence about the financial viability of local airport authorities in a financial climate where each is not only to be financially self-sufficient in an operating sense but also to pay rents of an uncertain amount to Transport Canada.

2.0 THE POST REVOLVING FUND PERIOD

With the winding up of the Revolving Fund, the stage was set for the devolution of the national airports to local authorities. As the first stage, Vancouver, Calgary, Edmonton and Montreal/Mirabel became Local Airport Authorities (LAA) , the transfer taking place in 1992 . Some of the early financial results appear in Table 4 for all the Authorities combined..

Table 4
Canada Airport Authorities Revenues and Expenses
1993 to 1996

Year	Revenue	Expenses	Net Income
1993	263.8	191.3	72.5
1994	288.2	202.7	85.5
1995	321.4	233.1	88.4
1996	380.5	285.6	94.9

Source: Transport Canada, Annual Report 1997.

The operating ratio, the ratio of operating expenses to revenues, was in the range of 70 to 75 per cent over the period. Of the four authorities, three had positive operating income in all years. The other, Edmonton, experiences losses in all years. Of the four authorities, Vancouver was the strongest financially , having the lowest ratio each year. The other ratio of interest is the ratio of net income to fixed assets. For all four authorities, this ratio fell during the period indicating that there was sufficient financial strength to finance the acquisition of capital assets.

The Federal Government announced it National Airports Policy in 1994. While the document covers all levels of airports in Canada, out interest is with the National Airport System. Included are the LAA's above plus 20 other major airports across the country. Data for these airports appear in Table 5 below. These data reinforce the position taken earlier that Canada's airports are diverse.

Table 5
Selected Operating Data National Airports 1992

Airport	Passengers	Revenues	Surplus
Kelowna	297609	1887000	(275472)
Prince George	234768	1323800	(1331202)
Victoria	697478	4198400	541026
Regina	578917	4164300	(143025)
Saskatoon	57689	4390300	(57796)
Winnipeg	2142124	16055400	3442478
London	257888	1988200	(1010268)
Ottawa	2495746	20981600	8314974
Sudbury	207253	816000	(1275700)
Thunder Bay	496235	2828000	(1359468)
Toronto	19118887	142865000	76343798
Quebec	680957	6594000	629080
Fredericton	213323	1672400	(800787)
Moncton	230303	2456500	(817989)
Saint John	196052	1911900	(965032)
Halifax	2310146	15413000	4219621
Charlottetown	191918	1154100	(1145231)
Gander	1331251	2908300	(4391964)
St. John's	622266	4310400	(430786)
Yellowknife	191410	979700	(2186580)
Whitehorse	122380	529900	(1489052)

Source: Transport Canada, National Airports Policy, 1994.

It must be emphasized that the financial data provided are for operations only. Capital expenditures have been (apparently)

excluded. Even on that basis, only 5 of the 20 airports managed to earn operating surpluses. In terms of passenger volumes, the smallest of these was Quebec City with a volume of about 681,000. Of this volume, outbound passengers approximate 340,000. Given an Airport Improvement Fee (AIF) of $10 (integrated into the ticket price so there are no additional costs involved), the annual inflow would be $3.4 million. With a real interest rate of 5 per cent and a twenty year life-span, this cash-flow would support a capital expenditure of $34 million. This is not sufficient to support significant improvement at that airport. In the case of Fredericton, a departure tax of about $8 per passenger would be required to liquidate the existing deficit.

At the same time, it must be remembered that the Minister remains responsible for system integrity and safety standards. In other words, through the process of upgrading both, Transport Canada can force local airports to undertake expenditures without the Department incurring any financial obligations.

At this juncture, one could say that the current airports policy is appropriate for the larger airports in the Canadian system. This is certainly true for those with passenger volumes in excess of 1 million, but appears true for those between 600,000 and one million as well. It is equally clear that the policy does not meet the needs of the smaller airports as it is now constituted. The question is whether it can be fixed without imposing financial demands on Transport Canada.

3.0 IMPROVING THE CURRENT POLICY :

If one accepts that one airport is part of a broader system, then it follows that there is justification for financial inter-relationships among them. Passengers originating from the smaller airports in the system generate revenues for those with AIF's on their return journey. Were the smaller airport to disappear, there would be a modest decline in revenues and net incomes at the other end of the link. For

this reason, it is important that the smaller airports continue in operation to generate feeder traffic for the larger ones.

At the same time, as Transport Canada continues to withdraw from the day-to-day operations of a variety of transport facilities, it is unreasonable to expect a policy reversal leading to the direct subsidization of small and/or isolated operations. It follows logically that there must be some sort of internal cross-subsidization within the National Airport System. There is inter-connectivity among these airports. The system involves more than a set of spatially separated monopolies. This was recognized by the 1979 Task Force Report . It remains as true now. The Task Force proposed to balance things through a formula for the allocation of the Air Transportation Tax. At this point in time, a system of positive and negative rents seems to be the most promising approach.

The Auditor General expressed concerns about airport rents in Chapter 10 of his October 2000 Report. Our discussion will focus on Exhibit 10.11 of that Report. The Auditor General notes that Calgary, Pearson and Vancouver airports accounted for 95 per cent of 1998 rent revenues (p. 10-21). For other authorities, the Auditor General notes the existence of negative rents. These are defined as payments by Transport Canada to the airport authorities. What is not clear from the Report, nor available in the Public Domain is information about the nature of the transfer agreements, in particular, the financial aspects of the transfer agreements. Given the timing of the transfers involved, one is driven to the conclusion that much of these transfers are transitional , dealing with the need to provide seed money, particularly on the capital side, for the airports being transferred. If this is the case, then these so-called "negative rents" will disappear through time.

We must also note that the increase in net rents paid to Transport Canada is some cause for alarm. In 1992, the net rents stood at $20.3 million in nominal terms. After staying at that level for two years, they

more than doubled to $44.5 million in 1995. By 1998, they had reached $179 million. After falling slightly the next year, they grew to $593 million in 1999. Gross rents reached almost a billion dollars in that year. There is some evidence that Transport Canada views the airport system as a significant revenue source.

More important here is the question of whether a true system of positive and negative rents can be established so as to provide the requisite financial support to the smaller players in the system and in so doing, enhance the fiscal health of the airports system as a whole. While we have not completed this aspect of the research, it appears that the zero rent thresh-hold is about 350,000 outbound passengers per year. A negative rent of $10 per passenger on the difference between this amount and the actual volumes would generate sufficient revenues to cover many of the deficits and allow some surplus to cover the carrying costs of airport improvement. It is envisaged that AIF's would be collected as well.

4.0 CONCLUSIONS:

This paper has examined the evolution of Canada's airports policy since 1969. The fourth iteration - airport devolution to local authorities - came after three failed attempts to operate the major airports on a self-sustaining basis. The present policy does not recognize that airports are interconnected in a system. We regard this as a serious weakness. It could be addressed through the adoption of a system of positive and negative rents. These could be structured so that there would be a neutral revenue impact on Transport Canada while the financial position of the smaller airports would be strengthened. Needless to say, the need for these individual airports to become more efficient would remain.

AIRPORT PRIVATIZATION IN BRAZIL: QUESTIONS AND ANSWERS

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1. INTRODUCTION

Since the mid 90s, Brazil has undergone a series of privatization processes involving various public service activities: telecommunications, water and power distribution, financial institutions and also transportation (highways, railroads, port terminals, etc.). Meanwhile, the air transportation industry did not follow the steps of those other sister industries: indeed, only the state of São Paulo's airline was privatized (in 1990/91). Regarding the airports and related infrastructure, there were no signs of a political shift in the mid 90s.

Even without any signs coming from the federal government during the 90s, some states began their privatization processes. The state of Bahia has already three of its airports managed by private groups, while the state of São Paulo is undergoing public hearings to privatize some of its most important state-run airports. But in 1999, following a more aggressive privatization policy, the federal government appointed the first civilian president for the federal

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airport management company, the INFRAERO. His main roles include restructuring the entire organization and considering the privatization of the nation's major airports. Moreover, the creation of the Brazilian National Civil Aviation Agency (ANAC) will directly influence the privatization processes as it will regulate airline competition, and establish airport fees, among other roles.

In view of this, the objectives of this paper are: (1) analyse the current practices and the alternatives being thought for the privatization of large/medium federal and state-managed airports in Brazil; and (2) comment on how the new domestic regulatory environment may impact the privatization process in the country.

2. CURRENT AIRPORT MANAGEMENT MODELS IN BRAZIL

This section will give a brief overview of the federal, centralized management model in practice for the major airports in Brazil, while pointing the efforts and the recent policy being pushed forward by some state transportation authorities to privatize its main airports.

2.1 The Federal Airport Authority: INFRAERO

In order to cope with the technological demands regarding Brazilian airport infrastructure, originated from the introduction of the jet in the late 50s and the widebodies in the late 60s, the federal government creates the International Airport Project Coordination Commission – CCPAI in the late 60s. Its main objective was to coordinate all the necessary studies regarding the planning and construction of the new international airport in the country: Rio de Janeiro's Galeão International airport (GIG). In May, 1970 the federal government turns the CCPAI into the ARSA – *Aeroportos do Rio de Janeiro S.A.*, which builds itself into a very successful company managing not only GIG's planning and construction but also several other airports in the state of Rio de Janeiro and two other neighboring states. Following its great success, in December 1972 the federal government, through the Ministry of Aeronautics, transforms ARSA into the Infraero – *Empresa Brasileira de Infra-*

estrutura Aeroportuária or Brazilian Airport Authority, with the responsibility to manage the most important airports of the country (Rosa *et al*, 1999).

Today, Infraero manages 67 airports in Brazil, from the very major airports (i.e. São Paulo and Rio de Janeiro Internationals) to general-aviation (GA) airports, like Campo de Marte and Jacarepaguá, respectively in the city of São Paulo and Rio de Janeiro. It is a centralized federal government-owned company under the Ministry of Defense since 1999. From its creation in 1972 until 1999 it was directly under the Ministry of Aeronautics (Air Force Ministry), thus it has been a military-run and military-structured organization for its entire life. Infraero is divided into seven "business centers" (CNs), each responsible for a certain region of the country and its airports. Control is totally centralized in Infraero headquarters in the country's capital, Brasília. This centralized structure prevents any independent management decisions from the CNs: for instance, each CN cannot set individual/particular terminal and/or landing fees for its airports. As a measure of its importance, Infraero-managed airports are responsible for about 95% of the total scheduled passenger traffic and more than 99% of the cargo.

Indeed, the concept of a centralized airport administration company was very important in developing a nation-wide high standard airport infrastructure during the 70s and 80s. But the concept has come to some critical drawbacks. Being under a centralized management policy, each airport management team lives with a permanent limitation towards developing studies, strategies and policies in order to better interact with the particular characteristics (i.e.: economic, touristic, cultural) of the communities or region it has its business. This precludes the management to fully explore the infrastructure potentials in regard to its surrounding activities, not to say that it also prevents a closer participation of the mentioned communities in the airport life. In turn, these factors combined lead to a series of management practices and strategies that are not linked at all to the communities' needs and interests. Moreover, due to the

centralized policy, there is also a centralized management and control of resources. Dealing with the nation's major airports together with low-traffic and also with GA airports, in other words to very profitable airports to very unprofitable ones, a logical consequence is the need for cross-subsidies. The very benefit of this model is that those always-unprofitable airports have guaranteed resources for keeping them as fully usable and safe facilities. But the benefit is limited: as the airport authority does not set individual studies and goals for each airport and its surrounding communities, say through detailed passenger and cargo profile analysis and economic impact reports, those allocated resources do not function as economic multipliers to the communities and regions, staying almost totally limited to the operational needs of the infrastructures themselves.

Suffering the most of this centralization are the profitable airports. In fact, they never get to see their profits returning as possibilities to really continue their roles of being *the* entry doors of the country. An example is Brazil's largest and most important airport, São Paulo/Guarulhos International (GRU): it has reached its maximum capacity in terms of passenger traffic, but there are not enough resources to build a third terminal. If GRU's profits could have been used in its own benefit for the last several years, the third terminal could be nearing its operational status in 2001.

Another great disadvantage of the current model is that it has developed a culture that can be referred as a *lack of stimuli* for unprofitable airport managers as well as for those executives serving in the profitable ones. The first group may well think that their role is just to keep the infrastructure opened and running, as the resources for any improvements may eventually arrive, even though it will not come from its own facilities. On the other hand, the executives from the profitable ones may well think that they can also rest: even if they work hard to make their airports more and more profitable, this increasing amount of resources will most likely be distributed and allocated to maintain and improve those "poorer" but

essential facilities, through cross-subsidies. The "amount left" would, again, be inadequate to cope with the needs of the profitable ones, as they continue to grow theirs passenger traffic and aircraft movements. This put, every single airport, from the profitable to the "poor" ones would certainly continue to be far away from fulfilling their role as true economic engines for their communities or regions.

2.2 Airports Managed by the State's Transportation Authorities

All Brazilian states have their transportation authority. These entities, generally through an aeronautical department, manage some of the secondary airports located in the state, except for those located in the state capital. This is the case of GA airports like Jacarepaguá (city of Rio de Janeiro) and Campo de Marte (city of São Paulo), managed by Infraero.

Completing the airport management structure in the country, other secondary and tertiary airports are run by the cities' transportation authorities or directly by the military under the Aeronautics Command (former Air Force Ministry). The types of airport management in Brazil are shown on Table 1.

Table 1 – Brazilian Airport Infrastructure

Certified Aerodromes	Public-use aerodromes	711
	Private-use/owned aerodromes	1,291
	Total aerodromes in Brazil	2,002
Airport Administration Figures	Infraero-managed airports	63
	Infraero in partnership with cities	4
	State Transportation Authority-managed	121(*)
	City Transportation Authority-managed	131(*)
	Under Military Management	392

(*) Indicates airports that may be privatized without the need of federal policy and/or intervention. Three airports in the state of Bahia are already privately managed, while some airports in the state of São Paulo are beginning their processes of privatization. The states of Rio Grande do Sul and Paraná may soon follow

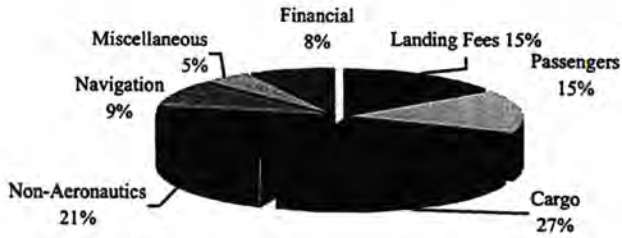
Source: Department of Civil Aviation – DAC.

3. AIRPORT PRIVATIZATION METHODS IN CONSIDERATION

First of all it is important to define what the term "privatization" means in Portuguese: "privatization" is not the selling of public infrastructure or services to private groups; it is the concession or lease of public services and/or infrastructures to private groups interested in their managements. Therefore when "privatization" is *correctly* mentioned and used in Portuguese, it will refer to public facilities and/or services being privately management under a concession/lease contract.

Following this definition, we could ask why would Brazilian or international private consortiums be interested in managing some of the country's airports. Running beside all the capitalistic and profit-oriented answers, Brazil has demonstrated in the last several years its economic stability while showing consistent signs for a growing economy. Moreover, the Mercosur or even the forthcoming free-trade area of the Americas (ALCA) is a guarantee for a greater development of the air transportation industry in the country and the south-american region. With an ongoing economic growth and with international trade and commerce flourishing, there is a huge potential market for domestic and international travel to/from Brazil. The country also has dozens of unique tourist sites in its continental territory. Although not yet greatly explored, its tourism potential is indeed immense. Regarding airport-related issues, there is still a long way to go towards exploring non-aeronautical revenues. Non-aeronautical revenues represent only about 21% of total Infraero revenue sources, as shown on Figure 1. Non-aeronautical revenues for the four major airports in Brazil (GRU, GIG, plus both downtown airports in São Paulo [Congonhas, CGH] and Rio de Janeiro [Santos Dumont, SDU]) vary from 20-26% in GIG and GRU to almost 42-44% in SDU and CGH. According to Behnke (2000), average non-aeronautical revenues at ACI's 1,400 member airports were more than 50% in 1997.

Figure 1 – INFRAERO Revenue Sources (1999)



But are there problems? Of course! Infraero officials interviewed revealed that about 20 out of the 67 airports are profitable, discarding depreciation and amortization. But if counted in every financial term, less than half of these profitable would be *truly* profitable. In view of this, another intriguing question often arises: *Who would be interested in the non-profitable airports?* But if approaching the problem from another perspective, a more important question must be made: *What set of factors can make an airport profitable or unprofitable in Brazil?* Recent academic studies briefly demonstrates that the current sets of procedures, policies and the centralized management conducted by Infraero greatly limit its own overall performance (Pacheco, 2000; Palhares and Espirito Santo Jr., 2000).

In short, what Brazil needs is a modernization throughout its airport management practices and strategies. Due to many successful experiences worldwide, privatization could be a way. But as Table 2 will point out, there are several difficulties including a strong resistance towards favoring decentralization and towards a more liberalized environment involving air transportation issues.

When confronted with the privatization dilemma, Brazilian specialists point out that privatization processes should look at some

critical issues: attract national and foreign investments for airport expansion; attract new services to the airport; stimulate airline service and airline competition to/from the airport; enhance airport competition; multiply investments in the airport area of influence; establish closer links between the new airport authority and the communities in the vicinities; improve airport management performance and productivity, and enhance non-aeronautical revenues; plus other relevant issues.

But as can be seen on Table 2 and in the following section, some of the privatization models being considered in combination with the proposed attributes being envisioned for new National Civil Aviation Agency may not pave the way for accomplishing these critical goals.

Table 2 – Major Methods in Consideration for Brazilian Airport Privatization

Method Considered	General Description	Main Reported Difficulties
Infraero maintained, airport terminals privately operated under a concession/lease contract.	Passenger and cargo terminals are licit-out/ /leased to private groups for individual management under an Infraero-managed airport.	Officials from the aeronautical authority and Infraero say it would be difficult to manage and coordinate operations with various independently operated terminals.
Infraero maintained and new terminals under a B.O.T. agreement.	Brand new, yet-to-be-built terminals in a B.O.T. agreement.	In essence, is the same difficulty mentioned above, but with a fewer number of private terminals.
Infraero is gradually phased out, individual airport privatization.	A transition phase would be planned for a dismantling of Infraero. Airports would be licit-out individually.	Officials from the aeronautical authority and Infraero say it would be easy to licit-out the "good" and profitable airports, but they argue that no private consortium would be interested in the unprofitable ones.

Method Considered	General Description	Main Reported Difficulties
Infraero is gradually phased out, airports would be privatized in batches.	A transition phase would be planned for a dismantling of Infraero. Airports would be licit-out in batches. For example: a winning consortium would take a batch of 2 "good" airports plus 2 "near-good" ones and 3 unprofitable.	Many officials from the aeronautical authority and Infraero say this would be the best model, as would obligate the private consortiums to handle many unprofitable airports. For this, these same private consortiums may turn away from their initial interest in Brazilian airports.
Infraero gradually disapears; airports would not be privatized, but turned to state and city management.	Again a transition phase would be planned for a dismantling of Infraero, but the major airports would be turned to their states and/or cities for management and operation.	Many officials from the aeronautical authority and Infraero say this non-privatization model could be chosen in "the public interest", as a public management would still be in place. On the other hand the majority of Brazilian states and cities do not have the financial and economic capability of managing a major airport with their own resources.
States and cities licit-out their managed airports	Already done by the state of Bahia (in 3 airports) and to be implemented by other major states.	In general, state and city-managed airports have very low passenger and cargo traffic. Private consortiums' interest could be low.

4. CREATING THE NATIONAL CIVIL AVIATION AGENCY (ANAC)

In late November 2000, the Office of the President sent to Congress a draft project (project-of-law) containing the text for the creation of the National Civil Aviation Agency (ANAC), in order to replace the existing military-run and structured Department of Civil Aviation

(DAC): the first most noticeable difference is that ANAC will be a civilian agency under the Ministry of Defense, while the DAC has been a military organization under the Ministry of Aeronautics (today Air Force Command). In this section, we will explore three major points within the ANAC project-of-law that may interfere with any kind of airport privatization being considered: control of the concessions, tariffs and slots, and airfares.

4.1 ANAC Establishing Concessions Policies

Under article 10, parts XXI to XXVIII and XXXIII, the ANAC would have the responsibility to regulate, coordinate, control and propose issues regarding licit-out policies and procedures of airport-related infrastructure. While not referring directly to the term 'privatization', parts XXIV to XXVIII and specifically part XXXIII, are clearly aimed to establish the ANAC as the sole authority to conduct proposals relating to the privatization of the major airports in the country. By doing so, the proposed new Agency would again maintain and encompass a centralized policy towards privatization of all the nation's main airports. This would preclude any significant set of efforts that could be pushed forward by airport neighboring communities and the state that it is located in order to analyse in detail its potentials and overall influence on the communities' and state's economy, mainly through economic impact analysis and reports. Moreover, as it will be seen in the next item, an ongoing centralized conception may continue to limit any kind of competition between near-located airports.

4.2 ANAC Establishing Airport Charges, Fees, and Slot Allocation Rules

Under article 10, XXIX, the ANAC would have the responsibility to establish, control, monitor and publish the charges and fees regarding airport infrastructure services and operations. This would create a monumental barrier for airport competition, even if some major airports were individually managed by its state or city transportation authority, or even by a private consortium. So, if interpreting *ipsis litteris* part XXIX and others similarly oriented,

airport "A" would not be independent to establish its own aeronautical fees, thus limiting the competition say, to equally classified and rated airport "B", as both and all other equally classified and rated airports would have the same aircraft landing and parking fees, communication fees, passenger terminal user fees, etc. In view of this, direct competition, if any, would be limited mainly to airport location, level of service and fuel costs. Moreover, the new sort of regulation-imposed bureaucracies over this particular subject would most probably turn any attempt by an airport management team to establish differentiated fees (low season and/or night landing fees, for instance) into a nightmare.

Being infrastructures built for public use, airports should play their role in guaranteeing new entrant carriers the opportunity to access the markets they wish to operate (FAA/OST, 1999). As pointed out by government agencies and academics (Fawcett and Ferris, 1989; U.S. GAO 1993, 1997 and 1998; McKenna, 1999; Espirito Santo Jr., 2000), the lack of available aeronautical infrastructure represents one of the main barriers to entry and direct competition in the airline industry. This means that imposing slot allocation rules to airports where several airlines are competing *or have the potential to compete* is an anti-competitive policy. This is exactly what Infraero has been doing with the downtown airports in Rio de Janeiro and São Paulo for the last three years and exactly what the ANAC project points out as a policy to be continued (article 10, part XIX).

4.3 ANAC Establishing Air Fares

One of the critical negative issues nested within the ANAC project-of-law, as it is, is the control over airfares. Article 2, under part VI plus articles 3 and 4 state that the ANAC will foster the principle of "free competition", but, on the very other hand, article 10 part XV, directly states that the Agency will *"establish, control, monitor and publish the price policy of all regular air transportation services, fixing fares under the conditions of this law"* (free translation by the authors from the original text in Portuguese). Again, considering *ipsis litteris* the draft proposal text, part XV clearly *re-regulates* the

policy of near-deregulation pursued by the DAC since 1990. With this fare control, airports under any kind of public or private management would be extremely if not totally limited to conduct agreements in an airline by airline basis in order to negotiate good fare levels for its passengers, cargo shippers and neighboring communities. In fact, modern-minded and community-oriented airport managers and executives should be totally free and able to pursue exactly this kind of agreements (Cook, 1998a/b). Instead, what the project for the new Agency is proposing is just the opposite, thus severely limiting modern and pro-active executives to manage their infrastructure in fine tune with the neighboring communities' interests.

The three aforementioned attributions proposed within the ANAC project-of-law would certainly create barriers to establish a more direct competition between Brazilian carriers. As the U.S. and other countries deregulation experiences have demonstrated and continues to demonstrate, airports play a key role in promoting and enhancing competition among domestic and international carriers. Taking this extremely important competition tool from the hands of airport executives will in fact be a huge step backwards from the envisioned and much needed modernization of Brazilian air transportation policy.

5. CONCLUSIONS

As seen in the previous sections, some of the privatization models currently under consideration in Brazil may pave the way for a positive airport individualization and/or privatization. But great difficulties do exist, since Brazilian aviation authorities and government officials are not yet fully tuned in favor of a deregulated and multi-competitive environment. In addition to this cultural dilemma, the centralized management model still in place for Brazilian major airports continue to severely limit Infraero's overall performance, thus also prompting any significant fulfilling contribution of these airports as true economic engines for their neighboring communities. Moreover, as no airport authority in the

country is considering elaborating detailed studies on economic impacts for the targeted-for-privatization infrastructures, these authorities will certainly have difficulties in establishing a closer-to-reality minimum price for an international bidding. In addition, if the new ANAC project-of-law being discussed in the Congress is approved *as it is*, there will be another set of very important implications running severely against the success of any kind of airport privatization in the country.

In any case, it must also be said that no effort is being implemented by either Infraero or Brazilian aviation authorities to discuss in open and public forums what most appropriate privatization model(s) could be implemented for Brazilian major airports. The discussions and official studies being done (if any!) on this subject are not released to the public. Any concrete and relevant information regarding the aforementioned privatization issues are obtained only through informal conversations and personal sources within the government agencies, the aviation authority and Infraero. This lack of publicity and transparency is precluding any major participation and/or contribution by society groups, the directly benefited or negatively impacted airport communities, the academia, and even the Brazilian Congress in the current issue of airport privatization.

Therefore, as shown in this article, by maintaining the current centralized model, by not establishing concrete policies and strategies to push forward the privatization process, by letting the ANAC project interfere negatively with the desired goals for privatization, and by limiting any significant "outside" contribution to the relevant issues, the country's major airports will continue neither fully exploring their potentials to cope with community needs and interests nor enhancing their role as economic engines to foster Brazil's growth.

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The Internet-Enabled Supply Chain and Transportation

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Overview

Electronic commerce is both a challenge and an opportunity for transportation. It is an opportunity for transport firms to use technology to improve service, increase productivity and reduce cost. It is a challenge as it creates new supply chain requirements and capabilities that impact the demand for transport services, in many cases creating new demands on fulfilment. It is both a challenge and opportunity as the Internet reinvents the marketplace through the creation of freight exchanges.

This paper reviews the current trends in e business, supply chain management and the response of the transportation industry. Particular emphasize is placed on the changing demand for product delivery that are reflected in the nature of the product delivered, the speed and reliability of delivery, flexibility and responsiveness, and the origins and destinations. Whereas, traditional transportation and logistics service offerings have met some of this demand, new transport products have been developed and now organization structures have evolved. This paper describes the trends that have been occurring in transportation supply. How are modes, carrier services and organization structures changing? What is the role of transport firms versus third party logistics service providers? These

trends have tremendous implications for product strategy of transport firms as well as infrastructure policy planners.

Electronic Business and Supply Chain Management

E Business

Electronic business (E business) is any commercial transaction carried out, facilitated or enabled by the electronic exchange of information. Transactions can be buying and selling, servicing customers, collaborating with business partners, and conducting transactions within a company. Transactions can be internal to a company and affect the internal supply chain process or be across firms, affecting external supply chain processes. Electronic transactions that involve the change of ownership (purchase or sale) of a product or service is formally known as electronic commerce (E commerce). E business has changed the way in which businesses transact with other businesses (B2B), how businesses transact with customers (B2C), and how businesses conducts it's internal operations or operations with its partners in the supply chain.

The growth and potential magnitude of E business is astounding. AMR Research estimates electronic B2B activity at $5.7 trillion in 2004 or about 29 percent of all business transactions. AMR states that leading companies will move over 80 percent of their activity to the Web. Like the B2B market, the business-to-consumers (B2C) segment is undergoing rapid growth. Forrester Research estimates online consumer spending will amount to $2 trillion or one out of eight dollars of all retail transactions by the year 2003. Forrester Research also forecasts that the number of households that shop online will grow from its current 17 million to 49 million by 2004.

Supply Chain Management

The supply chain is all of the firms and processes involved in producing and delivering the product to the end consumer. Supply chain processes include all of the activities required to source supplies and raw materials for production, finished goods for resale,

and parts for after sales service. Supply chain processes include making and producing the product or service, and the delivery of goods to each member of the supply chain, encompassing both inbound and outbound logistics as well as reverse logistics. The supply chain itself may be a single vertically integrated firm and it's final customer. However, few firms are this comprehensive, instead the majority of firms operate as part of a larger supply chain, a network of suppliers and their suppliers, customers and their customers. This market based industry structure benefits from the lower costs and productivity of specialization, with different members of the supply chain adding value. It is predicted that the supply chain itself will become the trading entity, that functions as a corporate family with each member contributing a specific core competency. This form of organization will not become dominant overnight because the sharing of commercially sensitive information is foreign to the culture of many firms. However, there are real cost savings that can be gained from collaboration between supply chain partners and even between competitors and the process has already begun in a number of industries. For example a number of industries have made tremendous gains through Collaborative Planning Forecasting and Replenishment (CPFR).

The management of the supply chain involves the planning, execution and control of these processes to deliver products to end customers at the lowest cost. Information has always been critical to all three of these management tasks. Information such as forecasts of demand and future cost conditions are the foundation for optimizing decisions involving the production - distribution network and product flow, through collaboration across the supply chain. Information flow initiates transactions and enables more precise coordination across the supply chain during execution. Detailed and real time information permits close monitoring of processes, enabling agility and responsiveness to changing market conditions or out of control processes. Thus information technology has always had an important influence on the efficiency and effectiveness of the supply chain.

Transportation is one of the most important and critical supply chain processes. Transportation costs account for approximately 60 percent of total logistics costs and in many fulfilment situations transportation is the largest component of the order cycle, influencing the speed and reliability of the order cycle and the quality of the customer experience. The transportation sector is an industry unto itself, composed of multiple modes and thousands of individual firms competing for the shipper's business. The services and capabilities that the transportation industry needs to provide and the means by which transport firms market and produce service are profoundly impacted by e business. We now focus on these impacts with particular attention to the domestic truck and rail segments of North American transportation.

E Business Impact on Supply Chain Strategy

Supply Chain Integration

Supply chain integration is the tightening of links within the firm and among participants in a supply chain, along one or more of three dimensions: goods, information and funds. Firms have always sought this integration to reduce cycle times, inventory and supply chain costs, particularly in industries with high risk of inventory obsolescence or high inventory value. The impact of the internet is that it is an incredible medium that allows supply chain activities to be carried out in a truly synchronized manner.

Successful integration enables the supply chain to move from a push to a pull fulfilment strategy. The traditional model of a push supply chain had been to forecast demand, produce the product and locate it close to the customer to meet demand. This achieved production and transportation cost efficiencies but at the expense of holding large inventories. Pull systems such as assemble to order or produce to order, result in postponing the production of the product or holding inventories as far upstream in the supply chain as possible. Pull systems are more responsive to actual customer demand and result in

the movement of smaller quantities more frequently. JIT in manufacturing and quick response in retailing are examples of pull strategies. For these systems to work, information such as supply, demand and shipment status must be shared across the supply chain.

With visibility of moving or standing inventory, various participants in the supply chain can plan and synchronize their processes better. This requires logistics service providers to have the capability to trace and track shipments in their control and making that information readily accessible to customer or supply chain partners. The combination of information technology and outsourcing philosophy has also led to the development of "Value Webs" as opposed to linear supply chains. An example of a Value Web is Cisco's supply chain consisting of a network of customers and suppliers completely connected though the Internet. Manufacturing is outsourced to dispersed locations and merge in transit assembly is employed to complete the production of build to order products. The manufacturing network is heavily web/portal oriented at supplier, customer, and supplier interfaces. Real time knowledge of both supply and demand allows Cisco's suppliers to ship components directly to customers, bypassing Cisco itself. Direct fulfilment means reduced transportation expense, faster cycle times and reduced inventories but it places a heavy premium on both service reliability and shipment visibility, both required to enable Cisco to be responsive to customers. For example, Cisco internal systems are connected to UPS's logistics management system allowing Cisco to track product status in real time. This allows Cisco to intercept, reroute or reconfigure orders on short notice. Cisco can defer a delivery so that it arrives just in time, not early or late. This type of virtual supply chain also creates demand for smaller, more frequent and faster shipments, favouring air and expedited ground delivery.

Synchronization of the supply chain has already occurred in many industries, particularly among larger firms and situations where the number of transactions justified the investment in EDI. The lower cost and easier implementation of Internet communications has

made it feasible to achieve such coordination in small and medium size firms as well. In addition, the network feature of the Internet enables coordination across multiple members of the supply chain simultaneously rather in a sequential manner. In some supply chains; the Internet also facilitates crucial and strategic management decisions. Once partners in the supply chain have developed the trust required in true supply chain alliances, they can communicate proposed plans such as product development, capacity strategy and marketing plans. Concurrent planning between suppliers and buyers in the supply chain can recognize the tradeoffs and synergies between partners because information can be transmitted quickly, accurately, securely and at low cost.

Information sharing and collaboration between supply chain partners including transport firms and other logistics providers enable supply chain integration and synchronization. The implication is that transportation firms must have the capability to share information with their shippers and increasingly be able to do this through the Web. Many transportation or logistics service companies are providing this real time information in a personalized way to become an integral part of their customer's supply chain. This creates the opportunity to secure long-term business by embedding their processes into those of their customers and adding value beyond traditional transportation and logistics offerings. The Cisco-UPS case is an example.

Improved communications is a necessary but not sufficient condition for implementing pull based supply chains. The Internet enables the substitution of transportation as well as information for inventory. Transportation will have to be more reliable and flexible as inventories are reduced in the supply chain and no longer available to offset uncertainty. Pull systems inherently result in smaller quantities of product required in each stage of the supply chain but this does not necessarily mean smaller vehicle loads. Logisticians seek the right combination of consolidation and break bulk through

cross-dock and traditional distribution center operations to minimize transportation costs and maximize vehicle utilization.

The Internet enables real time management of supply chain processes and collaboration. Shippers will want transport suppliers that are flexible and responsive to rapid changes in their own demand patterns, ease of dealing with transport suppliers and the ability to collaborate across the supply chain. Information sharing capabilities will be critical and information requirements will go beyond shipment status to the ability to supply timely and detailed information about expected delivery times, inventory status, equipment availability, and prices. Carriers may be required to provide such information proactively instead of on request. This is corroborated by a mid 2000 survey of 250 major U.S. shippers by Morgan Dean Stanley Whitter (MDSW). The survey found that 70 percent of respondents expected their freight transport needs to change as a result of e commerce, and 44 percent said that a freight transport provider must have e-commerce connectivity in order to bid for their business. The most highly prized features of carrier web sites were real time tracking and tracing.

Procurement

The Internet has improved and enabled the re-engineering of the procurement process for many firms. Through the automation of purchasing processes via the Internet, companies have reduced procurement transaction costs, speeded up the purchase cycle and increased control. It is estimated that the average manual purchase transaction can be reduced from over $100 to less than $10 through automation. The same automation can be used to control maverick or unauthorized spending. The Internet permits instant transmission of request for bids, quick access to available sources and prompt responses.

Logistics service providers such as transportation firms are important suppliers just as much as suppliers of physical goods. The process of purchasing transportation services can potentially be

automated and better controlled through Internet based purchasing automation. Transportation firms that are not Internet accessible may not have access to customers who rely on the Internet to identify suppliers and transact business. The MSDW survey of U.S. shippers supports this conclusion. The survey found that manual transactions with freight transport providers, which include face-to-face, telephone, fax and regular mail communications, will decline from the current 67 percent to only 31 percent in the next two years.

Transport firms themselves, purchase large quantities of equipment and materials, repair and operating (MRO) materials. These include tires, wheels, fuel and vehicle parts. Automation of purchasing through e-procurement is an area that is just as easily justified for transport firms as they are for manufacturers. Class I railroads are large enough to develop internal e procurement solutions. CN implemented Internet procurement in 2000, using software developed by Ariba Inc. and BCE Emergis to create supply chain efficiencies for CN and its suppliers. The set of services would include online ordering processing, invoicing, dynamic pricing auctioning and electronic payment. The procurement system will be integrated with the SAP system at CN.

Transportation companies can also rationalize the process and reduce the price of supplies by participating in online market exchange sites for supplies and equipment. Railnet.com is a subscription based web site offering marketing, bidding and communications capabilities to railroads and its suppliers, contractors and service providers. 1Rail.com is another online marketplace for railroads to procure equipment, materials and supplies globally.

The creation of RailMarketplace.com (RMP) was announced on Jan. 17, 2001. Five Class I railroads (CN, CP, UP, NS and BNSF) are providing slightly less than half the equity in the new company. The five railroads combine to have $15 billion in purchasing power. RMP would be a neutral, global exchange for rail goods and

services. Member carriers have initially indicated that the percent of their purchases going to RMP could be very small to half of their annual purchases.

In contrast to the rail sector, the trucking industry is highly fragmented and few trucking firms have the same buying power as the railroads. This is especially true in the TL sector versus the LTL segment of trucking. Therefore, numerous market exchanges exist for the purchase of supplies and equipment in the trucking sector and it is more likely that trucking firms participate in an on line buying exchange. An example is TruckXChange.com.

A 1999 Statistics Canada survey depicts the degree to which Canadian transport has adopted electronic procurement (Bakker). The survey found:

> 10.7 % of transport and warehousing enterprises used Internet to purchase goods or services.
> 27.8 % of economic activity was attributable to transport and warehousing enterprises that use the Internet to purchase.
> 24.4 % of transportation and warehousing enterprises that use Internet, use it to purchase goods or services.

While the percentages most likely have increased since 1999, there appears to be substantial opportunity for further productivity gain and cost reduction in the purchasing process as a relatively small percent of enterprises use the Internet to purchase goods or services.

Dis-intermediation and Online Business

Dis-intermediation is the elimination of participants in the supply chain and represents a strategic re engineering of the organization of the supply chain. The Internet and other information technologies have produced greater flows of information with customers so as to reduce the value of middlemen or other participants who do not add value to the chain. The sharing of information on supply and demand along the supply chain, coupled with improvement in

transportation reliability, diminishes the need for inventory as a buffer between production and consumption. The roles of intermediate warehouses and middlemen in both industrial and consumer markets are diminished in supply chains where information was once the primary value added service of the middleman. Thus Dell and many other companies have eliminated retailers, selling online and delivering directly to customers. The majority of online retailers compete on the basis of price and reduce their costs by stocking and delivering from a centralized stocking point rather than from stocks located in every local market (the retail store model). This distribution strategy has increased the demand for long distance delivery of small packages to residential locations, 7 days a week and in the evenings. This represents a shift from transporting larger TL shipments to warehouses and LTL shipments to stores where the customer traditionally picked up the goods themselves. In addition these deliveries tend to be time sensitive, requiring reliability and increased speed. Similar trends have and will continue to occur in B2B markets where distributors and wholesalers are losing share.

This is confirmed by the MDSW survey that found that 65 percent of the shippers shifted freight to parcel and express services and that there was an increase in use of local trucking and courier services.. The shift to parcel delivery has benefited the sectors of the transport industry already in these areas such as Federal Express, UPS and the public postal services. In addition, new transportation or e fulfilment companies are being created to meet the demand for fast, reliable movement of parcel size shipments by on line companies. These include TPL firms which provide or coordinate all the processes required in fulfilment of on line orders and virtual companies which non asset information management firms leveraging the assets of existing transportation companies. Sameday.com and NextJet are examples of such firms..

Internet Impact on the performance of transportation operations

Transport firms, like other members of the supply chain can utilize the Internet to improve service performance, productivity and reduce cost. Successful transport firms have always adopted new technology and the adoption of electronic commerce technologies is no exception. As with any information technology, the web has enabled transport firms to re engineer procurement, operations, marketing and administrative processes. The use of e procurement has already been discussed.

The Internet enhances the communications capabilities both within the carrier and between the carrier and shipper. Using the internet is simply another step in the long path to seamlessly connecting every process in the transportation operation to integrate operations better. Whether by the web, EDI, satellite communications or cell phone, information that is available in real time and in advance allows synchronization of operations and advanced planning. The Web's impact however is changing competitive relationships. For example, smaller trucking firms frequently cannot afford to invest in EDI, but the threshold cost of entry into the Web is relatively inexpensive and can be rapidly implemented and access is nearly universal. Similarly, this has increased the ability of short and regional rail lines to communicate across the supply chain with out expensive investment in EDI.

Electronic technology includes many information and communications technology applications that have been in development in the transport field and particularly the trucking sector, for over a decade under the grouping of Intelligent Transport Systems (ITS). These include traffic control, in vehicle driver information and navigation, fleet management applications such as fleet tracking systems, electronic tolling, smart card technology, automatic accident monitoring and other remote diagnostic systems. For example, a critical function in the truckload segment of trucking is the dispatching of drivers and assignment of loads to drivers. Dispatching requires balancing conflicting objectives of maximizing vehicle productivity, maximizing driver revenue and minimizing

driver time. Landstar has developed a unique approach to dispatching which has successfully met the needs of the drivers and the company. Each Landstar subcontractor (owner operator) carries a cell phone on the vehicle that can access the loads available to the driver. The driver views the loads available and chooses the loads that he/she desires. Information technology has allowed the dispatching process to be decentralized to the drivers themselves. An interesting variation is occurs when the spouses of the drivers access the load availability information and make the routing decision, facilitating the drivers return home at desired times. As a result, the persons most affected, rather than the carrier makes the balance between driver revenue maximization and life style.

Most railroads have always been major users of information technology to plan and control operations. For example, the BN developed the Transportation Control System (TCS), which was also adopted by CN to control train operations. Both railroads are in the process of converting their IT platforms to enable e commerce applications on these systems. Most of the e commerce applications are to provide a means of interaction between the railroad and customers, rather than improve rail-operating efficiency. Both the CN and CP have also installed SAP, an Economic Resource Planning (ERP) software package to provide an enterprise wide data warehouse to support purchasing, human resources and financial decision-making.

Traditionally, companies brought software solutions and necessary hardware and implemented these solutions on-site. Transportation Management Systems (TMS) can be expensive, a high-end carrier selection system often runs more than half a million dollars. Increasingly, customers are buying or leasing these solutions and having them hosted offsite at the software supplier's headquarters or with the supplier's infrastructure provider. For these hosted solutions, the upfront cost is a small fraction of the costs to buy software and have it installed on site. Application hosting also allows the service firm to become the information hub where

everyone connects. Access to technology via application service providers (ASP) make sophisticated supply chain software more accessible to small as well as large companies. The threshold cost of adopting modern technology is lowered encouraging adoption of technology and again, there is easier access to technology to smaller shippers and carriers, increasing their competitiveness with larger competitors.

Internet Impact on the Customer Management Relationship And Service Offering

The interface between the transportation firm and the customer is critical as transportation process starts with the customer's inquiry or search for service and ends with payment upon confirmation of delivery. Parcel companies such as UPS, Federal Express and Purolator are highly e commerce enabled. A customer can determine the service it needs; it's availability and price and tenders a shipment in seconds with these carriers. Other processes such as shipment tracking and payment are also highly electronic and fast. Trucking firms are less electronically enabled. The process of a shipper finding the right service, determining the price and tendering a load may take minutes. Depending on the carrier, loads are easily tracked, and invoices and payments may be made electronically. The railroads are the least electronically enabled. Railroads may take days to respond to service and price inquiries and the ordering and confirmation of equipment requires additional days. Most railroads send BOLs and get ETAs electronically and depending on the railroad, may also send out invoices and receive payments electronically.

North American railroads are in the process of re engineering and aligning their operations processes to achieve the best in class speed and responsiveness of competing modes. These include:

- Immediate rate and service retrieval to find service and price for customers in seconds.

- Buy transportation in one-step, immediate commitment of pickup and delivery to tender shipment in seconds.
- Shipment tracking and notification using customer identities to track and confirm shipments in seconds.
- Automatic trigger payment after proof of delivery, effectively combining invoicing and payment processes.

Different railroads are at different stages in achieving these transformations. For example, the BNSF announced in August 2000 that it was the first railroad to offer shippers transit information through the Internet versus requiring the shipper to telephone an agent or account manager. This service complements the availability of intermodal transit times that are already on web.

KPMG developed the e-business maturity model, which describes the stages of development in utilization of the Internet by transportation companies. In Stage 1, a carrier is using the Internet as a billboard to broadcast basic company information, such as name, brand, products, and locations. Examples include posting information about locations, executives, products, and company history. In Stage 2, The carrier is using the Internet to reduce the costs of publishing specific company information to customers, partners, and the workforce. Communication remains one way and typically involves a company's private intranet. Users can download attachments such as: pricing information, HR benefits manuals, invoice information and annual reports. In Stage 3, called the transactional stage, the carrier is using the Internet to create two-way information flows, allowing a small number of business transactions with customers or partners. For example, customers have the ability not only to access information about their shipments, but also to place and change orders. This could include some level of integration with back-office and legacy systems, but often serves only as a front-facing connection and involves limited process or technology redesign. Capabilities include: online order placement, supplies purchasing,

shipment tracking, time and expense reporting, online communication, stock purchase and freight bill payment. Stage 4 is the interactive or process coordination level of maturity. Here carriers use the Internet to conduct all business transactions and information sharing with customers, employees, and partners. Technology enables visibility across information sources to help maximize efficiencies from supplier to consumer. This includes a totally paperless business platform and extremely tight integration of back-office, front office, and customer/partner systems. Integrated capabilities include: Real-time shipment visibility, customer order management, collaborative planning and employee field communications.

The CN is representative of the situation characterizing many of the Class I railroads in North America. The CN established a web presence that focussed on broadcasting marketing information for a minimum investment starting in 1996 (Stages 1 and 2 in the maturity model). This was expanded beginning in 1997 to provide interactions such as basic queries, personalization and linking of sites advancing the railroad towards stage 3 in the maturity model.. In 1998, true Stage 3 transaction oriented features such as customer self service, supply chain planning and links to supply chain communities were being developed for completion in 2003. Finally CN began it program to bring its e commerce capability to Stage 4, the interactive level, in 2000. Features that CN were developing included CRM applications, supply chain optimization, real time ATP, and advanced personalization.

The Statistics Canada survey of Internet usage in Canada would suggest that the majority of the Canadian transportation is not web enabled. Less than 18 percent of the firms had a Web site, significantly less than manufacturers. An even smaller percentage of transportation enterprises use the Internet to sell services (slightly over 10 %) with Internet sales representing only .3 % of total operating revenue.

KPMG (with Benchmarking Partners) recently surveyed large transportation and large shippers using this framework. The survey found that shippers want carriers to be at the interactive stage but that most of the carriers were only at the transactional stage of internet maturity. The same survey indicated that carriers, shippers and analysts all agree that the planned e business investments will not drive carriers to meet carrier or shipper expectations with respect to collaboration, instead carriers and customers seem to be building independent rather than interdependent technology solutions. Indeed, there seems to be a major opportunity or window for competitive advantage, perhaps from the technology suppliers themselves. Carriers who reach the Stage 4 level of maturity will be able to embed their people, processes, and technologies inside their customers own processes and will capture market share and raise switching costs, potentially locking out carriers unable to reach stage 4 or reach it too slowly. While there is no excuse for laggards, small carriers may be at an inherent disadvantage, being forced to be "subcontractors" providing capacity to the carriers who own the relationship with the customer.

On line Marketplaces

An electronic market exchange has the purpose of bringing together previously fragmented buyers and sellers into one community, through a many-to- many electronic platform. Through the web, suppliers have access to more buyers and vice versa.

There are a number of paths upon which transport services can be sold electronically. These electronic transport marketplaces present both challenges and opportunities to transport companies.

A carrier can transact directly with sellers or buyers (depending on who controls the freight movement) through their company Web site. For example shippers can view rates and service of UPS and FedEx, order a pick up and delivery, and track shipments online.

A carrier may participate in a vertical or horizontal electronic marketplace as a preferred or only supplier of logistics services to complete a transaction. For example in the B2B market, Schneider Logistics is the transportation services provider for the online plastics exchange, PlasticsNet.com. When a sale is transacted on the exchange, Schneider provides the traders with instant rate information on transportation alternatives and later with cargo tracking and billing services online. e-Chemical is a neutral online marketplace that allows registered buyers and sellers to select a product, get a price, and order and track small chemical shipments online through its web site. It uses Yellow Freight system as its primary transportation provider. Many B2C on line companies have preselected transportation options using specified carriers to provide different levels of service at set prices.

A carrier may participate in a freight transport exchange as one of many suppliers of transport services. The buyers in the transport exchange are either buyers and sellers of the products in the horizontal or vertical market exchange. There are several different business models represented:

Some exchanges are customized for a specific industry sector. Pittsburgh Logistics Systems set up eflatbed.com which is dedicated to the flatbed shipping industry and originally set up to meet needs of the metals industry, managing movements of metals, metal intensive products, and raw materials such as coke, coal and iron. It has since expanded into other vertical segments of lumber, fabricated wood, heavy equipment and other industries that use flatbed equipment.

The exchange may be a Virtual TPL dot.coms. These are one-stop sites to access multiple transportation and logistics services from multiple suppliers with extensive decision support provided as an Applications Service Provider. Logistics.com is the representative example. It offers to use its extensive array of shipper bidding tools, Transportation Management, routing and motor carrier schedule

optimization software to create a comprehensive marketplace and provide decision support as an ASP that covers all key decisions by carriers and shippers at the strategic level (e.g., core carrier selection), tactical level (e.g., shipper transportation management) and operational level (shipper spot market selections, carrier dispatch optimization). It seeks to create a Digital Transportation Marketplace (DTM) where it performs many services that TPLs currently perform off line but does not perform any actual transportation, handling and storage of product. The dot.com basically arranges for these processes to be completed by the chosen carriers and other logistics providers. Other virtual TPL sites also take advantage of new Web based capabilities and provide decision tools to automated shipper processes that manage ordering, tracking and transportation workflow.

Sites may representing multiple transport carriers but not offer the extensive decision support delivered as an ASP . Instead the logistics expertise is offered as a consulting service. TruckersCo-op.com represents small and medium size TL carriers, Transplace.com represents 6 large TL carriers, Freightwise represents railroads and WebModal represents intermodal transportation. While all of these market exchanges provide support for transactions management of the carrier - shipper relationship, the Transplace market exchange offers extensive decision support service based on the logistics decision software of the exchange's lead member, JB Hunt Logistics. In fact, Transplace was formed from the third party logistics units of the founding 6 truck line members. Thus Transplace competes directly with logistics.com with the advantage of real assets and the disadvantage of only having a limited number of carriers on the supply side of the exchange.

A carrier may be part of the stable of carriers subcontracted by a TPL linked to an exchange. C.H. Robinson is the TPL that is linked to Paperexchange.com. When a customer makes a purchase, C.H. Robinson provides the transportation alternatives based on the capabilities of its subcontracted carriers.

There are several variations of on line transportation that are notable. A carrier may participate in a freight transport exchange as one of many suppliers of transport services that are linked with a vertical market exchange. For example, Ryder System is the anchor client of the transport e marketplace, Freight Matrix, which is intended to integrate logistics planning, commercial transactions and execution in a comprehensive B2B marketplace. Ryder would be major TPL provider on site, Central Transport would be LTL carrier provider and forwarders and customs brokers provide ancillary services. FreightMatrix is than linked to vertical marketplaces such as HiTechMatrix and positioned as the one-stop service source for all shippers participating in that specific industry marketplace. FreightMatrix would provide decision support and ability to complete a purchase transaction started in the vertical exchange site.

Another freight exchanges is the freight buying exchange based on the Nistevo software platform. This was initially set up by an alliance of five major shippers in the consumer package goods business. The exchange's main purpose is not to leverage their buying power but to collaborate among each other and with carriers with the objective of achieving cost reductions by coordinating shipping lanes of the five buying members to fill backhauls and achieve higher carrier asset utilization. The carriers participating in the exchange are already suppliers with long-run contracts with the shippers. Thus the focus is on contracted freight rather than spot trading, combining contract buying practices with modern exchange technologies. Essentially the freight movements of the shipper members are put into one database, increasing the opportunities for improved equipment utilization. To date this is one of the most successful Internet based marketplaces as 7 more major shippers have joined the exchange. Nistevo leverages existing relationships and brings benefits to both carriers and shippers through increased productivity through collaboration. This is not to imply that the collaboration in Nistevo was easy. Clear and firm rules govern what information is shared and how shipments and capacity are matched.

As noted in the section on supply chain integration, sharing commercial information is a new paradigm in North American business practice.

The common objective of all railroads is to be able to offer seamless service. Since freight must often be interchanged between railroads, information exchange on car status is critical to the e commerce efforts of all railroads with respect to providing both shipment and equipment visibility. Steelroads.com is a Railinc (AAR information technology unit) site that serves as an information exchange for the industry. The exchange connects all Class I and 300 regionals and short lines, enabling customers to electronically set up and track freight shipments across all of these lines. Though Steelroads, customers can locate and determine the most efficient route for shipment, specify equipment required and determine if that equipment is available along the entire route, as well as track and trace.

As noted above, transportation sold on line in Canada is a very small percentage of transportation revenues. The MDSW survey indicated that 75 percent of the respondents indicated that they transacted less than 5 percent of their transportation shipments electronically. Salomon Smith Barney found in their survey that two thirds of respondents do not use online auction sites and have no intention of doing so in the near future. There are many explanations for the low utilization of the Internet for transport purchasing and they include:

- The majority of transport purchases are under contract from carriers with whom the shippers have developed a trusted relationship. Much of this has to do with trust and risks if there is failure. Most shippers are not going to do business with someone they are not familiar with for the sourcing of a mission critical function which cannot tolerate disruption.

- The transport purchases most susceptible to on line exchanges are spot purchases, which represent less than 10 percent of total traffic.
- Many shippers are not web enabled.
  Shippers continue to want quality and capacity.
- Many shippers want to know that their suppliers owns or control the assets so the customer can be guaranteed capacity during peak periods.
- Shippers are waiting to see what on line exchanges survive and are dubious about claimed benefits.
- Shippers are not ready to participate due to the non-functionality or incompatibility of their legacy information management systems.
- Carriers will not commit anything other than excess capacity to transportation exchanges due to the low margins in this aspect of the business (price pressure) and loss of customer relationships to dot.coms.
- Carriers are better off pursuing their own internal on line offering.
- Carriers not ready to participate due to the non-functionality or incompatibility of their legacy information management systems.
- The market has not reached the growth portion of the product cycle for Internet transportation.

The e-transport marketplaces in North America are still in development. Practically all are under two years old, many with venture capital financing. A rationalization has already started and is expected to continue over the next two years. Though electronic transport marketplaces have had a minor impact up to now, one can expect their impact to eventually come.

Intramodel competition dominated the 1960's, the 1970's saw the growth of intermodel competition and the 1990's saw the rise of TPL competition. The internet has brought virtual competition as

we enter the 2000's. Competition will be between electronically enabled communities of enterprises working together rather than individual business. Shippers won't value the ability to move goods from A to B as much as they will value the company that provides a complete logistics solution, leveraging all transportation networks as well as other logistics capabilities.

There is still the question of asset ownership. One view is that non-asset logistics service providers are the ideal virtual competitors, as they do not need to own hard assets. Their value proposition is their ability to use the Internet and information technology to plan and co-ordinate movement and track goods across all modes, globally. These virtual carriers can leverage the assets of all transportation companies, and the value that they add is information management. Another view is that asset ownership or control is critical. The rationale is that the needs for coordination will involve sufficiently complicated interactions among the firms that alliances will only provide partial solutions. Business acquisitions are required in order to undertake the substantial changes that Internet based business will require (Nagarajan, et. al., p. 12). Major transport firms such as UPS, Federal Express, CNF Transportation, USFreightways and CRST International have developed portfolios of asset based transportation management services through mergers and acquisition. The internet enables these firms to effectively manage and coordinate these multiple resources in order to provide one stop shopping of multiple services.

Summary and Implications

The impact of E Business on Transportation is both direct and indirect:

> E business has facilitated the dis-intermediation of participants in the supply chain, changing the nature of transport demand and the types of services demanded.

E business has provided new or improved methods for transport firms to interact and serve customers at lower cost or with improved service.

E business has enabled supply chain integration that places new requirements on transport firms with respect to technology, services and other capabilities.

E business has created new market relationships through electronic market exchanges. These relationships threaten traditional buyer - seller relationships and affect the market structure of transportation.

The on line share of the freight market is still small and for the near future, traditional channels of channels for selling transportation will continue to dominate. This includes third party logistics companies as well as pure transport firms. While some new entrant transport exchange companies will survive the current rationalization, existing carrier and other logistics service providers are in the best position to develop the public e logistics and transport marketplace offerings. These firms already have a customer base, reputation and partnerships that can be leveraged as shippers get used to on line buying of transportation. For the moment, the most successful transportation marketplace exchanges will continue to be semi private exchanges such as Nistevo where a limited number of shippers and their contracted carriers participate. Theses exchanges promote collaboration between competitors as well as partners in a supply chain; to increase productivity for all involved parties. Actual Internet usage for procurement, for operations and for selling in the transport industry does not appear to be high. Carriers are generally low on the e commerce maturity scale. Pure pull supply chains are a rarity and both B2B and B2C e commerce are a small percentage of total transactions. However, there is pressure to increase all of these e commerce applications. Transportation companies need to understand the electronic community and how it will impact their business and the business of its customers, as well

as how it can be used to gain new business, protect existing business, and lower internal costs. Current B2B exchange models and supply chain strategies are still evolving so this understanding must be continually revised. Perhaps the most strategic of these issues is the basic business proposition of transportation firms. If traditional transportation companies don't refocus their proposition, they'll lose ownership of the customer relationship. Transportation will still be required, but the firms that provide solutions based on information management rather than asset ownership will own the customer relationship.

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GIS APPLICATIONS IN TRANSPORTATION

David Spearin

In today's business world, the complex and changing transportation environment makes it harder to forecast and assess the impact of changes to a company's competitive position. With time influencing all business decisions and with less time available for analysis, decision-makers need tools to quickly explain current and future impacts of change and to develop the appropriate response.

In the business world, the planning of logistics can be defined as the process of managing the production of raw material into finished goods. The meaning of logistics is expanding and has been incorporated into Supply Chain Management or SCM. SCM encompasses the definition of logistics, but also incorporates people and information flows that parallel the physical flow of processing products. Logistics is more physically oriented, while SCM also incorporates the human and technological aspects of information processing.

Geographic Information Systems (GIS) are technical applications that can be applied to the transportation function. It can assist companies and regulators to ensure that the right goods are delivered to the right place at the right time. This report will provide examples of GIS applications to transportation. These examples will illustrate the

power of these new systems and how they can be applied to most transportation decision-making functions.

With increasing demands on time, the use of Geographic Information Systems (GIS) allows practitioners to quickly evaluate changes and monitor current transportation activities. The application of GIS to evaluate logistics and supply chain dynamics will strengthen the role of the decision-makers. These systems are computer driven by complex database sets that are linked to computer mapping software. Integrated geographic database sets are large and can combine data on a broad basis such as a geographic region, county or country, or as specific as a single point location. The database sets are multi-dimensional containing demand and supply parameters of the region or the specific location such as a city, town, production facility, terminal, or a customer. GIS has been applied to various applications such as environment, marketing, site location, real estate, and economic development among others.

With the increased use of Global Positioning Systems by Transportation companies for the tracing of trucks, rail cars and vessels can be shown through GIS map platforms. This provides close to real time positioning of goods for delivery. With detail tracing and historical data being collected, this data can be then applied to a GIS, to monitor and evaluate trends and changes in distribution systems. This provides increased knowledge of change

and the factors of change so that the decision-maker can plan accordingly. Whether it's for infrastructure planning, traffic monitoring or locating plants and warehouses the use of GIS will be standardized by both government and industry in future years.

Geographic Information Systems can be used to simulate What IF?, conditions in order to compare the impact of change due to government policy or due to location decisions. GIS applications illustrate spatial relationships that bring new meaning to the phrase " a picture is worth a thousand words".

To an industrial manufacturer GIS applications can illustrate items such as:

- Site selection for plants, terminals or warehouses,
- Compare competitive positioning,
- Evaluate market share to service territory,
- Compare Supply Chain options,
- Identify operational and equipment demand,
- Identify opportunities for backhauls,
- Identify trade patterns from a local, regional, national, continental or global.

Other GIS applications by government are used to evaluate transportation demand. One can compare impact to the infrastructure and identify demand changes arising from policy changes. GIS

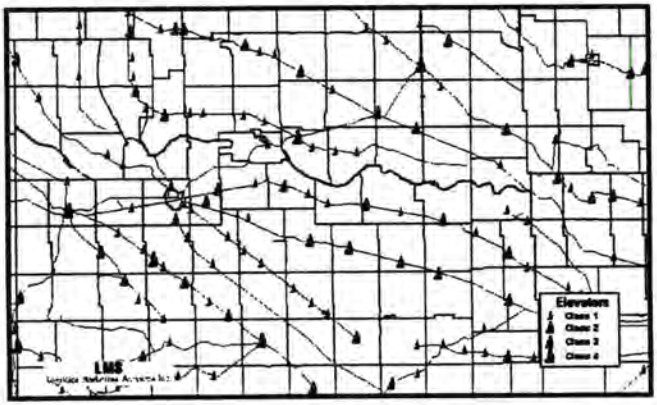
and identify demand changes arising from policy changes. GIS applications are also valuable in planning maintenance, developing new roads, and designing compliance programs.

To illustrate some GIS applications we will use examples from the Western Canadian grain handling system, fertilizer network, and global containerization.

Western Canadian Grain Handling System

GIS applications to the grain handling system can illustrate the impact of policy change on the locational concentration of collection systems. It can also be used to identify service and equipment allocations, and to evaluate increased trucking demand. The following examples were generated through GIS systems.

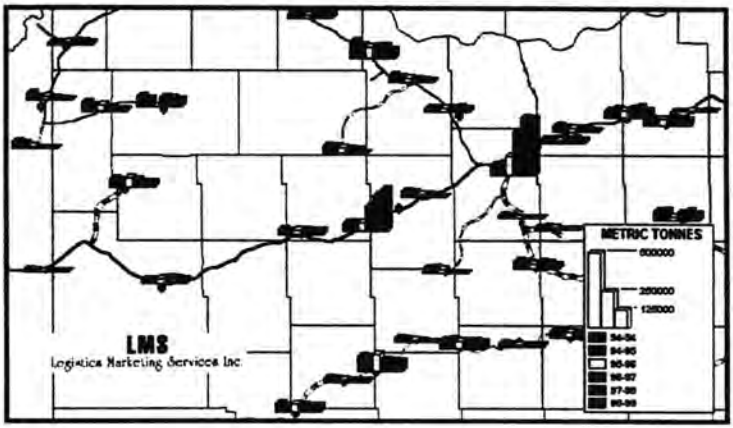
Slide 1: Collection Systems
Illustrates current collection system of elevator locations across South Central Saskatchewan



Elevators can be classed by capacity and car spot size, thus differentiating service and rates. GIS also allows comparison by Grain Company, railroad, and type of rail line such as mainline, short line, and grain dependent line. Consequently, GIS can compare where unit trains or single cars originate. These applications can be applied to equipment and service planning. Other data regarding the types of grains handled by each location can be also compared.

Slide 2: Grain Handling by Elevator Location

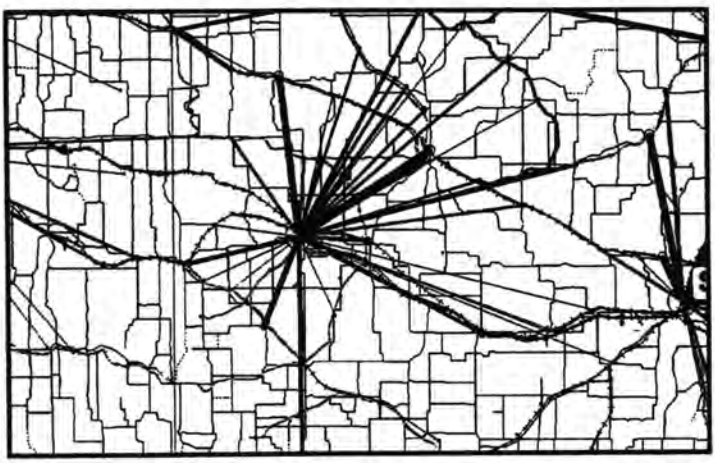
The next slide illustrates the change in volume attracted to each location over last six crop years.



This slide illustrates how higher volumes of grain are attracted to main line locations over time because of new elevator locations. Using a GIS, you could compare this delivery pattern to both the road network and crop production in the region. By further integrating GIS, into transportation network and optimization models it is possible to illustrate grain flows based upon different variables. Slide 3 illustrates an application showing the least cost movement of grain to Vancouver based on using Super B freight and rail rates for single car and unit trains. The model shows this location's competitiveness to attract grain to its location based on costs. Models can apply other conditional components of the supply chain such as comparing road

supply chain such as comparing road miles to differences in elevator handling costs, inventory turns and working capacity.

Slide 3 : GIS Simulation Model



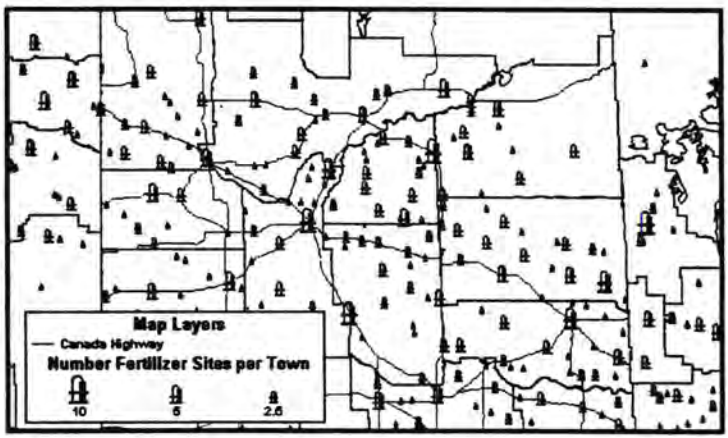
The model can show which roads would have increased traffic. The thicker lines indicate greater volumes of grain movement. This illustration can assist decision-makers in planning future expenditures by assisting them to prioritize where funds to upgrade roads should be allocated.

Fertilizer Backhaul Example

In evaluating the inbound grain collection system, there are increased opportunities to capture backhauls for truck traffic of fertilizers that

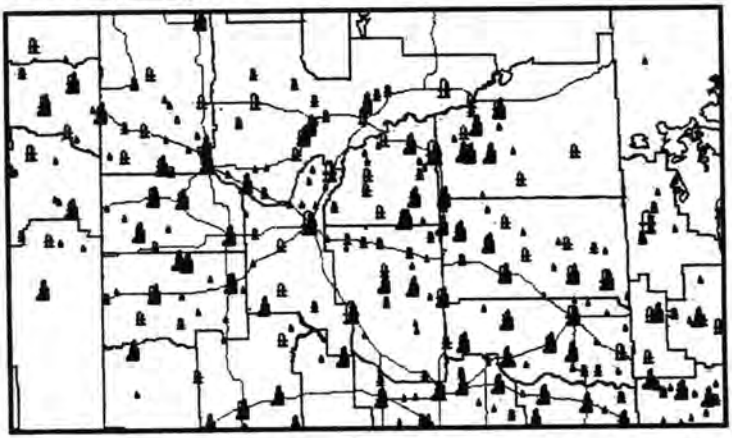
are demanded by farmers during spring planting. The use of GIS can illustrate where there are opportunities to capture these backhauls from inbound grain. Over the last five years there has been an increase in the number of locations with larger high throughput capacity elevators. More inbound trucks are attracted to these locations thus increasing the opportunity for empty return of trucks back to the market region. The next set of slides illustrates the demand location of fertilizers and the fertilizer distribution system relative to the High Throughput Elevator system. Although there are other planning considerations, the use of GIS can assist in the identification of opportunities to plan and initiate the backhauls.

Slide 4: Location of Fertilizer Blend Plants Demand



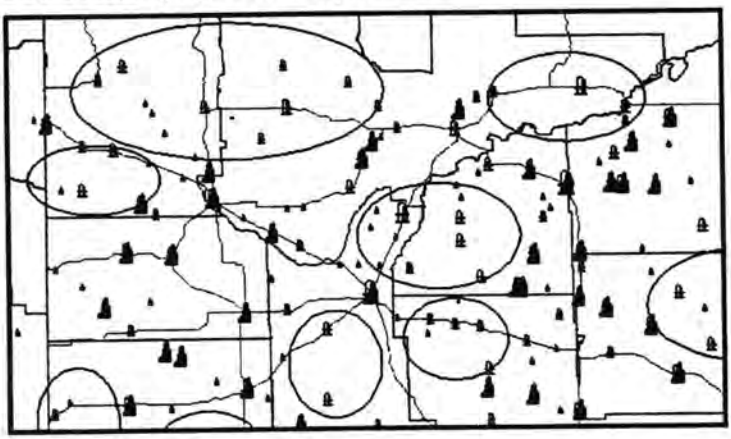
The concentration of sites indicates areas of greater demand.

Slide 5: Highthruput Elevators to Blend Plants



The location of high throughput elevators indicates where the grain will flow with the highest probability.

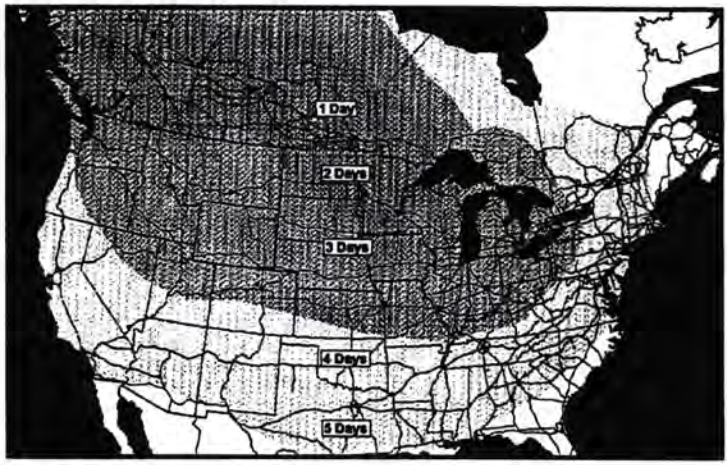
Slide 6 : Identifying Backhaul Opportunities



Matching the fertilizer network to High throughput elevators identifies pockets to match headhaul with backhaul opportunities. The increased matching of shipments will increase the utilization of trucks thus improving profit margins.

GIS can be applied to evaluate truck service delivery across North America. The next slide illustrates truck transit to and from Saskatoon in days across North America.

Slide 7 : Service Applications



Days to service are critical in planning equipment to meeting on-time deliveries.

GIS integrated with Global Positioning Systems can trace and evaluate the flow of goods from origin to destination, truly showing the global supply chain. The next group of slides illustrates how these systems would trace a movement through the world. With the increased development of Intelligent Transportation Systems we are moving closer to a seamless environment.

Slide 8 : Vehicle Routing

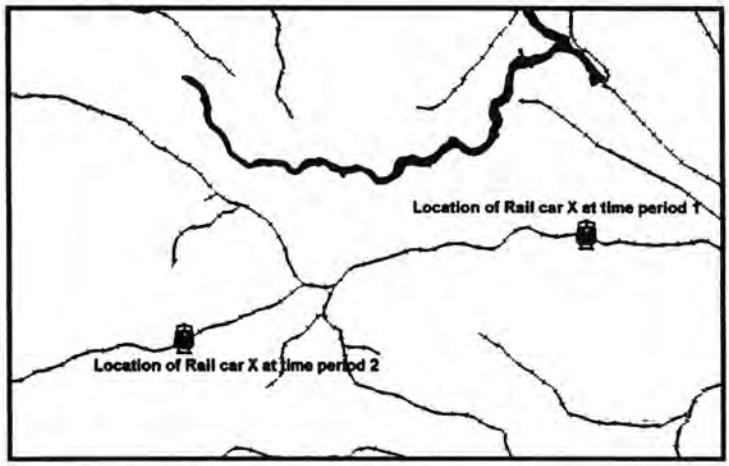
Vehicles are traced as goods are picked up from customers.



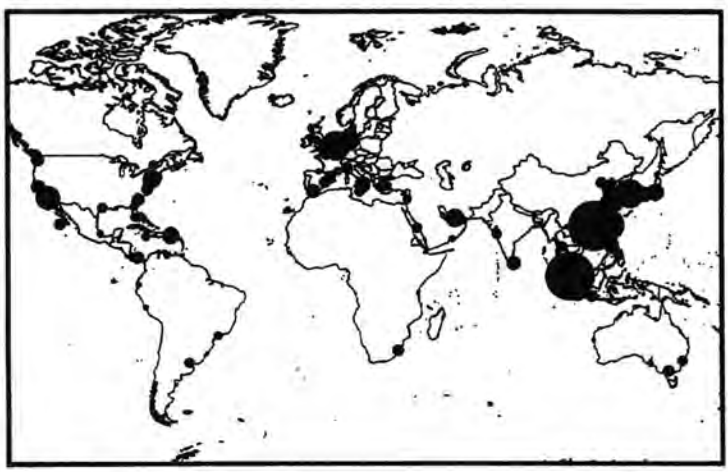
As the shipment starts from pick-ups to consolidation. Containers are loaded on rail and head for the port of export.

Slide 9: Rail Car Tracing

Container-train is traced to port.



Slide 10 : World Container TEU Volume by Port



Container is loaded on vessel heading overseas. The last slide illustrates the volume of container traffic across the top 100 ports around the world, indicating trade volumes and the importance of ports in the international market place. Other transportation data such as cost per unit or transit time and service information can be incorporated for each container line.

Conclusion

The application of GIS by shippers, suppliers and customers will increase. As costs for these systems decline and the GPS and Intelligent Systems are integrated into the monitoring of freight, GIS will become the standard window to evaluate transportation performance and monitoring. We have illustrated some applications of GIS to transportation functions and there are many more that are not described in this paper. The increasing use of GIS within the transportation sector will provide invaluable insights to the transportation manager, service provider or regulator in achieving and ensuring that the right goods are delivered, to the right place, at the right time.

The Japanese Takuhaibin System - Prototype for a Universal Solution of the Distribution Challenges in the Age of E-Business?

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Introduction

Internet shopping nowadays allows placing orders online "within a few mouse clicks". This creates the need for efficient and modestly priced distribution solutions. This paper aims to investigate whether a "takuhaibin style" distribution system can be a model for the challenges of E-business.

Takuhaibin, or "home delivery service", is highly popular in Japan: Every year, nearly 2 billion parcels are sent in Japan – more than 15 per inhabitant and year. In this highly competitive and efficient market, Yamato Unyu, the company that had invented and developed the system in the mid-1970s under the brand name "Takkyubin", now handles a volume of more than 2 million parcels per day. In contrast to the well-known international actors, the Japanese takuhaibin companies have a strong focus on the private customer, and are little known outside Japan. Another important element is the dense network of agents that can act as pick-up and drop points if needed.

Takuhaibin started as a traditional parcel service competing with the parcel service offered by the national postal service, the product developed further since then. In 1998, Yamato has entered the world

of E-business by setting up an Internet portal through which other companies can offer their products. Likewise, the more innovative retailers have set up Internet shopping malls, which benefit of the readily available distribution channel offered through the takuhaibin system.

Takuhaibin offers a high level of service and "convenience" to its private and commercial users throughout Japan. On the other hand, especially the big cities complain about problems arising from the increasing fleets of delivery vehicles. Technological and organizational solutions are looked for. Some elements of such proposals will be described in brief before some conclusions are drawn and an outlook is given.

History and Development of the Japanese Takuhaibin System[1]

Takuhaibin, which is Japanese for "home delivery service", came to Japan some 25 years ago when the company Yamato Unyu (Yamato Transport) introduced the first home delivery service on January 20, 1976 under the brand name "takkyubin" (express home delivery service). In the following, the focus is on the Yamato Unyu Company as the pioneer and biggest player in the market. As the story goes, Mr. Ogura, who was then managing director of the Yamato transport and forwarding company, was impressed by the UPS delivery model he saw during visits to New York[2]. After adapting the UPS approach to Japanese conditions, he was able to overcome the serious resistance of his Board of Directors to enter that new and seemingly risky business field. In the first year, 1.3 million parcels were delivered, mainly in the Greater Tokyo area. Success and growth followed swift, attracting a number of competitors. By 1981 the number of parcels shipped annually had increased to 10 million, in 1985 the figure reached 50 million. Ten years later the volume had increased tenfold to 500 million, and in 2000 around 800 million parcels were handled

[1] based various Yamato company brochures translated from Japanese
[2] N.N., A run for the money, Tokyo Classified No. 285, Tokyo, 1999

by Yamato Unyu, which equals a market share of around 40% of the Japanese parcel market standing at around 2 billion parcels. The brand recognition of Yamato's 'black cat' (kuro neko) symbol is extremely high; 'takkyubin' has become the colloquial name to describe all takuhaibin services. The current figure means that the average Japanese household uses Yamato's services 18 times per year, or once every three weeks.

The nationwide infrastructure built up to deliver such a performance is likewise impressive: Yamato has 75,000 employees and 29,000 vehicles. As system hubs and sorting centers, 67 bases are linked with each other in a raster system, and connected to 1.395 distribution centers from which the parcels are collected and distributed by one and two ton delivery vehicles from and to offices, households and 300,000 (!) agencies (which is 1 per 420 inhabitants) acting as pick-up and drop points. More than 90% of shipments are scheduled for delivery within 24 hours; the more remote islands are reached within a 48-hour time frame.

Such a growth does not come automatically; it was enabled by a continuous number of product innovations and improvements. As competition in the market is tough, most inventions spread quickly among the main competitors Yamato Unyu (kuro neko takkyubin), Nippon Express (pelican-bin), Nihon Unsoo (Footwork) and Seino Unyu (kangaroo-bin). In the early 1980s, the service was extended to carry not only classic parcels, but as well sports equipment, namely skis and golf bags. In 1986, a collect service was introduced, through which products delivered could be paid on receipt, which made takkyubin a useful distribution channel for catalog and mail order companies. A year later, Yamato and a publishing house formed a joint venture and book delivery through takkyubin started, with orders taken by phone, fax or postcard. In 1988, Yamato introduced cool takkyubin, a complete temperature controlled distribution chain for three temperature bands (-18, 0 and 5 degrees centigrade). These catered for the quick shipment of local specialties and fresh delicatessen, which are highly popular in Japan. Local and regional

products are often marketed directly by their producers and agricultural cooperatives through catalogs, cutting out the long chains of intermediaries for which Japan's distribution system is often (in)famous.

The development of new services did not stop there, in 1989 airport baggage delivery services were introduced, following in 1990 by a joint venture with UPS for international services. The standardized product was supplemented by premium products, e.g. guaranteed delivery until 10 a.m. on the following day (in many regions) or the option to choose 2-hour time slots for the delivery. For the handling of documents, the Kuro Neko Mail Service was introduced in 1997, as was the Kuro Neko Maintenance Service for spare parts.

Takuhaibin & E-commerce

Finally, in 1998, the "Kuro Neko Exploration Corps" internet portal[3] was created. Not only tracking & tracing over the internet is possible, through the portal some 2.400 (Sept. 2000) customer sites and e-shops become accessible for which Yamato provides distribution services. Actually, Yamato does not only provide the delivery, but also offers a fill range of 3PL services, ranging from warehousing, stock management, packaging to payment collection. Apart from developing a new business field, Yamato aims to use unused capacities (e.g. at the second and third floor of transshipment centers and bases) and to balance out fluctuations in workload. Cooperation with partners, e.g. Softbank, allows entering new market segments in the C2C field: For the increasingly popular private auctions, Yamato offers an "escrow service" which includes the money transfers between buyer and seller.

The Role of Convenience Stores

Convenience stores (CVS) have come play a major role in Japan's

[3] www.kuronekoyamato.co.jp/index.html

retail business over the past two decades. The mainstay is food items. Typically, CVS have an average size of just under 100 square meters, and are open for at least 14 hours during 7 days per week. About 60% of the 40.000 CVS in Japan are open 24 hours/365 days per year[4]. The biggest CVS chains are Seven-Eleven and Lawson with ca. 8,000 outlets each. The key products offered change up to five times per day, with fresh food products and lunch packets ("bento") being of special importance. As store sizes and storage space are small, and Japanese are very concerned about the freshness of products, CVS receive several deliveries per day from a variety of suppliers. A highly developed POS system, consisting of networked electronic cash registers with laser scanners; the software allows for item-based inventory control and dynamic replenishment. For each transaction, customer sex and age group is registered, producing a stream of valuable marketing data[5].

Enabled by the networked and standardized POS systems, CVS have developed into service centers for all kind of transactions: Paying bills (utilities, telephone, TV, insurance) at CVS is common. Facsimiles can be sent and received. Some CVS chains co-operate with banks and are have equipped their stores with cash dispensers.

Nearly all CVS have contracts with takuhaibin express parcel companies: The stores are convenient pick-up-and-drop points, solving the "last mile" problem for both the express parcel company and the consumer who does not need to be present at their home to receive a packet or wait for the pick-up. The customer gets a small discount for foregoing the home delivery; the CVS gets a small compensation for handling the parcels. An additional benefit to the CVS is clearly that the customer, once in the premises, will very likely not leave with empty hands.

In fact, not only the 40.000 CVS act as agents for the takuhaibin

[4] Japan Almanac 2001, Asahi Shimbun, 2000
[5] Memo, Prof. Iwanari, Tokyo Univ. of Fisheries, Oct. 2000

companies: A huge number of traditional rice stores, liquor stores, laundries and other "mom and pop" stores are under contract. Yamato Unyu as the biggest express parcel company alone has 300.000 agents – 1 for every 420 inhabitants, which virtually means that the nearest pick-up-and drop point is rarely further than a few minutes away.

Webvan, Peapod & Co. – A Snapshot of US E-Grocers

The future of E-commerce, which looked so bright only one year ago, has become more cloudy after the world-wide collapse of share prices throughout the new market, followed by the bankruptcy or closure of a number of US companies like Streamline or eToys that were considered the heralds of the new economy only months ago. Others were rescued from the same destiny by "brick-and-mortar" chains: One such example is the e-grocer Peapod, which was bought by the Royal Ahold conglomerate in spring 2000[6], in the following moving away from ambitious growth targets, out of some markets, and changing its original distribution model. In fact, the current trend points towards a comb ination of "old economy" distribution recipes and some "new economy" marketing and service ideas. Many incumbents e.g. in the catalog order business reposition themselves, adding the internet to their current portfolio of sales and marketing channels.

In the light of these recent developments, the forecasts about the growth of e-commerce, especially B2C shopping over the internet, as presented in 1999/2000 by Forrester Research or Jupiter Communications, appear to be overly optimistic.

The (original) concept of companies like Webvan, Streamline, HomeGrocer or Peapod foresaw the replacement of recurrent shopping activities for groceries with home delivery – catering for the bulk volume, on top of which extra services like video rental, and delivery of books and other goods ordered via the internet could be

[6] www.ahold.nl/INTERNET.NSF (press notice)

placed. In Japan, the delivery of some 2 billion parcels per year forms exactly this base loads, which allow to piggy-back specialty services and e-commerce deliveries. In the US, UPS handles a similar volume. But in contrast to the Japanese takuhaibin companies, UPS focus is on the business segment and bulk market.

There are different philosophies whether and to which extent own distribution systems are a necessary part of successful E-business models. A number of companies claim that it is crucial to cover everything including the "last mile" to have direct, personal customer contact. Some companies optimize their websites and leave distribution to third-party specialists; others run own distribution centers and only leave the transportation to delivery companies. Furthermore, the preferred solution may change over time, as experience and handled volumes increase if the business is successful. The use of 3PL and its infrastructure and facilities allows ke eping control over costs during the start-up phase. In case the "demand density" (customers per area) is not very high, 3PL may be the only way to achieve a desired full coverage: Greater Tokyo has more inhabitants than the whole of Canada.

None of the cited companies came anywhere near a nationwide coverage, typically only 6 to 12 high-density cities of areas are (or were) served. The upfront investment to open up new local markets with customized distribution systems is large and probably has been underestimated by hopeful e-grocers aiming to quickly tap an as-large-as-possible share of the online market: Webvan's operation to serve the Dallas market employed 220 workers when Webvan announced to withdraw in February 2001 "in order to conserve operating capital and focus on the profitability of its nine other markets"[7].

Another online grocer, NetGrocer, achieves national reach for its offer,

[7] Press notice, 20. Feb. 2001, www.webvan.com/WV/Marketing/zGlobalPrel/pr021601.asp

which are only non-perishable goods. From one single distribution center, delivery is within 1-4 days through Federal Express. If the customer agrees, the order can be left at the customer's doorstep if the FedEx driver "feels it will be safe". The customer has to pay the hefty delivery charges, which are in the range of 5-10% of the order value[8].

Looking at the American case, it may be said that the Japanese takuhaibin companies could have fulfilled most of the given distribution needs and service profiles from scratch.

Japan: Ecology and Congestion – New Technologies

Congestion and Pollution, Wasteful Transport

The volume and service level of the delivery services adds to or in some cases creates a congestion problem: In Tokyo, about 30% of all vehicles are delivery vans, they comprise about 50% of all vehicles which are parked (often illegally) on public roads. There is no night or weekend ban on vehicles that would limit the operation in residential areas. As air quality in the big cities is perceived to be unsatisfactory, most big express parcel companies in Japan operate some non-diesel vehicles to reduce local emissions. Electric vehicles were not successful in the past; LPG (liquefied gas) is the preferred alternative where local rules in the largest cities restrict the introduction of new diesel vehicles for delivery purposes. About 10% of Yamato's fleet in the two largest cities, Osaka and Tokyo, is gas-powered.

Customer service levels offered influence both cost and environmental impact of a distribution system: Nationwide same-day delivery promises or tight delivery time slots from which the customer can choose add largely to the costs of distribution. And, at least the latter is likely to decrease vehicle capacity usage and increase the time and mileage needed to fulfill a given number of

[8] www.netgrocer.com/fedex.cfm?

orders, adding to the environmental and traffic burden in the serviced areas. While in the Japanese case, the volume of shipments may necessitate several delivery rounds per day for some areas, service promises may be in some cases overdone: Half-hour delivery time slots from which the customer can choose add largely to the costs, mileage driven and the resulting environmental burden without adding real value.

Drop boxes and pick-up agencies

Drop-boxes are a way to overcome the problem of out-of-home recipients. A company actively promoting the use of drop-boxes was Streamline in the US, until they went out of business in September 2000: Included in the 30 US$ monthly membership fee was a password-protected refrigerated box, installed in the garage or outside the house, into which Streamline delivered its groceries. The investment appeared justified, given 46 orders per year and an average annual spending of Streamline customers of 6000 US$[9]. The question however arises, whether the space is available to install such a box, and how many people would accept such an addendum in their garage or forecourt.

In the Japanese case, where space at a premium at least in most cities, such a concept looks rather infeasible – there is simply no space available for "full-sized streamline.com refrigerator"-like solutions. Alternatives, already tried out, are shared drop boxes installed on public ground or the entrance areas of apartment blocks. As vandalism is generally not an issue in Japan, lockers can be found in many places, like most subway stations, but as well in unguarded places along the street. Most of these lockers are low-tech key types, but keyless code systems begin to spread. A problem that remains is the acceptance of shared facilities, as cleanliness and hygiene are very high on the list of Japanese consumers. If several delivery companies share delivery boxes, the problem of responsibility to keep the

[9] Evan Schwartz, *Digital Darwinism*, Penguin Books, 1999

facilities clean and in good repair arises. Therefore, the popularity of drop-boxes in Japan has remained low – part of the reason is, that there is usually always the alternative to use a convenience shop nearby. This works in both ways: The convenience stores are points to pick up parcels, to sent parcels – or to return unwanted or unsatisfactory deliveries to the shipper. In fact, it is this part of the business that creates major headache to most e-commerce companies in Western countries: Estimates are that 5-30% of all goods sold by mouse-click are returned to the sender as they do not match customer expectations[10].

The opportunities in offering "convenient" pick-up-and-drop points especially for orders over the internet – which in Japan often means orders over the I-mode service of the mobile phone – is recognized by many parties: The large railway company JR East wants to use its railway stations for such purposes. The argument is the reach: Seven-eleven or Lawson with around 8000 convenience stores nationwide has around 8 million customers per day, but 10 million commuters and shoppers are channeled every day through the 82 JR stations in the Greater Tokyo area. Space is available in principle at many stations, as former freight handling facilities are no longer used.

The takuhaibin company Yamato Unyu has an answer to such approaches as well: It plans to cooperate with private commuter railways for the same purpose. With the very large number of convenience stores and other agents around, identification of the correct pick-up point may become a problem, but every regular user knows her or his local railway station, and in the large conurbations most pass through it twice a day for commuting.

A New Role for Railways?

Like in other countries, political circles wish to shift some long-distance goods traffic towards rail, but the tight delivery time

[10] N.N., *Return to Sender*, Modern Materials Handling 05/15/2000

promises are not compatible with the current services offered by the JR Freight company. A specific Japanese problem is the loading gauge restrictions, as the conventional railways in Japan operate on 1067 mm track, making piggy-back transports impossible without specialized equipment. On the high-speed Shinkansen network, only passenger trains operate, and permissible axle loads are unsuitable for heavy freight services along these lines. However, Yamato Unyu is actively exploring the feasibility of a parcel freight version of a Shinkansen train[11]: Such a service would enable to reach the markets and customers on the two large islands of Kyushu and Hokkaido overnight, which is not possible by road due to the distance: The 1200 km between Tokyo and Hakata on Kyushu take approx. 17 hours by lorry, 24 hours given the current railway offers by JR Freight, but could be managed in 7 hours (including loading/unloading) by a Freight Shinkansen comparable to the "TGV Poste" high speed trains in operation in France for the French post office. The current daily parcel flow on the southern route to Kyushu would fill capacity of a full train, the same holds for traffic towards Hokkaido in the north. The main obstacles appear to be not financial or technical, but are rooted in a missing willingness of the JR Passenger companies to enter the express freight business.

MUJI: An Example for the Integration of Internet, Catalog and Shop Business

Like in most developed countries, many Japanese companies have started to integrate internet, catalog orders and shops: Items can be ordered over the net or from catalogues to be home-delivered, or picked up in the outlets - if desired by the customer - as not all articles may be readily available in every shop. Prime example is Ryohin Keikaku, known for its MUJI "no brand" brand, selling a range of over 4,000 items ranging from fashionable apparel to foodstuffs and furniture and household items, following a "lifestyle

[11] Memo, Mr. Masatoshi Tsuru, Gen. Manager Yamato Unyu, 18.12.00,

concept" successfully targeted at single Japanese in the 20-35 age bracket. Recently, MUJI has reduced its number of in Japan warehouses from 50 to only 3 to serve its brick-and-mortar business in about 300 own stores. A limited product range is also delivered to the convenience stores of the related "Family Mart" chain. MUJI keeps its promise of two-day-delivery for catalog orders in 97% of cases. Warehouses show a quite low degree of automation, which is explained by improved flexibility in a fast-growing market. This flexibility is further increased by the use of external staff for most non-critical warehouse operations. Transport operations are fully sourced out. For orders received over the internet, a new, separate warehouse was built for the parcel-sized shipments, which are distributed through the takuhaibin company Nippon Express. Internet and catalog orders for furniture and large household appliances, however, are handled through the original three distribution centers and delivered directly to the home of the customers[12].

Conclusions and Outlook

Japan is often blamed to be on the slow side in adoption of IT and the internet: The ratio of internet users is lower than in many western countries and even lower than that of the Asian neighbors South-Korea, Singapore and Taiwan[13]. A number of other factors play a role: One is language, as the use of the internet is at times cumbersome given the complexJapanese alphabets. Access fees are high, to a large part attributable to a telecommunications market with little deregulation. Another cause – hampering Eshopping - is that Japan is still very much a cash society, leading to a little ownership rate of credit cards, and a considerable hesitance to use it for payments on the net.

But then, a further factor may be that Japan already enjoys a very

[12] notes taken during visit at Ryohin Keikaku Urayasu Logistics Center, 27.10.00

[13] State of the Internet 2000, usic.wslogic.com/into.html

high level of services of all kinds readily available to the customer. E-shopping often is not perceived to fulfill urgent needs, it is not trivial to find market niches not occupied by existing delivery services.

There is an area where Japan can claim world leadership in IT: Already in 1999, the number of mobile phone has overtaken the number of fixed lines. Most of the newer mobile phones are internet-ready: In July 2000 there were nearly 23 million subscribers of the "i-mode" service[14] with no end of growth in sight.

Timely order fulfillment is at the core of e-commerce. Even in the cyber-era, warehousing means "pallets in and packets out", with picking, packing, labeling and order processing as processes that have to work smoothly. Therefore, there may well be an advantage for companies that are affiliated to "brick and mortar" businesses and can hence built on proven warehousing operations, albeit possibly with different requirements concerning response times and integration of the information system. In Japan, costs are often kept under control by sourcing out labor while using relatively simple technology, which leaves room for adaptations to changing demands. In some cases it is favorable to separate e-business distribution with its small or even single-item shipments into separate warehouses. On the other hand, companies like catalog-order companies will find little change on the distribution side, whether the orders were received by mail, phone, or online. Ryohin Keikaku (Muji) is only one of many Japanese companies that appear to have managed the transformation smoothly, expanding its business in the process.

Of course, warehouses are only the one-but-last step in the distribution chain; therefore the efficient and timely organization of the supply chain and the whole distribution channel is crucial. This may be less of a problem to achieve for non-perishable and rather homogenous products like books, which is probably the reason why

[14] Japan Almanac 2001, Asahi Shimbun, 2000

books have been among the first products added to the portfolio of takuhaibin companies, and later among the first offered on the internet.

For more "advanced" products like fresh fruits a control of the whole distribution channel and even manufacturing is at least helpful: For big Japanese Takuhaibin companies this is daily practice since about two decades. One of the services offered through temperature-controlled distribution chains (in the form of catalog business, so far) are fresh fruits, vegetables and food specialties, the which are produced by companies founded as joint venture with participation of the express parcel company. In an ideal e-commerce world, the production would be completely integrated into the information chain, so that every order triggers action on the manufacturing side. The highly developed POS systems in use in Japanese convenience stores show the way to solutions on the software side.

The Japanese combination of takuhaibin companies taking care of all kind of nationwide home deliveries including frozen food and cooled, fresh produce, baggage and sports equipment, up to flowers or dialysis liquid. Synergies are achieved with the omnipresent 24-hour-7-days-a-week convenience stores where quick shopping for foodstuffs is combined with the possibility to pay bills and post or receive parcels. Hence, most segments that American or European-style e-commerce start-ups have hoped to fill are already occupied. The difference is, that in Japan the system is mature: Logistics and information flows are proven and integrated, and include solution for reverse logistics. Takuhaibin systems have proven to be scalable, leaving scope for further growth in volume or product innovation.

Some developments in America or Europe appear to follow the recipe that made takuhaibin so successful in Japan: FedEx has launched FedEx Ground, recognizing that its technology in place for B2B operations is not well suited for B2C/C2C services with its specific

problems of the presence of the addressee and the handling of returns. A solution could come from Seven-Eleven in North America, which was taken over by their former subsidiary Seven-Eleven Japan some time ago: There are apparently plans or tests the offer of drop-and-pick-up services for express parcel delivery companies in the United States, following the Japanese model. The largest German express parcel service, Hermes, is moving into a similar direction by building up a network of pick-up and drop agencies: Due to the absence of Japanese-style convenience stores, which in turn is attributable at least partly to the rigid German shop-opening hour legislation which is in the process of being liberalized, shops like newspaper kiosks, dry cleaners, and small grocery stores are approached to become agents for Hermes, currently forming a network of 3300 agencies throughout Germany[15].

On a broader scale, the European Union has smaller domestic markets than USA/Canada or Japan, international links are more important. Formerly monopolistic or state-owned postal companies in Europe are moving actively into the direction of becoming third party logistics providers: The French La Poste and British Royal Mail have moved into the German express parcel market, swallowing Deutscher Paket Dienst (DPD) and German Parcel, respectively. The former Dutch Post office has bought up TNT, the German Deutsche Post AG has acquired Danzas, a part of DHL, and express parcel companies in several European countries to form a European network. In very much the same way as Yamato, through its internet portal, "www.evita.de", Deutsche Post links to e-shops that use the former post office for their distribution, or their whole logistics chain. But still, the Japanese competitors appear to be the yardstick against which the smooth distribution of a large number of small items to private customers should be measured.

[15] www.hermes-vs.de /business / index.html

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Canada Transportation Act
A Snapshot of Key Stakeholder Opinion

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1. Background and Introduction

Manitoba Highways and Government Services (HGS) commissioned the Transport Institute at the University of Manitoba (UMTI) to gather information with respect to the Canada Transportation Act. The CTA Review Panel is considering many issues under the CTA, and HGS commissioned UMTI to conduct a survey-based study designed to provide input for the Province's submission to the Review Panel.

The target population for this study was defined as the full group of Manitoba transportation sector stakeholders. The objective was to ensure all stakeholders would have an opportunity for responses, although the choice to forego providing such feedback would ultimately rest with the individual stakeholders. A canvassing of the stakeholders from the carrier, shipper, community, and labour sectors would comprise the base for the survey of stakeholders.

2. Objectives and Methodology

Members of the target group of this study were to be interviewed and asked a series of questions designed to ascertain:

1) Perception of the Operation of the Canadian Transportation System, with comparisons to the U.S. System
2) Trade-Offs between Transport and Policy-related Statement pairs, and CTA Policy Statement Agreement
3) Assessment of Efficiency, Viability of Transportation Modes

4) Response to a National Transportation Policy Declaration
5) Operational Issues dealing with; Fuel Tax Distribution, Canada/U.S. Reciprocal Access, Airport Taxes, Support and Air Sector Ownership, and Impact of Regulations on Carriers
6) Vision Statement Topics

The survey was conducted from Oct. 26 to Nov. 9, 2000, with the final composition of the survey comprising; 7 Airline Companies, 9 Trucking Firms, 5 Railways, 5 Other Carriers, 23 Shippers, and 7 Interest Groups. It should be noted that an overall sample of fifty-six respondents would normally place limitations on the validity of extrapolations to the population (and inferences about any subsets would be suspect). However, in the study at hand, some of the sector samples essentially represented a Manitoba census of that sector.

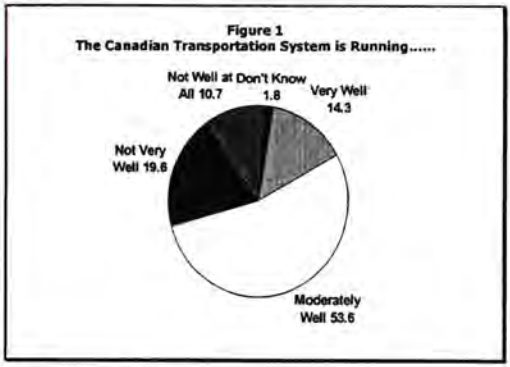
The following sections provide a condensed presentation of a selection of results of the survey, and of subsequent industry discussions and anecdotal commentary by industry practitioners.

3. Key Findings

3.1 Canadian vs. U.S. Transportation Systems

Respondents were asked to assess the Canadian transportation system. They were asked to indicate if they believed the system was running very well, moderately well, not very well, or not well at all. About two-thirds of respondents suggested the system was running at least moderately well (68%) (Figure 1).

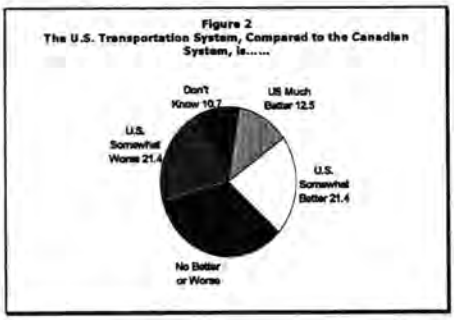
While the Canadian Transportation System tended to receive a passing grade from the overall sample, subgroups differed in opinion. Respondents from the airline sector as well as those from the railway sector appeared to speak more highly of the current status of the Canadian system than did the remainder of respondents.



Where concern with the Canadian system was expressed, respondents primarily focused on a perceived suboptimal transportation infrastructure in Canada. Respondents expressed a concern regarding congestion in the transportation system. These congestion criticisms were leveled at airports, seaports, and rail. As such, these congestion criticisms could also be considered as infrastructure concerns.

Other competition-related concerns were raised, as were concerns about a lack of consistent standards from jurisdiction to jurisdiction, or concerns about interprovincial issues. In further discussions, a lack of a national set of standards and practices was seen as a significant concern for the trucking sector.

About one-third of respondents believed the U.S. transportation system was either somewhat better or much better than the Canadian system (see Figure 2). A further one-third indicated the U.S. system was no better or worse than the Canadian system. About one in five (21%) believed the U.S. system was somewhat worse than the Canadian system. On balance, the U.S. system fared better than the Canadian system in this measure.



Those who indicated the U.S. system ran better focused on a perceived superiority in the higher level of investment in infrastructure. This perception was particularly common among the Airlines, trucking companies, and interest groups. The next most common mention for the superiority of the U.S. system is that the Government plays a better role, particularly in maintaining National infrastructure in the U.S. Taken collectively, these two main mentions paint a strong view that the U.S. Federal Government is doing more (or at least doing the right things) for the U.S. transportation system, reinforcing the suggestion that the U.S. appears to have a more cohesive national transportation policy.

Awareness of CTA Review Panel Topics

Fewer than one in five of respondents indicated they were very familiar with all topics under the CTA Review Panel activities, and one-third confessed a complete lack of familiarity with the topics and discussions. If there was one subgroup that professed a higher level of awareness of the topics, it was the Railway Sector.

Where awareness of the topics was indicated, Rail Sector respondents and shippers cited Open Access as a topic of interest. Trucking firms focused on highways and infrastructure, hours of work for truckers, safety regulations and weight regulations. In further discussions, this interest was expanded to describe a concern over a lack of nation-

wide standards for vehicle operation or inconsistent road quality from area to area. Air carriers mentioned competition issues and executive accountability, while interest groups mentioned northern airfare issues.

3.2 Trade-Off Statements and Policy Statement Agreement

Respondents were presented with ten pairs of position statements and were asked to choose which statement in each pair best fit their own positions. The statements covered topics of regulation vs. free market, monopoly powers, government role in mergers, use of public funds for infrastructure, and Canada/U.S. reciprocal access. The findings show a significant polarization of opinion on some topics and almost unanimity on others.

Regulation / Deregulation

In terms of the regulation vs. de-regulation trade-off questions, almost two-thirds of respondents suggested that "competition and market forces should determine routes and modes" rather than believing that "economic regulation of carriers and modes is necessary." This opinion was particularly strong among air, rail and truck carriers, with shippers, interest groups and other carriers being less convinced about this position. In contrast, interest groups and other carriers were more likely to indicate that economic regulation of carriers and modes was appropriate. There was a fairly even split between those who feel "transportation should be a tool to ensure regional economic development" and those who believe "transportation should just be a component in moving goods and people". Those who were less positive about "competition and market forces", were also those more likely to believe "transportation should be a tool to ensure regional economic development."

For the most part, carriers presented opinions consistent with a pro-competition stance, where transportation should not be used as a tool to ensure economic development, and that there are no natural transportation monopolies. Rail carriers leaned towards this profile,

although at times showed some consistency with the opposite opinions, held collectively by the group comprising shippers, interest groups, and other carriers.

Eighty-five percent of respondents felt that the public good is best served by "promoting the entry of competitors" into a monopoly situation rather than "controlling the monopoly's prices and services." The logical extension of this argument is that monopolies should be broken up, but a significant percentage of respondents also support the contrary belief that there are indeed natural monopolies in the transportation sector.

Federal Government Role in Mergers

Respondents were asked to indicate if the Federal Government should be involved in mergers in the air, rail, and truck sectors. There is support for Federal Government control over mergers, but that support differs based upon the sector being discussed. The highest support for control is found in the discussion of air sector mergers, with the lowest for control of trucking company mergers. Major carrier groups did not support Federal Government control over mergers, while shippers, interest groups, and other carriers were the main source of support for Federal Government control over mergers.

Public Funds and Infrastructure Maintenance

There was support for public funds being used to support transportation infrastructure (55%) rather than having all costs borne by providers and customers of transportation services (32%). However, the strongest focus of opinion was in support of the use of fuel taxes to support the transportation infrastructure (93%).

Canada and U.S. Reciprocal Access

In the final trade-off question, respondents were asked to choose between the position that "Canadian and U.S.-based carriers should have open access to moving goods and passengers within each other's

borders", or "Canadian and U.S.-based carriers should be limited in their ability to move goods and passengers within the other's borders.". The former position is the more popular of the two, being supported by two-thirds of respondents to the survey.

Shippers, interest groups and other carriers tended to be less "pro-competition" and more "pro-regulation" than the group represented by air, rail and truck carriers. However, they seemed to be more "pro-Free Trade" than the carrier group when it came to trans-border business. Rail carriers were positive about open reciprocal access with the U.S., but air carriers and truckers were less sure. The relative size of companies on either side of the border was a main source of concern. As one trucker put it, "they (U.S. companies) are just too big." Another acknowledged that "they (U.S. firms) could just take over if they wanted to." However, the prospect of completely open access of Canadian and U.S.-based carriers to each other's markets was not without its supporters.

Respondents are generally proponents of competition and minimal monopoly power, but with interest in transportation as a policy and economic development tool. Respondents support public funding of infrastructure, and U.S./Canadian access to each other's markets. It is a blend of deregulation and policy steering of transportation.

CTA Policy Statement Agreement

The Canada Transport Act sets out numerous policy statements. Questions were presented to ascertain the respondents' level of agreement with each of four statements. The respondents were asked to indicate if they strongly agreed, somewhat agreed, somewhat disagreed, or strongly disagreed with each statement. The policy statements, for the most part, registered strong support, with "strong" or "somewhat" agreement dominating. In fact, several respondents labeled the policy statements as "motherhood" issues, being hard to oppose, but also being difficult to present as operational statements. The policy statement that transportation should "Not set fares, rates and conditions to carry traffic in Canada that unreasonably hinder the

mobility of persons or commodities" recorded very high agreement, as did the proposition that "competition and market forces are, whenever possible, the prime agents in providing viable and effective transportation services". Similarly, "any economic regulation of carriers and modes of transportation should not unfairly limit the ability of any carrier or mode to compete freely with any other carrier or mode" was a statement with few dissenters.

The final policy statement, that "rates or fares should reflect the true cost of delivery of routes and modes of transportation", while garnering a high level of agreement, did not register the same almost universal support as did some of the other statements. Only one-half of respondents strongly agreed with this statement. Railways and interest groups were more likely to actually disagree with the statement, possibly for entirely different reasons. Perhaps the railways chose to disagree with this statement in order to support the ability to charge differential pricing. Interest groups, with a significant northern Manitoba representation, possibly chose to disagree to support route cross-subsidization, thereby keeping fares to remote areas lower.

3.3 Assessment of Efficiency, Viability of Various Modes

Respondents were presented with three statements and were asked to indicate the degree to which each of six transportation modes fit that statement. Respondents were asked if the statement definitely applied to the mode, applied somewhat to the mode, applied only slightly to the mode, or did not apply to that mode.

In terms of "moves traffic under reasonable fares, rates and conditions", truck freight was given the highest mean rating, well ahead of rail freight or bus passenger service. All carrier groups gave truck freight a relatively high mean rating. Bus passenger service and rail freight ranked behind truck freight but ahead of airfreight. Air passenger service recorded a low mean rating of 2.9, although higher than the 2.6 recorded by rail passenger service (on a 1 – 5 scale).

The other two statements; "bears a fair proportion of the real cost of resources, facilities and services provided to that mode at public expense", and "this mode is economically viable", recorded generally high and even mean ratings for all modes except rail passenger service. Rail passenger service was clearly singled out as falling short in these measures. In reviewing truck and rail, the trucking sector appears quite positive in its assessment of rail. Rail is also positive about truck's ability to deliver its product in a cost-effective manner, but seems less convinced that truck pays its fair share of infrastructure support. In discussions, some of these assessments were reinforced, at least in terms of the trucking sector's view. For example, trucking firm representatives stated that rail had paid for its own infrastructure, and hence it would be "only fair" that rail receive tax credit back for fuel taxes collected that were destined for infrastructure.

Rail Passenger service is perceived as limited in all three measures, with air passenger being less likely to be perceived as moving traffic under reasonable fares, rates, and conditions. Most modes are clearly considered to be economically viable

3.4 Response to a National Transportation Policy Declaration

Respondents were presented with one target of the National Transportation Policy declaration, that there be a "safe, economic, efficient, and adequate network of viable and effective transportation services." Respondents were asked to indicate how important it be that this goal be reached. This statement drew extreme agreement, with nine out of ten respondents believing that it was "very important" that this goal be reached. However, it is clearly a composite statement. Terms such as "safe", "economic", "efficient" and "adequate" could be expected to draw differing levels of perceived value. Comments made during the data collection phase as well as during subsequent discussions placed a particular emphasis on the safety and efficiency aspects of the goal.

Respondents were then asked to indicate what role, if any, the Federal Government should play in reaching this goal. As illustrated in Figure 3, about seven out of ten respondents believed the Federal Government should play at least a major pole in reaching the goal of a "safe, economic, efficient, and adequate network of viable and effective transportation services." Among those who believed reaching the goal was very important, the expected participation of the Federal Government was even higher, with 95% of these respondents expecting at least a major role from the Federal Government.



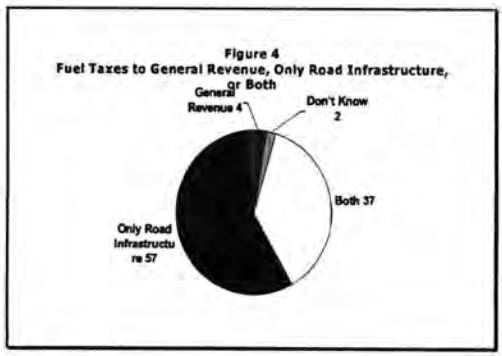
The high level of expectation for significant Federal Government involvement appears to create a contradiction in *laissez faire* vs. government control or involvement, given participants' stance on other issues. Participants suggested the Federal Government be more involved in setting national standards by which transportation providers can function, and a reversal of abdication of federal standards which had caused a lack of interprovincial consistency.

3.5 Operational Issues

Fuel Tax Distribution

Respondents were asked if they agreed with Federal policy of using fuel taxes for general revenue, or if fuel taxes should go only to road

infrastructure, or if the revenue should be split between infrastructure and general revenues. Figure 4 shows respondents favour a strong link between fuel taxes and infrastructure maintenance and improvement.



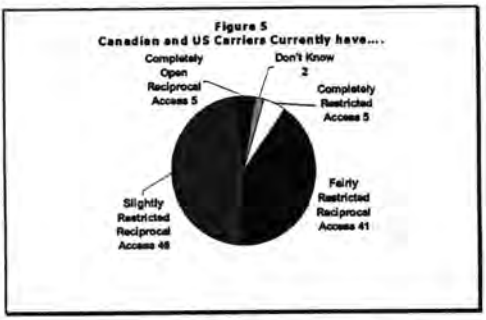
Only four percent of respondents favoured the current approach of using fuel tax funds for general revenue. Railways, while still favouring infrastructure expenditure, also were a source of perception that it would be better to keep the funds in general revenue. It was pointed out by rail respondents that since rail essentially pays for its own infrastructure while still paying significant fuel taxes, diverting the revenues to road infrastructure would not be in rail's best interest.

In discussions, participants reiterated linking fuel taxes mode-specifically. This would result in a rebate to rail, and reduce mode cross-subsidization. A cost-sharing mechanism for the use of the various sectors' fuel taxes in the support of the growing Intermodal sector was also proposed.

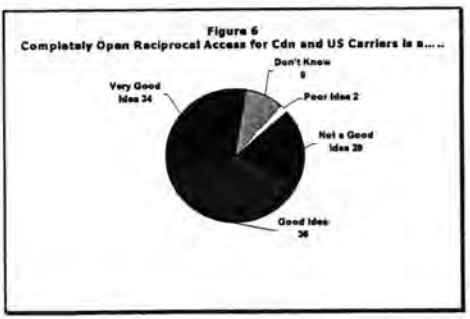
Canada/U.S. Reciprocal Access

In terms of open reciprocal access, respondents were split in their perceptions of how open or restricted the Canada/U.S. border is. Only 5% of respondents perceive the border as completely open,

while 5% of respondents perceive the border as completely restricted (Figure 5). The vast majority of opinion fell in the middle, perceiving varying degrees of restriction or openness across the border. For some respondents, the issue hung on the term "reciprocal", as survey participants did not see balance in the trans-border relationship, citing the absence of a "level playing field".



Overall, about seven out of ten respondents felt completely open reciprocal access would be a good idea or a very good idea (Figure 6). Trucking firms appeared slightly fragmented in opinion, and in fact contributed the only opinion that completely open reciprocal access would be a poor idea.

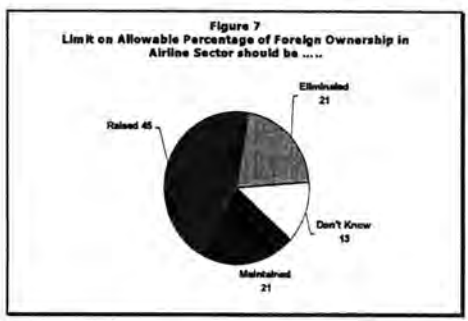


Airport Taxes, Airport Support and Air Sector Ownership

Survey participants were asked if it is appropriate for rent from major airports to be used to support smaller airports and there was clear support for this position. In fact, all airline respondents, interest group participants, and other carrier respondents agreed that small airports should be supported by the rent from the major airports.

Respondents were then asked if the current level of taxation of major airports is appropriate, followed by a question about the level of support provided to the smaller airports. Respondents generally believe major airport taxation is at an appropriate level, but support for smaller airports is too low. Generally, the pattern of response suggested a low level of awareness of these topics by the overall sample.

The final series of questions dealing with the air sector focused on the current limit on foreign ownership in the airline sector. Respondents were asked if the current limit of foreign ownership in the airline sector should be raised, lowered, maintained, or eliminated. There is strong support for having a greater allowed level of foreign ownership, (Figure 7) with about one in five of respondents going so far as to suggest the limit on foreign ownership should be eliminated. In discussions, support for allowing increased foreign ownership appeared linked to increasing access to capital.



Impact of Canadian Regulations on Canadian Carriers

Respondents were asked to state the degree to which they believed Canadian federal regulations place Canadian-based carriers at a disadvantage. Regardless of mode, about one-third of respondents believed that Canadian regulations placed Canadian-based carriers at a disadvantage. In comparing how each sector's respondents assessed their own situation, each sector considered itself more handicapped than the other sectors.

Some participants commented that they were not placed at a disadvantage by Canadian regulations, but rather were being handicapped by U.S. regulations, and suggested much was yet to be done in Canada/U.S. negotiations to "level the playing field."

3.6 Vision Statement Topics

In a final question, respondents were asked to put forth suggestions for topics to be addressed in a National Vision Statement for Transportation. Many observations, anecdotal comments and suggestions were cited, and these will be incorporated into this report's conclusions.

4. Concluding Observations and Direction for the Future

In summarizing the survey results as well as the subsequent discussions, it was clear that while researchers and policy analysts may "live and breathe" the topics of the CTA Review Process, such is not always the case with those involved in industry. There were many astute transportation practitioners who understood the intricacies of the process and implications for their industry. However, there were likely many more who were far removed from the process, and had little appreciation for the CTA Review Process, or even the particulars of the status quo's influence on their operations.

There is general support for economic deregulation of the transportation sector but also for the Federal Government to play a major policy role in steering the transportation sector. Simply put, the Federal Government is to be "hands off", except in ensuring transportation practitioners are able to function in a safe, fair, and stable business environment. Participants also expressed a concern over re-regulation of the sector, fearing creation of a new government bureaucracy. Some would argue that is a very difficult and narrow path to tread.

Negotiated, not regulated "Open Access" is needed in rail, with fair compensation for those that provide the infrastructure.

There is a perceived lack of transparency in information about regulation and support provided to the different sectors. Few really understand the quantifiable impact on different sectors of federal support or regulations, and in the absence of information transparency, misconceptions are fostered.

There is no perceived current level playing field with the U.S (e.g.: the capital cost allowance structure and Canadian tax structure creates disparity). In addition, the U.S. highway system is more standardized (at least on the National Highway system), placing Canadian carriers at a disadvantage. U.S. carriers are perceived to have easier access to Canadian markets than the reverse. Canadian and U.S. governments need to get together to harmonize standards (reinforcing need for Canada to first be internally standardized).

Air sector participants also saw limitations unique to the air sector as being arbitrary and indefensible, and a barrier to access to capital.

There is concern over the long-term availability of replacement drivers. A joint federal/industry partnership of apprenticeship should be launched to ensure a continued supply of high quality drivers and support system operators to maintain Canada's competitive position.

Taxes collected from transportation should go back in to transportation infrastructure, and ideally mode-specific.

Economic development and cross-subsidization should be transparent. The Surface Transportation Board (STB) in the U.S. is transparent and accessible, and may provide a model.

CTA direction is transportation in perceived as general, but issues tend to be mode-specific. For example, foreign ownership is seen as an air issue. Use of fuel taxes to support infrastructure and national standards is looked upon as a trucking issue, while access to the infrastructure is a rail issue – the only infrastructure that is not publicly supplied.

The Federal Government should re-enter the arena of national standards, to assist in R&D, set the guidelines for safety, technology development, and a National Highway System infrastructure, and set uniformity across the country in compliance and administrative function. The Federal government would establish standards, but standards and infrastructure are delivered by province, municipalities, and partnerships with industry.

Regulatory Reforms in Canadian Transportation Since 1987

Joseph Monteiro, Competition Bureau, Industry Canada*

Transportation in Canada has been undergoing a revolution. The fifteen years of the last millennium has been an exciting period in the history of regulatory reforms. These reforms which eliminated the majority of controls on market entry and pricing together with other economic regulations began to have its effect in the 1990s. With these changes, a revolutionary restructuring of government management of transport was undertaken in the mid 1990s. The central theme of this restructuring was commercialization and decentralization of government operations together with further deregulation of commercial transport. The major regulatory achievements of the federal government, the success of the transportation industries in transforming itself and adapting to changes have laid the foundation for significant progress and advancement in the new millennium. This article briefly reviews the regulatory changes that have occurred in the four major sectors of transportation.

A. Rail Transportation

Background: The history of regulation in rail goes back to the middle of the second last century of the previous millennium. In 1851, the first general law on rail transportation, the *Railway Act*, was enacted. Rail regulation played an important role in consolidating Canada in the Confederation scheme of 1867. Since then, up until the mid 1980s, the railways were regulated by several federal acts - the *Railway Act*, the *Transport Act*, the *National Transportation Act 1967*, the *Railway Relocation and Crossing Act*, the *Canadian National Railway Act*, the *Western Grain Transportation Act*, the *Government Railways Act*, the *Maritime Freight Rates Act*, and the *National Energy Board Act*. In addition, the railways are also subject to their respective provincial regulations. Apart from technical regulatory activities, the two major facets of economic regulation involves ensuring adequate quality of service to users, and costing and rate matters.

Rail transportation services in Canada are categorized into freight and passenger services. The railways providing these services are classified into: Class I railways: CN, CP and VIA Rail; Class II railways: regional and shortline railways; and Class III: terminal railway operations (subsidiaries of US carriers operating in Canada also fall into this group).

Regulatory Reforms

i) Reforms Before 1988

The first major impetus for reforms in Canadian railways came from the regulatory reforms introduced in the U.S. as a result of the *Railroad Revitalization and Regulatory Reform Act*, and the *Staggers Rail Act*. The offering of rebates made possible by the *Staggers Rail Act* which were prohibited in Canada led to substantial loss of traffic to American railroads.

General and specific proposals to introduce reforms were reflected in the July 1985 Discussion Paper *Freedom to Move* of Transport Minister. These proposals were later embodied in the *National Transportation Act, 1987*. This Act "signals a new era in Canada's transportation history - an era of greater competition, less regulatory intervention and more innovative transportation services. There will be more choices and greater competition in rail transportation." Reforms were introduced in four areas: 1) Access to Alternative Rail Service; 2) New Tariff Provisions; 3) Rail Network Rationalization; and 4) Dispute Resolution Services.ii)Review of Legislative Developments and Reforms After 1988.

ii) Several legislative reviews and a few regulatory reforms on rail transportation have been undertaken since 1988: The Royal Commission on National Passenger Transportation in 1992, The National Transport Act Review Commission in 1993, The Report of the Standing Committee on Transport in 1993, the new *Canada Transportation Act* in 1996, the Estey Review and Kroeger Reports in 1998-1999, and Amendments to the *Canada Transportation Act* in 2000. In addition, there were also special studies. These reforms and national reviews will be briefly summarized.

a) The Royal Commission on National Passenger Transportation: The recommendations of the Royal Commission on National Passenger Transportation in rail dealt basically with VIA Rail. It recommended: giving VIA Rail a legislative basis to operate on a commercial basis; phasing out the subsidy in ten years; freeing VIA Rail to compete for commuter services and mail transportation; removing any limit on track abandonment; protecting the potential of railways' rights-of-way by a more formal process; and filing with the federal government in addition to publishing annual operating plans and

reports which include costs and revenues related to individual routes.

b) The National Transport Act Review Commission: The National Transport Act Review Commission (i.e., NTARC) proposed that CN be privatized. In addition, it proposed that the railway companies (CN and CP) should be able to adjust and control their costs through liberalization of rail rationalization, rationalization of Prairie branch line network, facilitation of short-lines, promotion of joint track usage, and investigation of separating operations and ownership of rail. The NTARC also recommended modifying the competitive line rate (i.e., CLR) and the final offer arbitration (i.e., FAO) provisions and abolishing sections dealing with compensatory rates and requirements for filing confidential contracts.

c) The Report of the Standing Committee on Transport: The Report of the Standing Committee on Transport (i.e., SCOT) acknowledged the competitive necessity of rationalizing the rail infrastructure indicated by the NTARC. It accepted their recommendations on conveyance of rail lines and further proposed a new policy to facilitate the creation of short-line railroads and regional rail networks on a large scale. It, however, suggested that abandonment be halted until a basic national rail network is established. Further, the SCOT rejected the NTARC recommendations to amend the CLR and FOA provisions. It also rejected the consideration of separating operations from ownership or of abolishing the provision on compensatory rates. Regarding passenger services, the SCOT agreed with the recommendation of the NTARC that VIA Rail should be given a legislative mandate to operate passenger rail services in Canada.

d) The *Canada Transportation Act*: On July 1, 1996, the *Canada Transportation Act* (i.e., CTA) was enacted to modernize and streamline transportation and to enhance the viability of Canada's major rail carriers. A number of new provisions were added to the predecessor legislation, the *National Transportation Act, 1987*. The focus of the new provisions were on the development of a healthy short line industry, cost reduction of the major Class I carriers through rationalization, and provision of opportunities for retaining rail services. First, the Act eases the entry of smaller, low cost rail carriers into operations in concert with CN and CP. The basic intent here is to encourage the development of shortline railways as they complement the mainline carriers as feeders of traffic. Lines must be offered for sale before they are abandoned and the legislation affords governments ample opportunity to acquire such lines when no interested party is found. Second, to provide for rail rationalization along more commercial lines and to make it a less adversarial

process and more conducive to the sale or lease to new operators, revisions were made to the old act. Third, the new Act introduces a new statutory requirement for federal railways to issue a three-year network plan. This is intended to protect the public by providing an opportunity to interested parties to purchase the discontinued lines.

In addition to the above, a number of other changes were made that did not receive much attention: the provisions pertaining to non-compensatory rates were repealed; a substantial harm test was added to section 27(2); the public interest test was removed for: CLRs, level of service and interswitching but retained for the grant of running rights; the Agency's review of a transport acquisition was dropped; a new subsection 4(2) was specifically added to the Act indicating that nothing in or done under the authority of the Act affects the operation of the *Competition Act*; and in the event of an extraordinary disruption, the Governor-in-Council may take steps, notwithstanding subsection 4(2), and it will prevail over the *Competition Act*.

e) Estey Review and Arthur Kroeger Reports: The most recent attempt to bring about railway reforms resulted from the Estey Review relating to Grain Handling and Transportation and Kroeger's follow-up report on how to implement the Estey recommendations.

The Estey Review made several recommendations relating to rail transportation of Canadian Wheat Board grain. First, the maximum statutory rate scale for rail movement of grain be repealed i.e., the preordained freight rates controlled under sections 149-153 of the CTA should be replaced by negotiated contract rates. Second, it recommended that the provisions of the CTA relating to various methods of seeking access to other connecting lines be simplified and clarified so as to better serve the national interest in obtaining competitive transportation by rail. Third, it made recommendations on the abandonment of branch lines (e.g. consolidating the CTA provisions so as to give an opportunity for the community to acquire the abandoned lines as a complete unit and to run it, etc.). Fourth, it made recommendations regarding final offer arbitration. In addition, it also made recommendations on the disposal of hopper cars and its allocation policy so as to increase the supply of rail cars.

Mr. Arthur Kroeger developed operational details to implement Estey's recommendations at the request of three Ministers. These recommendations as they relate to rail are: 1. A revenue cap on railway revenues should replace the present rate cap, starting with a 12 percent reduction from the revenues in the base year 1998, with rate reductions in subsequent years being effected by

competition rather than regulation. 2. Steps should be taken to increase competition between the railways. The pros and cons of full open access were considered in detail. While the Stakeholders participating in the process opted for a system of running rights, the railways were opposed as they claimed that it would have a serious consequence for the integrity of their system and their financial viability. Since, no consensus could be reached, it was recommended that a whole range of open access measures be considered with the review of the CTA to be undertaken in 2000 with particular emphasis on full open access (i.e., running rights). 3. Before having recourse to the final offer arbitration provisions, a check list should be followed. The consensus of opinion indicated that negotiations were preferable to arbitration and the latter should be used as a last resort. 4. Proposed changes to the branch line abandonment provisions were developed to provide for a more effective discontinuance and transfer process. Railways would be required to separate lines into two categories: operating and discontinuance. Discontinuance could only begin after these lines have been listed for twelve months by the railways. The Canadian Transportation Agency would have a dispute resolution role and it could also address issues of de-marketing, if it had a de-marketing remedy.

f) Amendments to the *Canada Transportation Act*: *An Act to Amend the Canada Transportation Act* went into effect on July 26, 2000. The amendments dealt with a revenue cap, final offer arbitration, and branch line abandonment. First, the revenue cap will result in a reduction of an estimated revenue from freight rates by $178m. This is approximately an 18 percent reduction in grain freight rates from the 2000-2001 levels. Second, the final offer arbitration provision will provide for a summary process for disputes of less than $750,000, exchange of offers after ten days, a faster process (i.e., 30 days for disputes of less than $750,000 and 60 days for disputes of more than $750,000), and a three person arbitration panel. Third, the branch line amendments facilitate branch line rationalization and the measures to achieve this include the following: compensating affected municipalities or districts with transitional payments of $10,000 per mile for three years when a grain line is closed, operating the remaining part of the branch line for three years, discouraging de-marketing (i.e., purposefully deferring maintenance to make operations uneconomic) of grain lines by ordering improvement of services, granting running rights and identifying lines for discontinuance in the three year plan. In addition to the amendments, the Minister of Transport identified further issues of rail competition - running rights, access concepts and regional railways - for review in the upcoming CTA 1996 review. An interim report on these aspects will be

issued by the end of December 2000.

B. Air Transportation

Background: Interest in aviation in Canada began with air ballooning in 1837. Regulations, however, in aviation did not occur, until the first act governing aviation, the *Air Board Act*, was passed in 1919 in response to the need for safety. In 1927, the *Aeronautics Act* replaced the *Air Board Act*. With the start of World War II, the Air Transport Board was formed which was empowered to regulate many economic aspects of commercial aviation. It was not until the *Trans Canada Airlines Act* was passed in 1937, which provided for the creation and preservation of a virtual monopoly for Trans Canada Airlines in transcontinental and domestic areas, that the era of economic regulation commenced. Economic regulation in the airlines from then onwards to the mid 1980s increased and was governed by the *Aeronautics Act*, the *Air Carrier Regulations* and the *National Transportation Act* of 1967. At this stage, the major facets of economic regulation were: control of entry, prescription of routes and licence restrictions, cancellation or amendment of licences, regulations pertaining to tariffs and tolls, base protection and positioning charges, suspension or disallowance of tariffs, appeal of freight rates, and acquisitions.

Air transportation basically involves air passenger transportation: scheduled and charter services. It also includes air cargo transportation, and provision of specialty services (eg. off-shore oil drilling services, emergency medical services, forest and fire services, etc). Before regulatory reforms were introduced in 1987, air services and the role of air carriers in Canada were specifically classified. The former into various classes and the latter into national, regional and local services. This classification while no longer relevant is often used in considering market competition.

Regulatory Reforms

i) Reforms Before 1988

During the mid 1980s, regulatory changes gradually evolved in response to the deregulatory move. The major milestones were: changes to the regulations governing 'domestic advance booking charters', the Ministerial statement of the 'New Canadian Air Policy' on May 10, 1984, Proposals of the Minister of Transport in his discussion paper *Freedom to Move*, and the *National Transportation Act, 1987*. The *National Transportation Act*, 1987 turned de facto deregulation introduced in 1984 to official regulatory reform on January 1, 1988. The Act removed most of domestic economic regulation (entry, pricing control, carrier roles, licence restrictions on frequencies, routes

and aircraft) in Southern Canada while retaining it in Northern Canada and in international air services. The market entry test of 'public convenience and necessity' was replaced by the test of 'fit, willing and able' for licence applications in Southern Canada. Further, the advance notice required for exit was 120 days. Furthermore, domestic tariffs had no longer to be filed, however they were required to be published. Finally, there was limited control over fares on monopoly routes in the South or routes in the north.

ii) Review of Legislative Developments and Reforms After 1988

After 1988, several regulatory reforms were introduced and a few legislative developments occurred. These were: A New policy for international air passenger scheduled service in 1994, the Open skies Agreement with the U.S. in 1995, the *Canada Transportation Act* in 1996, the restructuring of the Airlines in 1999, a new international charter passenger air services in 2000, and Bill C-26 relating to the amendments to the restructuring in 2000. These are examined hereafter.

a) New policy for international air passenger scheduled service: Regulations on international scheduled passenger services over the period 1984-1993 was left relatively untouched. In December 1994, the Minister of Transport announced Canada's new policy for international air transportation. This policy was designed: to make the best use of Canada's international route rights through a 'use it or lose it' approach; to facilitate access to Canada for foreign carriers; and to provide consumers with more travel options and to improve protection for their travel arrangements. In March 1995, criteria for designating a second carrier for international routes were announced.

b) Liberalization of international air service with the U.S.: The first attempt to liberalize international service began with the *Open Skies Agreement* in early 1995. The main elements of this Agreement were: 1) Canadian and US airlines will be able to provide unrestricted cross-border services (without restrictions on capacity, frequency and aircraft size), with the exception that the US service to Montreal and Vancouver would be phased in over two years and the US service to Toronto would be phased in over three years; 2) Canadian carriers will be provided with limited number of slots at O'Hare in Chicago (10) and at La Guardia in New York (14); 3) The process for approval of Canada-US fares was liberalized; and 4) Canadian and US airlines will be able to operate unrestricted cross-border cargo service, with the exception that US service to Montreal, Vancouver and Toronto would be limited for the first year.

c) The *Canada Transportation Act*: The process of deregulation that had begun in 1984 continued in 1996 with legislative amendments to the *Canada*

Transportation Act (formerly known as the *National Transportation Act, 1987*) by removing the last of the residual restraints on services in the North and by abolishing it as the 'designated area'. All domestic air service licences are now subject to the same entry and exit requirements for all operators. Further, formal exit notice of 60 days will be required of the second last and last carriers, unless a shorter notice period is approved by the Agency. This notice provision is intended to ensure that the community is made aware of exit and to alert other carriers of potential competitive opportunity. The Agency continues to be responsible for hearing complaints about unreasonable basic (economy) fares and unreasonable fare increases on monopoly routes anywhere in Canada. On review, it can order roll-backs and even refunds. The *Canada Transportation Act* of 1996 also introduced a minor amendment to the regulations concerning international passenger charter service. The requirement for Canadian applicants to demonstrate 'public interest' when seeking an international non-scheduled charter licence has been eliminated together with concurrence of the G-I-C for certain ministerial directions concerning international air services. Further, the Agency may subject to ministerial direction temporarily authorize international air services that are not permitted by an air agreement. This was intended to allow for adjustments such as unforseen circumstances - equipment failure.

d) International charter passenger air services: In early 2000, after consultation with various stakeholders, the Transport Minister announced a new policy on April 4, 2000 for international charter passenger air services. "This policy removes fences surrounding international passenger charter services, such as advance booking and minimum-stay requirements, and restrictions on one-way travel." This policy is expected to enhance international travel options for Canadians, encourage competition, innovation and growth in the charter air industry.

e) The restructuring of the Airlines: The restructuring of the airlines as a result of the purchase of Canadian Airlines International by Air Canada led to several reports. First, on October 26, 1999 the Minister of Transport published "A Policy Framework for Airline Restructuring in Canada". This policy indicated that its principles were uncompromising safety and the application of the *Official Languages Act*. The five areas of concern were: pricing (i.e., price gouging and consumer protection), fostering competition (by discouraging predatory behaviour, improving access to airports, allowing participation in frequent flyer programs, reviewing the computer reservation systems to address competitive concerns, reviewing international air policies, etc.), ownership and

control by Canadian, serving small communities, and treating employees fairly. A special review process for mergers and acquisition in the airline industry would be put into place. Second, the House Standing Committee and Senate Committee on Transport and Communications in December 1999 issued two reports. The first made forty-two recommendations and the second made nineteen recommendations. The recommendations largely follow those introduced in Bill C-26 (indicated below). However, the recommendations of one or the other of these two reports that were not acted upon in the regulatory reforms that were adopted were: increasing foreign ownership limits (i.e., to forty-nine percent); allowing for the establishment of foreign subsidiaries to set up Canadian companies to serve only the domestic market; and increasing domestic competition by foreign carriers through the use of US airports as an intermediate stop (eg. Montreal-O'Hare-Vancouver) often described as a modification of the 6th freedom rights. In response to the reports by the two Committees, the Minister of Transport on February 17, 2000 tabled legislation to protect the public interest during the airline restructuring.

f) Regulatory developments resulting from the restructuring of the Airlines: Bill C-26, *An Act to amend the Canada Transportation Act, the Competition Act, the Competition Tribunal Act and the Air Canada Public Participation Act and to Amend Another Act in Consequence*, went into effect on July 5, 2000. The amendments to the CTA include: increased powers to the Agency to review prices and prevent gouging on monopoly routes; restored powers for the Agency to deal with conditions of carriage for domestic service; improved notice of exit provisions; required compliance with the *Official Languages Act* by Air Canada and its affiliates in case of significant demand; and the required setting up an Air Travel Complaints Commissioner to review and resolve complaints. The amendments to the *Competition Act* include: cease and desist powers in case of predatory behaviour (injury to competition or the likelihood that a competitor will be eliminated or suffer harm that cannot be remedied by the Competition Tribunal); new powers to deal with anti-competitive behaviour (i.e., specification of a list of anti-competitive acts specific to the airlines industry together with specification of facilities or services essential that will be considered as denial of access under paragraph 78(1)(k) of the *Competition Act*); powers to prohibit of use of exclusive clauses in confidential contracts for domestic service to encourage competition for corporate travel; and more freedom for travel agents to negotiate collectively with a dominant carrier on domestic commissions. Further, a formal three track merger review process (i.e., review by Competition Commissioner, report to the

Minister of Transport and recommendation to the Governor-in-Council), involving major airline mergers was introduced. The *Air Canada Public Participation Act* increased individual voting shares to fifteen percent from ten percent. On October 10, 2000, the Transport Minister announced consultations with stakeholders to draft legislation to create the Transportation Appeal Tribunal of Canada. This multimodal tribunal would be an expansion of the Civil Aviation Tribunal and would rely more on administrative enforcement practices rather than resolution of maters through criminal courts.

C. Water Transportation

Background: The history of the *Shipping Conferences Exemption Act*, the basic legislation applicable to international waters, can be traced to the Helga-Dan incident that led to an inquiry under the *Combines Investigation Act* and subsequently to a Report by the Restrictive Trade Practices Commission. Based on the recommendations of this Report the *Shipping Conferences Exemption Act 1970* was passed. The basic laws applicable to domestic waters ((Pacific waters, Atlantic waters, inland domestic waters (i.e., the Great Lakes and the St. Lawrence River), Mackenzie river and Arctic waters)) before the era of deregulation were the *National Transportation Act*, *Canada Shipping Act*, *Transport Act* (except part V), the *Inland Water Freight Rates Act*, the *St. Lawrence Seaway Authority Act* and the *Pilotage Act*.

Water transportation in Canada can be divided into transportation activities in international waters and operations in domestic waters. The transportation activities in international waters are basically provided by liner services (usually container services) and tramp vessels (usually bulk non-container services). The domestic activities include freight services provided in inland waters: St. Lawrence and Great Lakes, Canadian Atlantic Coast, Canadian Pacific Coast and Fraser River, Mackenzie River and Western Arctic, and Eastern Arctic; and passenger services in domestic waters: consisting basically of services by cruise ships and ferries.

Regulatory Reforms

i) Reforms Before 1988 - *International Waters:* The *Shipping Conference Exemption Act* 1970 exempted shipping conference agreements from certain provisions of the *Combines Investigation Act*, subject to certain prohibitions. To strengthen the bargaining position of shippers vis-à-vis the conferences, members of a shipping conference were obliged to meet with a shipper group when requested in writing and to provide information sufficient

for the satisfactory conduct of the meeting in the 1979 amendments to this Act. About a decade later, the Act was amended and called the *Shipping Conferences Exemption Act, 1987.* It contained important provisions to promote competition. It restricted the exemption to conference or interconference agreements (independent ocean carriers were excluded from the exemption); restricted loyalty contracts to less than one hundred percent of the shippers' goods to be transported; contained a provision for service contracts; contained a provision for independent action on rates; limited the exemption in the case of conspiracy, combination, agreement or arrangement to engage in predatory pricing described in section 50(1)(c) of the *Competition Act*; and restricted the exemption to agreements that do not cover multimodal rates.

Domestic Waters: The regulatory reforms brought about in domestic shipping were rather limited. The changes in the *National Transportation Act* (Part V - relating to Mackenzie River and Western Arctic) continues to acknowledge that some economic regulation is necessary to ensure the viability of essential resupply operations. Consequently, this Act continues to provide for regulation of entry, capacity and area of service for the transport of resupply goods through licences for ships whose tonnage exceeds 50 tonnes. The tariff provisions relating to this area have been simplified. Tariffs have to be published in every community served and have to be adhered to. Tariff increases have to be published 30 days before becoming effective and the Agency is allowed to disallow or suspend a tariff or part thereof which it determines is unjust or unreasonable. In the Pacific and Atlantic waters, the basic form of economic regulation is ship registration.

ii) Review of Legislative Developments and Reforms After 1988 - *International Waters:* The five major developments after 1988 on *SCEA, 1987* were: A review by the Industry Advisory Group on *SCEA, 1987* in 1992, A review of the *National Transportation Act* by the NTARC in 1993, Report of the Standing Committee on Transport on the review of the NTARC in 1993, Transport Canada's Discussion Paper on SCEA in 1999, and Proposed Amendments to SCEA 1987 in 2000. These developments will be briefly examined hereafter.

a) The Report of the Industry Advisory Group (IAG): The IAG conducted hearings across Canada in their review of *SCEA, 1987*, during the months of September and November 1992. The major issues recurring through the majority of the submissions were: 1. Is there need for conference exemption from the *Competition Act?* and 2. What are the difficulties with the enforcement of *SCEA?*

b) Report of the National Transportation Act Review Commission (i.e. NTARC): In March 1993, the NTARC made three recommendations on conference liners together with a few proposals. The NTARC noted that the exemption runs counter to the general policy of encouraging competition. In principle, opposition was expressed regarding the intent of the *SCEA* as it is clearly in conflict with the competitive thrust of the *NTA, 1987*. The NTARC recommended that "the Minister of Transport introduce legislation to repeal SCEA at such time as United States antitrust immunity for shipping conferences is withdrawn." On the issue of multimodal rates, the NTARC recommended that "the Minister of Transport introduce amendments to section 5 of SCEA to permit shipping conferences to contract for and quote through freight rates for precarriage or onward land carriage." To encourage more carriers to set independent rates the NTARC recommended that "the federal Cabinet reduce to ten days the notice period for independent action by shipping conference members." The NTARC also listed a number of other proposals for considerations.

c) The Report of the Standing Committee on Transport: In June 1993, the Standing Committee on Transport commented on the recommendations of the NTARC. The Standing Committee agreed with two of the recommendations of the NTARC: to shorten the notice period to 10 days; and to permit intermodal contracts for 'through freight rates for precarriage or onward land carriage'. Regarding the NTARC's recommendation to repeal *SCEA* when the US does so, the Standing Committee did not accept the NTARC's recommendation and recommended that the matter be referred to the Standing Committee on Transport.

d) Transport Canada's Consultation Paper on the *Shipping Conferences Exemption Act*, 1987: In 1999, Transport Canada put forward four options in its consultation paper of possible amendments to SCEA. The options ranged from retaining the present status quo, to retaining antitrust immunity while adding provisions which could have a pro-competitive effect and could improve efficiency. The later option included providing for an end of tariff filing; electronic filing of documents; shorter notice period on independent action; mandatory individual service contracts; and a proposal to raise fines.

e) Amendments to SCEA 1987: In early 2001, a Bill is to be introduced in the House to amend SCEA 1987. It contained two basic competitive measures: the first is concerned with a reduction in the notice period before independent action could be taken to five days from fifteen days, and the second

involved mandatory individual service contracts. To enhance efficiency, conferences have no longer to file tariffs with the Agency, further conference documents can be filed electronically and tariffs can be obtained electronically from conference offices. Finally, to ensure compliance with this Act it was proposed that the fines were to be increased to $10, 000 from $1,000.

Domestic Waters: In domestic waters, the major reforms and legislative developments after 1988 were: the *Coasting Trade Act* in 1992, the Comuzzi Report in 1994, the SCOT Report in 1995, the *Pilotage Act* in 1998, the *Canada Marine Act* in 1998, and the Ministerial Review of Outstanding Pilotage Issues in 1999. These will be briefly summarized.

a) *Coasting Trade Act*: This Act came into force on December 1, 1992 and replaced Part X (sections 590-595) of the *Canada Shipping Act*. This Act restricts to Canadian ships the transport of cargo and passengers, along all commercial marine-related activities in Canadian waters. It also extends this restriction to the Canadian continental shelf for activities related to exploration and exploitation of non-living natural resources. This restriction, however, has waivers which permits the use of foreign ships in Canadian waters. A provision in the *Coasting Trade Act* that is a major change from the *Canada Shipping Act* is the reservation of this trade in the Atlantic only to Canadian ships (formerly Commonwealth ships were permitted).

b) Comuzzi Report: The Parliamentary Sub-Committee on the St. Lawrence Seaway prepared its report (referred to as the *Comuzzi* Report) and recommendations in October 1994. The Committee urged immediate and dramatic action to restore viability of the St. Lawrence Seaway. It made nine recommendations: 1) The creation of a self-financing Canada-U.S. binational agency to manage and operate the Great Lakes/St. Lawrence Seaway System, and the exemption of the system from the (U.S.) *Jones Act* and the *Coasting Trade Act*; 2); The replacement of the current toll system with a new harmonized cost recovery program similar to the U.S. ad valorem harbour maintenance tax based on tonnage; 3) A repeal of the *Pilotage Act, 1972* and provision of pilotage services of the new binational agency; 4) A change to the *Western Grain Transportation Act* to eliminate distortions in grain shipment patterns.; 5) An amendment of the *Coasting Trade Act* to incorporate a 14-day waiting period before the issuance of a licence to a foreign vessel; 6) An extension of the Sub-Committee's mandate to study Canada's ports and harbours; 7) An investigation of provincial and municipal costs borne by the Seaway and related facilities; 8) A re-imbursement of the Seaway Authority's expenses for operation and maintenance of the Valleyfield, St. Louis and

Mercier bridges and the Melocheville Tunnel; and 9) An initiation of a joint Canada-U.S. study on the feasibility of a cruise ship industry on the Great Lakes/St. Lawrence Seaway System.

c) SCOT Report on 'A National Marine Strategy': This Report examined: 1) the Canadian Ports System, 2) the provision of pilotage services, 3) the St. Lawrence Seaway, and 4) the Canadian Coast Guard.

On the Canadian Port System, the Standing Committee heard a great deal of criticism of the 'oversight' role of the Canada Ports Corporation (CPC) and concluded that a complete overhaul of the ports system was needed. This was to improve efficiency and competitiveness of the ports. The port policy was basically divided into one for commercial ports and another for non-commercial ports. Regarding the former, the Federal government would continue to have direct responsibility for a national ports system and CPC was to be dissolved. Regarding non-commercial ports, the Committee recommended the creation of a new ports desk/secretariat which would involve classification of ports into commercial and non-commercial.

On pilotage, the Report made a number of recommendations: 1) The new national marine transportation act will provide for the repeal of the *Pilotage Act* and the dissolution of the Pilotage Authorities. They would be replaced with a Pilotage Desk/Secretariat to regulate pilotage in Canada; 2) The new national marine transportation act will provide for the commercialization of pilotage services in Canada; 3) The new Pilotage Secretariat will undertake an immediate review of all compulsory pilotage areas to determine: the need for safety of navigation; protection of the environment; and development of a uniform set of criteria for exemptions; and, 4) The new national marine transportation act will make provision for a final offer selection mechanism for the settlement of all disputes between pilots and consumers.

On the St. Lawrence Seaway, the Report made a number of recommendations: The new national marine transportation act include provisions to: 1) discontinue the St. Lawrence Seaway Authority through repeal of the *St. Lawrence Seaway Authority Act*; 2) establish a financially self-sufficient, non-for-profit corporation to administer the Seaway, including the operation of locks, setting of tolls, and routine maintenance; 3) relieve the new operating corporation of all non-marine responsibilities such as bridges and tunnels; and 4) recognize that the federal government will be responsible for the capital costs of all non-routine maintenance and rehabilitation projects to maintain the safety and the integrity of the Seaway.

Regarding the Canadian Coast Guard, the Committee recognizing the

need for greater cost recovery and efficiency recommended that: "No national cost recovery program should be implemented until the Coast Guard has clearly examined its costs for services, the future levels required, and demonstrated it has its costs under control and down to the lowest-cost operation possible." It went on to make specific recommendations with regard to specific Coast Guard services.

d) *Pilotage Act*: A number of studies were undertaken to examine the problems in pilotage. In 1998, amendments were made to Part VII of the *Canadian Marine Act* relating to the *Pilotage Act*. The amendments which took effect in October pertain to: the appointment of members of the pilotage authority; a faster setting of tariffs; an end to appropriations by Parliament to cover losses except in emergencies; a provision for borrowing of money fixed by the Governor-in-Council; a dispute resolution mechanism; and a review of pilotage issues by the Minister of Transport within one year of coming into force of the Act.

e) *Canada Marine Act*: The *Canada Marine Act* received Royal Assent on June 11, 1988. The Act defines three categories of ports: Canada Port Authorities; regional and local ports; and remote ports. Part III of the Act establishes the new framework for the management of the St. Lawrence Seaway.

f) Ministerial Review of Outstanding Pilotage Issues: On November 15, 1999, the Ministerial Review of Outstanding Pilotage Issues submitted its report to the Minister of Transport. The Report made recommendations covering compulsory pilotage and designations, training and licensing requirements for pilots, the pilot certification process for masters and officers, dispute resolution mechanisms and the measures taken in respect of financial self-sufficiency and cost reduction.

D. Highway Transportation

Background: Highway transport in the early 1920s was regulated by the Provinces. Since 1954, jurisdiction over highway transport was divided between the federal and provincial governments as a result of a case brought before the Supreme Court which gave responsibility for extra-provincial highway transport to the federal government. However, regulatory control over highway transport continued to be exercised by the Provinces as Federal economic regulatory responsibilities for extra-provincial commercial highway traffic, have been delegated to the provinces since the passage of the *Motor*

Vehicle Transport Act in 1954.[1] Before regulatory reforms were introduced in 1987, economic regulation of highway transport was extensive. Economic regulation of highway passenger and traffic carriers covered: 1) Entry-Exit and Transfer Control; 2) Rate regulation; 3) Rate filing; and 4) Authority restrictions (i.e., restrictions on goods that can be carried, origin and destination and routes, etc.).

Highway transport in Canada includes private trucking, for-hire trucking, courier services, and busing (i.e., urban transport, intercity busing, and school buses). For-hire trucking services are usually classified into truck load (often referred to as TL) and less than truck load (often referred to as LTL). The for-hire segment is often further classified according to the type of freight carried - general freight, household goods, liquid bulk, dry bulk forest products and specialized freight. The intercity bus segment is often broken down into scheduled, charter and other (parcel). These various components for statistical purposes are demarcated using a financial criteria, in the past they were classified into Class I, Class II and Class III.

Regulatory Reforms

i) Reforms Before 1988

The first indication of regulatory reform in highway transportation resulted from a statement by the federal Minister of Transport on September 28, 1984 which indicated that his government in cooperation with provincial governments should "proceed towards the establishment of a uniform and scaled-down regulatory framework for the trucking industry." Shortly thereafter, on February 27, 1985 the Council of Transportation of Ministers signed a Memorandum of Understanding proposing changes related to entry, elimination of rates, exemption of commodities from economic regulation and streamlining the application process. Besides these specific proposals which were later reflected in the July 1985 Discussion Paper *Freedom to Move* of the Minister of Transport, general principles underlying regulatory reform of transport were also contained in it. These proposals were later embodied in Bill

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This Act is divided into three parts: Part I allows each province to licence extra-provincial bus undertakings; Part II of the Act allows each province to licence extra-provincial operations of extra-provincial truck undertakings; and Part III allows each province to licence extra-provincial truck undertakings involved in intra-provincial operations.

C-127 (*An Act Respecting Motor Vehicle Transport by Extra-Provincial Undertakings*) and Bill C-126 (*An Act Respecting National Transportation*).

The basic reforms relating to economic regulation introduced in the *Motor Vehicle Transport Act, 1987* (i.e., Bill C-127) were: 1) Relaxation of extra-provincial trucking regulation by easing market entry. (More specifically, beginning January 1, 1988, the current 'public convenience and necessity test' was to be replaced by a 'fitness' entry test and a 'reverse onus' public interest test. Further, on December 31, 1992 the public interest test was to expire); 2) Discontinuation of rate regulation; and 3) Restrictions on existing licences were to expire on January 1, 1993, for example extra-provincial licences were not to be limited to specific commodities or specific routes. The revised *Motor Vehicle Transport Act, 1987* (i.e., MVTA) left regulation of intra-provincial operations by extra-provincial truck undertakings (Part III of the MVTA) and regulation of busing (Part I) unchanged. At the provincial level, provinces also began to introduce regulatory reforms for intra-provincial carriers.

ii) Review of Legislative Developments and Reforms After 1988

The federal regulatory framework introduced in 1987 has been left intact for busing regulation though the residual regulation on intra-provincial trucking was removed. Impetus for these developments largely arose as a result of: the Agreement on Internal Trade in 1994, the Royal Commission on the National Passenger Transportation/National Transportation Act Review Commission/ Canadian Intercity Bus Task Force Study in 1992/1993/1996, MVTA Review Discussion Paper/Review of the *Motor Vehicle Transport Act* in 1997/1998, and Bill C-77 to amend the MVTA. These national and international trade initiatives which sought to remove obstacles to trade in transportation services will be briefly reviewed hereafter.

a) Agreement on Internal Trade: In the mid 1990s, the federal-provincial internal trade negotiations led to the Agreement on Internal Trade. According to the Agreement, all provinces agreed to deregulate intra-provincial trucking and the federal government agreed to repeal Part III of the MVTA through the *Agreement on Internal Trade Implementation Act.* The date for repeal was January 1, 1998, however, in response to requests from British Columbia and Québec, the Minister agreed to postpone the repeal to January 1, 2000. The federal-provincial internal trade negotiations, however, did not lead to any reforms in intercity busing. A number of reviews were undertaken on busing in the 1990s but no consensus was reached.

b) Royal Commission on the National Passenger Transportation/National Transportation Act Review Commission/Canadian Intercity Bus Task Force

Study: First, in 1992 the Royal Commission on the National Passenger Transportation was undertaken. It recommended deregulating the extra-provincial bus industry. Second, in 1993 the National Transportation Act Review Commission confirmed the general policy recommendation and recommended further effort to ensure national consistency in industry operational and safety standards. Third, in 1996 the Canadian Intercity Bus Task Force recommended deregulation of the charter bus industry and streamlining the regulatory requirements for scheduled bus service to eliminate or minimize most forms of economic regulation, other than entry control.

c) North American Free Trade Agreement (NAFTA): The NAFTA, an agreement to liberalize trade between Canada, Mexico and the United States, as it relates to trucking provides for graduated access by certain dates and access to 'all' Mexican states by US and Canadian carriers and provides for access to Canada and US by Mexican carriers in 2000. It also provides for ownership and investment in Mexican trucking companies providing international service upto 51 percent by the year 2001 and 100 percent by the year 2004. As a result, new market opportunities for Canadian motor carriers are being made available.

d) MVTA Review Discussion Paper/Review of the *Motor Vehicle Transport Act*: The above developments provided the impetus for further review. In 1996, Transport Canada after consultations with the provinces and industry released a MVTA Review Discussion Paper in April 1997. The Discussion Paper "proposed deregulating charter bus services and streamlining the regulatory requirements for scheduled bus service through amendments to the Act, followed by full deregulation after a two-year interval." A year later in February 1998, Transport Canada published its Position Paper "Review of the Motor Vehicle Transport Act" outlining proposed amendments to the *Motor Vehicle Transport Act*. The Position paper recommended the coming into force of the MVTA motor carrier safety performance assessment regime and bus deregulation on January 1, 2000. All extra-provincial motor carriers would then require a MVTA safety fitness certificate issued in a manner consistent with the provisions of the Act. The amendments would allow extra-provincial bus licences to continue in those provinces which retain them in addition to the MVTA safety fitness certificate. It would also provide for comprehensive review of the effect of the provisions in the fourth year.

e) Bill C-77: In light of the above, amendments to this Act (i.e., Bill C-77) were introduced by the Minister of Transport in the House of Commons on March 25, 1999. The amendments sought, over a two-year period to deregulate extra provincial and international bus services, while leaving the provinces and

territories the discretion as to whether to continue to regulate intra-provincial bus service during the transition period. The amendments were also designed to improve safety. The amendments were introduced because the current regulatory regime in which extra provincial bus carriers operate is becoming increasingly inconsistent and fragmented, and since a number of provinces and territories are prepared to abandon economic regulations. Further, deregulation through the MVTA framework was to ensure that extra provincial carriers are treated consistently. Furthermore, this deregulation by increasing competition will help the bus industry operate in a more efficient and productive manner. These amendments did not complete the legislative process prior to prorogation in September 1999. However, with regard to intra-provincial trucking "On August 26, 1999, the Governor in Council approved an order establishing January 1, 2000, as the date for repeal of Part III of the MVTA. As of this date, trucking is no longer subject to economic controls, such as economic entry controls and tariff regulations in any part of Canada."

In September 1999, the Minster of Transport "announced that, in the absence of consensus on the future of extra-provincial bus regulation in Canada, he would not proceed with the proposed amendments to deregulate the bus industry." Instead, he would refer the issue of bus regulation in Canada to a Parliamentary Committee for examination. On March 3, 2000, the Minister of Transport re-introduced amendments to the *Motor Vehicle Transport Act, 1987.* These amendments are basically concerned with the federal government's objective to promote safety.

CONCLUDING REMARKS

The last fifteen years of the previous millennium was an exciting period in the history of transportation reforms. The impact of regulatory changes in the mid 1980s began to unfold. It was a period that witnessed a major restructuring of government management of transportation through commercialization, privatization and decentralization. The new transportation acts and amendments of several transportation acts were a major achievement of the federal government.

In rail transportation, a review of the period 1988-96, reveals that the regulatory reforms in rail on competition achieved mixed success. Two that were popular among shippers and the railways were confidential contracting and interswitching together with a dispute resolution mechanism, (i.e., FOA). Success however was not achieved with respect to: extended interswitching, competitive line rates and running rights. After 1996, greater success has been

achieved with respect to the reforms to rationalize the railways through transfers. This has led to the growth of the shortlines.

In air transportation, the period between 1988-96 witnessed the simultaneous expansion, consolidation and reorganization of the air transport industry resulting from expansions, acquisitions, alliances and commercial agreements that were made possible by the removal of economic regulations. After 1996, the major achievement was the open skies agreement reached with the U.S. Several new services were initiated after the agreement. The domestic airline market structure in 1999 also changed dramatically with Air Canada's acquisition of Canadian Airlines International.

In water transportation, the years 1988-96 were not a particularly interesting for water transportation. If there were any noteworthy observations these were with regard to international waters. The pro-competitive measures introduced in SCEA 1987, independent action and service contracts, were not very successful. The period after 1996, proved to be more exciting for domestic water transportation as it witnessed commercialization of the St. Lawrence and decentralization of Ports.

In highway transportation, during the 1988-96 period, the major reforms that went into effect were the removal of the reverse onus test for extra-provincial trucking licences and the liberalization of trade in trucking services as a result of NAFTA. This witnessed a rationalization in the trucking industry through consolidation, mergers and acquisitions and a start of alliances of Canadian with US carriers.

Transport industries have undergone dramatic changes. Restructuring was accomplished by rationalization, mergers, acquisitions, cooperative agreements and alliances. Many of these changes were driven by technological developments and some by international developments such as globalization and liberalization of trade, besides regulatory reforms. Overall, it was a period of progress in which major achievements in transportation were accomplished. It has laid the foundation for significant progress and advancement in the new millennium.

***The views are those of the author and not necessarily those of the Competition Bureau.**

Planning a Transportation and Technology Museum: Concept and Market Analysis

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Introduction

This paper will present research undertaken as part of the creation of a business plan for a Transportation and Technology museum. The paper will focus on how planning the museum concept has occurred in conjunction with analysis of the potential market, or audience, for the museum. The market analysis is crucial for three basic reasons. First, the transportation community organizations and clubs that form the museum stakeholder groups are different from the core market for the museum. Second, declining government support for museums makes it necessary to maximize earned revenues. Third, in order to attract the level of government and corporate funding necessary to provide world-class programming, it must be able to attract visitors. The museum market will determine the type and size of building, its location, the number of artifacts to be displayed and the programming to be offered. Given the size of transportation artifacts, the difficulty moving them and the nature of collecting done by community groups, adapting museum collections, programs and services to the market poses some unique planning challenges.

Declining government support for culture has made museum groups much more conscious of the need to define their markets and develop programming suited to the interests and sophistication of visitors. The Transportation Heritage and Technology Centre will target three market segments (a) museum visitors, (b) transportation enthusiasts and (c) tourists. The paper will discuss the current markets for two

transportation museums in Winnipeg and compare them with the market for typical (history or art) museums.

The Concept

The Transportation Heritage and Technology Centre (THTC) will exhibit all modes of transportation and transmissions technology – including marine, road, air and rail transport, communications, pipelines and hydro technologies. The Centre's mission is to present transportation and transmissions technologies in their scientific, social and economic contexts and to communicate how they reflect Manitoba's history as one of Canada's historic transportation gateway regions. Currently there is no museum in Canada that treats transportation history and technology as an integrated concept.

Mandate: Statement of Core Topics and Purpose

The Transportation Heritage and Technology Centre will focus on interpreting transportation and transmissions artifacts in a regional (Manitoba) context. At the same time, local developments will be linked to global social and economic phenomena. The THTC will consider the effect of war, immigration and colonialism on the development and use of transportation systems and technologies. It will link transportation developments with historical land use patterns, exploring urbanization processes and the movement of people and goods between and within cities and regions. Finally, it will address issues related to transportation and transmissions infrastructures.

THTC programs will demonstrate how Manitoba's cultural and social diversity has been reflected in the history of transportation in Canada. Curators will interpret the history of transportation and technology in light of present and future possibilities. The THTC will undertake academic quality research on the history of transportation and transmissions technologies in Canada and provide a forum for public debate on scientific and historical issues related to transportation and transmission technologies and infrastructures. The museum will

communicate technological processes and evolution with the use of hands-on and interactive exhibits to make learning fun for children.

Stakeholders

The museum stakeholders reflect different interests and demographic backgrounds than typical museum audiences. The stakeholder group is composed of organizations and individuals with a special interest in transportation artifacts or activities. They are not necessary motivated by any particular interest in museums or history. A transportation connection or interest has motivated them to preserve artifacts. The groups that came together to found the THTC include local transportation museums, clubs, retiree groups and collectors. Most of the members of these groups work in, or have retired from, the transportation sector. Others are transportation hobbyists. These community organizations are grass roots, volunteer organizations that formed spontaneously to preserve artifacts relating to transportation history. None of the THTC members benefit from the support of a wealthy patron or substantial government support. None have professional museum expertise.

Community group collecting is indiscriminate and antiquarian – it tends be governed by the assumption that "anything old is valuable". The large size of transportation artifacts and the difficulty moving them makes collecting every type of plane, train, boat or vehicle impossible. The costs would be prohibitive. Even with government support, operating costs would exceed the Winnipeg market's ability to sustain them. Consequently the THTC has decided to adapt its collections in a way that best reflects the history of transportation as laid out in the museum's mission and mandate. It will plan programming around the interests and expectations of the museum audience. These two steps represent progress in the evolution from an association of community, volunteer-run organizations, to a professionally run and of world-class museum.

Situation Analysis - External

Trends favourable to museum development are the growth in tourism, the retiring baby boom phenomenon, increasing levels of educational attainment in the Canadian population and the increasing significance of technological "literacy" to the Canadian economy. The national and international growth of tourism provides an opportunity for increasing attendance of tourists that conform to the profile of museum visitors. The increasing importance of technological education and technological skills in the global economy represents an opportunity for the museum to extend its reach into segments of the population that do not fit the profile of the usual museum goer. Arguably, the outlook is particularly advantageous for the THTC, given its modern and relevant subject matter. Retiring baby boomers looking for safe and age-appropriate leisure activities while traveling will be a prime target market.

Two factors will pose some fundamental challenges to the THTC. First, population growth in Manitoba is occurring within the Aboriginal segment of the population. Aboriginal people generally do not fit the profile of the usual museum visitor. The second and most significant challenge is related to the steady decline in the level of government funding for culture since the 1980s.

The five factors crucial to the THTC's success will be its ability to achieve world-class museum standards, to maintain local community support, to attract tourists, to adapt to a changing demographic environment and to maximize earned revenues in the context of declining government support for culture.

Tourism Growth

The local community will provide the Centre with its core audience but growth will occur in the tourist sector. In Canada, tourism expenditures grew 5.3 percent between 1996 and 1997[1] and 7 percent between 1997 and 1998.[2] Even in Winnipeg, the number of tourists increased at an average annual rate of 4 percent between 1994 and

1998. Canadian tourism is expected to continue to grow by 5 percent per year until 2010. As a result, demand for cultural tourism, including visits to museums, art galleries, historical sites and national parks, is expected to continue to rise in the 21st century.[3] The fact that Winnipeg tourism is not growing at as high a rate as the rest of Canada means that the local population will have to provide the THTC's core audience base. At the same time though, a 4 percent growth in Winnipeg tourism is a healthy enough base to increase tourist admissions to the museum. Furthermore, the baby-boom phenomenon is likely to add to tourism growth. Starting in 2001, baby boomers will begin retiring, producing the "greatest surge of older travelers on the Canadian travel market."[4] These travelers are highly likely to visit a museum during their trip.

Technological Literacy

The increasing emphasis that both governments and business are putting on technological literacy is advantageous for the THTC. In recent years, the Government of Manitoba and the City of Winnipeg have expressed concern about the technological literacy of the Manitoba population, especially of school age children.[5] The THTC by providing hands-on, interactive exhibits and educational programming designed for school age children and teenagers will be able to stimulate interest in technology. The technological focus of the Centre will help students understand their world and might encourage young children to start to think about careers in fields related to transportation and applied science and technology. At the same time, the THTC can be a valuable resource to instruct engineering students and trades-people on the historical and social context that gave rise to the development of particular technologies.

Shifting Canadian Demographics

The socio-demographic trends that will have significant impact on the THTC's attendance are the aging baby boomers, a large and economically significant segment, the growing ethnic diversity of the Canadian population and changing family structures. Aging baby

boomers are an enormous opportunity for all museums. Many baby boomers are well educated, have high incomes, even in retirement, and have considerable leisure time to travel and attend cultural events. First wave baby boomers have just started to retire. Baby boomers will provide a significant audience segment for the THTC for the next 25 years.

On the other hand, the nature of population growth, especially in Manitoba, is occurring amongst aboriginal peoples. Aboriginal people represent only 3% of the Canadian population. Yet they represent 12% of Manitoba's population and almost 7% of Winnipeg's.[6] In 1996 Manitoba's aboriginal population accounted for 15.4% and 9% of the Manitoba and Winnipeg's population between the ages of 15 and 24. As significant segment of the population, aboriginal people could be an important future target market for the THTCC. Attracting them, however, is likely to be a major challenge given that they are not well represented in museum audiences and do not, as a group, fit the other demographic characteristics defining the museum-going population, middle class, university-educated and professional. Although the THTC will have to provide museum programs that reflect the importance of aboriginal peoples to the history of Manitoba, they will not form a significant market for the museum unless the social conditions in which they live alter drastically in the future.

Families form the core audience of any museum. For example, 80 percent of Smithsonian visitors are composed of adults with elementary school aged children.[7] Families on vacation tend to be more active and are more likely to visit a museum or zoo, than adults traveling alone.[8] The changing demographic of Canadian families will impact the THTC. The proportion of single parent families is increasing.[9] Baby boomers have moved into the "empty nest" stage of life. Canadians are having fewer children. The proportion of people living alone has risen[10] and people who do get married are doing so later.[11]

Families will remain the museum's core audience. Nonetheless, in order to adapt to late marriage and declining fertility rates, the THTC will have to diversify its audience base to include single people, teenagers and young adults without children, segments that are currently under-represented in museum populations. Baby boomers who attend with children (grand children) will look for different activities and programming than those who come alone or with their spouses. Single parents might benefit from a daycare at the museum. Lower fertility rates, later marriage and increasing divorce rates will mean that family visits to the museum will be headed by older parents or grand-parents, tourist families will more likely come from areas closest to Winnipeg as the logistics of juggling children from mixed-marriage families makes travel more difficult.

Steady Decline in Government Support for Culture

Museums preserve and collect artifacts for "future generations". The fact that future generations do not exist to influence the market, means that the current generation has to subsidize museum activities, especially the ones related to preservation. At the same time, museums undertake educational and cultural activities that have traditionally been, and still are, considered a public good for the current population. These arguments have always been used as the rationale for public subsidies. Although the positive benefits generated by museums are difficult to measure,[12] it is clear that museums cannot thrive without public funding. Even the most successful museums are not self-sustaining. No major museum in Canada is able to charge visitors the full cost of providing service.[13]

In fact museums in Canada and Britain especially, but also in the United States have only started to introduce admissions fees in the past 15 years, mainly as a means to cope with declining government funding. As a result heritage institutions (including museums, public archives, historic parks, botanical gardens, planetariums, zoos, aquariums etc.) have had to increase revenues through admissions and private support. People are willing to pay. In Canada, museum attendance declined only slightly with the introduction of admissions

fees.[14] In fact, heritage institutions increased their earned revenues by 17 percent. In Canada, between 1990-91 and 1995-6 total government spending on culture fell about 5 percent.[15]

Private support for museums is unlikely to ever compensate for government cuts. Private sector support, including donations by foundations, corporations or individuals accounted for only 8 percent of operating expenses of heritage institutions in the period between 1991 and 1996. Between 1992-4, private sector funding for museums, from corporations, foundations, individuals and "friends" organizations fell 10 percent, though that was still 13 percent higher than it had been 4 years earlier.[16]

The THTC will have to obtain government funding in order to be viable. At the same time, a focus on earning as much as possible from admissions fees and other revenue generating activities will not only help defer costs but will provide an indicator of the extent to which the museum is meeting the needs of its visitors.[17]

Museum Audiences

Museum audiences are composed of predictable demographic and psychographic segments that are similar for both tourist and local visitors. The most significant predictor of museum attendance is level of education.[18] Increasing levels of educational attainment within the Canadian population is an opportunity for all museums to increase attendance. The "typical" museum visitor has the following characteristics.

- Museum-goers value learning, seek the challenge of exploring and discovering new things and place a high value on doing something worthwhile in their leisure time.
- They are active people who like to spend their leisure time outside of the home.
- Museum visitation is a social activity – people generally go with either friends or family.
- Demographically, museum visitors are typically:

- University educated (50 percent of a typical museum's audience)
- High-income earners (household incomes of $60,000-$80,000) over-represented in museum visiting populations
- Employed in the professions or management (40 percent)
- Families with elementary school age children. Most visitors thus fall into two age groups – children aged 5 to 12 years and adults from 25 to 44.[19]

Transportation Museum Audiences

The THTC's audience* will correspond to the demographic profile of the typical museum visitor. Unlike other museums the THTC audience will also contain transportation hobbyists, technology enthusiasts and transportation workers. They currently represent 22 percent of the Western Canada Aviation Museum's audience and 25 percent of the Winnipeg Rail Museum's. Transportation workers and managers will form the THTC's core membership base. Transportation hobbyists – model builders, automobile, railroad or aviation buffs will also provide a solid base of support for the THTC. The THTC, unlike other museums, will focus on issues and material culture that are of significance to trades-people. It will also provide a milieu for people interested in fixing and restoring machinery.

Gender Bias

Most museums attract as many women as men. The Winnipeg Rail Museum and the Western Canada Aviation Museum attract twice as many men as women. At the WCAM, the gender bias is even apparent in the child visitors, indicating that men choose to take their boys to the aviation museum. The THTC will have to correct the gender bias if it is to take full advantage of opportunities presented by tourists, especially cultural tourists that are more likely to be women.

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* This section is based on results of a survey done at the Winnipeg Rail Museum and the Western Canada Aviation museum in the late summer of 2000. N = 324.

In order to ameliorate the gender bias, the THTC will offer programming that puts transportation in its historical and social context, rather than focusing solely on the evolution of technology.

Winnipeg Tourism

Geographically, the THTC's audience will be composed of a core audience of local Winnipeggers and an initially secondary, but increasingly significant tourist component. Given the slow or stagnant growth of Winnipeg's population and the growth and increasing significance of tourism in Canada, THTC audience growth will occur within the tourist segment.[20] Initially tourists will compose approximately one third of the audience, by year 15 of operations they could account for nearly 50 percent of the THTC visitors.

Tourists are an important target market for museums because an important subset – the cultural traveler – has the same demographic characteristics as a typical museum visitor. Cultural travelers differ from other tourists in that they travel greater distances, stay longer and spend more per trip than other leisure travelers.[21]

The following table shows the number of tourists to Winnipeg in 1998, broken down by trip purpose. THTC will target leisure and pleasure tourists.

Table 1: Winnipeg Tourists 1998, by Trip Purpose

Pleasure	715,000	29%
Business	423,000	17%
Visit Friends and Relatives	731,000	30%
Other Personal	594,000	24%
Total	2,463,000	100%

The THTC's geographic target markets will reflect the composition and significance of Winnipeg tourism. 55 percent of the tourists coming to Winnipeg are from other parts of Manitoba. The next most important source market for Winnipeg is from the mid-west United

States. The tourists to target will be the ones coming to Winnipeg either for leisure or to visit friends and relatives.

Overseas travelers are also important even though they account for only 2 percent of Winnipeg's tourists.[22] They are more likely than other travelers to attend a cultural event, mainly because their visits tend to be longer.[23] In 1997, 27 percent of all international travelers visited a zoo, museum or natural display. Overseas international travelers visited at a rate of 42 percent compared to 22 percent of U.S. travelers[24] and 12 percent of all leisure travelers in Canada.[25]

The THTC will work to attract overseas travelers that are already visiting Winnipeg for some other purpose. Manitoba and Saskatchewan together get only 3 percent of Canada's overseas travelers.[26] It would not be cost effective to actively market overseas, partly because of the difficulty predicting that particular market. Since 1991, the overseas travel market has fluctuated widely, depending on the economic situation (relative value of their currency, the amount of discretionary income in the source country etc.) and global politics.[27]

Annual Admissions Scenarios

As the core of the THTC's audience will be local, community support will be crucial in its early years. THTC has estimated its audience to be about 250,000 in the fifth year of operations. This estimate is close to the admissions figures the Museum of Man and Nature currently attains and it conforms to the size of Winnipeg's local and tourist populations.

Given the slow or stagnant growth in Winnipeg's population, tourists will be the basis for the THTC's audience growth. In 1998 Winnipeg had a total of 1,446,000 tourists visiting for leisure or to see friends and relatives.[28] Heritage attractions are rarely stated as the reason for a tourist's visit to Winnipeg but people who come to the city for other reasons will attend a museum or other cultural establishment. In a 1995 provincial survey, 17 percent of air and 13 percent of highway

travelers from outside of the province indicated that they had been to a museum during their stay in Winnipeg.[29] The following section shows the assumptions behind best, worst and average case scenarios for THTC attendance.

Scenario 1: Best Case

THTC could have a total of 384,600 admissions per year initially, rising to 475,538 visits by year 15 of operations. This is an optimistic but possible estimate, based on the following assumptions:

- One in five people in North America will be regular museum goers. In a population of 600,000 people there should be 120,000 will be regular museum goers. Each will attend the THTC twice a year, generating 240,000 resident visits per year.
- Estimating that 6.5 percent[30] of Winnipeg's leisure tourists and those visiting friends and relatives will attend the Centre, tourists could account for 93,990 visits per year.
- Estimating a 5 percent growth rate per year – tourist visitation would rise by 7,230 visits in year 6 of operation and by 11,216 in year 15. (5 percent of 144,600). Assuming a constant 5 percent growth rate from years 6 to 15 of operation, THTC tourist visits could rise to a total of 235,538 per year.
- No "draw" factor has been incorporated. Yet if the THTC succeeds in achieving its vision as a unique and world-class transportation centre, tourists could come to Winnipeg for the sole purpose of visiting the THTC.

Scenario 2: Worst Case Scenario

A worst case scenario would be total visits of 172,469 in year 15 of operation. The worst case estimate would include 120,000 local visits per year and 39,042 tourist visitors in year 5 of operations tourist visits, with 3 percent tourist growth in years 6 to 15 of operation. The assumptions behind the worst case scenario are:

- Local visits of 120,000 per year based on regular museum goers attend THTC only once per year.

- Tourist visitation based on Statistics Canada findings that 15 percent of all leisure travelers are culture travelers and 18 percent of them will visit a museum.[31] The 39,042 projected visits was generated by taking 15 percent of the total number of Winnipeg's VFR and leisure tourists and then taking the 18 percent of that 15 percent.[32]
- Tourism growth estimated at only 3 percent per year

Scenario 3: Average Case Scenario

The average case scenario for THTC admissions is 249,177 admissions by year 5 of operations. The target figure will be rounded up to 250,000. THTC's vibrant, modern and diverse interpretive content is likely to attract visitors. Science and technology Centre admissions have been rising while natural and human history museum admissions have been declining. Science and technology museums earn higher proportions of their revenue than do other types of museums because they are able to attract more visitors.[33]

The THTC's ability to adapt programs and services to the changing demographic environment and to deliver them in the context of declining government support for culture will be essential. The Centre's ability to deliver broad-based programming will, nonetheless, depend to some extent on its ability to obtain public support.

Conclusions

Analysis of the potential market is driving planning for the Transportation Heritage and Technology Centre. Within the Winnipeg market the THTC will be able to attract between 200,000 and 300,000 visitors per year. While this is a respectable attendance rate, it is not sufficient to sustain a huge building – the size the might be required if the THTC were to commit to collecting, researching and displaying all significant artifacts related to transportation and transmissions technologies.

[8] Shaienks, "The Changing....", p. 5.
[9]Ibid., p.1.
[10]It was 13.4 percent in 1981, 15.8 percent in 1996. *Ibid.*, p. 1
[11] In 1981 women first married, on average, at age 23.5. Men married at 25.7. In 1996 women were marrying at 27.3 years and men at 29.3. Shaienks, "The Changing....", p. 3.
[12] Peter Johnson and Barry Thomas, "The Economics of Museums: A Research Perspective" in *Journal of Cultural Economics*, #22, 1998, p. 75-85.
[13]The Council for Business and the Arts in Canada, *CBAC Annual Survey of Public Museums & Art Galleries 1997-1998* provides a breakdown of expenses to revenues for 46 major museums in Canada. A quick calculation of CBAC's figures (expenses / number of visitors) for those 46 museums produced an average cost per visitor of $20.
[14]Erika Dugas, "Admission Revenues Rising for Heritage Institutions" in *Focus on Culture*, Winter 1995, p. 5.
[15] Durand, "The 1990's....", p. 1-3.
[16] Durand, "The 1990s....", p. 2.
[17]Visitor amenities are significant means for museums to earn revenues. Visitors will spend as much money on gift shop and restaurant purchases as on admissions. Robert Kelly, UBC and Statistics Canada. "The Cultural Tourist – Friend or Foe?" in *Focus on Culture*, Winter 1994, p. 1-2. This study of tourists at British Columbia museums found that nearly 1/3 of them did not go into the exhibit spaces of the museum.
[18]Another significant indicator is art education. Neil Kotler and Philip Kotler, *Museum Strategy and Marketing: Designing Missions, Building Audiences, Generating Revenue and Resources* (Jossey-Bass Publishers, San Francisco, 1998), p. 117.
[19] John Falk, "Visitors: Who Does, Who Doesn't and Why?" *Museum News*, Mar/April 1998, p.38-43. The average age of adult museum visitors (38 years) is increasing as baby boomers get older and people have children later.
[20]Given the significance of technical education in the new economy, there is the potential for museum audience growth even if the

population remains stagnant. Nonetheless, we have not included such growth in current calculations.

[21]*Laurie McDougall, Statistics Canada. "A Close-up of Culture/*Heritage Travel in Canada", *Focus on Culture*, Summer, Vol. 10, #2, 1998, p.5.

[22]In 1996 U.S. visitors composed 12.2 percent of all tourists to Winnipeg. The highest proportion of U.S. tourists to Winnipeg come from North Dakota and Minnesota, 3.2 percent and 3.3 percent respectively. The main catchment area for Winnipeg would include the U.S. northern mid-west, including Kansas, Wisconsin, Michigan, South Dakota and Illinois. Winnipeg Tourism, *1996 Winnipeg Visitor Profile.*

[23] Ruth Martin, Statistics Canada. "Time for Travel, Time for Culture: Attendance at Cultural Events by Canadian Travellers, 1992" in *Focus on Culture*, Spring 1995, p. 4.

[24] Statistics Canada, "...*Statistical Digest*", p. 34.

[25] McDougall, "A Close-up...." p. 6.

[26] Statistics Canada, "... *Statistical Digest*", p. 35.

[27]Monique Berouti, "Overview of International Travel" in *Travel-log*, Statistics Canada, Summer 2000, p.1-3.

[28]Tourism Winnipeg, *Profile of Visitors to Winnipeg, 1998.* The *Profile* is based on Statistics Canada's *Cities* Profiles.

[29]Health, Leisure and Human Performance Research Institute, University of Manitoba, Tourism Winnipeg, Manitoba Industry, Trade and Tourism and Canadian Heritage. "Travel Report: No.2" from *1995 Manitoba Tourist Exit Survey* (MTES), Table 2.

[30]This assumption uses the Manitoba Exit Survey results that 13 percent of highway travelers visited a museum. Assuming that half will visit some other museum, 6.5 percent of them will visit the THTC.

[31]McDougall, "A Close-up...." p. 6.

[32]Leisure and VFR tourists to Winnipeg number 1,446,000 *.15 (.18) = 39,042

[33]Neil Kotler and Philip Kotler, *Museum Strategy and Marketing: Designing Missions, Building Audiences, Generating Revenue and Resources* (Jossey-Bass Publishers, San Francisco, 1998).

The Evolution of Airlines in Canada with Emphasis on the Competition Bureau's Role in the Restructuring of the Airline Industry

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I. Introduction

The year 1999 was a year of dramatic change for the airlines. Never in Canadian history has there been so much written on the airlines. The newspapers were inundated daily with news on the sale of Canadian Airlines International Ltd. from late August to the end of December. In early March, the Jacques Kavafian report drew attention to the potential crisis at Canadian Airlines. The three earlier attempts by Canadian Airlines to restructure had ended in failure. Its quarterly losses of several millions and losses for several years, its past mistakes, its over capacity on domestic routes, and the inadequacy of its earnings on domestic operations appears to have forced Canadian to throw in the towel in the competitive struggle. Political intervention increased to such a visible extent as to make it highly controversial. Initially, no one was certain of the extent of secrecy that surrounded some of the negotiations long before the public or the competition authorities were aware of it. If one envisioned political manoeuvres as occurring only when dealing with bilateral agreements on routes, this experience changed that view. The developments that occurred also resulted in a major setback to the deregulatory process. There was an increase in regulations and a decrease in the powers of the Competition Bureau. The restructuring that finally occurred together with the measures by the government to alleviate the subsequent problems from the creation of a dominant carrier have yet to convince everyone that the industry has been returned to its former competitive state. In this paper, we shall review the evolution of airlines in Canada and emphasize the role of the Competition Bureau in the recent acquisition of Canadian Airlines by Air Canada.

II. The Evolution of the Airlines in Canada

Interest in aviation in Canada began with air ballooning whose earliest recorded experiment took place in 1837. It was not until February 23, 1909 that the first flight by a powered heavier-than-air machine took place at Baddeck, Nova Scotia. A few years later, during the First World War, sustained interest in aviation began with the production of the Curtiss JN-4 for military training and flying. Post war activity witnessed the beginning of commercial activity[1] and the year 1919 marked the beginning of government involvement. During that year, the Canadian Government passed the *Air Board Act*[2] in response to the need for safety standards. The decade that followed witnessed a gradual shift of control of aviation to the Federal Government.

Shortly thereafter in 1936, a watershed year for civil aviation, the Government asserted its authority through a massive reorganization resulting in the creation of the Department of Transport. This Department assumed responsibility for Canada's non-military flying, and the implementation of air regulations under the 1927 *Aeronautics Act* (which replaced the *Air Board Act*). The beginning of World War II, led to the decline in commercial activity and an increase in military activity due to the restrictions imposed under the *War Measures Act*. At this stage, other important developments occurred, the Air Transport Board was created (empowering it to regulate the economic aspects of commercial aviation such as control of entry, route allocation, investigation of rate and tariff complaints) and Canada's national airlines were formed. These developments will be examined under two separate periods: the era of economic regulation of the airlines; and the era of deregulation,

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1 Most of this activity was directed to exploring and developing Canada's North. Some of the earliest airline companies involved in this activity in part were Laurentide Air Services, Western Canada Airways, British Columbia Airways, Patricia Airways, Fairchild Air Transport Limited, etc.

2 This 1919 Act provided for the establishment of the Air Board and empowered it to control all flying in Canada and to implement the International Convention on Air Navigation. A year later, the Canadian Air Force (later called the Royal Canadian Air Force) was created, and in 1923 the Department of National Defence took over the responsibility for aviation and the Air Board ceased to exist.

competition and monopoly. The structural characteristics of the airlines in each of these periods will be first described followed by the regulatory tenets and policy that conditioned that structure.

The era of economic regulation of the airlines (1937-1983): Before the establishment of the national airlines, the extent of economic regulation was rather limited. As indicated above, it was basically designed in response to the need for safety standards. The structure of the industry before this period was characterized by numerous local air carriers such as Canadian Transcontinental Airways, Western Canada Airways, Canadian Airways, British Columbia Airways, Fairchild Air Transport Limited, Brooks Airways, United Air Transport, General Airways, Mackenzie Air Services, Arrow Airways, etc. Many of these carriers formed the beginnings of the national and regional carriers.

Canada's first national airline, Trans-Canada Airlines (i.e., TCA) was formed as a result of an agreement between the federal government and the Canadian National Railways, one of the major achievements of Canada's first Transport Minister, the Honourable C. D. Howe. This agreement led to the enactment of the *Trans Canada Airlines Act* in 1937, which provided for the creation and the preservation of a virtual monopoly for TCA in transcontinental domestic and international areas of operation. In addition, certain airmail contracts were to be awarded only to TCA. In 1964, TCA was renamed Air Canada (i.e., AC) and the original structure of AC remained unchanged till 1979 when it acquired Nordair, a regional carrier. A few years after TCA was formed, Canada's second national airline, the United Air Services Ltd. was created in 1941 by Canadian Pacific Railways through an amalgamation of eleven aircraft operations.[3] A year later, the airline was called Canadian Pacific Air Lines (i.e, CPAL).

Besides the national carriers, Canada's other regular airline services were provided by the regional and local carriers. Canada's four regional carriers were: Pacific Western Airlines, Nordair, Quebecair and Eastern Provincial Airways (i.e., EPA). 1) Pacific Western Airlines' origin can be traced to Central B.C. Airways which was formed in 1946. The name PWA

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3 These carriers were: Canadian Airways, Brooks Airways, United Air Transport, Ginger Coote Airways, General Airways, Mackenzie Air Services, Wings, Dominion Skyways, Prairie Airways, Starrat Airways, and Arrow Airways.

came into existence later after the amalgamation of five carriers.[4] In the mid 1950s, PWA acquired Associated Airways and in 1979 it acquired Transair Canada (formed from Central Northern Airways and Arctic Wings) and Midwest Airlines. 2) Nordair was formed in 1957 from the amalgamation of Mont Laurier Aviation, Boreal Airways and Nordair. It later acquired Wheeler Heavy Transport Division. 3) Quebecair was established in the mid 1950s from four carriers some of these carriers operated as early as 1945.[5] 4) Eastern Provincial Airways was created in 1949. In the 1960s, its operations were amalgamated with Maritime Central Airways. Besides these regional carriers, there were local and charter carriers. This structure of Canadian airlines before deregulation was largely shaped by government policy and so was the extent of any competition. Hereafter, the evolution of the policy which governed the limited competition is reviewed.

The *Trans Canada Airlines Act* initially embodied the Government policy towards competition by virtually preserving the transcontinental and international routes for the national carrier, TCA. It was not until 1948 that the government decided to give CPAL, the right to carry the Canadian flag in the Pacific and to represent the nation as its chosen instrument in that half of the world. However, the domestic transcontinental routes continued to be reserved for TCA. It was not until May 1959, that CPAL was granted the right of one transcontinental flight between Vancouver, Toronto and Montreal reflecting the protectionist policy of the Government. The reasons for its justification were: limited market size, adverse financial impact on the Crown carrier (TCA), and the requirement to serve non-viable markets.

After this period, the Government issued various policy statements between 1959 and 1983. These statements can be grouped under three basic headings: 1) International scheduled passenger policy, 2) Domestic scheduled passenger policy, and 3) International and domestic passenger charter policy. These groups are reviewed.

1) International scheduled passenger policy: International scheduled

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4 These carriers were: Central B.C. Airways, Associated Air Taxi, Queen Charlotte Airways, Kamloops Air Service, Skeena Air Transport and Whitehorse Flying Service.

5 These carriers were: Le Syndicat d'aviation, Rimouski Airlines, Gulf Aviation and in part Matane Air Services.

service was not to be competitive or the policy was not to be in conflict. This continued the policy of the past. A year later in 1965, the Minister of Transport, the Honourable J. W. Pickersgill announced a policy giving effect to the earlier statement whereby international routes would be geographically divided. AC was to serve: U.K., Europe (Western, Northern, and Eastern) and the Caribbean; and CPAL was to serve: the Pacific area, Asia, Australia, New Zealand, Southern and South Eastern Europe and Latin America. It would also continue to serve the Netherlands. Further, Africa was not yet allotted to any of the carriers as there was no interest in serving this continent. Finally, bilateral negotiations were underway regarding how the U.S. should be further divided. Ten months later, AC was awarded the right to serve Miami from Toronto and Montreal, Chicago from Montreal, and LA from Toronto; and CPAL was designated to serve the Vancouver-San Francisco market.

On May 8, 1973 a major bilateral agreement was signed between US and Canada, and on May 8, 1974 an international bilateral package of three agreements was signed between External Affairs Minister Mitchell Sharp, Transport Minister Jean Marchand and the United States Ambassador to Canada William Porter. On August 1, 1974, the Minister of Transport, the Honourable Jean Marchand awarded the rights agreed to in the agreement: 14 to AC and 1 each to CP Air, Nordair and Pacific Western Airlines.

2) Domestic scheduled passenger policy: The domestic scheduled policy regarding the national carriers continued to protect the financial viability of TCA. CPAL, now called CP Air, was gradually allowed to increase its presence in the transcontinental market. By 1967, it was allowed to increase its market share to 25 percent of total seat miles on transcontinental flights. This percentage was increased to 35 percent in 1978 and then raised to 45 percent in 1979. Later that year, all restrictions were removed and CP Air was allowed to fully compete with AC.

Regarding the application of domestic scheduled policy to other carriers, the 1964 policy briefly dealt with the regional air carriers ensuring that their role did not conflict with the transcontinental carriers. A couple of years later, the Minister of Transport, issued a statement on the principles for regional carriers. Regional carriers were to provide regular route operations into the north and were to operate regional routes to supplement the domestic mainline operations of the two transcontinental carriers. Greater opportunity was to be provided to regional carriers in the development of routes together with the possibility of limited subsidies. In 1969,Transport Minister, the Honourable Don Jamieson further elaborated on the policy for regional carriers. He indicated that they were not to become directly competitive on any

substantial scale with the two mainline carriers. In addition, the geographical areas in which the five regional carriers were to operate was defined. On August 14, 1981, Transport Minister Jean-Luc Pepin released a proposed policy defining the future role of Canada's national, regional and local air carriers.

3) International and domestic passenger charter policy: International charters attracted the attention of the government as early as November 23 , 1973 and on May 8, 1974 it signed a new air charter agreement with the U.S. The new liberal agreement included a formula permitting U.S. carriers having charter rights to share with Canadian carriers in the Canadian originating markets to the U.S. From April 1, 1978, U.S. carriers would be entitled to operate 25 percent of the forecasted charter seats from Canada to Hawaii and Florida and 40 percent of the forecasted charter seats from Canada to California, Arizona, Nevada, Puerto Rico and U.S. Virgin Island. This agreement created the opportunity for competition not only between the domestic charter and scheduled carriers but also between these carriers and U.S. carriers.

One of the major characteristics of Canadian international and domestic charter policy was the lack of a definitive policy or more accurately a policy that was largely developed via regulation. It was not that the government did not make an attempt. In August 1977, the Minister of Transport, the Honourable Otto Lang, released a discussion paper on *International Passenger Charter Policy*. The paper continued to reflect the old protectionist policy of capacity control, frequency control, load control and the possibility of the Air Transport Committee stepping in if the free play of market forces proved to be too strong for scheduled operators. Wardair and the regional carriers while praising the Ministers effort, were critical of the proposed policy together with the argument that it would lead to diversion of traffic and dilution of revenue of the scheduled carriers. In the meanwhile, Laker Airways, a international charter carrier, entered the market having a resounding effect on the industry; further, competition between the charter carriers and scheduled carriers became quite intense. However, the Air Transport Committee did not share the same concern over what was happening in the marketplace. In addition, the numerous deep discount fares offered by the skeds to compete with the charters led to a confusing maze of fares and attempts to get around the regulations.

On September 5, 1978, Department of Transport released a statement by the Minister of Transport, Otto Lang on the International Air Charter Policy. The main objective of this policy statement was to promote a mix of

charter and scheduled air service that would meet the needs of all segments of the travelling public. In this brief summary, we shall not attempt to describe all the events that occurred before the announcement of this policy or what occurred afterwards as it can be found elsewhere. But stated summarily, a hole had sprung in the dike which would ultimately lead to a destruction of economic regulation of air transportation.

Towards the end of this period, there was considerable dissatisfaction with the state of airline regulation. The annual volume of passenger traffic was stagnant, the travel trade deficit rose to a staggering $1.1 billion by 1976 and there was a distortion in traffic together with an increasing demand for low cost air travel.

The era of deregulation, competition and monopoly (1984-1999): The period of defacto deregulation brought about a change in the structure of the airline industry. The concept of 'hub and spoke' replaced the well defined role of national, regional and local carriers with a structure involving 'networks' and 'alliances'. We shall first briefly describe some of the structural developments and competition that occurred todate followed by the government policy that shaped it.

The most prominent development that occurred until the late 1999s was the creation of two large carrier families headed by AC and Canadian Airlines International (CAI). These families evolved through a series of acquisitions, mergers, and alliances from coast to coast to produce two fully-competitive networks. How these families evolved is described hereafter.

In the early 1980s, the only subsidiary of Air Canada was Nordair. By 1999, AC's family included a number affiliates. These were: Air Nova, Air Alliance, Air Ontario, Air BC and NWT Air. These affiliates ensured its presence in Atlantic Canada, Québec, Southern Ontario, Central and Western Canada and the North West Territories, respectively. The second family, headed by CAI was formed from an acquisition of CPAL by Pacific Western Airlines. Before CAI was formed, interests in several other airlines were obtained by the two acquired carriers. This, together with other acquisitions and internal restructuring led to the formation of its affiliates: Air Atlantic, Inter Canadien, Canadian Regional and Calm Air. This ensured a presence of CAI in the whole of Canada similar to that of its competitor.

Besides the two large families of carriers, there are independent carriers and charter carriers. The independents filled in the some of the small niche markets and the charter carriers basically concentrated in certain domestic and international markets. The charter carriers have also witnessed its share of turbulence. Carriers that were well known names such as Wardair

and Nationair no longer exist. The major charter carriers are now Air Transat, Canada 3000, and Royal Airlines.

The first few years following relaxation of regulatory constraints in the early 1980s witnessed intense competition, expansion of service and consolidation in the industry. Air Canada's long standing dominance was eroded substantially by 1988. In October 1988, the government sold 45 percent of Air Canada to the public, the remaining to be sold later. The Gulf War, the recession of 1991-2, and the costly fight for market share had a severe impact on the two major carriers. In 1991, PWA announced a loss of over $160 million and attempted to negotiate an alliance with American Airlines but failed. In October of that year, it signed a pre-merger agreement with Air Canada but the agreement failed to receive approval by Air Canada's board of directors. It subsequently returned to negotiations with American Airlines and continued to operate on a $50 million loan from the Federal Government and other loans. Later in December 1991, it reached an agreement with American Airlines. In 1999, CAI once again encountered severe financial difficulties which led to its acquisition by Air Canada. This will be described in the next section.

In addition, to the intense competition between the two major families. There were various other indicators of competition. In the first few years after deregulation, the availability and use of discounted fares (i.e., charter class, seat sales, advance purchase excursion, group, etc.) on domestic traffic grew dramatically. Estimates for the first quarter of 1988 indicated that 61.9% of all passengers carried on domestic scheduled services travelled on some form of discount ticket compared to 36.8% for the same period in 1983, this represents a difference of 25.1 points or a percentage increase of 68.2 These statistics have continued to increase in the 1990s as 80.4% of all passengers travelled on some form of discount fare in 1997.

As far as the trend in average fares are concerned, the statistics on fares indicated that during the first quarter of 1988, the average fare (all fares) paid by air passengers in all domestic city-pairs amounted to $140 compared to $120 for the same period in 1983, an increase of 16.6%. This average fare increased to $176.80 in 1997, representing an increase of 47.3% over the entire period. For discount fares, the fare increased by 9.3% (from $97 to $106) for the period 1984-1988 and by 32.6% (from $97 to $128.70) for the period 1988-1997. These increases however, were lower than the increases in the consumer price index for the 1984-88 period which was 17.5% and 49.2% for the period 1984-1997.

Passenger air traffic on level 1 carriers increased to a new peak since

deregulation. In terms of unit toll passenger kilometers, the number increased from 34,105m. passenger kilometers in 1984 to 45,967m. in 1988, and then to 61, 836m. in 1997. Passenger traffic on commuter and local air carriers recorded staggering annual increases of over 30 percent from 1984 to 1987 (i.e., 3,885,000 to 9,137,000).

Besides the above competitive developments, three other facets of competition that developed were: the frequency flier programs, the computer reservation systems (i.e., CRS), and international alliances. These will be briefly described. On July 13, 1984, Air Canada introduced 'Aeroplan', a scheme whereby frequent flyers are entitled to bonuses or rewards in response to CP Air's 'Travel Bonus Program' (now known as 'Canadian Plus') which was introduced on July 8, 1984 to reward the frequent travellers. Second, the CRS also became an important facet of airline competition. Air Canada established its own CRS, known as Reservac, which gave it a near monopoly on travel agency automation. In response, CPAL launched its own system known as Pegasus 2000. Today, both are managed by Gemini, owned by a company known as Galileo, one of the five largest CRS companies in the world. Finally, competitive forces at the international level led to the formation of alliances. As a result, AC has forged alliances with United Airlines, Lufthansa, Thai Airways International, VARIG and SAS and Canadian has alliances with AA, British Airways, Quantas and Cathay Pacific, the former is known as 'STAR' alliance and the latter 'oneworld'.

The resulting competition and structural changes described above would not have been possible if the policy and regulatory tenets that conditioned these dimensions of industry structure and performance had not changed. Accordingly, a brief review of these policy developments will be provided hereafter, first on domestic scheduled policy then on international scheduled policy and international charter policy.

1) Domestic scheduled policy: An end to economic regulation came in 1984. On May 10, the Minister of Transport, Lloyd Axworthy announced the *New Canadian Air Policy*. The essence of the new policy was less regulation and more competition. First, competition was at the heart of this policy. Second, the major thrust of this policy was the elimination of pricing controls. This policy had a few key features: elimination of defined roles for carriers; relaxed entry into markets; elimination of licence restrictions on frequencies and aircraft types; and freedom to discount ticket prices.

The above initiative was affirmed and extended by the Honourable Don Mazinkowski, Minister of Transport, in the document *Freedom to Move* released in June 1985. Entry into domestic commercial service was to be

governed by a 'fit, willing and able' requirement. Further, compliance with safety regulations and adequate insurance coverage would satisfy the above requirements. Furthermore, market exit would not be impeded except by a requirement to provide advance notice. In addition, there would be no ongoing regulation of domestic tariffs unlike international tariffs. Finally, legislative authority was to enable the Minister of Transport to designate Canadian carriers on international routes and the Government was empowered to retaliate when safety is jeopardized in international aviation.

The changes indicated above were later embodied in the *National Transportation Act, 1987* which turned de facto deregulation to official regulatory reform on Jan. 1, 1988. The Act removed the bulk of economic regulation in Southern Canada while retaining it in Northern Canada and for international air services. The market entry test of 'public convenience and necessity' was replaced by the test of 'fit, willing and able' for licence applications in Southern Canada. Further, the advance notice required for exit was 120 days. Furthermore, domestic tariffs had no longer to be filed, however they were required to be published. Finally, there was limited control over fares on monopoly routes in the South or routes in the North.

The process of deregulation that had begun in 1984 continued in 1996 with legislative amendments to the *Canada Transportation Act* (formerly known as the *National Transportation Act, 1987*) that removed the last of the residual restraints on services in the North by abolishing it as the 'designated area'. All domestic air service licences are now subject to the same entry and exit requirements for all operators. Further, formal exit notice of 60 days will be required of the second last and last carriers, unless a shorter notice period is approved by the Agency.

2) International scheduled passenger policy: During the period 1984-1993, regulation of international air services was left relatively untouched. In December 1994, the Minister of Transport announced Canada's new policy for international air transportation. The policy was designed: to make the best use of Canada's international route rights through a 'use it or lose it' approach; to facilitate access to Canada for foreign carriers; and to provide consumers with more travel options and to improve protection for their travel arrangements.

One of the developments of the above liberalization was the signing of *The Open Skies Agreement* with the US by US President on February 23, 1995. The main elements were: 1) Canadian and US airlines will be able to provide unrestricted cross-border services (without restrictions on capacity, frequency and size), with the exception that the US service to Montreal and

Vancouver would be phased in over two years and the US service to Toronto would be phased in over three years; 2) Canadian carriers will be provided with limited number of slots at O'Hare in Chicago (10) and at La Guardia in New York (14); 3) The approval process for Canada-US fares were liberalized; and 4) Canadian and US airlines will be able to operate unrestricted cross-border cargo services, with the exception that US service to Montreal, Vancouver and Toronto would be limited for the first year.

Numerous other international initiatives have also been undertaken during this deregulated period. A few of these will be mentioned: International Bilateral Air Negotiations, Multilateral Negotiations (ICAO), and Harmonization of Aviation Regulations and Standards (NAFTA).

3) International passenger charter policy: The first attempt to deal with international charter policy since 1978 was in 1996. The *Canada Transportation Act* of 1996 removed the requirement for Canadian applicants to demonstrate 'public interest' when seeking an international non-scheduled (charter) licence. In addition, the *Air Transportation Regulations* incorporated changes to the charter rules for Canada-US services. A year later, the Canadian Transportation Agency proposed amendments to the *Air Transportation Regulations* governing international charters. Due to adverse reaction from the industry, the amendments were not accepted by the Transport Minister until Transport Canada developed a policy for international charters. After consultation with various stakeholders, Transport Minister announced a new policy on April 4, 2000 developed by Transport Canada. "This policy removes fences surrounding international passenger charter services, such as advance booking and minimum-stay requirements, and restrictions on one-way travel." This policy is expected to enhance international travel options for Canadian consumers, encourage competition, innovation and growth in the charter airline industry.

The era of airline restructuring and dominance by Air Canada (1999-2000): The competition in the deregulated era of 1984-1999 and the financial difficulties of Canadian Airlines led to a major restructuring in the airline industry and the dominance of AC in the Canadian domestic market.

In July 1999, a few months before the restructuring, the domestic air market was dominated by Air Canada and Canadian Airlines. These airlines in cooperation with their subsidiaries and commercial partners provided competing network of services and belonged to a global alliance. In the domestic market, the market share (in terms of average daily seat-kilometres) of the two major carriers was eighty-seven percent, the charter carrier's market share was ten percent and the market share of Westjet was four percent. It

should be noted that Westjet operated in Western Canada and its market share there was twenty-two percent. Another carrier that provided services in the northern domestic market was First Air with a market share of 18% which was less than half a percent of the total domestic market. In the international market, the market share of the two majors was less impressive at thirty-nine percent, the share of foreign airlines was forty-two percent and the charter carriers share was 19%. The largest charter carriers were: Air Transat, Canada 3000, Royal Air and SkyService.

Policy developments: On October 26, Transport Minister David Collenette issued a policy statement for the restructuring of the airline industry in Canada, a plan for protecting the public interest. Its principles were uncompromising safety and the application of the Official Languages Act. The five areas of concern were: pricing (i.e., price gouging and consumer protection), fostering competition (by discouraging predatory behaviour, improving access to airports, allowing participation in frequent flyer programs, reviewing the computer reservation systems to address competitive concerns, reviewing international air policies, etc.), Canadian ownership and control, service to small communities and the fair treatment of employees. A special review process for mergers and acquisitions in the airline industry was to be put into place.

The above framework was presented to the House and Senate Standing Committees for their views. In light of their views and other representations, a Bill was tabled in the House of Commons on February 17, 2000. Before the Bill was introduced, on December 21, 1999, Transport Minister announced that the Government of Canada was prepared to approve the Air Canada offer to acquire Canadian Airlines as it secured commitments on its key principles from AC. On August 1, 2000, Transport Minister announced three appointees to monitor the progress of airline restructuring.

The amendments to the *Canada Transportation Act* introduced by the above Bill are: to increase the powers of the Canadian Transportation Agency to review price and prevent price gouging on monopoly routes; to restore powers for the Agency to deal with conditions of carriage for domestic service; to improve notice of exit provisions; to oblige airlines to consult with communities when planning service reductions or withdrawals; and to create an Air Travel Complaints Commissioner at the Agency. Further, Air Canada and its affiliates will have to comply with the *Official Languages Act* where there is significant demand. In addition, the *Competition Act* was amended and these amendments are examined.

III. Competition Bureau's Role in the Restructuring the Airlines

Perhaps the most dramatic and controversial event in the recent history of the Canadian aviation industry was the restructuring of the Canadian airline industry through the acquisition by Air Canada of control of Canadian Airlines. Beyond the obvious impacts this transaction had on the industry, however, were the additional implications that the transaction had on the Competition Bureau's role in the transportation sector of the economy, and regarding airlines more specifically.

The restructuring of the airline industry, from the point of view of the role of the Competition Bureau, can be divided into three broad phases. The first phase of relevance was the ninety-day period, beginning on August 13, 1999, during which the Competition Act was suspended, allowing for the open negotiation of restructuring. The second phase began with the ending of the suspension of the *Competition Act*, and ended with the Competition Bureau's announcement on December 21, 1999 that it would allow the takeover of Canadian Airlines, subject to certain undertakings agreed upon with Air Canada. The third and final phase of the Competition Bureau's involvement with the restructuring of the airline industry regards the passing of Bill C26 and the associated regulations, which redefine the Competition Bureau's role in the airline industry. We will discuss these phases.

Phase 1: The Suspension of the Competition Act

The dramatic first sign that the Government intended the Competition Bureau's involvement in restructuring of the domestic airline industry to differ from its role in other industries came on August 13, 1999 with the issue of an Order in Council, pursuant to Section 47 of the *Canada Transportation Act*. This Order in Council effectively suspended the *Competition Act* with regard to negotiations concerning transportation industry restructuring. In particular, the Order in Council permitted the major airlines and other interested parties to negotiate a new arrangement and industry structure without fear of violating the *Competition Act*. In addition, if any agreement were to be reached within the ninety-day period, this agreement would be subject to assessment by the Minister of Transport, whose recommendations would be considered by the Governor in Council in issuing the formal decision and any imposed conditions. Thus, for a ninety-day period, the Commissioner of Competition's usual role in the review of any airline merger was suspended.

In assessing any agreement reached by the airlines or other parties, however, the Minister of Transport would attempt "to ensure the long-term stability of the airline industry, and to maintain the benefits of competition for

consumers." To the latter end, David Collenette, the Minister of Transport, wrote a letter to Konrad von Finckenstein, the Commissioner of Competition, requesting the Commissioner's views regarding issues pertaining to domestic airline competition, in the event of restructuring that increased concentration in the Canadian industry. The Commissioner was given specific instructions regarding the scope of his advice:

> There are some fundamental policy guidelines which will have to be kept in mind in identifying issues or problems affecting competition and possible solutions or conditions to alleviate them. Specifically, any restructuring will have to take place within the current framework respecting Canadian ownership and control of air carriers. This will be Canadian-based restructuring so the introduction of foreign carriers on domestic routes, i.e. cabotage, will not be considered.

The Commissioner responded on October 22, 1999 with a 33-page letter (plus annexes) to David Collenette, expressing serious concerns regarding the potential lessening of competition that would result from the move to a dominant domestic airline. Competition concerns were expressed regarding both domestic routes and Canada-U.S. markets. The Commissioner then provided a long list of thirty-six recommendations aimed at mitigating the effects on competition of a move towards a dominant airline. These recommendations were aimed at promoting the entry of new airlines or the expansion of existing domestic airlines, and included possible terms of restructuring, changes in government policy, regulatory changes, and legislative changes. The recommendations focused on items as diverse as, the availability of slots, airport facilities and surplus aircraft, the use of loyalty programs by a dominant carrier, international charter policy, and the on-screen displays of computer reservation systems.

Interestingly, while the commissioner followed the instructions given him by the Minister of Transport to the extent that he did not recommend complete cabotage, he did go so far as to recommend what was termed in the letter "modified sixth freedom rights." This term refers to the right of a foreign carrier to fly passengers between two Canadian airports, through a foreign airport. For example, if this recommendation of the Commissioner was followed, then a U.S. airline would be able to sell tickets for travel between Vancouver and Toronto, by taking these passengers through a U.S. hub airport.

Further, while the Transport Minister had asked the Commissioner to take as given the then-current framework regarding Canadian ownership, the Commissioner in fact noted that "Canada's policy on foreign ownership

is one of the largest regulatory barriers to entry, and the consequences of a dominant carrier scenario are compelling enough to reconsider this policy." Further, the Commissioner recommended that Canadian policy should be revised so as to allow for 'Canada-only carriers,' which would be licensed only for domestic routes but could be up to 100% foreign owned. The Commissioner indicated that this remedy would be potentially more effective than anything else: "In the Bureau's view, the creation of such Canada-only Carriers could potentially be more effective in contributing to domestic competition than all the other recommendations in this letter."

Finally, recommendations that, arguably more than any others, would lead to redefining the Competition Bureau's powers and role in the airline industry targeted the *Competition Act*. The Commissioner of Competition argued that the nature of costs in the airline industry make proof of predatory conduct under the criminal predatory pricing provisions of the *Competition Act* "all but impossible." Further, he argued that while the civil provisions of the *Competition Act* could be used to deal with anti-competitive conduct by a dominant domestic carrier, there was insufficient guidance for the Competition Tribunal regarding the behavior that should be considered anti-competitive. Finally, the Commissioner of Competition argued that the existing civil provisions did not provide sufficient protection to competition because of the time required to establish a case before the Tribunal. Therefore, the Commissioner recommended that the Governor in Council be given the power to specify, through regulation, airline-specific anti-competitive acts for the purposes of the civil abuse of dominance provisions of the *Act*, and that the Commissioner be given the power to issue cease and desist orders regarding behavior that is believed by the Commissioner to be predatory.

Phase 2: The Negotiation with Air Canada

During the autumn of 1999, while the Competition Bureau's powers were suspended, the battle between Air Canada, who wished to attain control of Canadian Airlines, and Onex, who wished to acquire both major airlines, was ongoing. On November 5th 2000, however, a Quebec court ruled that Onex Corporation's bid for control of both Air Canada and Canadian Airlines was illegal, as it would break the law that limits ownership of Air Canada to 10%. This left Air Canada free to pursue its takeover of control of Canadian Airlines without competition. On Nov. 14, 2000 Air Canada submitted a takeover bid to Canadian shareholders.

By mid-December, the Competition Bureau's powers were once again in effect, and the Competition Bureau engaged in its review of the proposed transaction. On December 21, 2000 the Competition Bureau

announced that it would allow the takeover by Air Canada of Canadian Airlines, provided that Air Canada meets certain negotiated undertakings. The letter from the Commissioner of Competition to Air Canada's counsel stated that in the opinion of the Competition Bureau, Canadian was facing immediate insolvency and that there is no potential purchaser that would be preferred from a competition viewpoint. The Commissioner concluded that, conditional on the agreed upon undertakings, the takeover of Canadian by Air Canada was preferable to the liquidation of Canadian. It is worth noting, however, that the Commissioner did not state that the undertakings would entirely alleviate a lessening of competition, which was consistent with his statements in the letter that the key to competition in the airlines was "modified sixth freedoms" and "Canada-only carriers."

The agreed-upon undertakings largely followed the Commissioner's recommended "possible terms of restructuring" contained in the October 22, 1999 letter. The undertakings included:

The sale of Canadian Regional. In his October 1999 letter to the Minister of Transport, the Commissioner stated that without a detailed examination it was unclear whether divestiture of the regional carrier would be an appropriate remedy in the event of a dominant domestic carrier. This statement was based in part on the observation that regional carriers are dependent on partnerships with a national or international carrier for success, as the role they serve is primarily one of providing feeder traffic to a larger network. However, two months after this statement was made, Air Canada was required to sell Canadian Regional as part of the merger undertakings. Canadian Regional went on sale for a sixty-day period beginning June 30th, 2000. At the time that this article is being written, the sale period had not yet ended.

Perhaps to alleviate concerns about the success of the divestiture of Canadian Regional, as well as to promote the success of start-up and existing Canadian carriers, the undertakings contained a number of remedies that opened up facilities, services and capital to other airlines. In particular, Air Canada was required to surrender at least 28 takeoff and landing slots at Pearson International Airport, and sell other airport facilities such as ticketing/check-in positions and gates back to either the local airport authority or Transport Canada.

As well, AC was required to form partnerships with certain new and existing carriers. Specifically, one of the undertakings specified that Air Canada must enter into interlining and joint fare agreements with Canadian carriers meeting certain industry standards. These standards related to safety

and commercial reasonableness, as well as requiring that the firm wishing to interline or enter a joint fare agreement with Air Canada be an IATA member (International Air Transport Association). Air Canada was also required to give other domestic airlines access to its frequent flyer programs.

Finally, undertakings were specified to promote the entry of a domestic low-cost carrier, of a similar nature to Southwest in the United States. To this end, Air Canada was required to relinquish to such a new carrier, if one emerged, the facilities it had secured at Hamilton Airport, which was considered to be a likely entry point for a new low cost carrier because it could serve the southern Ontario market, while still having some distance from Pearson International Airport. In addition, Air Canada agreed to cease any plans to start its own low cost carrier until September 2000 if no new low cost carrier emerged, and September 2001 if one did.

Phase 3: Bill C-26 – The Future of Antitrust Enforcement in the Canadian Airline Industry.

The final phase of the Competition Bureau's involvement was its role in the formulation of Bill C-26, which would result in legislative changes, many of which were recommended by the Commissioner in his October 1999 letter. On February 17, 2000, Bill C-26, which would amend several acts including the *Canada Transportation Act*, the *Competition Act* and the *Competition Tribunal Act*, received first reading. This Bill came into force July 5, 2000. From the point of view of the role and abilities of the Competition Bureau, several amendments were critical. *The Introduction of Cease and Desist Powers.* Bill C-26 amended the *Competition Act* by allowing the Commissioner of Competition to order an airline to cease behavior that the Commissioner believes likely to cause harm to either competition or a competitor that could not be remedied by the Competition Tribunal. The air carrier would be required to cease the specified practice for 20 days, with two possible 30 day extensions. In order to issue such a cease-and-desist order, the Commissioner would need to believe that in the absence of the order

> (i) injury to competition that cannot adequately be remedied by the Tribunal is likely to occur, or
>
> (ii) a person is likely to be eliminated as a competitor, suffer a significant loss of market share, suffer a significant loss of revenue or suffer other harm that cannot be adequately remedied by the Tribunal.

As these powers have yet to be exercised, it is unclear to date whether the Commissioner will in fact be willing to issue cease and desist orders only

under condition (ii) above, in which harm to a competitor, but not necessarily to competition, is required.

The Specification of Potentially Anti-Competitive Acts in the Airline Industry.

Following the other recommendation for legislative change, made by the Commissioner in his October 1999 letter, legislation Bill C-26 amends Section78 of the *Competition Act*, which lists behavior that could potentially be considered anti-competitive when undertaken by a dominant firm. The Bill both specifies anti-competitive behavior specific to the airline industry, and allows for the specification of additional anti-competitive acts through regulation. The amended Act identifies as potentially anti-competitive when conducted by a dominant firm:

> (k) the denial by a person operating a domestic service, as defined in subsection 55(1) of the *Canada Transportation Act*, of access on reasonable commercial terms to facilities or services that are essential to the operation in a market of an air service, as defined in that subsection, or refusal by such a person to supply such facilities or services on such terms.

Essential facilities and services are described in draft regulations prepared by the Competition Bureau as those:

> (a) that are required in order to provide a competitive air service;
>
> (b) that cannot reasonably or practicably be purchased,
>
> acquired, provided or replicated by another air carrier on its own behalf;
>
> (c) that are effectively controlled by the air carrier who denies access to them
>
> or refuses supply of them; and
>
> (d) that can be feasiblely provided to another air carrier, having regard to
>
> operational or safety considerations, or legitimate business justifications
>
> of the air carrier referred to in paragraph (c).

These conditions would not replace the basic requirements of an abuse of dominance case under Section 79 of the Act, which are (i) that the offending firm be dominant in a market, (ii) that it has engaged in a practice of anti-competitive acts, and (iii) that its behavior has resulted in or would likely result in a substantial lessening or prevention of competition. Therefore, while the above description of an essential facility does not discuss the necessity of the firm being excluded for competition in a market, in order to make a case

the Bureau would still need to satisfy the third element of an abuse of dominance case.

Section 78 is also amended by giving the Governor in Council the power to specify additional airline-specific anticompetitive acts that would apply to s. 79 of the *Competition Act*. Draft regulations, publicized by the Competition Bureau on July 11, 2000, provide a list of anti-competitive acts, which describe the predatory use of fares and capacity, the pre-emption of airport facilities, services and takeoff and landing slots, and the use of loyalty programs with anticompetitive purposes.

The role of the Competition Bureau in evaluating airline mergers. Bill C-26 transferred from the Commissioner of Competition the final power to approve or disallow a merger involving air transport. As stated in Bill-C26, the Commissioner of Competition will report to the Minister of Transport any concerns the Commissioner has with the transaction. Transport Minister then makes recommendations to the G-I-C, who ultimately decides whether or not the transaction is approved.

IV. Concluding Remarks

In this paper, we have briefly reviewed the structural evolution of the airlines in Canada and have described the role of the Competition Bureau in the 1999 restructuring of the airlines industry.

The restructuring process raised a number of issues. First, it led to the use of section 47 of the *Canadian Transportation Act* by the Governor-in-Council which suspended the powers of the *Competition Act* for a period of ninety days. The use of this section for the first time, created considerable uncertainty in the administration of the *Competition Act*; the role of competition and the Bureau; and whether the exercise of such power is possible if a criminal investigation on the matter is underway. Second, by using its power under this section and by constraining the proposals that the Transport Minister would consider in restructuring the airlines, it somewhat weakened the contribution that could be made by the competition authorities. Third, it raised questions as to what is meant by the term 'extra-ordinary disruptions' and whether this matter could be considered as such and whether the matter would not have been more expeditiously resolved under the *Competition Act*. Fourth, by using the powers of suspension when Parliament was not in session, it raised questions as to whether the timing of such exercise was prudent. Finally, by transferring the ultimate decision in the evaluation of mergers to the Governor-in-Council, it not only turned back the clock to the way in which mergers were dealt with under section 27 of the Canadian

Transportation Act of 1967 but raised questions as to future of mergers in other regulated sectors.

Despite recent government initiatives which were quite substantial and the role played by the Competition Bureau, several competition problems continue to exist given the high barriers to entry into network service industry of the airlines (i.e., feed traffic, frequent flyer plans, commission overrides, frequency of service and peak hour slots and gates) and the history of carrier failures. Perhaps, when the recent recommendations to alleviate the problems of high barriers to entry takes effect and gradual entry by existing and new carriers erode the dominance of AC, the need to consider some of the important pro-competitive measures (such as removal of cabotage, modification of sixth freedom rights, and foreign ownership of airlines) which the Transport Minister was reluctant to consider will fade away and the chance to introduce competition will be lost if not delayed.

*** The views expressed in this paper are those of the authors.**

ADVERSE EFFECTS OF MERGERS ON AIRLINE PERFORMANCE – THE CASE OF CANADIAN AIRLINES INTERNATIONAL, LTD.

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Introduction

Supporters of airline mergers generally argue that mergers will strengthen the surviving airline by decreasing expenses and/or by increasing market shares. However, reality does not have to conform to expectations. Mergers have a long history in Canada and the U.S. so it is possible to investigate their effects.

An article published in the *Transportation Journal* in 1988 analyzed the 16 mergers that took place in the U.S. under full Civil Aeronautics Board regulation from 1938 to 1978, plus the four subsequent mergers that occurred before the CAB's powers over acquisitions and mergers were transferred to the Department of Justice on January 1, 1983.[1] This article also reviewed two mergers in Canada – the Pacific Western/Transair acquisition and merger in 1978-79, and the CP Air/Eastern Provincial acquisition and merger in 1984-86. Covering periods up to four years after the mergers, the analyses of these 18 mergers yielded two findings challenging the widely held belief that mergers strengthen the surviving airlines.

First, it found that both Canadian and U.S. carriers experienced increased operating expenses per revenue ton-mile (RTM) relative to other airlines *unless* service was terminated at many airports after (or immediately before) the merger occurred. Second, during the years following a merger, the surviving carrier's traffic either declined, or grew more slowly, relative to that of similar unmerged carriers. Thus, traffic shares of these carriers decreased relative to that achieved by the combined carriers prior to their merger.

Canadian Airlines International Ltd. provides another case with which to analyze the effects of mergers on airline performance. That company was the result of four mergers between 1986 and 1990, involving CP Air (CP), Eastern Provincial (PV), Nordair (ND), Pacific Western (PW), and Wardair (WD). Its performance during and following this series of mergers will be analyzed in this paper to provide additional evidence of whether mergers are beneficial or harmful to the surviving airlines.

Acquisition and Merger Dates

Table 1 lists the dates of the four acquisitions and mergers that established Canadian. Three dates are provided – the acquisition date, the date the corporate merger occurred, and the year the merged carriers began operating as a single unit.

While acquisitions are important, the major impact on performance occurs after two formerly independent operations are merged into one integrated operation. This development is indicated by a single schedule being published in the *Official Airline Guide*, by statements in corporate reports, and by Statistics Canada reporting combined data for the surviving carrier. It is changes after these years of initial operating integration that are focused on in this analysis.

Operating Expenses per RTM

Operating expenses per RTM are depicted in Figure 1.[2] They show that Air Canada and CP Air moved largely in parallel in this factor

Figure 1

Dates of Acquisitions,Corporate Mergers and Operation Mergers CP Air, Eastern Provincial, Nordair, Pacific Western & Wardair

Merging Airlines	Day/Month/Year of Acquisition	Corporate Mergers	Operation Mergers
CP Air/Eastern Provincial = CPAL	31/08/84	12/01/86	1986*
CPAL/Nordair	27/01/86	02/01/87	1987
Pacific Western/CPAL = CAIL	01/02/87	26/04/87	1988**
CAIL/Wardair	25/04/89	01/01/90	1988/90

Notes: *Eastern Provincial's data were reported separately by Statistics Canada through 1986. However, the *Official Airline Guide* and CP Air's *Annual Report* treated PV as integrated with CP Air. Thus, in this analysis PV's data are combined with CP Air for 1986.

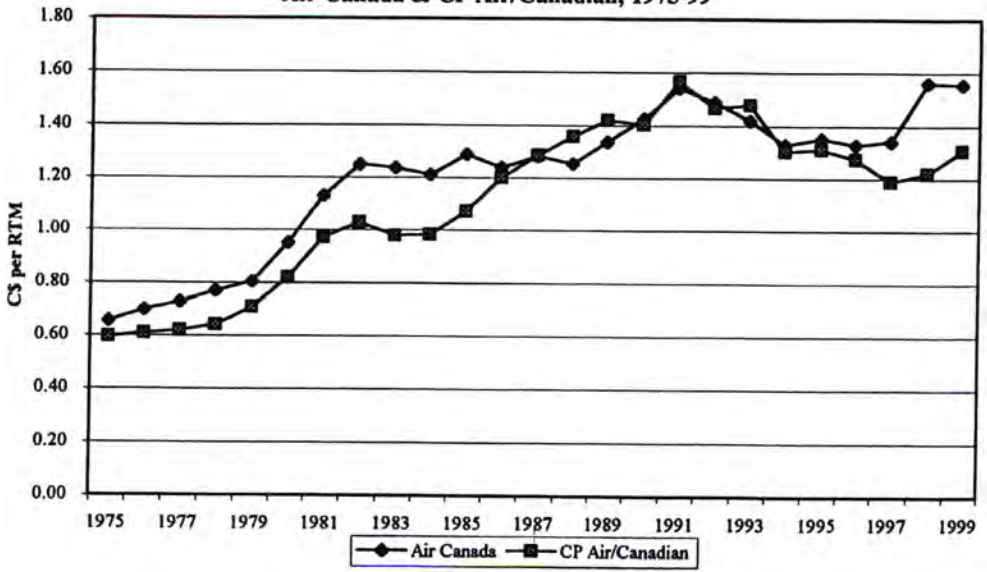
**Traffic data and scheduled passenger revenue data were reported separately for these carriers through 1987. Other financial data were combined. Operating permits of the four units of CAIL were kept separate until January 1988.

Sources: Canadian Pacific Air Lines, *Annual Report* (1984, & 1985.
Globe & Mail (September 15, 1987), p. B4.
Official Airline Guide, (June 1, 1986).
PWA Corporation, *Annual Report* (1987-90).
Statistics Canada, Aviation Statistics Centre data (1987-89).

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from 1975 through 1985, with Air Canada having higher operating expenses, especially in 1981-85. Both carriers experienced increases in 1985 but, while Air Canada returned to its prior level the following year, CP Air/Canadian's unit expenses continued to increase through

Figure 1. Operating Expenses per Revenue Ton-Mile
Air Canada & CP Air/Canadian, 1975-99



1989. This, or course, was when the mergers with Eastern Provincial, Nordair and Pacific Western occurred and data for their operations were added to the totals in 1986, 1987 and 1988.

The merger with Wardair began in October 1989 and was fully implemented in 1990.[3] Canadian's operating expenses per RTM declined slightly in 1990, while Air Canada's continued an increase that began in 1989. The Gulf War brought higher fuel prices in 1991 and both Air Canada and Canadian had increased operating expenses and declining traffic. Following the war, the operating expenses of the two airlines declined through 1997, before increasing in 1998-99.

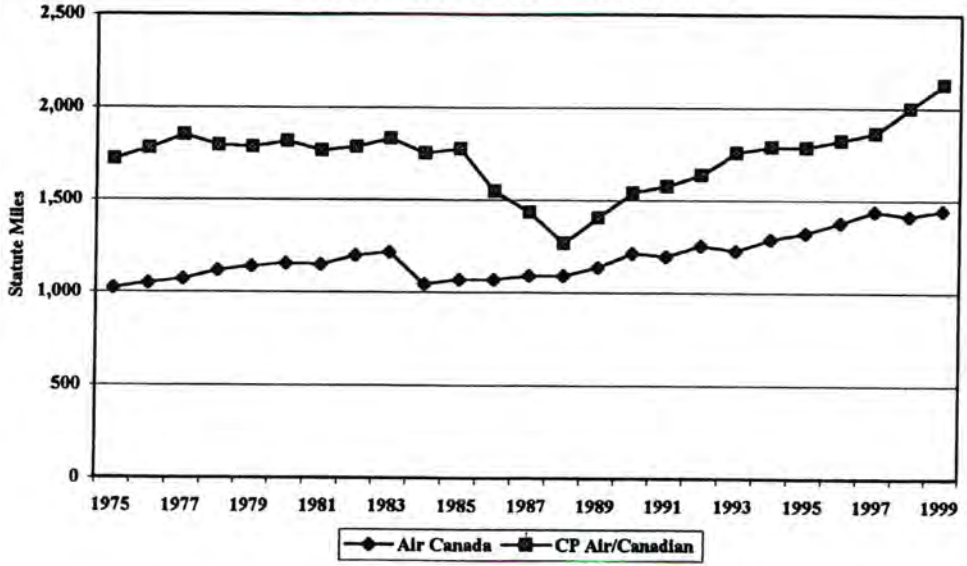
Operating expenses per RTM vary inversely with distance flown and Figure 2 shows that CP Air/Canadian had appreciably longer passenger trip lengths from 1975 through 1985. Thus, its unit expenses were understandably lower than Air Canada's. However, with the Eastern Provincial, Nordair and Pacific Western mergers, CP Air/Canadian's trip length fell sharply towards Air Canada's level. These changes are consistent with the increases in its operating expenses per RTM in 1986-88 shown in Figure 1.

Index Numbers

A way to more clearly indicate the impact of mergers on CP Air/ Canadian's operating expenses per RTM is to compare its index numbers for this factor with those for Air Canada which did not undertake mergers.[4] Since index numbers measure changes within each series, if Canadian's numbers increased more, or declined less, than Air Canada's during the merger period, it would provide evidence that the mergers had an adverse effect on its performance

Two series of index numbers need to be calculated because two different kinds of mergers occurred. Three short-haul carriers merged with CP Air in 1986-87 (leaving PWA Corporation the surviving corporate entity) and long-haul Wardair merged with Canadian in 1989-90. Simply adding the data for these carriers to those of CP Air as the mergers occurred would result, initially, in increased index

Figure 2. Passenger Trip Length
Air Canada & CP Air/Canadian, 1975-99



numbers (because adding short-haul operations reduces average passenger trip lengths) and, then, decreased numbers due to the addition of long-haul operations. In essence, this would commingle the effects on operating expenses of both mergers and distance.

A way to avoid this problem is to combine the relevant data for all the individual carriers for the years prior to the mergers, and then calculate the index numbers over the entire period. Thus, since the surviving carrier was merely doing what several carriers did before the mergers, any significant differences in its index numbers relative to Air Canada's can be attributed to the mergers because other major factors remained the same or changed for both carriers.

Short-Haul Mergers

Figure 3 shows the index numbers for 1975-99 calculated from the combined data for CP Air/Canadian Eastern Provincial, Nordair and Pacific Western, including Transair (TZ) through 1979. To provide an overview of the 25 years covered in this paper, Wardair is also included after 1990 when it became part of Canadian. However, the effects of the Wardair merger are analyzed in the next section.

1985 was chosen as the base year prior to the short-haul mergers because, even though the acquisition of Eastern Provincial by CP Air occurred on August 31, 1984, the two carriers operated independently through 1985 so only small acquisition costs were included in expense data. Fortuitously, the 1985 expenses per RTM of CP/PV/ND/PW/TZ and Air Canada were virtually the same – C$1.280 versus C$1.288. Thus, the same changes in index numbers for both reflect virtually the same dollar changes in unit expenses.

The index numbers for CP/PV/ND/PW/TZ and Air Canada were very similar between 1975 and 1985, with the combined carriers' numbers being slightly below Air Canada's whenever there was more than a half point divergence. This changed abruptly from 1986 through 1989. The CP/PV/ND/PW/TZ index numbers were 6.34 points above Air Canada in 1986 (the Eastern Provincial merger), 6.62 points in

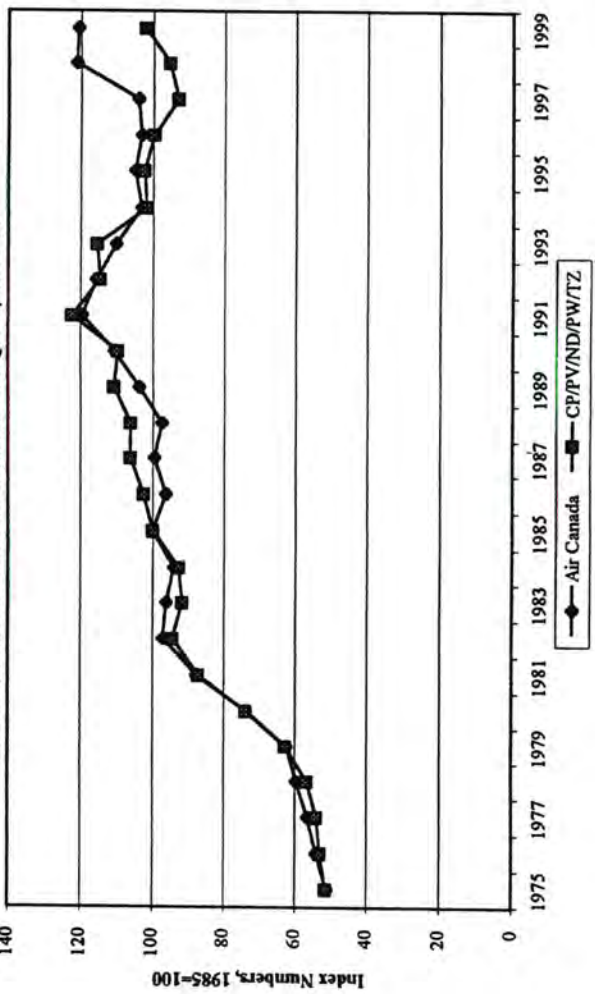


Figure 3. Operating Expenses per RTM (Index Numbers, 1985 = 100)
Air Canada & Combined CP/PV/ND/PQ/TZ, 1975-99

1987 (Nordair merger) and 8.75 points in 1988 (Pacific Western merger). Then a slight decrease to 7.06 points occurred in 1989, the year after the conclusion of these mergers. This implies two things. First, through 1989, the three short-haul mergers increased operating expenses per RTM by about seven percent over what would have been achieved without the mergers. Second, later mergers offset any expense-reducing efforts implemented following earlier mergers.

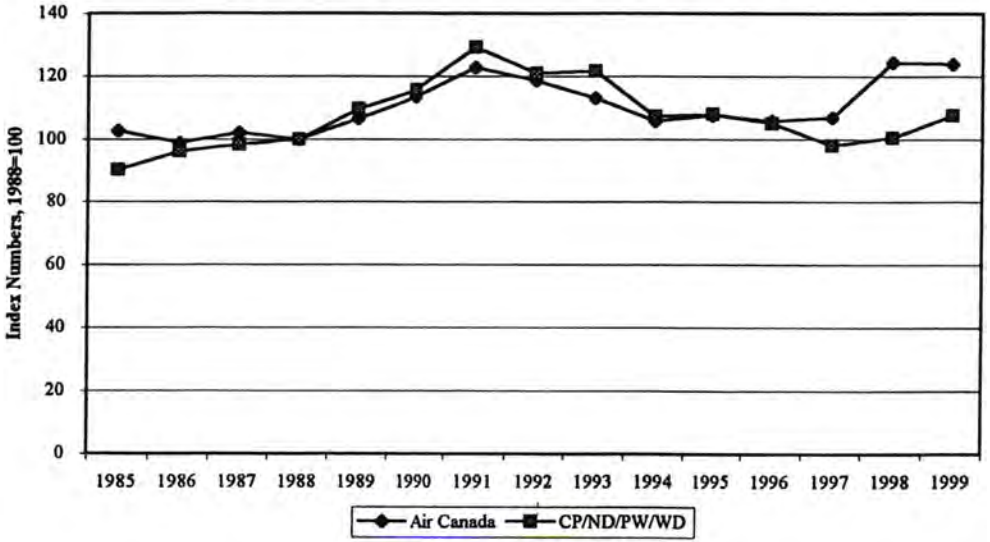
Long-Haul Merger

Figure 4 provides the same analysis for the Canadian/Wardair merger. It shows index numbers for all the combined carriers from 1985 through 1989, and then on to 1999 for the fully merged carrier. The base year is set at 1988 because "In October 1989 the Corporation commenced the integration of its two airlines"[5]. Wardair was a large, low-cost charter carrier prior to its inauguration of scheduled service in 1985[6]. In that year its total RTM was 26 percent larger than the combined RTM of Eastern Provincial, Nordair and Pacific Western, and its operating expenses were only C$0.707 per RTM. Thus its operations had a large impact on the data for CP/PV/ND/PW/WD and served to bring the combined operating expenses per RTM below Air Canada's during 1985-89. In the base year, the combined carriers produced at C$1.213 per RTM (including C$0.863 for Wardair alone), compared to C$1.254 for Air Canada.

While Air Canada's index numbers changed little between 1985 and 1988, those for the combined carriers rose almost ten points due to the impact of the three short-haul mergers and Wardair's 22 percent increase in operating expenses as it expanded scheduled service.

The index numbers for both Air Canada and CP/PV/ND/PW/WD increased steadily from 1989 to 1991, with those for the combined carriers increasing more than for Air Canada. The interval between index numbers was 2.99 points in 1989, 2.17 in 1990, 6.36 points in 1991 during the Gulf War, 2.17 in 1992 and 8.57 in 1993.. This implies that the merger increased operating expenses per RTM by about three percent. One reason that this impact was less than for the

Figure 4. Operating Expenses per RTM (Index Numbers, 1988 = 100)
Air Canada & Combined CP/PV/ND/PW/WD, 1985-99



short-haul mergers was that Canadian already served all domestic points served by Wardair, and only four of Wardair's ten international points were added to the merged system in 1990 – San Juan, London, Manchester and Paris.[7] This was a much smaller expansion of the network than was the case for each of the short-haul mergers.

After 1993 Canadian's operating expenses declined relative to Air Canada and its index numbers even fell well below those of Air Canada in 1997-99, where a 13-day pilot strike in September 1998 doubtless played a role.[8] The question becomes why did Canadian's performance improve so significantly?

Number of Airports Served

The 1988 article identified large decreases in numbers of airports served as a factor associated with declines in operating expenses per RTM. Figure 5 shows the number of airports CP Air/Canadian served before and after its mergers.[9] In 1984, CP Air operated at 31 airports – 17 domestic, two transborder, and 12 overseas. The *Official Airline Guide* added Eastern Provincial's airports to this network in 1986, Nordair's in 1987 and Pacific Western's in 1988. During 1988 Canadian served 91 airports (67 domestic, 5 transborder and 19 overseas) -- almost triple the total number served by CP Air in 1984, and virtually a quadrupling of domestic airports! This truly massive change in network coverage and complexity makes the increases in operating expenses per RTM understandable

Canadian soon set about deleting service to points, many of which were transferred to its commuter subsidiaries. Sixteen domestic points were dropped in 1989, 18 more by 1993, and, a total of 55 were gone by 1999. Only 36 airports were served in 1999 – 11 domestic, 11 transborder and 14 overseas -- a net gain of five over 1984. Only transborder points increased significantly over these years due to the open-sky policy introduced in the 1995 Canada-U.S. bilateral agreement. Back in 1984, 55 percent of the points served were in Canada, -- in 1999, only 31 percent were domestic.

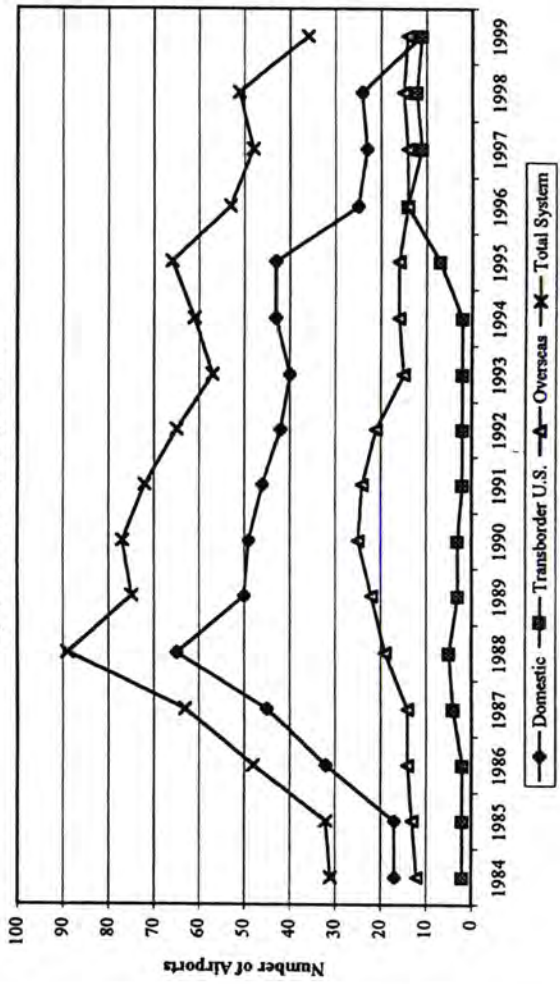


Figure 5. Number of Airports Served by CP Air/Canadian, 1984-99

Figures 1 and 4 show marked reductions in Canadian's operating expenses per RTM after 1991. By 1994 its unit expenses fell below Air Canada's, while the index numbers interval declined to 1.43 points from 8.57 points in the previous year. At this time it was serving 61 airports – down 30 (33 percent) from the 1988 peak. These trends continued through 1999, its last year of independent operation prior to being acquired by an Air Canada subsidiary on January 4, 2000[10]. By then it had essentially returned to its 1984 position – serving just five more airports, flying passengers an average of about 700 miles farther than Air Canada, and with operating expenses per RTM 16 percent lower than Air Canada. Unfortunately, shareholder deficit had increased from C$33.4 million for CP Air in 1984, to C$567.7 million for Canadian in 1998.[11]

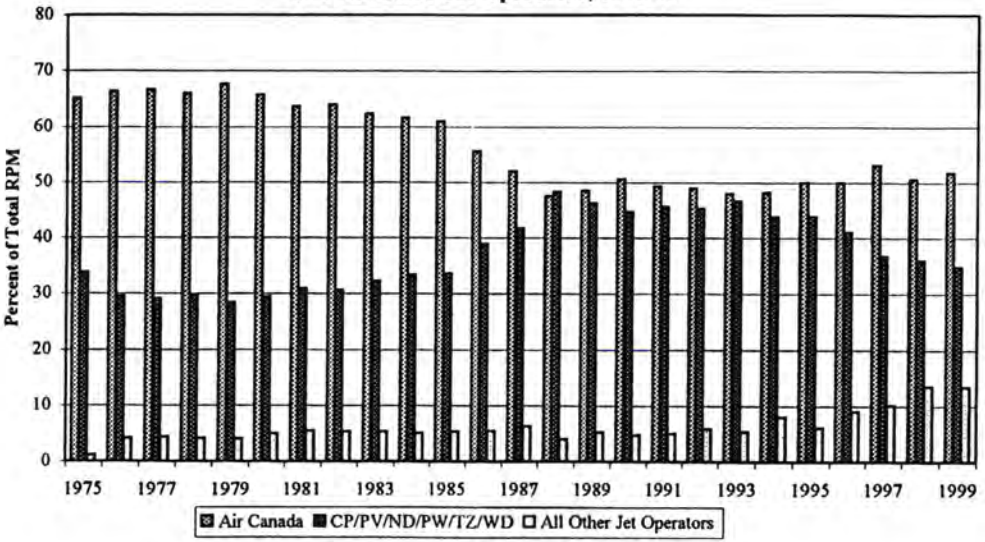
Clearly, the 1988 finding regarding operating expenses is supported by the Canadian merger experience. Decreases in operating expenses per RTM following mergers are associated with terminations of service at a large number of airports, not with mergers per se.

Traffic Shares

Under the restrictive regulatory environment existing in Canada until 1984, scheduled passenger service with jet aircraft was limited to Air Canada, CP Air and five regional carriers. Liberalization changed this and allowed several other carriers to introduced scheduled service with jet aircraft.[12] Some of these were subsidiaries of Air Canada and Canadian (Air Atlantic, Air BC, Air Nova, and Time Air), others were former charter carriers (Air Transat, Canada 3000, Nationair and Royal), and still others were independent, mainly scheduled carriers (First Air, Grayhound, Intair and Westjet). Mergers are supposed to increase market power and this should be reflected in increased traffic shares. What happened following the CP Air/Canadian mergers?

The best way to show whether or not mergers helped Canadian increase its traffic shares is to compare post-merger shares with those of the combined carriers prior to and during the merger period. This is done in Figure 6 for scheduled revenue passenger-miles (RPM).

Figure 6. Traffic Shares of System Scheduled RPM Air Canada, Combined CP/PV/ND/PW/TZ/WD and All Other Jet Operators, 1975-99



Between 1975 and 1985, CP/PV/ND/PW/TZ accounted for 28.4 to 33.6 percent of the total RPM transported system wide by Canada's jet operators, and Air Canada carried 60.97 to 67.64 percent. It wasn't until Wardair was added to the combined carriers that their traffic share rose steeply to 48.4 percent in 1988, while Air Canada's share fell to only 47.6 percent. Despite its subsequent merger with Wardair, Canadian never again attained this 48.4 percent share, nor did it ever exceed Air Canada's share. Instead, there were small decreases and then increases in Canadian's shares after 1989, reaching 46.7 percent in 1993. From there its shares went steadily downhill to 34.9 percent in 1999.

There are at least two reasons for this decline. First, the decrease in airports served. – Canadian's 91 points in 1988, and Wardair's additional ten airports in the United Kingdom and Caribbean, brought their unduplicated total to 101.[13] By 1990 these had declined to 77, and only 57 were served in 1993. This decreased the population base available to Canadian. While service was doubtless terminated at the lowest traffic points, it is noteworthy that less than two percentage points of traffic shares were lost with a 44 percent reduction in points served. However, by the time Canadian's network covered only 36 points in 1999, there is no doubt that service had been terminated at a number points having greater impact on traffic volume.

The second reason for lower traffic shares was the increasing competition from new entrants. The traffic shares of all other jet operators ranged from four to six percent through 1993. They then rose to eight percent in 1994, and on to 13.4 percent in 1999. Figure 6 shows that Air Canada made small gains in traffic shares to over 50 percent despite the increased competition after 1993. In contrast, Canadian lost shares. If mergers increased market power, one would expect the carrier that did not merge (Air Canada) would lose traffic shares to the increased competition, while the carrier that did merge would gain shares. The fact that the opposite occurred indicates that mergers did not increase relative market power in this case. Again, the findings of the 1988 article are supported by performance of Canadian after its mergers.

Conclusions

The results of the CP Air/Canadian mergers provide additional evidence consistent with the findings of the 1988 article. Operating expenses per RTM increased following the mergers until Canadian terminated service at large numbers of airports. Whereupon they declined. At the same time, traffic shares decreased indicating a loss of market power. These reductions in network size and market shares are equivalent to firms in other industries selling divisions and subsidiaries after mergers to return to their "core business." Airlines are not exempt from widely experienced economic fundamentals.

These conclusions imply that the recent merger of Canadian into Air Canada will initially increase Air Canada's operating expenses per RTM and decrease its traffic shares. One wonders how many points will have to be dropped or transferred to regional subsidiaries before Air Canada's "anticipated annual synergy benefits of $650-800" are achieved.[14] Furthermore, how many points will be dropped if Canadian Regional is fully integrated into Air Canada's regional airline operations? Mergers are not a panacea for airline problems.

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* The support of the Earhart Foundation and the Social Sciences and Humanities Research Council is gratefully acknowledged. Special thanks are due to Mr. Robert Lund, Statistics Canada, Aviation Statistics Centre.

[1] William A. Jordan, "Problems Stemming from Airline Mergers and Acquisitions," *Transportation Journal* (Summer 1988), pp. 9-30. Also, *Airline Deregulation Act of 1978*, Public Law No. 95-504, 92 *Stat.* 1705, enacted October 24, 1978, Sections 408 and 1601(a)(3)

[2] The sources of the data underlying Figures 1, 2, 3, 4 and 6, and all the calculations in the text are:

1975-91 – Statistics Canada, Aviation Statistics Centre, Catalogues 51-002 (1975-91) and 51-206 (1975-91)

1992-99 – ____, Computer runs by Robert Lund, (Feb. 9, 1994, Sep. 12, 1994, Oct. 17, 1995, Sep.27, 1996, and June 16,2000).

[3] PWA Corporation, *Annual Report* (1989), p 37. The integration of Wardair resulted in a non-operating expense of C$73.8 million.

[4] Air Canada acquired parts or all of several small carriers in 1986-87 – Air Nova, Air Ontario, Air BC, Air Alliance, and Northwest Territories Airways Air Canada, *Preliminary Prospectus* (August 25, 1988), p. 16. CP Air/Canadian also acquired several commuter airlines, such as Time Air, Calm Air, Ontario Express and Air Atlantic. PWA Corp. *Annual Report* (1989), p. 20. These carriers are not included in this study since they were not merged into their parent company.

[5] *Supra,* note 3.

[6] Wardair inaugurated scheduled service to Puerto Rico on Nov. 5, and the U.K. on Dec. 9, 1985. Domestic service began in 1986. Wardair Int'l. Ltd., *Annual Report* (1985), pp. 7-9, and (1986), p. 15.

[7] Wardair, "Timetable" (May 1988), pp. 24-25; and PWA Corporation, *Annual Report*, (1989), p. 14, 18, 19, and (1990), p. 41.

[8] Air Canada, *Annual Report* (1998), p. 24.

[9] The sources of the data for in Figure 5 are: Canadian Pacific Air Lines, Ltd., *Annual Report* (1984 and 1985); and Canadian Air Lines International, letters from Dave Johnston to Statistics Canada listing sectors by route definition for Statement 10 (1988-99). Also, *Official Airline Guide*, North American Edition (June 1, 1984-87).

[10] Air Canada, *Annual Report* (1999), p. 15.

[11] CP Air, *Annual Report* (1984), p. 19; and, Canadian Airlines Corporation, *Annual Report* (1998), p. 38.

[12] Lloyd Axworthy, Minister of Transport, *New Canadian Air Policy*, presented to the Canadian House of Commons (May 10, '1984).

[13] Wardair, "Timetable" (May 1, 1988).

[14] Air Canada, "News Release" (October 26, 2000), p. 2.

ASSESSMENT OF RECENT PERFORMANCE OF CANADIAN CARRIERS IN COMPARISON WITH US CARRIERS

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Abstract

This paper provides an assessment of the performance of Air Canada and Canadian Airlines during the 1990s in comparison with eight major US carriers. In particular, we examine the airlines' performance in terms of input prices, total factor productivity (TFP) and residual TFP, unit costs and cost competitiveness, and profitability. Our results show that productive efficiency and cost competitiveness alone do not decide success or failure of an airline. This is clearly illustrated by the case of Canadian Airlines. Despite the fact that CAI was among the most efficient and the most cost competitive carrier among all North American carriers, but still it folded financially. On the other hand, although Air Canada was among the most inefficient carrier during the 1990s, AC was able to survive financially, and was able to acquire CAI at the end of 1999. CAI's high productivity and cost competitiveness are not sufficient to compensate for its exceptionally low average yield, leading to its financial disaster.

Mexico's Rail Privatization: Implications for Modal Competition in North American Grain Trade

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Introduction

Mexico's notoriously antiquated and inefficient state-run railroad has been revamped since privatization began in 1997. The three major railroads that emerged from the privatization process, Transportación Ferroviaria Mexicana, Ferrocarril Mexicano, and Ferrocarril del Sureste, have made impressive progress in their drive to achieve operational standards and service levels similar to the Class 1 railroads north of the border. New investment in rolling stock and infrastructure has been crucial to transforming the decaying Ferrocarriles Nacionales de Mexico (The Mexican National Railway) into a faster, more reliable and higher quality system.

Progress in the Mexican rail sector has caused grain exporters in Canada and the U.S. to re-examine their logistics options. Overland routes have advantages in quality and speed, but face fierce competition from ocean shipping in the Mexican grain market. Privatization and capital improvements at the ports have countered the growing market share of overland grain shipments that was observed in the early 1990s.

This paper provides a review of Mexico's rail privatization, examines trends in grain trade between Mexico and its two NAFTA partners, and assesses modal competition between rail, ocean shipping and trucking in bulk grain transportation.

Mexico's Restructured Rail Industry

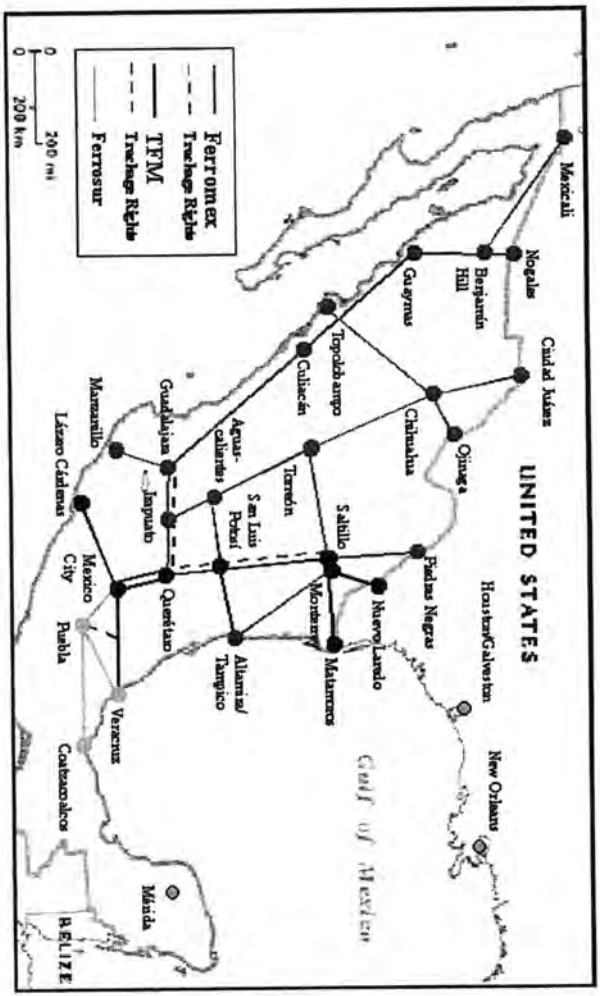
The Mexican government's decision to break up the rail monopoly held by state-owned Ferrocarriles Nacionales de México is widely acclaimed as one of the most significant developments in Mexican transportation history. Trackage rights to three regional networks were auctioned off to private companies as 50-year concessions.

The first concession offered was Mexico's 4,284-kilometer northeast system. This relatively short network links Mexico City with the industrial center of the north, Monterrey, and Mexico's strategic U.S. border crossing at Nuevo Laredo (see figure 1). The winning bidder, Transportación Ferroviaria Mexicana (TFM), began operations in May 1997 and is jointly owned by Transportación Marítima Mexicana and Kansas City Southern Industries (parent company of Kansas City Southern Railway).

The 10,526-kilometer west/central network was the second Mexican railway concession. Ferrocarril Mexicano (Ferromex), which inaugurated its service in February 1998, is controlled by Grupo México and 26-percent stakeholder, Union Pacific Railroad. The west/central network links Mexico City to the country's second largest center, Guadalajara, the Pacific Coast port of Manzanillo, and the five rail border crossings west of Nuevo Laredo (see figure 1).

Ferrocarril del Sureste (Ferrosur) is Mexico's smallest railroad and was the last to be privatized under the government's National Development Plan. Ferrosur's 1,484-kilometer network in southeastern Mexico serves Mexico City, Puebla and the Gulf Coast ports of Veracruz and Coatzacoalcos. An alliance with short-line railroad Ferrocarril Chiapas Mayab has extended Ferrosur's reach to the Yucatan Peninsula's largest and most important center, Mérida (see figure 1). Ferrosur was privatized in December 1998 and is owned by the Mexican conglomerate, Grupo Carso.

Figure 1: Mexico's Rail Network



Post-Privatization Investment and Progress

The growth of trucking in Mexico stems in part from decades of under investment in the state-owned railway. Upon deciding to privatize the nation's rail network in the mid-1990s, the Mexican government scaled back virtually all rail maintenance activities. By 1997, rail's share of surface freight transportation in Mexico had dropped to less than 10 percent and even core rail markets, such as the long-haul transport of bulk grains, were being absorbed by trucking (Prentice et al, 2000).

Due to the varied circumstances and timing of their start- ups, each railroad is at a different stage in the push to modernize. Beginning operations nine-months before Ferromex, TFM had a head start in the new Mexican rail industry. Its mainline's long-time status as the country's highest density rail corridor (carrying over 60 percent of all U.S.-Mexico rail freight) also meant that the northeast network had received higher levels of maintenance than other regional networks. TFM has capitalized on these advantages with an aggressive investment strategy. Since 1997, the company has spent more than US$1 billion on equipment, infrastructure, operations and customer service (TFM, 2000).

TFM's capital-intensive projects have included boosting the capacity of the Laredo/Nuevo Laredo rail bridge from 1,300 cars daily to over 3,000 cars daily, building new intermodal facilities at Laredo, Nuevo Laredo and Monterrey, and purchasing 150 new 4,000/4,400-hp locomotives. The railroad has also leased over 6,000 railcars, installed automatic equipment identification readers and hot box detectors on its mainline, and established a fully bilingual 24-hour customer service center and a centralized train dispatch system (TFM, 2000; Foran, 1999).

Between 1998 and 2000, TFM's operating ratio improved from 85 to 68. This astonishing turnaround places TFM among the most efficient Class 1 railroads in North America. Other TFM achievements include drastic reductions in Mexico City/Nuevo Laredo transit times (from

over 60 hours before privatization to between 35 and 40 hours today), an 87 percent decline in cargo theft, and a 75 percent reduction in bad orders (TFM, 2000; Foran, 1999).

Ferromex has also made significant advances in its brief history. Since taking over the west/central network in 1998, the railroad has spent over US$500 million on infrastructure, equipment, telecommunications and other areas. Investment priorities have included the repair and renewal of mainline track and bridge infrastructure, the purchase of 50 new 4,400-hp locomotives and over 1000 new cars, and the reconditioning of 100 locomotives in the company's existing fleet (Grupo México, 1999; Foran, 1999; Vantuono, 2000).

Like TFM, Ferromex has modernized its network through the installation of hot box detectors, automatic equipment identification readers and end-of-train devices. The construction of new railcar and locomotive repair facilities has enhanced service reliability and on-time performance. The returns generated by Ferromex's capital infusion include a 78 percent reduction in cargo theft between 1999 and 2000, a 43 percent rise in cargo volume between 1997 and 2000, and a US$335 million jump in revenue since privatization (Grupo México, 1999; Vantuono, 2000).

Ferrosur has not yet established itself as one of Mexico's privatization success stories. Unexpected difficulties with track, which had fallen into severe disrepair in the hands of the Mexican National Railway, have caused accidents and derailments. Ongoing repairs to Ferrosur's network have been costly and have created service disruptions.

These problems have exacerbated the inherent disadvantages faced by rail in southeastern Mexico. Ferrosur's 424-kilometer Mexico City/Veracruz rail line winds its way up to an altitude of over 10,000 feet before descending to sea level. Unit trains are restricted to 36 cars due to the route's tight curves and steep grades. Not only is

trucking better at negotiating the region's mountainous terrain, but the relatively short distances reduce rail's competitiveness.

Despite this, Ferrosur is proceeding with its development plan. After investing a meager $10 million in the railroad in 1999, the company pledged to spend over six times that amount in 2000. These funds have gone mainly towards infrastructure improvements. Other investments include the modernization of communications systems, the implementation of car control systems, the purchase of new locomotives, and the lease of over 1,000 hopper cars. Ferrosur's stepped-up investment plan was expected to help drive up sales by 20 to 25 percent in 2000 (McCosh, 2000). Given that the railroad's share of southeastern Mexico's freight transportation market was a scant 1.4 percent in 1999 (compared to 13 percent for Mexico as a whole and approximately 40 percent for the U.S), the potential for growth appears promising (Vantuono, 2000).

Mexican Agricultural Trade with Canada and the U.S.

Mexico's population has swelled from less than 70 million inhabitants in 1980, to over 100 million today. Income in Mexico has grown at an average rate of 5 percent per year since 1996. A greater number of Mexicans are moving into the middle and upper classes, now estimated at 30 million (Prentice et al, 2000). The combination of rapid population growth and increased affluence has contributed to heightened demands for American and Canadian bulk agricultural commodities for human consumption and for conversion into meat products.

Table 1 is a breakdown of Canadian and U.S. grains and oilseeds exported to Mexico since 1990. The vast majority of these exports are funneled through three gateways: Laredo, Texas, New Orleans, Louisiana, and Houston-Galveston, Texas. The most important gateway for southbound grains and oilseeds moving into Mexico by truck or rail is Laredo, Texas. The ports of New Orleans and Houston-Galveston are the two predominant gateways for bulk agricultural commodities being shipped via the Gulf of Mexico.

Table 1.

Canadian and U.S. Grain and Oilseed Exports to Mexico (000s of Metric Tonnes)						
Year	Cdn. Wheat	Cdn. Canola	U.S. Wheat	U.S. Sorghum	U.S. Soybeans	U.S. Corn
1990	62	205	358	2,899	830	3,487
1991	467	299	312	3,318	1,481	1,314
1992	592	274	409	4,965	1,914	1,148
1993	603	449	967	3,605	1,758	287
1994	829	485	625	3,407	2,073	3,058
1995	430	510	791	2,147	2,018	2,858
1996	415	612	1,554	1,971	2,648	6,335
1997	704	562	1,067	2,139	3,093	2,566
1998	769	772	1,591	3,205	3,100	5,246
1999	749	866	1,824	4,027	3,287	5,052
2000	779	682	1,560	4,257	3,194	4,760

Source: The ProExporter Network®

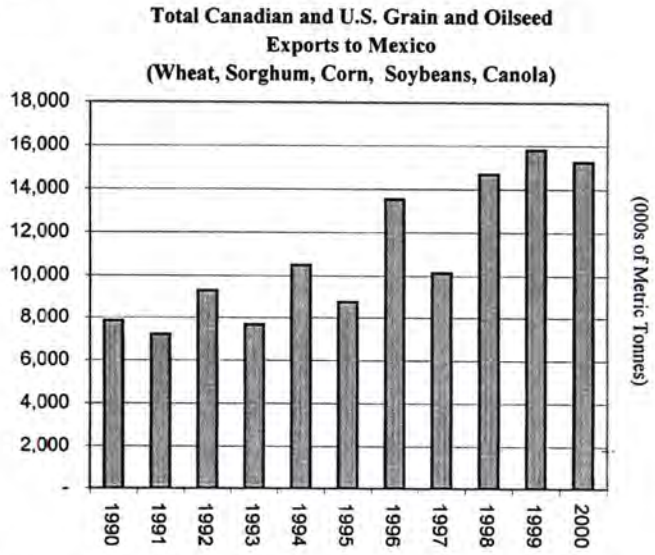
Figure 2 illustrates the yearly totals of U.S. and Canadian exports of grain to Mexico since 1990. During this decade, Mexican grain imports increased steadily and approximately doubled in volume.

Modal Competition in Grain Trade

The North American rail industry has changed dramatically in the last five years. Class 1 railroads now offer streamlined, single-bill international transportation services for bulk grains. One such service is the BNSF-Ferromex shuttle train. U.S. shippers utilize BNSF hopper cars to export grains to Mexican processing centers in Torreón and Aguascalientes.

The Canadian railways have also been active in nurturing alliances with the Kansas City Southern and the TFM to carry grain to Mexico. One Mexican importer is working with CN Rail to bring a "grocery train" to Mexico. This is a large block of cars made up of single carloads of grain, oilseeds, special crops and pulses. Per-unit border

Figure 2.



Source: The ProExporter Network®

crossing and clearance costs decline due to consolidation of inspection activities and documentation. Logistical savings are also obtained on freight discounts for the car block and distribution warehousing costs in a Mexico free trade zone.[1]

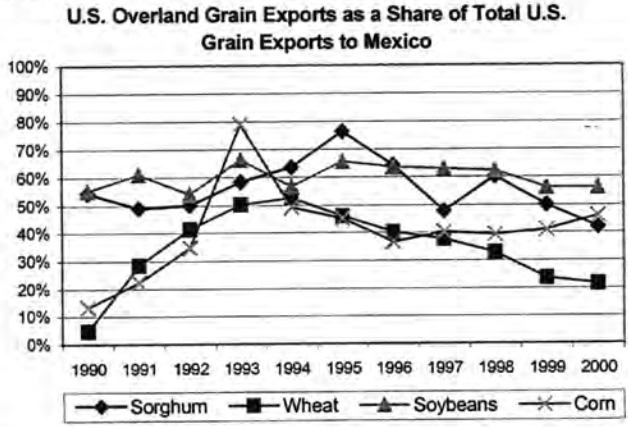
Equipment availability is a key issue in grain shipments to Mexico, from the U.S. and Canada. Despite the numerous car-hire and service agreements spawned by integration of the North American rail system, equipment shortages still exist. In Mexico, leased Canadian

[1] Miguel Pedraza, personal communication, January 2001

and U.S. hopper cars have alleviated some of the strain, but shorter car cycle times and improved asset utilization are necessary.

Privatization of the Mexican rail system and the introduction of new services have contributed to rising volumes of bulk grains for rail. With the exception of corn however, overland modes have not gained market share versus the marine routes. Figure 3 presents modal shares of Mexican imports of U.S. sorghum, wheat, soybeans and corn between 1990 to 2000. One explanation for the marginal impact of rail concessions in the late 1990s may be the privatization of Mexican ports that has also improved their productivity.

Figure 3.



Source: The ProExporter Network®

Port privatization in Mexico has increased investment in infrastructure and intensified competition among service providers. Output at Veracruz has jumped 200 percent at mechanized terminals and 300 percent at semi-mechanized terminals since privatization (Aguerrebere, 2001). Improved efficiencies in port operations and economies of size in ocean shipping have made marine routes more competitive with rail to Mexico. Hall (2001) estimates that rail is

approximately 10 to 15 percent more expensive than ocean shipping for U.S. grain exports to Mexico City. The railways offer volume discounts on direct rail shipments to large receivers. Veracruz is planning to offset this cost advantage by dredging its harbor to a depth of 40' to accommodate 65,000-ton Panamax vessels[2]. When this occurs (scheduled completion date 2002), rail's share of bulk grain transportation between the U.S. and Mexico could be difficult to retain, but this also depends on further landside port improvements. Waiting times for ships at the port of Veracruz have stopped improving and the harbour is approaching berth saturation[3].

Bulk grain imports at Veracruz are normally loaded directly into railcars and trucks. While both TFM and Ferrosur serve the port, only Ferrosur has harbor access. The resulting interswitching activities are costly, time-consuming and create congestion. This highlights the interdependency of rail and ocean shipping, and the importance of improving infrastructure and intermodal logistics at the ports.

Rail has some inherent disadvantages in Mexico, and particularly in the short hauls from the ports to Mexico City. According to Aguerrebere (2001) car cycle times can be up to 10 days (Veracruz - Mexico City -Veracruz), despite rail transit times of only 26 hours. Many shippers are forced to use trucks, which are more expensive, because the rail system is inadequate. In logistics, it is total costs that matter. Inadequate and inefficient landside operations on the marine route may mitigate the lower costs of larger ships.

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[2] Panamax ships could also make more distant Canadian ports more competitive with the U.S. gulf ports. The Port of Churchill has maintained a steady movement of Canadian wheat to Mexico via Veracruz. Larger ships provide line-haul savings that could help ports further away to compete with the greater proximity.

[3] Aguerrebere (2001) observes that average days in port at Veracruz dropped from 12 in 1990 to 8.5 in 1997, but have since leveled off.

The two northern railroads in Mexico have focused their investments on priority areas such as infrastructure repair and equipment renewal. These measures have yielded significant volume increases in the automotive and intermodal freight markets that utilize high-density rail corridors. But relatively little has been done to expand the country's branch line network. Between 1950 and 1999, the entire Mexican rail system grew by just 0.3 percent (Prentice et al, 2000). Rail's limited coverage, coupled with a scarcity of spurs and sidings capable of accommodating unit trains, has created an agricultural market in which few customers have storage facilities capable of handling large volumes of bulk grains.

U.S. overland shipments of agricultural commodities destined for Mexico's densely populated central region (the Mexico City-Guadalajara-Monterrey triangle) are transported by both truck and rail. Because bulk agricultural commodities are generally not time sensitive, rail's lower transit times are of relatively little consequence to shippers in this market. Indeed, faster delivery of bulk agricultural commodities by rail has arisen primarily from the railroads' efforts to improve asset utilization and operational efficiency rather than as a response to market demands.

North-south trucking of grains between the U.S. and Mexico occurs where producer and consumer regions are sufficiently close to negate the price advantages of rail, where limited storage facilities require delivery of smaller volumes, or where direct access to rail facilities is not available.

Deregulation of the Mexican trucking industry in the late 1980s, and the influx of NAFTA trade in the late 1990s has brought about higher vehicle standards and operating practices in the Mexican trucking industry (Harrison, 1999). Rail's poor reputation, combined with trucking's flexibility, reliability and competitive pricing, have enabled Mexican trucking to retain significant market share in the rail-dominated overland grain transportation market.

Recent developments in NAFTA Trucking

Under the original terms set out in NAFTA, trucks from the U.S. and Mexico were to be given access to border states on either side of the international boundary in 1995. By 2000, reciprocal nation-wide access was to be granted. The U.S. government has prevented enactment of these provisions.

Safety concerns were cited as the primary justification for blocking the opening of the border to Mexican trucks. However, it is widely accepted that the threat of layoffs in the U.S. trucking industry due to competition from cheaper Mexican services was the underlying cause for the U.S. government's decision. Ironically, the two most prominent trucking associations in Mexico, Canacar and Conatram, have supported the blockade; fearing giant U.S. carriers will swallow their nation's trucking firms.

In February 2001, the Bush administration confirmed that the U.S. would comply with an arbitration panel's decision stipulating that the U.S. must open its border to Mexican trucking. Despite the wide-spread trumpeting of this decision, practical changes to the complex trailer transfer process at the U.S.-Mexico border have not occurred. Politics aside, several issues may continue to impede the direct, single-carrier trucking of agricultural products and other freight between the U.S. and Mexico.

Cabotage regulations prevent Mexican carriers from transporting U.S. domestic freight and vice versa. This limits backhaul opportunities to international movements and may discourage cross-border service to regions with marked trade deficits such as Mexico City. For Mexican trucking firms delivering into the U.S., grain may represent an attractive backhaul market.

Cross-border runs deep into U.S. or Mexican territory may also be complicated by the differing sulfur content of diesel fuels in the two countries. Variations in the level of sulfur in diesel fuel can affect

ignition systems, engine performance, maintenance scheduling, and the selection of motor oil (McCosh, 2001; Giermanski, 1994).

Disparate Mexican and U.S. legal processes for traffic violations and accidents are potentially serious obstacles to cross-border trucking. Attorneys specializing in this issue have warned of the dangers of foreign carriers operating under laws and regulations they may not be familiar with.

Experts agree that these and other issues will likely take months, if not years, to resolve. Thus, the impact of cross-border trucking on market shares in the U.S.-Mexico agricultural transportation market is uncertain.

Conclusion

Mexico is an attractive market for grain exports from Canada and the United States. Exports of bulk agricultural commodities to Mexico are expected to grow in coming years. Population and per capita incomes are rising rapidly, while the potential to increase domestic grain production is very limited. If current trends persist, grain imports could double during the first decade of the 21st Century.

Rail and trucking will share in the total growth of grain transport to Mexico. Whether the overland routes will gain market share, relative to the marine routes depends on the ability of the ports to accommodate growth. Economies of size in shipping, more efficient port operations, and the proximity of Gulf Coast ports to Mexico's principal consuming regions are advantages for direct sailing routes to the U.S. Without efficient rail service to the ports, however, the direct overland routes may offer lower total costs.

The three rail concessions in Mexico each have an opportunity to gain grain traffic, providing they can continue to attract investment. Port congestion has created a window of opportunity for rail to expand its customer base. Similarly, opening of the U.S. border to Mexican trucks could create more competition in the overland routes.

Deregulation, free trade and privatization of the rail systems in Mexico are all combining to make this an increasingly attractive market for U.S. and Canadian grain exports.

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Trade and Transportation: The Impact of the 1995 Transborder Air Services Accord

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For many years, Canada and the United States have enjoyed the largest bilateral trading relationship in the world. In 1999 alone, the United States exported $187.9 billion in goods and services to Canada and imported $216.8 billion from it. While propinquity and cultural affinity no doubt play a role, most observers attribute their extensive trade to the generally open trading regime that has existed between the two countries for many decades. Both countries are members of the World Trade Organization (WTO), and its predecessor, the General Agreement on Tariffs and Trade (GATT). These organizations have striven to dismantle trade barriers on a multilateral basis, including, of course, transborder trade between Canada and the United States. The two nations have also utilized bilateral agreements to eliminate obstacles to trade. The 1965 Auto Pact, for example, provided for the duty-free movement between the two countries of motor vehicles and original equipment automotive parts. The 1988 Canadian-U.S. Free Trade Agreement (FTA) lowered barriers to Canadian-U.S. trade in most goods and services. In 1994, the North American Free Trade Agreement (NAFTA) was implemented among Canada, Mexico, and the United States, lowering trade barriers still further.

To be sure, not all sectors of the North American economy have benefited from an open trading regime. One important sector that has labored under high trade barriers for most of the post-World War II period is the transborder air services market. In 1966—roughly the same time that the Auto Pact was being implemented—a new air services accord (ASA) was struck by negotiators representing the two governments to govern aviation services between U.S. and Canadian

cities. Unlike the Auto Pact, the impact of the 1966 ASA was to limit trade, not facilitate it. Although it was amended several times, in essence it restricted air service to approximately 83 transborder routes. Moreover, on most of these routes only one or two carriers was authorized to provide service. The 1966 agreement governed Canada-U.S. air service for almost 30 years, finally being replaced in 1995 with a new ASA that has permitted freedom of entry, exit, and pricing on transborder routes.

The dichotomy between the progressive opening of most sectors of the North American economy and the "frozen in time" nature of the closed regime governing transborder air services creates a natural experiment for researchers interested in studying the relationship between population growth, trade, and air transportation. The goal of this paper is to analyze this natural experiment. The paper proceeds as follows: Section I briefly describes the evolution of the transborder aviation policies of Canada and the United States from 1966 to the present, while Section II discusses changes in the North American economy during that time span. Section III examines the relationship between merchandise trade patterns and air passenger traffic patterns from 1966 to the present. In particular, it focuses on three time periods: the advent of the 1966 ASA (1968 is used as a proxy, for it is the earliest year for which necessary data are available); 1994, which represents the ending of the 1966 ASA; and 1998, the latest year for which data are available after the new ASA became effective. Our summary and conclusions are offered in Section IV.

I. Regulation of Transborder Aviation Services, 1996-2001

In 1966, Canada and the United States signed a restrictive air services accord (ASA) governing transborder aviation services between the two countries. This accord, with minor amendments, remained in place until 1995. The 1966 accord as amended authorized commercial airline service in 83 transborder city-pairs. Most of these routes received monopoly service. Only 19 city-pairs were allowed to receive service from both a U.S. and a Canadian carrier. Twenty-six routes were reserved for carriers domiciled in Canada; the remaining

38 were to be served exclusively by U.S. carriers.[1] On most routes, each nation could designate more than one airline only with the permission of the other government. While capacity was left to the determination of the designated carriers, either government was allowed to reject proposed transborder fares.

This accord was amended twice in 1984. The first change, the Regional, Local, and Commuter Services Agreement, allowed commuter carriers operating aircraft of 60 seats or fewer to enter transborder city-pairs as long as the city met certain size and distance criteria.[2] The second change, enacted as an experiment, granted freedom of entry on transborder routes serving Montreal's Mirabel Airport or San Jose, California, although potential service between Mirabel and seven important U.S. gateway cities was excluded from this deal.

These modest breakthroughs encouraged negotiators from both countries to seek wholesale liberalization of the 1966 Accord. Despite many public statements about the need for a new ASA—such as that contained in the Shamrock Summit Declaration, a document issued jointly by President Reagan and Prime Minister Mulroney in March 1985—it took a decade of intermittent negotiations before a new, much liberalized transborder ASA was signed in February 1995.[3] After a two-year phase-in period that granted Canadian-flag carriers a head start in markets serving Toronto, Montreal, and Vancouver, the new ASA permitted unfettered freedom of entry and exit to Canadian- and U.S.-flag carriers in the transborder market. The 1995 accord also granted these carriers pricing freedom. Carrier-initiated prices could be rejected only if both governments found them unwarranted. The grounds for governmental disapproval were limited to protecting carriers from predatory competition or from having to compete against low fares resulting from government subsidies or to prevent unreasonable price discrimination or exploitation of a dominant position.[4]

II. The Evolution of the North American Economy, 1966-1999

The North American economy has undergone dramatic changes subsequent to the signing of the 1966 transborder Air Services Accord. As we noted in the introduction, trade barriers between the two countries have been significantly reduced due to the 1965 Auto Pact, the 1988 Free Trade Agreement, and the 1994 North American Free Trade Agreement. The reduction in trade barriers between the two countries intensified trade between them, and transborder trade and investment became a more important component of both countries' economies. Many firms integrated their U.S. and Canadian operations, focusing their production of given products or product lines in one country so as to achieve economies of scale. For example, DaimlerChrysler produces its Ram vans and wagons in Windsor, Ontario, while a Toledo facility assembles the company's Jeep Cherokees and Wrangler SUVs.[5]

Massive regional shifts of population and production occurred in both countries. As Table 1 indicates, in 1966, 52.5% of the U.S population lived in either the Northeast or the Midwest—the traditional heart of the U.S. economy; 56.7% of the country's personal income was generated in this region. By 1999, these percentages had fallen to 42.2% and 44.9% respectively. In Canada, similar, but less dramatic shifts took place, as is demonstrated in Table 2. In 1966, Quebec and Atlantic Canada contained 38.7% of Canada's population; by 1999, this figure had fallen to 31.9%. In 1966, Quebec and Atlantic Canada contributed 31.9% of Canada's GDP. In 1999, this figure had fallen to 27.1%. Conversely, the western-most provinces, Alberta and British Columbia, contained 16.7% of Canada's population in 1966; by 1999, this figure had grown to 22.9%. In 1966, 18.1% of Canada's GDP was generated by these two provinces; in 1999, Alberta and British Columbia produced 24.6% of Canada's GDP.

III. The Relationship between Trade and Air Transportation

Although the U.S. and Canadian economies underwent substantial transformation as a result of these regional shifts, for almost three decades the air services provided to transborder travelers did not. Not surprisingly, the pattern of air services authorized by the 1966 air services accord reflected the contemporaneous Canadian and U.S. economies. Most of the city-pair services authorized by the 1966 accord linked cities in the Northeastern and Midwestern United States with cities in Eastern and Central Canada. Excluding Alaskan and territorial routes, half of the authorized routes had either Toronto or Montreal as their Canadian terminus. Conversely, little service was authorized from the western or southern United States or from Canada west of Ontario. Particularly troublesome was the paucity of routes between the faster-growing regions of the two countries. Only 18 routes served a point in the southern or western U.S. and a point in the western provinces of Canada. Similarly, post-1966 changes in government aviation policy (e.g. deregulation) and industry practice (e.g. construction of hub-and-spoke route networks) meant that the routes created by the 1966 accord increasingly diverged from those that would be flown in a free market. For example, under the 1966 accord Delta, not US Air, received transborder rights between Toronto and Pittsburgh despite the latter city's later status as US Air's primary hub.

As time passed, the pattern of air service authorized by the 1966 ASA increasingly diverged from the pattern of population and economic activity in North America. Post-1966 shifts in North American economic activity left many booming cities with inadequate or nonexistent transborder service. Accordingly, many transportation, economic development, and government officials expressed concern that the inability of the two countries to renegotiate the transborder ASA would slow the growth of commercial ties between the two neighbors, misdirect transborder trade and locational decisions, and fail to meet the evolving needs of the increasingly integrated North American economy.

The failure of Canada and the United States to negotiate a new air services accord for almost three decades has one interesting benefit, however. It creates a natural experiment to assess the relationship between air transportation and economic activity. To evaluate this experiment, we begin by assuming that the transborder routes authorized by the 1966 ASA reflected in some large measure economic activity in the contemporaneous North American economy. That is, rational negotiators would have agreed to allocate routes to where they were most needed, ceteris paribus. (Of course, we recognize that political considerations could also play a role as well.) Thus we would expect to observe a relatively high correlation between economic activity and air passenger service during the initial period when the 1966 ASA was in effect. If, as we have argued, the North American economy evolved in the ensuing three decades while the transborder route network was "frozen in time," then we would expect the relationship between economic activity and air passenger service to atrophy over time. Finally, after the new, liberalized transborder ASA was implemented in early 1995 that allowed carriers to choose which routes to serve, we would expect to observe a very high correlation between economic activity and air passenger service.

To test this argument, we examined the relationship between merchandise trade and scheduled passenger traffic on a province-state basis for three selected years. The three years chosen were:

- 1968, which is near the advent of the 1966 air services accord. Also, 1968 was the earliest year for which "province to state" Canadian export data were available;
- 1994, the last complete year when the 1966 air services accord was in effect;
- 1998, the latest year for which data are available after the new air services accord became effective.

Merchandise trade statistics were drawn from Canadian merchandise trade export data. The Revenue Passenger Origin Destination Survey of Statistics Canada was used to measure scheduled passenger traffic.[6]

For each year examined, the top fifty city-pairs in the Canada-United States scheduled passenger aviation market were selected. These were grouped by common province-state combinations. For example, Vancouver-Los Angeles, Vancouver-San Francisco and Vancouver-San Diego were combined into British-Columbia-California. For 1998, the top fifty-city pairs, which accounted for 69% of the scheduled origin-destination traffic between Canada and the United States, yielded 37 province-state combinations. The Canadian merchandise trade export values for these province-state combinations were then tabulated. Next, the correlation between the province-state passenger traffic and province-state merchandise export values were calculated for each year.

Tables 3, 4, and 5 report these statistics for the three years. The correlation (measured using the Pearson product moment correlation coefficient) between province-state passenger flows and merchandise trade was 0.469 in 1968. The correlation declined to 0.105 in 1994, but then rebounded to 0.658 in 1998. These changes in the correlation between air passenger traffic and merchandise trade are consistent with our expectations. Because of the "frozen in time" nature of transborder air services, we expected that the correlation would atrophy in 1994 compared to 1966. Once U.S. and Canadian carriers were free to enter any transborder market, we expected that the correlation would be stronger in 1998 compared to 1994. This finding does suggest that in the absence of any government constraints a strong correlation exists between merchandise trade and air passenger service.

The information contained in Tables 3, 4, and 5 are consistent with the regional shifts in U.S. economic activity that occurred over the period 1966 to 1998. The economy's change in orientation from northern to more southern states is apparent over time in both the merchandise trade and the aviation passenger data. Consider merchandise trade: in 1968, of the top 50 province-state combinations, 11 involved southern or western states. This figure rose to 12 by 1994 and to 16 by 1998.

In the aviation data, not only did the number of province-state combinations increase, but more southern and western states became involved through time. In 1968, the top 50 city-pairs in passenger volume resulted in 34 province-state combinations. Only twelve of these involved southern or western states. By 1994, the top 50 city-pairs yielded 36 province-state combinations; 17 of these involved southern or western states. By 1998, the top 50 city-pairs yielded 37 province-state combinations, 22 of which involved southern or western states. Similarly, the aviation statistics reflect the growing importance of British Columbia and Alberta in the Canadian economy. In 1968, only 9 of the 50 largest transborder markets involved British Columbia or Alberta. In 1994, the corresponding figure was 10, while in 1998 it grew to 12.

IV. Conclusions

In this paper we have explored the impact of a natural experiment that occurred when transborder air services between Canada and the United States were frozen in place while the two countries were undergoing massive shifts in regional economic activity. We found that, absent government constraints, there is a strong correlation between province-state trade flows and province-state passengers flows. We also determined that the failure to renegotiate a transborder air services accord over a thirty-year period caused this correlation to atrophy. Presumably this failure damaged the ability of parties in both countries to develop additional beneficial economic linkages. However, we made no attempt to determine the direction of causality—i.e., does air passenger traffic generate trade or does trade generate air passenger traffic?

Table 1 – United States Population and Personal Income, 1966 and 1999

Population

	1966 Population (000's)	% of total U.S.	1999 Population (000's)	% of total U.S.
Northeast	47,788	24.4	51,830	19.0
Midwest	54,840	28.1	63,242	23.2
South	60,205	30.8	96,468	35.4
West	32,667	16.7	61,150	22.4
Total U.S.	195,501	100.0	272,691	100.0

Personal Income

	1966 Personal Income* $	% of U.S. Total	1999 Personal Income* $	% of U.S. Total
Northeast	158.9	27.2	1718.1	22.1
Midwest	172.0	29.5	1770.8	22.8
South	148.5	25.4	2511.0	32.4
West	104.4	17.9	1757.3	22.7
Total U.S.	583.8	100.0	7757.2	100.0

* in billions of U.S. dollars

Table 2 – Canadian Population and GDP, 1966 and 1999

	1966		1999	
	Population (000's)	Percent of total %	Population (000's)	Percent of total %
Newfoundland	493.4	2.5	540.8	1.8
PEI	108.5	0.5	137.6	0.5
Nova Scotia	756.0	3.8	939.2	3.1
New Brunswick	616.8	3.1	754.3	2.5
Quebec	5,780.8	28.9	7,349.1	24.1
Ontario	6,960.9	34.8	11,517.3	37.8
Manitoba	963.1	4.8	1,142.6	3.7
Saskatchewan	955.3	4.8	1,025.7	3.4
Alberta	1,463.2	7.3	2,959.4	9.7
B.C.	1,873.7	9.4	4,028.1	13.2
Yukon	14.4	0.1	31.1	0.1
NWT including Nunavut	28.7	0.1	68.1	0.2
Total Canada	20,014.8	100.0	30,493.3	100.0

	GDP, expenditure-based			
	1966		1999	
	GDP*	% of total	GDP*	% of total
Newfoundland	829	1.3	12,110	1.3
PEI	178	0.3	2,994	0.3
Nova Scotia	1,513	2.4	22,407	2.3
New Brunswick	1,222	1.9	18,390	1.9
Quebec	16,641	26.0	204,062	21.3
Ontario	26,182	41.0	396,775	41.4
Manitoba	2,669	4.2	30,995	3.2
Saskatchewan	2,965	4.6	30,143	3.1
Alberta	5,016	7.8	116,990	12.2
B.C.	6,538	10.2	118,783	12.4
Yukon	155	0.2	1,080	0.1
NWT	in Yukon		2,167	0.2

(including Nunavut)				
Nunavut	in Yukon		731	0.1
Total Canada	63,908	100.0	957,627	100.0

*millions of Canadian dollars

Source: CANSIM Matrix 60, The Daily, September 26, 2000, CANSIM matrix databank no.'s D24227, D24261, D24295, D24329, D24363, D24397, D24431, D24465, D24499, D24533, D24567, D24601, D29133, D29167, CANSIM matrix databank no.'s D31720, D31742, D31764, D31786, D31808, D31830, D31852, D31874, D31896, D31940, D44014, D31698

Table 3 – Province-State Passenger and Trade Flows, 1968

Province-State	Province-State Passengers (000's)	Province-State Exports $000's	Province-State Passengers Rank	Province-State Exports Rank
ON-NY	413.6	958,083	1	2
QC-NY	342.3	491,738	2	3
ON-FL	132.4	20,675	3	72
BC-CA	124.7	177,384	4	10
ON-IL	109.6	219,395	5	8
QC-FL	81.2	20,610	6	73
QC-MA	80.1	154,091	7	12
ON-CA	78.6	158,076	8	11
ON-OH	61.2	234,396	9	6
BC-WA	56.7	292,742	10	4
NS-MA	46.4	37,330	11	40
QC-CA	42.9	54,110	12	28
ON-MA	42.7	131,939	13	14
ON-PA	41.1	223,954	14	7
QC-IL	39.3	98,389	15	18
ON-DC/MD	36.2	47,198	16	33
ON-MI	34.6	1,571,167	17	1
QC-DC/MD	27.3	80,428	18	22
QC-PA	27.3	254,030	19	5

BC-HI	27.2	5,748	20	145
BC-OR	22.3	33,426	21	48
QC-OH	15.9	148,507	22	13
BC-NY	14.9	78,047	23	24
MB-MN	14.8	109,916	24	16
MB-IL	13	11,687	25	103
ON-MN	12.3	80,387	26	23
MB-NY	12.1	25,910	27	57
AB-CA	11.1	34,148	28	46
ON-CT	9.8	39,453	29	37
NS-NY	9.5	17,070	30	79
AB-NY	8.5	11,066	31	104
ON-MO	8.1	66,231	32	25
AB-CO	7.9	1,428	33	241
BC-IL	7.4	47,583	34	32

Source: see footnote 6

Table 4 – Province-State Passenger and Trade Flows, 1994

Province-State	Province-State Passengers (000's)	Province-State Exports $000's	Province-State Passengers Rank	Province-State Exports Rank
ON-NY	772.3	10,293,236	1	2
ON-FL	485.2	689,069	2	45
ON-CA	441.1	5,048,547	3	4
BC-CA	341.8	1,304,894	4	26
ON-IL	315	4,168,980	5	7
QC-NY	305.4	4,667,973	6	6
QC-FL	273.2	610,117	7	55
AB-CA	214.5	755,989	8	40
ON-MA	211.7	1,950,845	9	13
QC-CA	170.7	724,029	10	42
ON-TX	151.6	1,853,883	11	14
QC-IL	112.7	1,243,900	12	27
ON-PA	109.1	2,336,867	13	12
QC-MA	104.5	1,385,057	14	23
ON-DC/MD	101.6	610,691	15	54

ON-GA	90.5	1,230,322	16	28
ON-MI	80.8	45,460,969	17	1
BC-NY	78.5	316,987	18	86
BC-WA	69.7	3,027,972	19	8
ON-AZ	57.4	122,604	20	139
ON-OH	55.5	5,245,730	21	3
BC-IL	53.8	504,365	22	63
ON-MN	53	869,567	23	38
QC-DC/MD	52.8	387,616	24	71
QC-PA	45.9	1,798,433	25	17
ON-TN	43.6	1,081,666	26	35
ON-CO	41.6	222,214	27	103
BC-HI	40.5	36,043	28	244
AB-NY	39.8	1,819,137	29	15
QC-GA	39.7	540,460	30	60
AB-IL	39.4	2,774,859	31	10
QC-MI	39.2	4,681,717	32	5
BC-OR	39	755,772	33	41
AB-TX	38	1,098,975	34	34
NS-MA	37.3	443,490	35	68
QC-TX	35.7	1,308,010	36	25

Source: see footnote 6

Table 5 – Province-State Passenger and Trade Flows, 1998

Province-State	Province-State Passengers (000's)	Province-State Exports $000's	Province-State Passengers Rank	Province-State Exports Rank
ON-NY	1076.8	19,171,154	1	2
BC-CA	959.9	1,840,786	2	27
ON-CA	648.7	9,045,904	3	3
ON-IL	458.3	6,857,699	4	6
ON-FL	400.9	1,304,485	5	40
QC-NY	356.6	7,739,478	6	5
AB-CA	316.9	1,136,119	7	45
ON-DC/MD	299.3	829,337	8	55
ON-TX	257.9	3,217,576	9	12

ON-MA	255.8	2,688,094	10	17
QC-CA	227	1,381,010	11	37
QC-FL	202.9	1,071,001	12	48
ON-GA	197.1	1,892,168	13	26
QC-IL	165	1,772,661	14	30
ON-PA	151.2	3,925,293	15	9
BC-NY	131.6	395,510	16	91
BC-NV	125.3	105,718	17	192
BC-WA	118	4,808,146	18	7
ON-MN	108.3	1,631,752	19	34
QC-DC/MD	102.1	655,894	20	65
BC-AZ	99.6	2,296,980	21	153
ON-CO	97.8	409,517	22	86
ON-AZ	94.7	401,796	23	88
BC-IL	92.2	580,501	24	72
AB-TX	82.4	1,249,403	25	42
QC-GA	74.8	1,335,181	26	38
ON-NC	74.2	1,782,914	27	29
ON-OH	71.2	8,292,686	28	4
QC-MA	70.4	1,755,969	29	31
BC-OR	68.2	981,493	30	52
BC-HI	63.9	32,032	31	300
ON-WI	61.3	2,296,980	32	21
QC-PA	59.7	2,521,192	33	20
BC-TX	59.1	617,911	34	68
ON-MO	58.5	2,269,560	35	23
AB-NY	57	2,936,177	36	14
ON-WA	56.5	973,098	37	53

Source: see footnote 6

Footnotes

[1]Ira Lewis, "United States-Canada Air Services: The Role of Alliances in a Future Bilateral Agreement," *Transportation Journal*, Spring 1995, pp. 5-12.

[2]To qualify under the commuter services agreement, the U.S. city had to have a population of less than one million and the Canadian city less than 500,000 population. The stage length of the intended service had to be less than 600 miles, except in Central Canada, where stage lengths were limited to less than 400 miles.

[3]Raymon J. Kaduck, "*Break in Overcast: The Negotiations of the 1995 Canada-US Open Skies Agreement*", the Norman Paterson School of International Affairs, Ottawa, Ontario, October 1996 (mimeo), which provides useful information about the progress of these negotiations and important insights into why it took so long to reach an agreement acceptable to both sides.

[4]Ira Lewis, "The Emerging Integration of the Canadian and U.S. Airline Industries," *Transportation Journal*, Spring 1996, pp. 49-54.

[5]"Chrysler to cut 26,000 jobs," CNN website, January 29, 2001

[6]Statistics Canada catalogue 51-205, *Air Passenger Origin and Destination, Canada-United States Report* The survey estimates are produced from data that were drawn from lifted passenger flight coupons. A 10% continuous systematic sample of flight coupons lifted by the major Canadian scheduled air carriers and the relevant certificated United States air carriers was employed. From the Canadian survey are taken those itineraries which have pure Canadian carriage and mixed Canadian and United States carriage content. From the United States survey are derived those itineraries with pure United States carriage. Data exchanged include all itineraries in the O & D surveys of the two countries which have both a United States point and a Canadian point in the routing, or which involve a United States carrier to a Canadian point or a Canadian carrier to a United States point.

Statistics Canada catalogue 65-202, *Exports, Merchandise Trade* and special tabulation from International Trade Division, Statistics Canada, for 1968. Canadian exports to the United States are compiled

using United States import statistics (from the U.S. Bureau of the Census). In 1968 the province of lading was reported while in 1994 and 1998 the province of origin was reported. While these would largely give the same result there could be some differences. There may also be some bias in the state of destination in favour of border states as these can be reported in error as the first modal or carrier distribution change rather than the final destination.

Economics of Congestion at a Border Gateway: The Case of Laredo*

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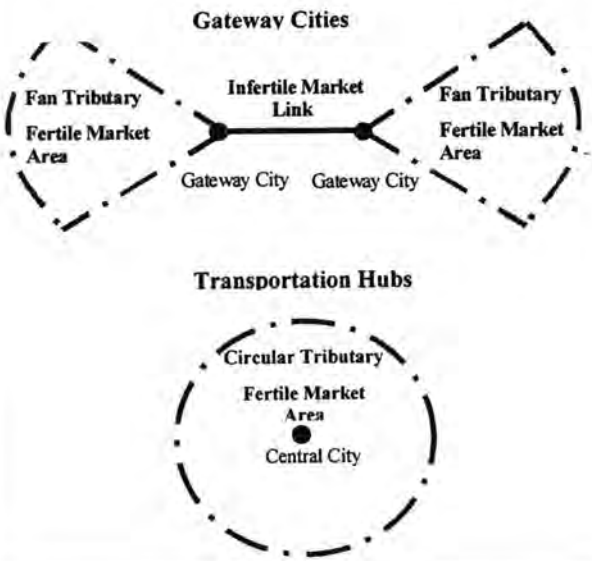
An urban center's location, size and composition are a function of its trading area and the proximity of other urban centers. General hierarchies of cities exist in which smaller and medium size centers grow in the shadow of larger cities. The largest cities provide the widest range of financial and distribution services, as well as the headquarter operations of business and government.

A city's transportation functions flow from the size and shape of its hinterland. The terms "transportation hub" and "transportation gateway" are often used as if they were interchangeable. This is not necessarily the case. Burghardt (1971) hypothesizes that gateway cities are different from other large cities that serve as regional transportation hubs. A gateway city is located at one end of an economic region where it provides a natural access point for transportation. Unlike a central place that might be envisioned to have a circular tributary area, a gateway city usually has a fan-shaped zone of economic influence. In other words, transportation hubs have many short spokes, while a gateway city typically occupies a strategic position and is economically dependent on a few long trade corridors for its traffic.

Figure 1 presents a conceptual model of gateway cities and transportation hubs. Gateway cities occur at geographical economic and/or political shear lines. The gateway is a convenient entrance for transportation into (and necessarily an exit out of) some fertile area.

The opposite side of the gateway is often an infertile area, or at least demands a change in transportation mode, to reach another fertile area. As a result, gateway cities are most often associated with ocean ports. In contrast, a transportation hub is characterized by a large central city that has a circular tributary market.

Figure 1



A geographical feature, such as a natural harbor, may facilitate one gateway city's competitive economic advantage over

other cities in the fan-shaped tributary area and retard the growth and economic importance of these smaller cities. Gateway cities located in the interior of the continent are more difficult to identify. Geographic features are frequently responsible for interior gateway city locations, such as the entrance to a mountain pass, but political boundaries can be equally important. The general requirement is some economic incentive that causes traffic to funnel through a narrow gap. The path of least resistance becomes the dominant gateway location.

Technological change can affect the relative advantage of gateway cities and alter their growth. In the economic development of North America, the substitution of rail transport for river barges caused Chicago to eclipse St. Louis as the major transportation gateway. As trucking replaced rail transport, the growth of competing gateways diminished the dominance of Chicago. Similarly, the introduction of giant containerships threatens to re-order the ports and favor new gateways and corridors. Information technologies may be as important as advances in transportation in the ordering of gateways. The falling cost of information handling and transmission reduces the need for concentration of office activities in an "industrial core" area.

A Tale of Two Border Crossings

The Laredo/Nuevo Laredo (Laredo) border crossing and the transportation congestion associated with this gateway is of principal interest in this paper. The role of congestion in the function of the Laredo gateway between Mexico and the United States can be examined by comparison with the Pembina/Emerson (Pembina) border crossing at the opposite end of the Mid-continent Corridor, between the United States and Canada. Figure 2 presents a diagrammatic view of the truck-based trade at the western border crossings from the U.S. perspective.

The Laredo and Pembina border crossings dominate their respective regions, but serve very different markets. Both locations owe their existence to transportation infrastructure. Rail services reached Pembina in 1879 and Laredo in 1881. Subsequently the Interstate Highway system (I35/I29), made Laredo and Pembina desirable route choices for truck traffic.

Laredo's U.S. hinterland includes all traffic east of the Mississippi River and is the main access point to the industrial heartland of Mexico. Pembina draws traffic mainly from the U.S. Midwest region, and serves the prairies of Western Canada. Although the volume of trade across Laredo is six times larger than occurs at the Pembina crossing, the respective populations of the two centers are disproportional. Including both sides of the border, Laredo has approximately 500,000 inhabitants, while Pembina has less than 1,500. Laredo has many functions that are associated with a gateway city, while Pembina offers little more than residential services for border employees.

The proximity of larger cities adjacent to a border crossing can have a barring on the size and function of border communities. Gateway functions can be performed away from the physical border. For example, the gateway services associated with the Pembina crossing are undertaken at Winnipeg and Minneapolis-St. Paul. Laredo has two major centers that are almost equidistant from the border (Monterrey and San Antonio), but these two larger cities act more like transportation hubs than gateways.

The processing time for a truck to cross at Pembina is between 15 minutes and one hour. In contrast, trucks can take from three hours to a day to cross at Laredo. These differences are related to border congestion, but does it also explain the relatively larger size of Laredo vis a vis Pembina? This is unlikely to be the case. Trade facilitation activities at the Laredo gateway have been amplified by the magnitude of the "political shear line" between Mexico and the United States.

Figure 2: Major Border Gateways of the Mid-Continent Trade Corridor

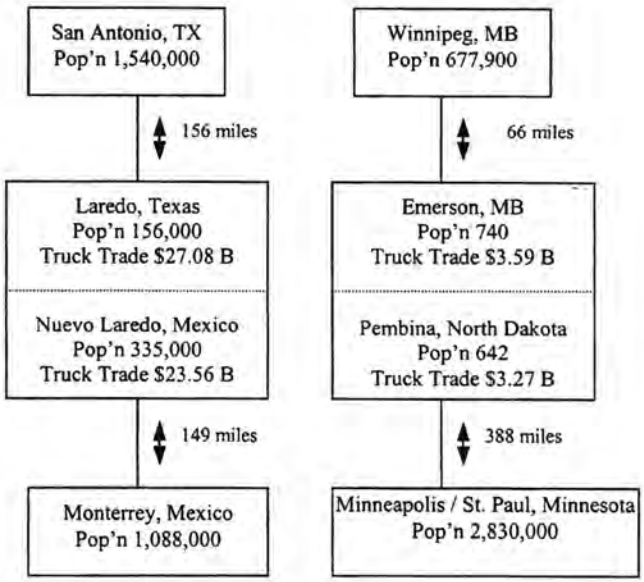


Figure 3 contains a list of cultural and economic considerations that may create social distance between trading

partners. The crossing at Pembina is rapid because Canada and the United States have nurtured an increasingly close trading relationship over the past 100 years. This has been easier because of cultural similarities, such as a common language and shared European heritage. Also, the two countries have developed similar legal and regulatory frameworks, and patterns of law enforcement, that make it easier to do transborder business.

Figure 3 Cultural and Economic Distances at NAFTA Border Crossings

	Mexico/United States	United States/ Canada
Culture & Language	Spanish/English	English/English
History	Armed Conflict 1846-48	NATO Allies, WI & II
Economy	Developing/G7 country	G7 country /G7 country
Trading System	Closed (pre-NAFTA)/Open	Open/Open
Customs	Border/Border	Border/Interior Points
Laws, Regulations & Enforcement	Divergent Approaches	Similar Systems
Financial	Peso/Dollar	Dollar/ ~~Dollar~~ - Loonie

Canada and the U.S. have a tradition of equivalent economic institutions and military alliances, which is characterized by a largely undefended border. In contrast, Mexico and the U.S. have had periods of difficult political relations. In particular, the U.S. and Mexican War (1846-48) made the southern border a greater psychological barrier to trade, than the northern border. This was magnified by the aftermath of the Mexican Civil war (1910-20) that resulted in a highly nationalistic, protectionist inward-looking government in Mexico for most of the 20th Century.

Canada and the U.S. have similar economies and trading regimes. Border clearance of goods between Mexico and the U.S. is subject to more scrutiny than at the northern border. Transport trucks are granted reciprocal access to cross unimpeded at Pembina to their final destination. In Canada's case, physical inspections often occur at internal "sufferance" warehouses and shipments clear customs electronically[1]. The U.S. and Mexico rely on border inspection, and require trucks to trans-load, or exchange trailers.

Infrastructure gaps are often blamed for much of the congestion at Laredo, but the greater problem seems to be regulatory practices. In particular, the Mexican government permits its customs officials to have very little discretion. Mexican customs brokers are required to get their information 100 percent right, 100 percent of the time. Failure on the part of the customs brokers is subject to severe penalties. In addition, Mexico requires that all documents be "originals". Consequently, missing documents hold up shipments until a courier can make delivery.

The additional time spent waiting at the border because of congestion and customs administration is a non-tariff barrier to trade. Higher transportation costs must be passed on to shippers due to lost opportunities for truckers to take additional trips and move more cargo. Is congestion a key to the sustainability of the gateway that exists to serve the border crossing function? What would happen at

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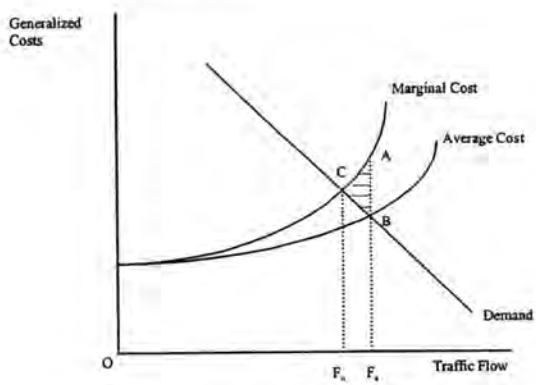
[1] Canada-U.S. border crossing time is influenced by many factors. "First, inspection rates and procedures vary by commodity type, previous history of the shipper, consignee, and transportation company, as well as the level of congestion at the particular border crossing. In general, the more information available to the primary inspector as the truck enters the booth, the faster that inspector can process the entry. There is certainly an opportunity to use advanced information technologies to improve the effectiveness of the system" (Nozick et al, 1998).

the Laredo border crossing, if the congestion were alleviated to a large extent? Could technological advances in customs processing, or other measures to reduce congestion, cause Laredo/Nuevo Laredo to decline economically? The next section considers the economics of congestion.

Economics of Congestion

Congestion is normally considered in terms of vehicle interaction and resulting flow patterns. Figure 4 illustrates the economic costs of congestion in a welfare setting. Traffic congestion is caused by vehicle volume increasing over a roadway length to the point that all drivers must slow down. Hence an opportunity cost (time) is inflicted on all drivers. Generalized costs include the costs of operating the vehicle as well as the opportunity costs of the time spent by drivers and equipment that are impeded by congestion.

Figure 4 Model of Deadweight-loss of Excessive Traffic Congestion



The individual user entering the system considers only the average costs that he personally bears, and not the externality, or congestion costs, that he imposes on all other users. For the new

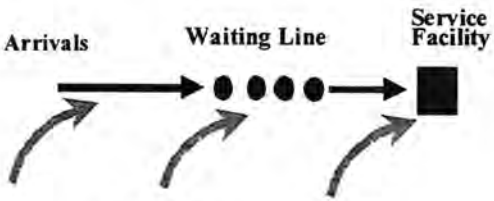
entrant, the average cost curve can be interpreted as his marginal private cost curve, while the marginal cost curve represents the marginal social costs of his actions.

If the congestion costs were recognized, the point F_o is the optimal traffic flow volume. From a social point of view, the actual traffic flow at F_a imposes a dead-weight loss on society. The F_ath driver is imposing costs of F_aA, while enjoying the benefits F_aB. The additional traffic beyond the point F_o is imposing costs of F_oCAF_a and obtaining benefits of F_oCBF_a. Hence, the deadweight loss of congestion is the shaded area *ABC*.

In the case of highway traffic flows, congestion can be viewed as a negative pecuniary externality, rather than as a real externality. If one wishes to consider the relevant market to be the services of the roadway itself, both cars and trucks are part of the same market meaning that the effect of congestion is internalized from one vehicle-operator to another.

Congestion at a border crossing could be treated as a real negative externality because the costs of congestion create a barrier to trade that affects the entire economy. Congestion at the border is characterized by the formation of queues. The basic components of a waiting line process are arrivals, servers, and waiting lines (queues) as illustrated below in Figure 5.

Figure 5 Basic Components of the Waiting Line Process



Input process
-source of arrivals (size and scope of calling population)
-manner of arrivals (random)

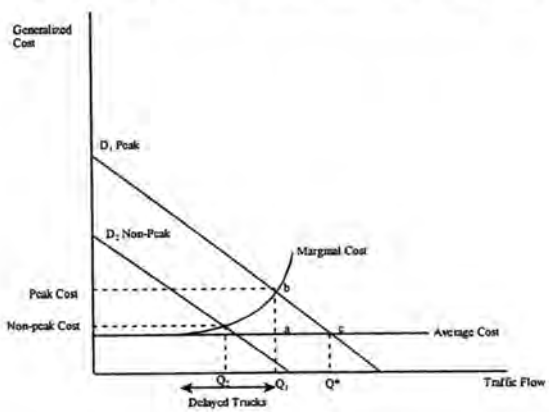
Length depends on:
-nature of arrival and service process
Queue discipline
-the decision rule that prescribes the order in which items in the queue

Server Mechanism
-one or more servers
-one or more service facilities

The waiting line can be made shorter by increasing the number of servers, or by speeding up the operations of each server. Such changes impose costs on the border operations. Mahoney (1985) the frequency of arrivals is random and is likely to vary over the course of the day, and season of the year. The operations of the border are sized according to fiscal imperatives that seek to balance service levels with budget availability.

Modeling congestion represented by a queue is complicated if the service facility does not have a constant waiting line. Arrivals vary over the course of the day such that queues only form at the peak demand times, and otherwise, the traffic is relatively free flowing. Drawing on the previous illustration of traffic flow, a peak load model is constructed in Figure 6.

Figure 6 Model of Border Congestion Costs and Social Welfare Losses



During the non-peak demand D_2, Q_2 trucks cross the border. The diagram is drawn with some congestion costs even in the non-peak, and some delayed trucks. However the length of the delay is relatively short in the non-peak period. In the peak demand period D_1, Q_1 trucks cross the border, but the queue increases, such that Q_1 - Q_2 more trucks are delayed, and the waiting time per truck is longer. The peak opportunity cost of crossing the border in the peak period rises significantly.

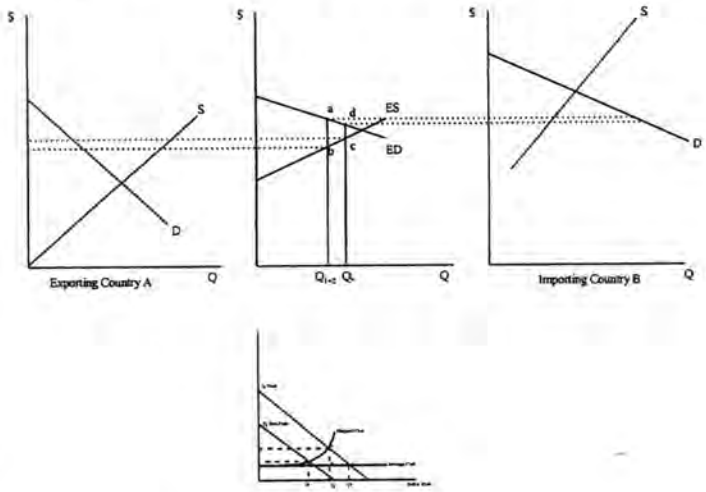
If the border were operated such that no truck ever waited, Q_* trucks would cross the border at the average cost. In this case, the dead-weight loss is hypothesized to be *abc*, the area under the demand curve and above average cost. This is a negative externality because it reduces the potential for trade.

It is unclear how shippers adjust for the risk of delays at border crossings. With experience, shippers could develop a subjective probability of delay and associated cost. For the sake of this model, shippers are assumed to be risk averse and to plan for the peak cost regardless of what time the vehicle leaves for the border.[2]

The impact of border congestion on trade flows is illustrated in Figure 7. The border congestion model is reproduced in the lower middle frame. The peak costs *ab* form the wedge between prices in the two markets. If congestion were eliminated transport costs would fall to *dc*, and trade would increase by $Q^* - Q_{t+2}$. The deadweight loss to trade is *abcd*, which is equal to the area as *abc* in Figure 6.

[2] It is worth noting that in practice the risk of delay may already be factored into the freight rate by the carrier.

Figure 7 Model of Border Congestion and Trade Related Social Welfare Losses



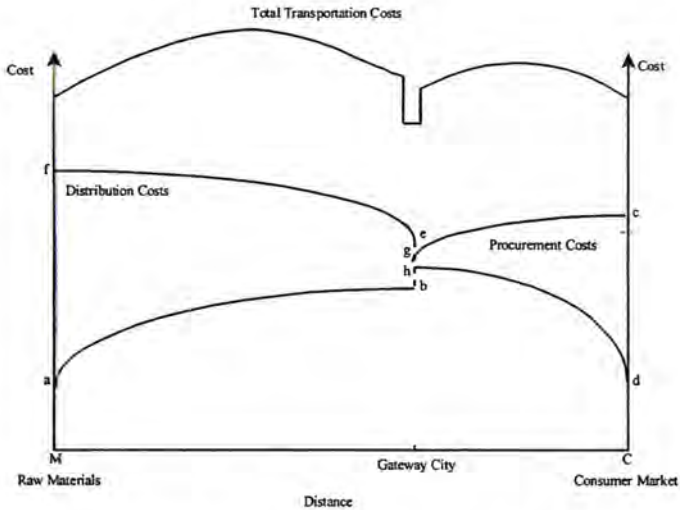
Trans-shipment Economics

Society can be better off in aggregate by a reduction in congestion, but is the community of Laredo likely to suffer economic decline? Essentially, this depends on whether gateway functions performed at Laredo shift to San Antonio and Monterrey. The political shear line is unlikely to be erased quickly and the economies of trans-shipment points further suggest that Laredo has more opportunities than challenges.

Typically, a processing/manufacturing location is either best sited near the source of raw materials to minimize procurement costs, or is situated near the consumer market to minimize distribution costs.

Following Stubbs, (1984), the trans-shipment case is illustrated diagrammatically in Figure 8. Depending on whether procurement costs outweigh distribution costs, a choice is made. A trans-shipment point, such as a gateway, provides a special case where an intermediate location may offer the lowest costs to locate a manufacturing facility.

Figure 8 Transport Costs involving a Trans-shipment Point



Assume the raw material, which is located at M, is brought to the gateway city where a change of transport occurs, and it is taken to the consumer market at C. The procurement costs are shown by the figure *Mabgc* if the raw materials are processed at the consumer market. If the raw materials are processed at their source, the distribution costs are C*dhef*. As trans-shipment is involved in either case, the curves both have a vertical rise at the gateway city. Consequently, the curve of total transport cost dips at the trans-

shipment point, and thus becomes the best place to process goods from a transport perspective.

A trans-shipment point is most effective if it involves a change in transport mode. This is one reason for the economic activity at seaports, however all that is required is for goods to be taken off one vehicle and placed on another to provide an opportunity for processing.

The future of Laredo as a center of manufacturing is improved by the maquiladora business that has already been established in the area. While congestion at the border crossing may have some side benefit for the service industry, it likely hurts the efficiency of the manufacturing and trans-shipment industries.

Conclusions

Queuing is the visible symptom of border congestion. With increased attention on an effective clearance system and advanced information technologies, the speed at which vehicles could pass through the border could increase. Faster processing speed is necessary to shorten queue lengths because the pressure of trade growth is likely to accelerate as Mexico's economy becomes further developed.

Within the past year, a new bridge has been built at Laredo to by-pass the downtown. The diversion of traffic reduced the visible congestion and noise in the center of the city, and gathered inspection functions together, which is more convenient, but has had only marginal impact on border crossing delays. Real improvements in border crossing times will require the harmonization of inspection and transportation regulations between Mexico and the United States.

Would the advent of improved efficiency at the Laredo border crossing be detrimental to the local community's economy? The political shear line between Mexico and U.S. is a long-term situation that will continue the need for vehicle processing at the

border. Without congestion, the service sector might lose some of its truck driver customer base and resulting service sector. What is envisioned however is the increased use of the location of Laredo/Nuevo Laredo as a manufacturing center and trans-shipment point. Increased manufacturing activity could bring positive economic growth to other gateway functions such as logistics and financial services.

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The Fight Between Technology and Survival:
Heavy Cars versus Short line Railroads?

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Background of Issue

The transition to heavier rail cars has been underway in the United States for some time. In the 1970's, much of the branch-line network was restricted to gross car weights of 220,000 pounds (which allowed net loads of 70 to 80 tons). However, the need for effective utilization of 100-ton hopper cars resulted in branch-line capacity limits being raised to 263,000 pounds. Today, most Class I railroad main lines allow 286,000-pound cars with net loads of 111 tons or greater. Most car purchases by Class I railroads have been of 286,000-pound cars in last 10-15 years.

Larger rail cars offer many cost savings to mainline railroads because of their higher net weight-to-tare weight ratios. Higher net-to-tare weight ratios reduce the annual car miles required to haul a given tonnage, and thus reduce car ownership costs per tone. A higher net-to-tare ratio also reduce the number of axles required to haul an equivalent train weight, and thus reduces train resistance and fuel cost per ton-mile. Finally, larger cars used in unit train service reduce labor costs per ton-mile because of a given train length is comprised of more revenue tons. If these cost efficiencies are transferred into rate reduction, shippers as well are directly benefited. However, the economic benefits of larger

cars should be weighed against the increased equipment and track maintenance costs that will result from their use.

System-wide use of 286,000-pound cars would require travel over branch lines and short line networks. Washington has an extensive array of abandoned and short line railroads. These tracks are not built to the same standards as Class I railroad mainlines. Moreover, many of them have suffered from deferred maintenance. In 1989, FRA concluded that the track rehabilitation needs of local and regional railroads averaged $27,400 per mile or $208 per car. However, the rehabilitation needs average $755 per car for railroads with traffic densities of 21-to-40 carloads per mile and $3,248 per car for railroads in the lowest density class (less than 20 carloads per mile).

These short line tracks were designed decades ago in an era of lighter car weights, often using 70-90 pounds per yard rail. Also the older lines often have thin ballast sections, weak bridges and deteriorated cross ties. The heavy axle cars exacerbate this deferred maintenance, caused by financial constraints of short line railroads.

These conditions point towards either an inability to handle these heavier cars desired by the Class I railroads or need for a substantial capital investment in these light density lines. Even as the short lines attempt to use lower speeds and patchwork rehabilitation in the short run to survive and service their customers, the long run problem exists.

Study Purpose and Objectives

The general purpose of the project was to study the potential impacts of heavier cars on light-density track and short line railroads in Washington and provide information for planning and investment purposes.

Methodology and Study Approach

The overall study approach was two pronged, a technical evaluation and an empirical market analysis. Determining the likely future and structure of use of heavy cars on branch lines was undertaken by a survey of major shippers and short line railroads, principally but not exclusively in eastern Washington. The results of this shipper survey generates a broad understanding of how the heavy cars are currently affecting the shipping industry, how the shippers and short lines are handling these impacts in the short run and, from their perspective, what are the alternatives for the future. The results of the survey and interviews were then used with other railroad and grain-marketing data in determining the overall industry response to the heavy cars.

The technical analysis for the study was conducted using railroad track models. As a heavy car moves over a line, the track is temporarily compressed or "deflects", and then recovers after the load has been removed. The up and down track movement under repeated wheel loads is a primary source of track deterioration. Railroad track models were used to simulate track deflections under varying loads, speeds and track conditions.[1] The American Railway Engineering and Maintenance Association recommends a maximum deflection of one-quarter inch. Track that deflects .40 inches or more will deteriorate quickly under heavy axle loads.

In this study, track deflections under 286,000-pound carloads are simulated for several types of light-rail sections and different combinations of track support. The performance of heavier rail also is simulated. The results are used to decide when tracks need to be upgraded and the minimum rail weights that are needed for long-term performance under heavy axle loads.

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1 For the complete technical analysis see Casavant, Ken and Denver Tolliver, Impacts of Heavy Axle Loads on Light Density Lines in the State of Washington. Final Report, Washington State Department of Transportation, February 2001.

A survey of Washington short line railroad and other light density lines was done by a combination of a mail questionnaire and a follow-up telephone survey. BNSF provided track charts for Class I branch lines. These conditions, combined with the simulations, produced a list of line segments that may need upgrading. From this total list it was possible to determine the investments needed in Washington state to handle the heavy rail cars.

Shipper and Short Line Impacts

Existing Situation

The existing agricultural situation has lessened, at least temporarily, the traditional chronic car shortage. The advent and growth of the Grain Train program (state owned and shipper managed cars), combined with slightly decreased shipment volume due to the Conservation Reserve Program (CRP), has been used judiciously by the region's shippers and short line railroads. Additionally, the low price differential for wheat and other grains has caused the Loan Deficiency Payments (LDP) to be commonly used by growers and shippers. Since this abstracts shipper price from any short-term changes in the market price, the result has been a more orderly movement of volume throughout the year, with fewer peaks of car demand. However, as prices recover in the crops industry the seasonal shortages are expected to once again become a problem.

Shippers and short lines have combined to expect and produce loads of a maximum of 198,000 pounds, to eliminate derailing and track damage. This rural standard, about 100 tons, is met quite well by shippers who are experienced in estimating such loads, if a scale isn't available, especially since the Class I railroads in the state will impose a penalty and mandate unloading if overloading is noticed.

Grain elevators thus far are still ordering C-6 cars (100 ton) and often get C-6X (110 ton). When this happens they pay at the C-6 rate, load

only to the 198,000 agreed upon maximum weight and ship to tidewater terminals. Managers are concerned about how long this payment at the lower level will be allowed by the Class I railroads and also see the unused weight as lost opportunity to increase the effective capacity of the existing car fleet.

The major shortline railroad has 410 miles of light density lines, bought or leased from the Union Pacific (UP) and/or the Burlington Northern Santa Fe (BNSF). The line is mostly 70-80 pound rail while, as indicated in the technical section of this report, 115 and 133 pound rail is desired and generates the desired performance standards. In addition, this railroad also has about 350-400 bridges on its trackage, many of which are expected to be impacted by the heavier cars. Current speed on these lines is 25 mph with some sections as slow as 10 mph, contrasted to the desired 40 mph of most short line railroads.

Shippers are clear in their preference for continued use of railroads as the preferred mode of choice. The current 26-car configuration allows 85,000 bushels to be moved in one, fairly flawless, movement from the elevator, in contrast to the multiple truckloads and loadings necessary in a truck- barge movement. Payment for the product is now very similar (railroad used to take longer), with a 90% payment upon shipping.

The rate structure among the alternatives available for shipping is quite close and shippers are quite responsive (elastic demand) to changes in rates charged. One major shipment pattern currently has rates of 32¢ per bushel in a 26-car train-movement, 36¢ for a 3-car shuttle to the barge on the river and 40¢ for the traditional truck movement to barge. Hence, any increase is cost (rate) to the shipper in the rail mode may generate significant traffic shifts from both the short line gathering railroad and the Class I railroad.

Another relevant concern for the short line railroad arises from their method of payment by the Class I railroads. The short line railroads are paid on a per car basis by the Class I so, if cars are loaded to the 110 ton capacity, the short line railroad effectively loses 10% of their revenue

producing traffic, even while the heavier cars cause increased costs to that railroad. Shortline railroads have initiated negotiations for a higher per car payment at the heavier carload; such an increased payment to the short line railroad can be expected to appear as an increased rate to the shipper.

Shipper alternatives

Shippers have been very active in working to develop solutions to the existing transportation problems. Working with the state of Washington, the Grain Train program, which uses refurbished 100-ton cars, now can be used, for at least a selected volume, to move grain to Portland and other markets. Such older, lower weight cars offer at least a partial, but probably temporary, solution.

Another alternative is the concept of "shuttle trains", now used in southeastern Washington. This is unlike the concept used in the Midwest to long distance western markets where trains are moved as a unit, returning back to the origin area. Washington's shuttle trains, developed by a partnership of port, railroad, barge and shipping elevators, drops off a given number of cars (port and railroad owned) at each location on a line, returning that day or so to put them together and shuttle them to the river in an innovative rail-barge movement. The use of this concept is spreading and is particularly useful for some of the emerging specialty crops in the region.

The third alternative is increased use of the truck-barge movement with direct shipments to the river. Shippers worry about the increased rates, the loss of past investment in rail loading facilities, new required truck loading investment and the condition of roads and bridges between the river and their elevator. Yet, new transfer elevator capacity has been and is being developed at the river to service such new demand, if it ultimately materializes.
A further alternative is simply to maintain the status quo, meaning to load light at 198,000 pounds. If rates are increased corresponding to the 110-ton capacity it can become an effective 10 percent increase.

Shippers, shortline and Class I railroads are actively looking at the issue of funding sources and investment arrangements to maintain the existing level of service. Industry members expect some rationalization (abandonment) of some light density lines and, in the worst scenario, a loss of economic viability for some short line railroads under this alternative.

Issues

It is evident that shippers and short line railroads have been innovative in dealing with the issues of heavy cars and overall car capacity. Thus far, rail rates have not been raised to the expected level. However, the alternatives are, at least, only short run fixes; long run solutions are based on investment in light density lines to capture, for the shipper and the railroad, the economics offered by the heavy cars. As such investment occurs, the quality of the track and attendant quality of service increases the economic viability of the railroads, maintaining or even enhancing the role of these lines in rural economic development.

The short-term use of shuttle trains has succeeded in keeping some traffic off of the state and local roads. However, movement to the truck mode entails damage and deterioration of rural and state roads as increased volume, sometimes in wet conditions, occurs. Shippers are very sensitive to the impact on their local community of their trucks moving over local roads; counties and the state are faced with increased highway maintenance and reconstruction as a result of the new traffic. Rebuilding the light density loads to handle the heavier cars is an effective 10% increase in car capacity, improving the perennial problem of chronic car supply shortage in this industry.

Creative partnerships have been developed in the short run by shippers, ports, railroads and barges. Such creative investment funding alternatives seem to be desired by the industry members as a long-term solution is developed. The impact of recent and future energy costs may well be the instigator of new financing arrangements.

Investment Needs for Washington State Short Line Railroads

The basic findings of the technical analysis and survey (Tables 1 & 2) are that significant improvements in light-rail sections are needed unless very slow speeds are acceptable. Such speeds are generally uneconomic to shippers and the railroads. Casavant and Tolliver's report contains the technical equations and simulations used in the analysis. The focus of the analysis was on what performance could be expected, what magnitude of investment per mile would be needed to bring typical light lines up to acceptable standards, avoiding the many impacts detailed in the previous industry section. Particular and detailed attention was paid to track components, speed, tie maintenance and deflection as it affected track performance. Then the survey of Washington short lines produced the current conditions of trackage in the state. The final outcome is a precise determination of track rehabilitation needs.

The track models and desired performance standards result in a need to upgrade any track with less than 90-pound rail, combining support and tie maintenance to achieve 25 mph speed. The existing 90-pound rail should be welded into longer sections to dampen dynamic effects and increase overall support.

It was found that approximately 480 miles of these lines, of a total of more than 1,500 miles in the state, will need to be upgraded to effectively handle the new 286,000 pound car loads. At a determined cost of $250,000-$300,000 per mile on average (Table 3) corresponds closely with estimates in other states, other studies and in specific interviews with short line operators in Washington, to upgrade Washington's lines needing repairs generates a cost of $117 million to $141 million (Table 4). What is unsettling is that these estimates do not include any bridge upgrading costs, and some bridgework will almost certainly be needed. These estimates are most certainly a minimum estimate of rehabilitation costs. The step-by-step analytical process detailed in Casavant and Tolliver reveals the conservative assumptions used and the overall cautionary approach to the analysis.

Table 1
Summary of Short Line Railroad Segments
in Washington State Needing Rehabilitation

Railroad or Segment	Carrier	Rail Weights (lb per yard)	General Condition of Ties/Ballast/ Subgrade	Miles
Schrag-Bassett Jct	CBRW	66, 72	Fair/Poor	12
Moses Lake-Bassett Jct	CBRW	60, 65, 80	Poor	15
Tri-Cities Railroad	TCRY	90	Fair/poor	7
Meeker-Southern		70	Not Available	4
Toppenish-White Swan	TWSR	90	Fair/Poor	19
City of Tacoma	TRMW	85 or less	Fair/Poor	54
Pend Oreille	POVA	75, 90	Fair/Good	16
Shelton-Elma	PSAP	90	Fair	24
PSAP: Scattered 72-lb	PSAP	72	Fair	5
Lewis & Clark	LINC	66	Fair	29
Walla Walla-Dayton	BLMR	56, 75, 80, 85	Fair	39
Hooper Jct-Colfax	PLRR	60, 75, 90	Poor	21
Colfax-Moscow	PLRR	56, 90	Poor	26
Winona-Thornton	PLRR	75	Poor	27

Railroad or Segment	Carrier	Rail Weights (lb per yard)	General Condition of Ties/Ballast/ Subgrade	Miles
Coulee City-Cheney	PRCC	85, 90	Fair/Poor	40
Columbia Cascade	CSCD	65, 90	Fair	46

Table 2
Miles of BNSF Branch Line in Washington State with Light Rail

Rail Weight	Miles	Percent of BNSF Branch-Line Miles
68	11	1.9
77	2	0.3
85	85	14.6
90	167	28.6

Table 3
Minimum Cost per mile
to upgrade to 115-pound Rail

Cost Item	Quantities	Unit Prices	Cost per Mile
Used 115# No. 1 rail	202.4	$625	$126,500
Tie Plates - 6,000 per mile	6,000.0	$4	$24,000
Rail Anchors - 6,000 per mile	6,000.0	$1	$6,000
Ties: 500 per mile	500.0	$41	$20,500
5/8 x 6 Truck Spikes - 50 kegs per mile	50.0	$65	$3,250
Labor - Rail relay @ $7.5 per foot	5,280.0	$7.50	$39,600
Field Welds - 8 per mile	8.0	$350	$2,800
Replace Crossings - 1 per mile	1.0	$3,000	$3,000
Ballast - 400 tons per mile	400.0	$16	$6,400
Surfacing per foot	5,280.0	$0.75	$3,960
Reclaim & reload rail and OTM - per mile	1.0	$3,000	$3,000
Labor & locomotive to distribute material	1.0	$2,000	$2,000
Subtotal: Direct Cost			$241,010
Contingencies: 10%			$24,101
Total per Mile			**$265,111**

Table 4
Range of Rehabilitation Cost Estimates
for Branch Lines in Washington State

Miles of Short-Line Railroad	384
Miles of BNSF Branch Line	85
Total Miles Needing Rehabilitation	469
High Rehabilitation Cost per Mile	$ 300,000
High Statewide Cost Estimate	$140,700,000
Low Rehabilitation Cost per Mile	$ 250,000
Low Statewide Cost Estimate	$ 117,250,000

Key Findings

Even with innovative short run solutions, investment in upgrading trackage appears to be the only long-term solution.

The grain industry, due to low product prices, government programs and innovative rail programs, has survived the current capacity shortages. The Grain Train program, combined with shuttle train efficiencies and loading only at 198,000 pounds has momentarily provided service and needed capacity. Seasonal shortages and rate increases are expected in the future.

The unused capacity of the 286,000-pound car could provide efficiencies and services not now available to shippers. Investment in infrastructure necessary to utilize this available capacity is critical to the shipper and short line railroads. Continued utilization of the railroads offers energy and road maintenance savings to both private and public stakeholders.

Light-rail sections will not perform adequately under heavy axle loads unless trains are restricted to very slow speeds

Rail weight, overall track support, and train speed are important factors in track performance. Very light rail sections (e.g., 70 pounds per yard) aren't likely to perform satisfactorily under heavy axle loads. With good tie maintenance, good ballast, and slow speed operations, 90-pound rail *may* perform satisfactorily under 286,000-pound carloads. However, deferred maintenance or higher-speed operations will increase deflection to unacceptable levels. In comparison, 112-pound rail with average track support exhibits good performance at speeds of 40 mph.

Recommended Actions

- All track built with less than 90-pound rail should be upgraded
- Unless a track has excellent support and tie maintenance, 90-pound rail sections should be upgraded so that branch lines can be operated at cost-effective speeds (e.g., at least 25 mph)
- Jointed 90-pound rail that remains in service should be welded into longer sections to dampen dynamic effects and provide for more continuous support

What will happen if the lines are not upgraded?

If branch lines can't handle heavy cars effectively, they will become obsolete. In the future, many of them may be abandoned.

Each year, more than 150,000 carloads of freight are originated or terminated on branch lines in Washington State. Approximately 600,000 additional truck trips per year would be needed to transport this freight.

Truck movements to and from branch-line stations travel over local arterial and collector highways. These secondary highways are not designed to the same standards as interstate or principal arterial highways. Consequently, highway maintenance costs will increase if branch lines are abandoned. If rail lines are abandoned, farmers, businesses, and communities will be left with fewer shipping options and may have to pay higher freight rates.

New possible car fleet capacity, to offset chronic car supply shortages, will be lost if the heavy cars cannot be loaded fully.

A Preliminary Feasibility Study About High-Speed Rail in Canada

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1. Introduction

The first high-speed train in North America, Acela Express, started its service in December 2000. 37 years has passed since Shinkansen was introduced in Japan. The earliest Shinkansen is 515 km in length, and links Tokyo with Osaka in 3 hours 10 minutes. France's TGV began its operations in 1981, which linked Paris with Lyon in 2 and a half hours. Italy's Direttissima got partly open in 1988, German's ICE in 1991, Spain's AVE in 1992, and Eurostar through Channel Tunnel in 1994. Moreover, some Asian countries, South Korea, China and Taiwan have subsequently been following. Now bullet trains are operated in almost every developed country.

Canadians may believe their only transportation options are either airlines or highways, because of low population density. This belief certainly has some merit. For example, it is surely not a realistic plan to build a new rail from the east shore to the west or from the midland to the Arctic Circle. However, it could be a practical project to provide a bullet train service in the corridor from Montreal to Toronto, because this area has enough population to realize.

The aim of this paper is suggesting the argument about a potential of high-speed rail in Canada through a comparative study, mirroring Japanese high-speed rail experiences.

2. The social background of Shinkansen in Japan

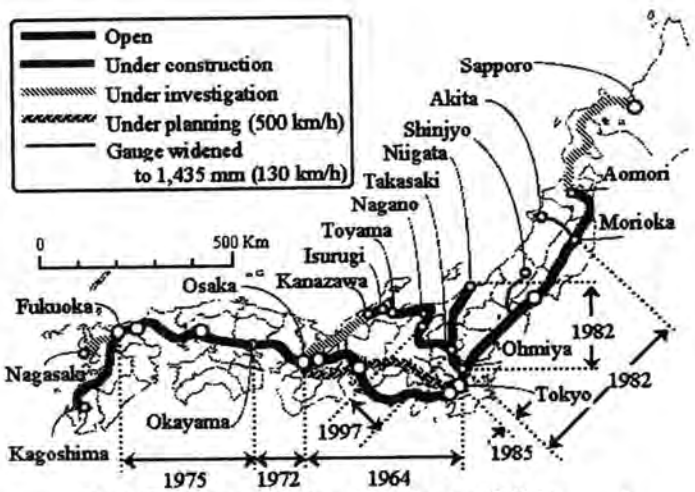


Fig.1 Shinkansen network in Japan (2001)

Shinkansen started running just before the 1964 Tokyo Olympics. As Japan was swiftly growing in economy at that time, Tokaido line that was partly open in 1872 and links Tokyo with Kobe through Yokohama, Nagoya, Kyoto, and Osaka was tight to carry many passengers and freight. In 1956, the number amounted to 366(Tokyo-Yokohama) or 541(Kyoto-Osaka) trains per day. There were no rooms for additional trains. So, it was decided that a new line should be constructed, which would link Tokyo with Osaka in 3 hours. It had been under construction in 1959 and got open 5 years later. Then some extension projects were started and a high-speed rail network almost 2,000 km (Fig.1) was constructed up to now.

Shinkansen lines were owned by Japan National Railway (JNR). However, they were built with full borrowings, because the earliest Shinkansen was very successful. Thus, construction fund for Shinkansen was raised from the Treasury Investments and Loans, of which money was supplied by Postal Bank, Postal Life Insurance, the Welfare Pension, and the National Pension. The interest was set to high, because we believed the economic growth would sustain for a long time. In other words, our government expected to collect money

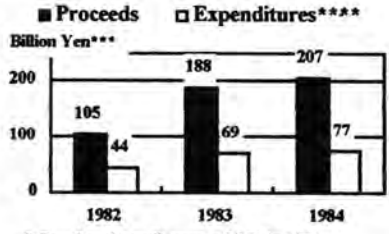
not only via tax but also via Shinkansen fare. The business was going well, but the interest was too high to pay back. JNR's debt had begun to grow, because the government revenue via tax was automatically reduced when economy was not so brisk, on the other hand, the amount of paying back was fixed. At last, the Shinkansen extension projects could not help being frozen.

In 1987, JNR was changed over to Japan Railway (JR) companies whose stockholder is the Government. The unbelievable huge debt was cleared up, and it was decided that tracks shall be provided by public and bullet trains shall be operated by JR. The extension projects were restarted in 1989, and Hokuriku Shinkansen (Tokyo to Nagano) got open under this scheme just before the 1998 Nagano Winter Olympics. Now, over 600 km lines are under construction, over 700 km under investigation, and MAGLEV that links Tokyo with Osaka in 1 hour is under planning.

3. Benefits of introducing high-speed rail (case of Japan)

a) Good profits

If bullet train service is provided on the equal term as other public undertakings without loans, it can beget a good profit every year as Fig.2.



* Based on the audit report of JNR in 1984.
** Tohoku and Jyoetsu Shinkansens
** Numerics are not adjusted with inflater.
*** 100 billion yen=$1,250 million($1=80yen, Jan. '01)
**** Excluding payingment back

Fig. 2 Annual Proceeds and Expenditures of Shinkansens*,**

b) Proper investment

Fig.3 is a comparison of annual G.R.P. (Gross Regional Products) with building cost of a new Shinkansen line under construction or investigation, which is almost 1,000 km in length. The annual building cost is less than 1% of GRP, thus, a high-speed rail project is not a huge investment compared with G.R.P.

c) Ecology

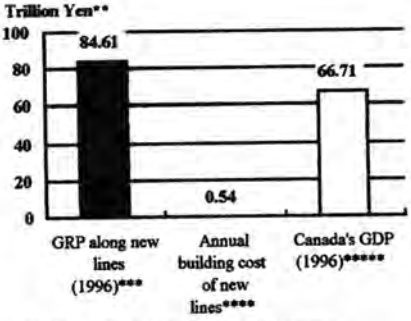
Fig.4 is a comparison among several transportations about discharge amount of CO2 per 1 km and per 1 person. According to this, high-speed rail is a good transportation for environment, but private car or airplane is not so good.

d) Safety

Fig.5 is a comparison of mortality rate. According to this, high-speed rail is very safety. Airplane is also safety, but if an accident was made it will be not so safety. Needless to say, private car is the worst transport.

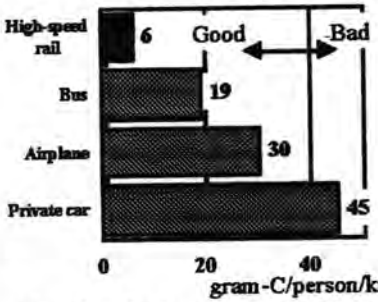
e) Effective

Introducing a high-speed rail is an effective method for reducing CO2 or persons killed by accidents. As Fig.6, a Shinkansen line carries as many persons*km as a subway in Tokyo.



* Tohoku,Hokkaido,Hokuriku,Kyushu Shinkansens
** 10 trillion yen=$125 billion($1=80yen, Jan. '01)
*** Total of prefectures' GRP along 4 lines
**** 15 years installments ***** Statistics Canada

Fig. 3 Comparison of annual GRP with building cost*



*Based on the Japanese M.L.I.T.'s data

Fig. 4 Discharge amount of CO 2 per 1 person per 1 km*

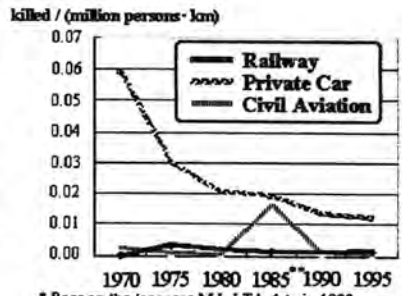
f) Nations' favor

Shinkansen is a favorite transportation of nations. At 200 - 500 km range in Fig.7, it has a strong competitive power against other modes. Even at 400 - 800 km range, it is used as much as airline.

g) User benefits

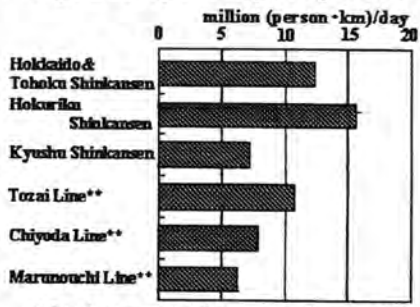
User benefits per person per kilometer of Shinkansen lines

under construction are estimated as followings: decreasing of traveling hours (from slow rail or car) is 16.7 yen, decreasing of fare (from airline) is 5.9 yen, decreasing of fare (from old slow rail) is minus 3.27 yen, and decreasing of fare (from private car) is minus 3.9. Decreasing of car traffic is 830,000 (cars km)/day, and saving life from accidents is 4.8 persons/year.



* Base on the Japanese M.L.I.T.'s data in 1999.
** 520 passengers were killed by the JAL123 accident.

Fig.5 Railway is a very safety mode.*



* Based on annual statistics report of railways in 1997
** Subways in Tokyo.

Fig.6 High-speed rails carry effectively*

4. Features of high-speed rails

Only trainsets often capture most of public attention when high-speed rails are discussed. But total system is much more important. For example, Acela Express train is operated operated with expensive trainsets, which has powerful locomotives for running at 240 km/h and tilting mechanism for passing faster at curves. Unfortunately, they does not have exclusive tracks designed for high-speed trains, it takes the train 3 hours 18 minutes to run 368 km from New York to Boston, of which average speed is only 112 km/h. And 2 hours 43 minutes to run 362 km from New York to Washington, D.C., an average is 133 km/h. On the other hand it takes Canada's VIA train No.66 or No.67 which runs between Toronto and Montreal can reach its final destination in 3 hours 59 minutes. Their average speed reaches up to 135 km/h, that is, Amtrak has barely caught up with

VIA train now.

By the way, what kinds of traits does a high-speed rail system have? The followings are peculiarities of Japan's Shinkansen system. Others in Europe may have the similar points.

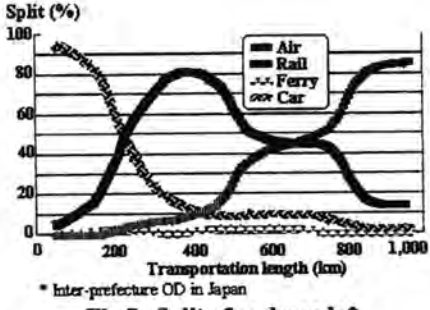


Fig.7 Split of each mode*

1) Separated track from any other slow trains
2) No road crossing (overpass or under pass)
3) 30~70 km apart from each stations
4) Fewer switch rails and no grade crossing
5) Gentle curve (R>4,000 m) and gentle slope (< 1%)
6) High-powered trainsets (16 electric cars with total 11,860 kWh motors)
7) Well-designed trainsets (air suspension, small current collector, and so on)
8) Cab signal (with automatic braking system)
9) Centralized Traffic Control (all signals and switch rails on whole line are controlled at only one center)
10) Computerized traffic management
11) Heavy track with maintenance under rigid standard
12) Track maintenance with machines

5. Distribution of population in Canada

The density of population in Canada is 3.0 persons/km2, so it seems to be impossible to success in high-speed rail project. However, more than 7 million peoples live in a small area which is 100 km wide and 1,000 km long, located in Quebec and Ontario from Montreal to Windsor, of which density is over 70 persons/km2. There is a interesting fact that the density of this area is more than Hokkaido, which is a northern island of Japan, of which population is 5,644 thousand, of which density is 67.6 persons/km2, where the 1972 Sapporo Winter Olympics was held, which is a granary in Japan, and

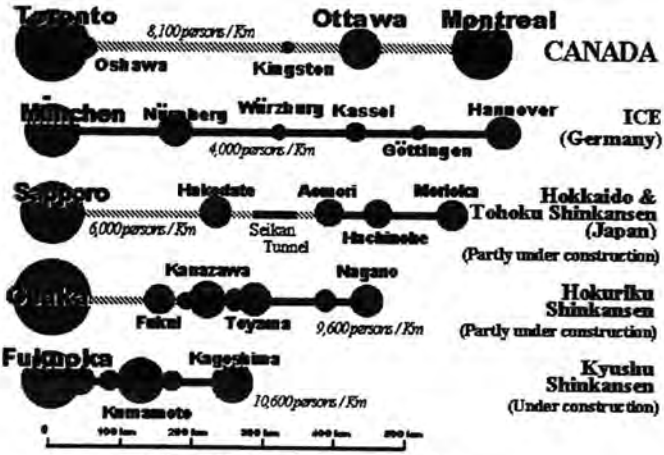


Fig. 8 City location and scale

where a Shinkansen line is under investigation to construct.

Fig.8 is a comparison about city location and scale along some high-speed rails. German's ICE has been already open, and other 3 lines in Japan are under construction or investigation, and also a virtual line of Canada is added. According to this figure, if a new rail is built from Montreal to Toronto via Ottawa, the average density along this will be as almost the same level as that of ICE, Hokkaido Shinkansen, and so on.

6. Why do Canadians use cars so much?

Then, why do Canadians use their own private cars in spite of such enough population density? The followings are kinds of answers based on 1-year-observation made by Non-Canadian (author).

a) Highway

It is more comfortable to drive a car on highways in Canada than in Japan. Drivers don't have to pay at each time. There are fewer congestions, plenty of parking lots even in large cities. Moreover, drivers can reach their destinations almost on time. It's a very useful and economy transportation for Canadians.

b) Airline

Using airline is the best method to get destination in short time. But it's also the most expensive. If a person lives in Toronto must make a return trip to Montreal tomorrow he may be bothered with the so complex fare system. After a while, he will find he have to pay $760 as return fare. Next morning at the airport, he may find his flight canceled by pilots' strike or any other reason, and have to join a long line to rebook or have to try to call to the reservation center again and again. If he is lucky enough to get on, the plane may arrive at Dorval Airport on "revised" schedule.

c) Railway

VIA train is a kind of economy and comfortable methods to move inter-urban. Train ticket of coach class is reasonable, but more expensive than bus, and sometimes sold out. A train runs as fast as it can, but its speed is just a little bit faster than a private car. Trains depart only a few times a day, the frequency has become fewer and fewer year by year. Delaying 30 minutes is a daily work without any apology. Overall, whoever enjoys travel itself can use trains.

d) Inter-city bus

Bus is the most economy transport. Its depots are located at downtown. In spite of traffic congestion, it can arrive almost on time. But unfortunately, it is slower than a car even on timetable.

e) Conclusion of observation

For these reasons as above, private cars are the most favorable mode for Canadians except businessmen who can use airplanes at business expense, travelers who can enjoy travel itself, and persons who cannot use cars.

7. Traveling time from Montreal to Toronto

a) How to read a chart

Fig.9 is a chart of changing traveling time of inter-city transportation. It indicates changing traveling time (vertical axis) from a city to another depending on starting hours (cross axis). Public transports depart several times a day, and each departure is displayed on a chart as a small circle mark. If a person wants to start his travel on a moment different from a departure time, he has to wait for it. So,

his traveling time from a city to another will be transportation's duration plus waiting time. Thus, the changing traveling time depending on starting hours is shaped like teeth of saw, and the true distance between these cities is estimated as the average of this notched chart

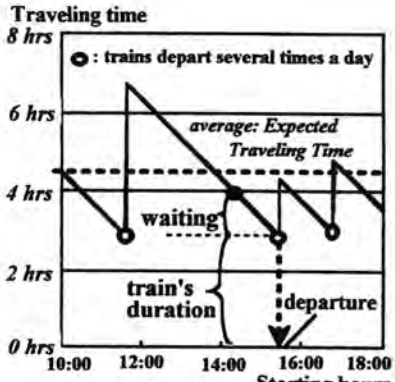


Fig. 9 Traveling time depending on starting hours

b) Traveling time from Montreal to Toronto

Fig.10 is a chart about traveling time of each main transportation from Montreal to Toronto. Traveling time includes access and egress to/from airports and so on. One of private car is assumed as constant. According to this chart, airline is the best mode to get destination at any moment, because of its speed and frequency. Private car is the

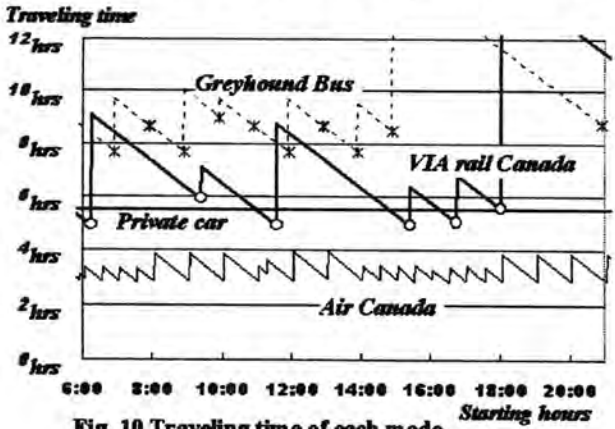


Fig. 10 Traveling time of each mode (Montreal to Toronto, summer ,2000)

second best almost anytime, because anyone can start travel anytime. Trains can run a little bit faster than private car, but passengers have to wait for train departures, thus an average time including duration and waiting time is longer than car. Inter-city bus is the slowest method to reach destination anytime except some moments.

8. Settings of Canadian high-speed rail

If Montreal is linked with Toronto via Ottawa by high-speed rail the estimated traveling time will be 2 hours 32 minutes. Fig.11 is a result of regression about a relation between distance of 2 stations and duration. Using this result, the estimated traveling time is displayed as Table 1. If train stops for 2 minutes at each station, total travel time will be 2 hours 32 minutes, and an average speed will be over 260 km/h. This speed is not an over estimation, because Shinkansen or TGV built in recent years has almost the same record.

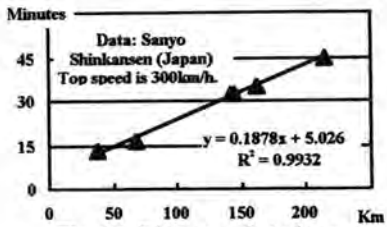


Fig. 11 Distance of stations and duration

Table 1. Estimated duration

Section			Km	Minutes
Toronto	–	Oshawa	51	15
Oshawa	–	Kingston	203	44
Kingston	–	Ottawa	191	41
Ottawa	–	Dorval	168	37
Dorval	–	Montreal	19	9

9. Existing travel demand and estimated travel demand

a) VIA rail Canada

On a weekday, 5 trains run on each way between Montreal and Ottawa, 5 trains between Ottawa and Toronto, and 7 trains including 1 night train between Montreal and Toronto. The same train sets is used in these operations except some. Trainsets may be added passenger cars on busy days, and two trains are operated with different type cars, however, it is assumed that each trainset consists with 3

Table 2 Existing seats of VIA trains (weekday, winter, '00-'01)

Montreal->Ottawa->Toronto: 272 seats * 5 trains = 1,360 seats			
Montreal	->	Toronto: 272 seats * 7 trains = 1,904 seats	
			Total: 3,264 seats/way/day

Table 3. Existing seats of Air Canada(weekday, winter, '00-'01)

(from\to)	Ottawa	Toronto	London	Windsor	
Quebec	159	483	-	-	
Montreal	311	4, 872	-	37	
Ottawa	-	3, 364	118	-	
Kingston	-	195	-	-	(seats/way/day)

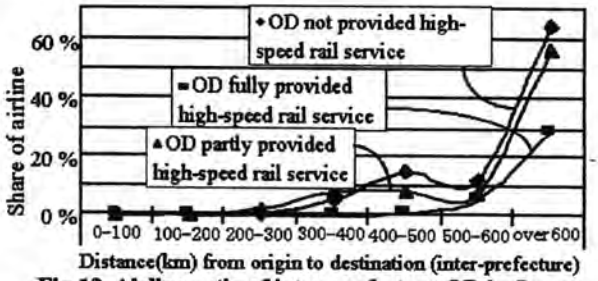


Fig.12 Airline ratio of inter-prefecture OD in Japan

second-class-car (216 seats) and 1 first-class-car (56 seats). It is assumed that VIA trains is fully replaced to the high-speed rail. In the end, total number of existing seats on VIA trains is estimated as 3,264 seats/way/day (Table 2).

b) Air Canada and Canadian Airlines

Air Canada group carries a large part of passengers from Montreal to Toronto. The numbers of provided seats in the corridor are indicated on Table 3. Other carriers are ignored, because their passengers are small in number. According to the share data about airline of inter-prefecture OD in Japan as Fig.12, if a high-speed rail service is fully provided at an OD, a share of airline will be reduced to almost half. If a distance of OD is less than 500 km, railway will win an overwhelming victory. If partly provided, a share will be reduced from about 65% to 55% at over 600 km range, that is, almost 15% will

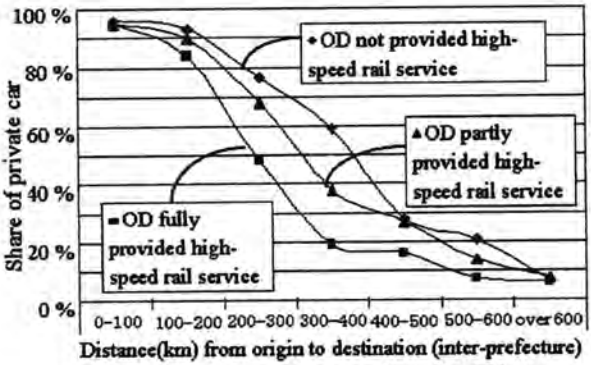


Fig.13 Private car ratio of inter-prefecture OD in Japan

shift to rail. At 400-500 km and 500-600 km ranges, almost half will shift to rail. At last, it is estimated that passengers on 6,523 seats will shift from air to high-speed rail.

c) Private car and bus on highway

According to the share data about private car as Fig.13, if high-speed rail service is provided at an OD, a share of private car will be reduced at least 8% (maximum 60%). But private cars are ignored in this paper, because it is not clear that Canadians driving cars return to rail or not. Buses are also ignored, because passengers' needs can be different from train or airplane.

d) Canadian high-speed rail

At last, the Canadian high-speed trains will carry 3,264 seats on existing VIA train and 6,523 seats from airline per way per day. If a trainset is designed as the same capacity as Acela Express (301 seats) 9,787 seats/way/day

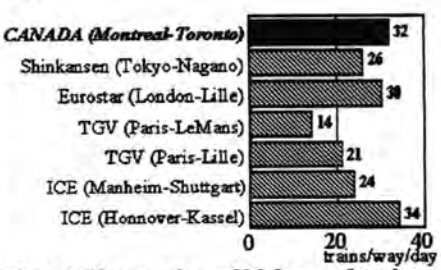


Fig.14 The number of high-speed trains

Table 4. SOFERAIL's estimation

Line	: Quebec-Montreal-Ottawa-Toronto-Windsor (1,215 km)
Speed	: 300 km/h (top speed)
Result	*: 10 million passengers/year*

Table 5. Estimation in this paper (2001)

Line	: Montreal-Ottawa-Toronto (632 km)
Speed	: 300 km/h (top speed)
Result	*: 9,787 seats/way/day =7.1 million seats/year*

Table 6. Estimation by Forinash and Koppelman (1993)

Line	: existing lines
Speed	: speed up from 100 km/h to 160 km/h (average)
Results	*: Toronto-Montreal +215%~+250%*
	Toronto-Ottawa +206%~+297%
	Ottawa-Montreal +65%~ +97%

should be provided by at least 32 trains/way/day. The Canadian high-speed trains have to depart at Montreal or Toronto station every 30 minutes from 6 o'clock in the morning to 9 o'clock in the evening. Thus, this line will be as busy as many European or Japanese high-speed rails (Fig.14).

10. Comparison with results on other reports

There exist 2 reports about Canadian high-speed rail as far as I know. One is reported in by SOFERAIL, which is a subsidiary company of SNCF. I could get only a result as Table 4.

On the other hand, a result in this paper is shown as Table 5. Both are different from each other, however, considering the length of line and the result of latter indicated by "seats", they are not so different each other.

Another is presented in a study by Forinash and Koppelman. This is studied about business trips, using nested logit models and the results are as Table 6. If assuming that shift rate of trips with other purpose is the same as Table 6, I can convert Table 6 to Table 7, using Table 2. This is almost the same result as Table 5. I think the study by Forinash and Koppelman is an underestimation, because of a train average speed. 10 years ago, an average speed of TGV or Shinkansen

Table 7. Seat amount (conversion from Table 6)

Toronto-Montreal	:1,904*(100+215)(%)=5,998 seats
Toronto-Ottawa	:1,360*(100+206)(%)=4,162 seats
Total: 10,160 seats/way/day = 7.4 million seats/year	

Table 8. Construction cost of Canadian high-speed rail

wetland	:$77.8 million/km *200 km=$15,560 million : near Ottawa
urban area	:$16.1 million/km * 90 km= $1,449 million : 30 km*3 cities
other	:$8.65 million/km *342 km= $2,958 million
	Total: $19,967 million

was 160 - 170 km/h, but it has grown up to over 260 km/h now. Canadian high-speed train will be able to run at faster than 160 km/h.

11. Break-even point of Canadian high-speed rail

Referring to Shinkansen's history in Japan, it is very clear that if Canadian high-speed rail is constructed with full borrowings it will surely fail. But provided without any interest, it can be success.

a) Construction cost

Construction cost of TGV line in recent years (Nord Europe line) is FF 40.1 million/km (=C$8.65 million/km), and one of Canadian high-speed rail will be almost the same level, because both are through areas with low population density. But in urban areas, cost will be higher. Cost of TGV line near Paris (La Jonction en Ile-de-France) is FF 74.8 million/km (=C$16.1 million/km).

On the other hand, Canadian high-speed rail may have to run through wetlands with soft ground in east Ontario. This section may cost as much as Japan's Shinkansen. Shinkansen track made in recent years costs up to 6,220 million yen/km (= C$77.8 million/km), because of high land price, intricate geographical features, soft ground, and preparations for earthquakes. So, total cost of Canadian high-speed rail is estimated as Table 8. It can be overestimation.

b) fare

Canadian high-speed train will have enough competition power against airlines, so its fare can be higher. A fare system of an airline is so complex, however, as far as I know, the cheapest return

fair from Montreal to Toronto under some conditions is around $300. Thus, Canadian high-speed rail fare can be $150 one way. According to data of East Japan Railway company, income is 26.4 yen/km, and expenditure is 10.03 yen/km, thus, net proceed is 62.0% of income. Using this ratio, $93 of $150 can be put to redeem for construction.

c) Break-even point

If Canadian high-speed rail is constructed without any interests and the cost is redeemed in annual installment of 40 years the break-even point will be calculated as a following:

$19,967 million/40 years/365 days /($150 * 62%)=14,705 persons

The number of provided seats is 9,787 seats/way/day, that is, 19,574 seats/day. So, Canadian high-speed rail can be realized, because 14,705 persons can sit on 19,574 seats. If over 75.1% of seats are occupied, Canadian high-speed rail can even go into the black.

12. Considerable features in Canada

a) A role of high-speed rail as a pivot of rail network

If an existing VIA train is smoothly connected with a Canadian high-speed train, a passenger lives along low-speed rail can be received benefits from the high-speed rail. If ignoring a role like this, the high-speed rail will be underestimated.

b) Coexistence with airlines

To put it simply, a large part of flights in the corridor will be replaced to high-speed rail, and it may break air-network. If a station of high-speed rail is open at an airport and a train has a flight-code it can be a pivot of airline network in Canada. For example, German's Lufthansa Airport Express is a train with a flight-code of Lufthansa.

c) Weather and wetland

Canadian high-speed rail may have to go through wetlands with soft ground, and it should be in operation even on a coldest day of winter. Keeping tracks rigid may be not so easy. However, some rainy or cold country may have effective answers.

13. Conclusion

Canadian high-speed rail is neither a dream nor a huge investment, but a practical project. It is also a very nature-friendly project. It saves number of Canadians' lives and a lot of hours. It will be a real "public" transport not only for businessmen but also for everybody. And it can be even a profitable business.

The riches of nature still around in Canada. Thus, Canadians' transportation shall be more nature-friendly, so I hope. Luckily you have a factory for bullet trainsets. All you have to do is making a track designed for high-speed trains. High-speed rail is a trend of the world. It's time to go aboard.

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OIL PRICES AND RAILWAY ELECTRIFICATION

F H Howard P Eng

Fuel is consumed much more effectively in giant central power plants than in scores of small locomotives of the same total horsepower.

The late great John Barriger, the outstanding railroad manager/student/engineer/philospher of the age, was an enthusiastic advocate of railway electrification and in 1974 recommended the replacement of diesel locomotives by electric. He reckoned that while their total horsepower at that time would amount to 12,000,000, a generating capacity of 3,000,000 would suffice, as that was the most that would be drawn at any one time.

Barriger was none too sanguine of this ever happening. He forecast that one major railroad would have to lead the way before any others would follow. In the event, no railroad was first.

This was the John Barriger who had some years earlier guided his own railway into complete dieselization, one of the first to abandon steam.

In those days the only railroad with any significant electric operation was the Pennsylvania. Between 1928 and 1935 it had completely electrified its main line between New York City, Philadelphia, Baltimore, Washington and Harrisburg. To the east the New Haven Railroad was similarly electrified, so that the entire east coast from New Haven to Washington was under wire. This territory embraced the greatest concentration of industrial and commercial wealth in America, perhaps in the world. Its traffic density was enormous and even more so in World War II. The Pennsylvania could not have coped without electricity.

Barriger much later commented that electric operation should have been extended further west, over the Alleghanies into Pittsburgh.

There had been a few minor electric projects, by steam railways over the Appalachians or through tunnels. The most ambitious was the Rockies crossing of the Milwaukee Road. All are gone now, and the Milwaukee bankrupted, mostly torn up.

Due to a New York City ordinance against steam or diesel in Manhattan, the New York Central third-railed the first 30 miles of its passenger line.

Commuter trains in the New York-New Jersey catchment area, and on Long Island, as well as in Philadelphia and Chicago are electric, some third-rail, so as to provide the great acceleration demanded by close train headway.

This discouraging history has been mitigated recently by AMTRAK completing the last limk to Boston, part of the Northest corridor improvement (using Bombardier-supplied passenger trains)

There was a brief revival of electrification when a Ohio short and private railway was built to serve its owner's power plant. It chose 60-cycle 25,000 volts AC, all to serve as a demonstrator of the possibilities of further electrification. A few years later, another public utility-owned coal railroad was built in Arizona, this time AC-rectified at 50,000 volts. The single Canadian venture into electric operation has been BC Rail with six 6000 HP locomotives from General Motors for use on a mountainous coal route; this was also to avoid having to clear a tunnel of diesel exhaust.

Otherwise, John Barriger's advice has been all but ignored.

It was easily grasped that electric was vastly superior to steam, although most railways either overlooked it or dismissed it. But in 1935 for passenger and 1941 for freight, another form of electric traction had appeared and was quickly adopted. In this case the power plant was carried on each locomotive, driven by a diesel engine. It matched the advantages of electrification, and most importantly, it escaped from under the wire; it could go anywhere. Like the electric, any number of them could be coupled together and run in multiple under one crew.

Fuel has been plentiful and cheap, so investment in electricity is no longer even considered. Over the years, some major railroads have looked into electrifying their main lines, but have gone no further. The Canadian Pacific has investigated it five times, going back to 1910, and always with the same conclusion.

Meanwhile the diesel has received massive improvement, not only much more horsepower, but the electric transmission has become three-phase AC. It is not the AC itself that is so important, but it is the absence of the DC brushes and commutators that has resulted in impressive reductions in maintenance.

Wheel-slip or the loss of adhesion to the rail has long been the bane of locomotive designers and many have been the devices to cure it. It is due principally to weight transfer, the front wheels trying to lift -just as with any wheeled vehicle. This has been rectified by adjusting the weight distribution over the wheels. Three-phase synchronous motors with computers can detect and correct a slip within a fraction of a second. This improved adhesion results in a much higher tractive effort, the index of "pull".

This is truly the zenith of diesel locomotive development.

Maintaining a diesel involves looking after a mass of heavy reciprocating weights, along with bearings, injectors and valves. With only a transformer, electric costs are half as much. Because it is so much simpler, it cuts first costs in half too, horsepower for horsepower.

Let us consider a 330-mile coal-hauling railway, 240 miles on the flat, the rest over heavy grades. Coal trains average at 16,000 tons at, say, 19 mph. Motive power to be three 4400 HP units two in front, one remotely controlled mid-train. Such locomotives weigh 210 tons each, on 6 axles with 6 motors.

To accept a heavier locomotive to pull a bigger train, the entire track structure, including bridges, would need upgrading. To move it any faster, the motors would need better cooling. So when examining the possibility of conversion to electric operation, we shall look at a 4400 HP electric, with the same details as diesels. It cannot start a heavier train, or move it faster

General Electric at one time did offer a 4400 HP electric locomotive like this. It operated over the Pennsylvania lines mentioned above, where power was supplied at 11,000 volts single-phase 25 cycle. Such a unit would be a suitable candidate, but at 50,000 volts (for the lightest wire). While three-phase power is effective on diesels, the conversion from single to three-phase, although not impossible, results in locomotives with only two speeds, 14 and 18 mph; useful for moving coal uphill, but not for extension into flat country. A three-phase power supply needs a pair of wires overhead, which is awkward. The 4400 HP electric would be modernized and ballasted up to the diesel's weight.

But, and however, world oil prices have escalated, and diesel fuel, once 28¢ a litre is that no longer. It is whatever a railroad can hedge it at, say 40¢ now, and more as different long-term prices are negotiated.

Consider now the relative fuel/ power figures for both locomotives in this assignment. At 4-5 trains a day, for every 825,000 gross ton-miles, fuel expenses are about $785,000, an average of 95¢ per gross ton-mile.

With electric power at 3½¢ per kwn the equivalent of about $1.20 per gross ton-mile, electric costs are $960,000 for every 825,000 gross ton-miles.

No fuel saving there.

But when diesel fuel costs 40¢ a litre, the 95¢ becomes $1.36, 11% higher than electric (with more to come as contracts run out). When extended over 12 months, so as to calculate payback (and with gross ton-mileage at 75 billion) and fuel costing now some $13,500,000, fuel cost per mile of line per year is $45,000

Our electric locomotive, with its 3½¢ per kwh power, draws only $11 million worth, equal to $37,000 per track-per year, a saving of about $8,000.

Power prices will vary by demand, time of year and negotiation. BC Hydro advises that it can go down to 2¢.

Nevertheless, at a steady power rate of 3½¢ per kwh, fuel costs alone cannot justify an investment in the new form of motive power, since oil at 28¢ remains superior. At 2¢ per kwh, it could be warranted, and fuel costs per mile of line would be equal at 2.8¢, not reason enough for replacement

Figure 1 shows the relationship of the two energies at various prices.

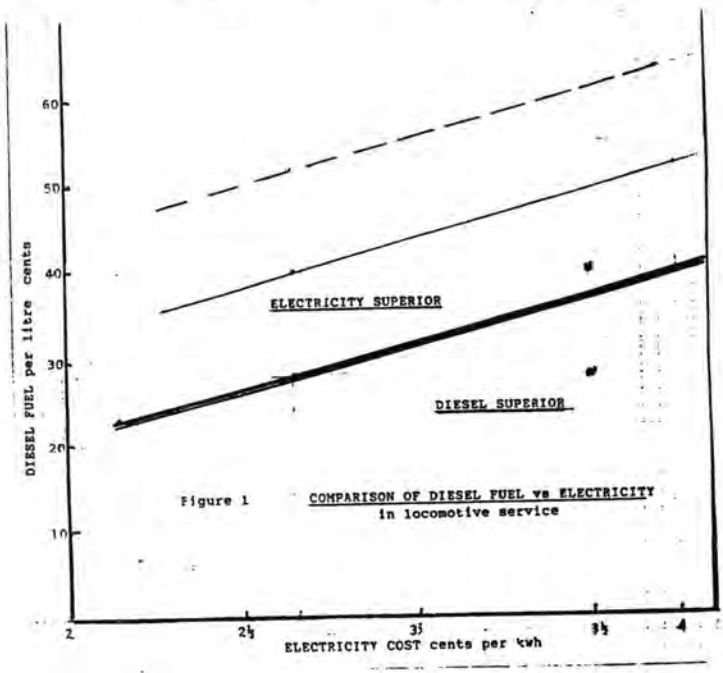


Figure 1 COMPARISON OF DIESEL FUEL vs ELECTRICITY in locomotive service

As long as world oil prices stay high - and nobody predicts otherwise - there is little likelihood that diesel oil will remain at today's hedged 40¢ a litre.

Turning now to maintenance, a survey of all North American railroads provide a figure of C90¢ per thousand gross ton-miles for diesel maintenance. Since these will be cut in half by the new electric locomotives, there will be a saving of 45¢ over the 75 billion yearly gross ton-miles, an amount of $11,000 per mile of track per year.

The total savings from maintenance plus power at 3¢ is therefore over more than $19,000 per mile per year at these traffic levels.

If and when other traffic moves over this line, similar savings will be established. While the electrification investment remains steady - unless it has to be upgraded in future - and traffic increases, so will the savings accumulate.

Electrification's capital cost is $300,000 a mile, to which must be added a further $100,000 for modifying the galaxy of electrical devices that accompany a freight train, such as crew to ground radio, radio that tells the engine crew what the caboose crew once knew, radio for controlling mid-train units, along with the particular system of signalling, all affected by high-voltage AC overhead.

At some point in the history of world oil prices, the fuel savings of electrics, plus their lower maintenance expenses will produce significant payback figures in their favour.

Since electrification can only be erected over some period of time, these savings will not accrue until it is complete, which the payback DCF will have to acknowledge,

As oil and electric power prices rise and fall, payback periods will be altered accordingly.

The capital cost of this motive power has not been considered, since the replaced diesels, of higher value, can be leased, sold or turned in a trade.

Needless to say, elaborate electrification cannot be extended to yards, or to branch lines with little traffic. It must be restricted to lines (with sidings) where traffic density is at least the same gross ton-mileage as on the main line.

There remains the supply of power. To convert all Canadian railway main lines results in demand beyond any unused supply in our system. Clearly more generation must be added. With diesel locomotives no longer burning a petroleum product, that same fuel can be burned in much more efficient power plants, the largest supplying 2¢ power.

The railways could possibly erect their own power stations, which would have to be major in scale for economy, but the surplus can always be sold to public utilities. BC Rail's 150 mw plant cost $225,000,000 in 1984, and will cost more to-day.

Of course, there is always nuclear

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Innovative Air Cargo Transfer Flexibility at Ted Stevens Anchorage International Airport

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Introduction

The strategic importance of Anchorage, Alaska to air cargo transportation has been duly recognized by the U.S. Department of Transportation (USDOT). At the behest of Ted Stevens Anchorage International Airport (hereafter ANC[1]), USDOT granted it, along with Fairbanks International Airport, expanded air cargo transfer flexibility in 1996. This was a unique development that has not been matched by any other airport elsewhere in the United States. In effect, it is the foreign cargo

carriers themselves which stop and refuel at ANC that have gained the most from this new flexibility. In other words, unilateral air cargo regulatory reform for the sake of international air cargo operations now has a precedent.

This paper will overview the path ANC took to spearhead this initiative, and discuss what was and what was not granted by USDOT. As a unique step in the air cargo reform process, the initiative will be set against further discussions concerning the issue of air cargo co-terminalization (co-T), in particular, and cabotage reform. While co-T and cabotage seem to be a distant hope within the bilaterals covering the U.S.'s trade partners, it is the case that ANC offers the first careful step in the right direction. An economic appraisal will be provided.

Ted Stevens Anchorage International Airport (ANC): An Overview

ANC is roughly a 5,000 acre complex with three major runways, two major terminals, four cargo airparks and an air cargo refueling ramp. The area designated for transient air cargo parking measures about 2 million square feet. Approximately 228,000 flight operations occur per year with approximately 230 to 260 revenue landings occurring per day--- about 40% of these being all-air-cargo. ANC operates 24 hours daily with no curfews; and approaches/departures normally occur over water (Knik Arm) which, along with a preferential runway policy, aids in noise abatement.

ANC's strategic location is exemplified by the fact that it is within 9 hours of flying time to about 95% of the world's industrialized nations. In terms of distances ANC is within a roughly 2,000-4,000 mile radius of the world's major air cargo centers as shown in figure 1.

Figure 1: The Strategic Location of Anchorage
(distances are in miles)



ANC is owned and operated by the State of Alaska and is self-supporting through rates and fees assessed to airlines and other tenants (see **Appendix I**). Through five-year operating and terminal lease agreements, the airlines guarantee revenue to cover ANC's operating expenses. For fiscal year 1999, these revenues totaled $52.2 million (US). By international standards, ANC has a relatively low landing fee. Given the $0.89/1,000 lbs. fee, a standard Boeing 747-200 weighing about 830,000 lbs. would be assessed a landing fee of $738.70. This is in comparison to an average signatory-carrier, landing fee of $1,281 for such aircraft calculated across all medium-sized, U.S. hub-airports (which includes ANC).[2]

ANC hosts, or is situated near to, 10 freight forwarder companies. It is within 2 miles of the nearest rail terminal and intermodal center; and within 3 miles of the nearest motor carrier terminal, inland waterway port and interstate highway. A foreign trade zone is located at ANC. Adjacent to ANC is the Anchorage Mail Processing Center (which processes an average of 1.2 million pieces of mail per day). It is powered by a $5.5 million fuel cell system (the U.S.'s largest commercial fuel cell system[3]).

As the largest airport in Alaska, ANC is ranked 6th in the world in terms of cargo weight (loaded and unloaded). Memphis International Airport is first in this category due, in part, to it being the main hub for Federal Express. However, ANC is ranked 1st in the world for landed cargo weight (which includes in-transit cargo). In 1998, ANC landed 13.4 billion lbs. of cargo versus 11.2 billion lbs. for Memphis. Between 1993-98, landed air cargo weight grew by 58% at ANC and 62% at Memphis. Both Federal Express and United Parcel Service maintain international sorting hubs at ANC's North Cargo Airpark while Northwest Air Cargo, United Airlines Worldwide Cargo, and Polar Air Cargo maintain transfer hubs. ANC is also ranked 1st in the world in terms of fueling of all-cargo aircraft. Fuel consumption at ANC in 1998 was approximately 648 million gallons. The West Cargo Airpark, being the least developed of the four, is the site for a planned 12 million gallon fuel farm.

A breakdown of the airlines serving ANC is provided in **Appendix II**. Out of the 17 all-cargo, international carriers serving ANC, their average weekly landings in 2000 were dominated by Federal Express, Korean Air, United Parcel Service and Northwest Air Cargo. A breakdown of these is provided in **Appendix III**.

USDOT granted 10 new China-U.S., weekly-service routes on Nov. 21 of 2000. Service may begin after April 10 of 2001. United Parcel Service, a new entrant to this market, received

6 of these. Among the three incumbents: Northwest Air Cargo received 1; United Airlines Worldwide Cargo received 2; and Federal Express received 1. Of these 10 new weekly routings 8 will be using ANC as an intermediate stopping point.[4]

On the passenger side of operations ANC, and Fairbanks International Airport[5], were granted passenger stop-over authority for various foreign air carriers in 1981 (see: **USDOT 1996, Order 96-11-2; *supra*-note 5**). Basically, a foreign carrier may drop-off passengers in Alaska and then proceed to the contiguous United States with any remaining passengers. This rather limited form of co-T has recently been expanded to air cargo as will be discussed in the next section.

Innovative Air Cargo Transfer Flexibility at ANC: Co-mingling

Double-digit growth in air cargo activity has been the case at ANC for several years now. Since the City of Anchorage represents a small market in terms of origin-destination, ANC has an incentive to enhance its relationship with international air cargo carriers and work to achieve efficiency gains through regulatory reform with respect to air cargo operations. Apart for ANC's strategic position as a major refueling stop, it is in a position to pin-point areas where regulatory restrictions could be relaxed. ANC recently established success in this area by way of persuading USDOT to agree to use:

> ... Alaska as a testing ground for even greater liberalization of foreign and domestic air carriers' rights to carry international air cargo on route legs between Alaska and other United States points. Such liberalization would optimize the geographic advantage of Alaska for air cargo

> transfer. In addition, such steps would also optimize the flexibility that [USDOT] has sought for Alaska as an international aviation hub. Without vigorous initiative on the part of [USDOT], the United States stands to lose to foreign airports the economic activity for labor, industry, and consumers that increased domestic and foreign transfer authority could generate for the United States.[6]

ANC, representing the interests of the State of Alaska, approached USDOT on the matter of air cargo co-mingling in 1995 and took the lead in the negotiation process. On Nov. 1, 1996, USDOT granted both ANC and Fairbanks International Airport the unique option of allowing a foreign air cargo carrier the right to move its cargo on ramp to either: (1) a U.S.-based air cargo carrier; (2) a *different* plane operated by that foreign carrier; or (3) a different foreign carrier to move the air cargo to a 3rd country.[7] Of course, points (1) and (2) can, in fact, necessitate the co-mingling of international freight and landed imports with domestic freight.[8] The new authority has been granted for an indefinite period of time; however, USDOT reserved the right to amend, modify, or revoke this exemption authority, without hearing, in response to any perceived need to respond quickly in the public interest.

Between 1996-98, ANC did not properly account for any co-mingling cargo transfers. For example, a 100 lb. shipment moved from one plane to another would have remained listed as cargo "in-transit". The practice since 1998 has been to report the transfer as both deplaned *and* enplaned international freight. Even if the cargo is enplaned to a domestic carrier for delivery to the United States the freight will be listed as international.

Currently, all foreign-based cargo carriers using ANC have welcomed the co-mingling reform. However, those carriers

that indicate activity in this regard (i.e., China Airlines, Japan Airlines and Nippon Cargo Airlines) use it sporadically at this time. Note, again, that Japan has only recently been granted the opportunity (***q.v.*, *supra*-note 7**).[9] Taiwan-based EVA Air, for example, sorts its cargo elsewhere meaning that there is no need for air cargo transfer at ANC since all cargo is proceeding to a common destination in the contiguous United States. Others, as well, simply "gas-and-go".

Economic Analysis

The most efficient form of international air cargo operations would be one that allows foreign and domestic carriers to compete on a level playing field. In terms of operations, unrestricted point-to-point domestic haulage by foreign carriers (i.e., cabotage) provides for the greatest degree of competition along routes.[10]

A step toward cabotage in the air cargo industry--- and a necessary condition--- is the ability of scheduled foreign aircraft to proceed, with some or all of their foreign cargo, from the (air)port-of-entry to at least one more domestic airport. This activity is known as co-terminalization (co-T). Currently, the United States does not allow air cargo co-T among its air-bilateral partners.[11]

Now a step toward air-cargo co-T among foreign carriers using ANC has been taken by USDOT in the form of the co-mingling option. Since ANC is a refueling stop it is only natural for it to become an inter-lining point as well. While the previous discussion has shown that co-mingling has not been a significant activity at ANC as yet, it is well known that inter-lining is a source of fleet economies. Furthermore, any inter-lining or trans-shipment point may also precipitate spill-overs such as: expansion of cargo warehouse space; and increased customs clearance activity for

cargo inter-lining between a foreign and domestic carrier. Of course, another spill-over would be the creation of new routes for foreign carriers through ANC. Recall, however, that USDOT required that no new routes be created under the reform which, thus, mitigated such an effect.

While the air cargo reform was measured in its construction, it has the effect of being a positive-sum game. The State of Alaska is viewed as a frontier by USDOT meaning that it is an area ripe for experimentation because of its dependency on foreign air cargo activity. Of course, the prohibition against new foreign carrier routes does protect U.S. labor to some extent. Co-mingling, to the extent that it occurs, at least adds to efficiency along existing routes. And inter-lining has the ability to benefit domestic carriers using ANC to the extent that they have excess capacity to offer the foreign carriers.[12]

Conclusions

Transportation deregulation is a slow process and the air carrier mode has been particularly slow to adjust in an international context. In that regard it is unique to see unilateral reform take place. While USDOT regards the State of Alaska as a frontier there is no economic rationale to suggest that co-mingling not be pursued at other airports under jurisdiction by USDOT. Of course, increased foreign carrier presence at other U.S. airports is likely to be something that USDOT would not find to be all that easy to achieve politically. ANC is a special political case. Nonetheless, if a particular airport wished to see co-mingling occur at its facility in order to realize spill-overs, it would be a useful first step along the way to introducing unrestricted co-T to the U.S. air cargo network.

Endnotes

[1] Ted Stevens is currently the State of Alaska's senior U.S. Senator and is also Chairman of the Senate Appropiations Committee.

[2] This figure was calculated by the American Association of Airport Executives for 1998 as quoted in: *Alaska Journal of Commerce*. (2001). vol. 25. no. 2. p. 13.

[3] A fuel cell converts hydrogen, via natural gas and air, into electricity. No combustion is involved. Rather than being burned the natural gas is subject to a chemical process. The by-product is hot water (which is used to enhance the heating process) and carbon dioxide.

[4] Bidders that were not successful were: American Airlines, Delta Air Lines and Polar Air Cargo.

[5] Both airports are under the auspices of the Alaska International Airport System (AIAS) which consolidates their accounts for fiscal reporting and manages both as a self-sufficient enterprise fund. Fairbanks is located in Central-Alaska and is 263 airline statute miles northeast of Anchorage. Air France, Lufthansa Cargo and Cargolux of Luxembourg are the airport's core group of air cargo carriers.

[6] United States Department of Transportation. (1996). Office of Aviation and International Affairs. HR 4475. p. 64.

[7] The governing section of the U.S. Code is: Title 49, U.S.C., Ch. 413, Sec. 41301, "Requirement for a Permit". Essentially, USDOT granted foreign air cargo carriers an exemption under this section for expanded cargo transfer flexibility. At the time, however, foreign carriers of both the

United Kingdom and Japan were not granted an exemption. This was due to on-going negotiations concerning their overall bilateral air agreements with the United States (**USDOT 1996, Order 96-11-2; p. 2**). USDOT felt that the granting, in effect, of extra-bilateral authority at the time of discussing the current bilateral would be improper. As of Feb. 1998, Japan is eligible to co-mingle while the United Kingdom is still not. And beyond ANC and Fairbanks International Airport, Honolulu International Airport was granted similar authority in 1999. As yet, no air cargo carrier stopping in Hawaii has made use of the co-mingling reform. Finally, USDOT is also willing to discuss expanding authority to other geographically-isolated parts of the United States; specifically, Guam and Saipan which are located between New Guinea and Japan.

[8] Note that U.S. Customs no longer makes a clear distinction between international freight (with a destination in a 3rd country) and landed imports (to be further moved point-to-point within the United States to its final destination). Until the imports reach their final destination as specified on the bill of lading, the imports are still considered international at their port of entry (**Prokop and Dean 1999**). It is also important to note that all city-pairs as specified within any current bilateral air agreement must be respected. This, in combination with the prohibition against cabotage, means that no new air cargo routes were sanctioned by USDOT as a result of the exemption.

[9] In fact, Japan Airlines co-mingled air cargo with a domestic carrier for the first time in Sept. 2000. One disincentive against further activity in this regard is that the refueling layover of their planes tends to range from 15 minutes to 1 hour thus providing little time for air cargo transfers.

[10] For a discussion of the efficiency gains resulting from cabotage reform--- specifically the effects on fronthaul and backhaul freight rates--- see **Prokop (1998)**.

[11] Technically, though, the 1995 Canada-U.S. Open Skies Agreement allows for co-T among their respective air carriers; however, the take-off weight of the aircraft cannot exceed 35,000 lbs. For an overview, see **Shurvell and Crockatt (2000)**.

[12] In particular, Evergreen International Airlines, Gemini Air Cargo and Tower Air provided positive testimony to USDOT regarding increased inter-lining options (**USDOT 1996, Order 96-11-2; p. 3**).

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Appendix I: Airline & Tenant Rates/Fees for Fiscal Year 2000

Landing Fees	$0.89 per 1,000 lbs. of Certified Maximum Gross Take-off Weight.
Fuel Flowage Fee	$0.023 per gallon for non-signatory airlines. $0.02 per gallon for *signatory airlines* (5-year operating and terminal lease holders).
Parking Fee	$0.15 per 1,000 lbs. of Certified Maximum Gross Take-off Weight per day. First 3 hours is exempt for non-signatory airlines; 12 hours for signatory airlines.
Terminal Building Rental	$37.40 per square foot per year.
North Terminal Docking Fee	$500 per docking.
Federal Inspection Fee	$25.89 per inspection.
Shared Use Ticket Counter	$55 per 3 hour use for 4 positions; $110 per 3 hour use for more than 4 positions.
Crew Processing Ticket Counter	$10 per 30 minute use for one position.
North Terminal V.I.P. Lounge	$50 per use for up to 4 hours; $100 per use exceeding 4 hours.

Source: Ted Stevens Anchorage International Airport.

Appendix II: Passenger and Air Cargo Carriers Serving ANC

Domestic Carriers	**International Carriers**
Passenger Operations	**Passenger Operations**
Alaska Airlines	Asiana Airlines *
American Airlines	Cathay Pacific Airways *
America West	China Airlines
Continental Airlines	Eva Air *
Delta Air Lines	Korean Air
Era Aviation	Mavial/Magadan
Frontier Flying Service	Northwest Airlines
FS Air	Reeve Aleutian Airways
Grant Aviation	
Northwest Airlines	* *in-transit only*
Peninsula Airways	
Reeve Aleutian Airways	**Passenger Charters**
Trans-World Airlines	
United Airlines	All Nippon Airways
	Balair
Passenger Charters	Canada 3000
	Canadian International
Hawaiian Airlines	Condor
Northwestern Arctic Air	Japan Airlines
Omni Air International	LTU International Airways

Source: Ted Stevens Anchorage International Airport.

Appendix II continued:
Passenger and Air Cargo Carriers Serving ANC

Domestic Carriers	**International Carriers**
All-Cargo Operations	**All-Cargo Operations**
Airborne Express	Air China
Air Cargo Express	American Transair
Alaska Central Express	Asiana Airlines
Alaska Airlines	Atlas Air
DHL Airways	Cathay Pacific Airways
Empire Airlines	China Airlines
Era Aviation	Eva Air
FS Air	Evergreen International Airlines
Greatland Air Cargo	Federal Express
Lynden Air Cargo	Japan Airlines
Northern Air Cargo	Korean Air
	Nippon Cargo Airlines
	Northwest Air Cargo
	Polar Air Cargo
	Singapore Cargo Airlines
	United Airlines Worldwide Cargo
	United Parcel Service
	All-Cargo Charters
	Emery Worldwide Airlines
	Gemini Air Cargo
	Malaysia Airlines
	Tower Air
	World Air

Source: Ted Stevens Anchorage International Airport.

Appendix III: Average Weekly Landings by All-Cargo, International Carriers

Carrier	Fiscal Year 2000
Air China	4
Asiana Airlines	21
Cathay Pacific Airways	14
China Airlines	37
Eva Air	30
Evergreen International Airlines	13
Federal Express	82
Japan Airlines	41
Korean Air	60
Nippon Cargo Lines	37
Northwest Air Cargo	46
Polar Air Cargo	6
United Airlines Worldwide Cargo	17
United Parcel Service	53
Others	52

Source: Ted Stevens Anchorage International Airport.

The Blurred Lines of Responsibility in Air Cargo Customer Service

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1. INTRODUCTION

Many transportation service providers have long recognized the importance of customer service. For many others, however, customer service has traditionally been a small concern. The recent trend is a growing emphasis on the competitive advantages that superior customer service can provide. Many shipping networks rely on multiple organizations, each with a different attitude toward customer service and each with a different level of customer service.

What exactly is meant by "the blurred lines of responsibility"? This paper focuses on Manitoba, and shippers that use air cargo to move goods to or from Manitoba. Shippers are concerned with the service level provided by the carrier being used – an airline or courier. However, there is usually some form of truck transportation to and from the airport. What about the trucking company's customer service level? Sometimes ground handling is done by a separate contracted company. What about their customer service level? If the shipment is passing through Customs, does their level of customer service have an impact? Did the shipper use a freight forwarder? What about the airport as a whole? Do they have a role in the overall customer service picture? Certainly the level of customer service offered by airport service providers (such as airlines and ground handlers) reflects upon the airport. To the shipper, the lines are blurred as to who is ultimately responsible for establishing the customer service level.

2. BACKGROUND

In recent years, Winnipeg International Airport (YWG) has become an increasingly important hub for air cargo activity, particularly for couriers and integrators. In the 1990s, Purolator Courier and Federal Express made multi-million dollar investments in sorting facilities at YWG. More recently, United Parcel Service (UPS) initiated direct cargo service between Winnipeg and Omaha. Winnipeg's 24-hour operations, excellent flying weather, uncongested conditions and central location are attractive for companies, like the integrators, who specialize in delivering time-sensitive goods.

There have been other global trends, such as the increase in value-added manufacturing and the growth of e-commerce, that have led to greater use of air cargo. In general, the higher the value of a product relative to its weight, and the shorter the lead time between order placement and final delivery, the more likely it is to be shipped via air cargo.

The emphasis of this paper is transborder air cargo service at Winnipeg International Airport, with a secondary analysis of domestic and international service. The concluding section of this paper reviews some of the issues and problems arising from the analysis, but stops short of proposing solutions, a task beyond the scope of the study.

This paper presents the findings of one component of a larger study that analyzed the volume of trade between Manitoba and the United States, and between Manitoba and Mexico. This focus here is on the qualitative results of the study, assessing the findings of a survey of Manitoba shippers.

The survey requested information about air cargo usage, commodities, the service level of air cargo in Winnipeg, international air freight issues, market information, and brand-name opinions regarding freight forwarders and cargo airlines. A total of 24

companies that ship air freight were contacted with 22 taking part in the survey for a relatively high participation rate of 91.7%.

3. SURVEY RESULTS

The companies represented a diverse set of Manitoba industries, representative of the top import and export commodities.[1] The industry breakdown is as follows[2]:

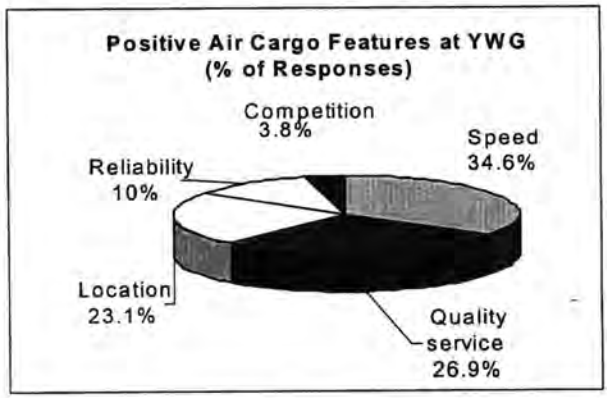
Companies Interviewed		
Company Type	**Responses**	**% of Total**
Aerospace	5	22.7%
Electronics	5	22.7%
Manufacturing	4	18.2%
Paper	3	13.6%
Steel	2	9.1%
Plastic	1	4.5%
Garment	1	4.5%
Rubber	1	4.5%

The companies indicated that time constraints were the single most important reason that air cargo was the chosen mode of transport. Over two-thirds of the total responses cited time as the main reason air shipping was chosen. Other reasons mentioned included the cost of air transport relative to the service provided, and safety.

Given that time was such an important factor in the decision to ship goods by air, it was not surprising that the top ranked positive feature about air cargo service at Winnipeg International Airport was also

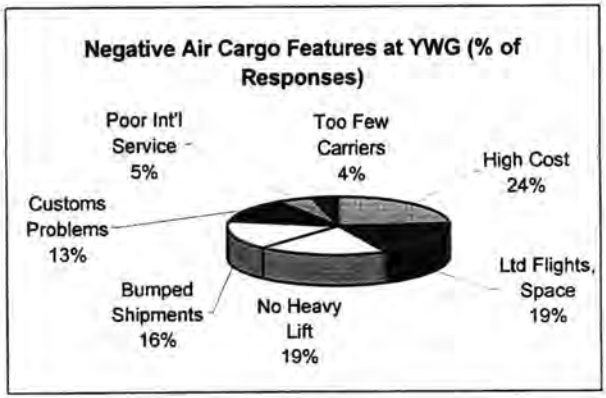
[1] This information was discovered in the first component of the larger study, which identified air cargo flows to and from Manitoba by commodity.
[2] It is important to note the difference between total responses and total respondents. While there were 22 respondents, they were encouraged to give multiple responses where applicable. Therefore, the total number of responses – used throughout the study – is not always equal to the number of respondents, nor is it the same value from question to question.

speed. Both the first and second most common features for the airport are speed-related. The positive attitude of shippers toward the airport's speed of service is a good feature for marketing cargo services at Winnipeg International Airport. The remaining features are more representative of the advantages that Winnipeg holds over other centres: location, access to carriers, reliability and good service.



The companies also identified some negative features for Winnipeg's air cargo service. Issues related to cargo space and flight frequency were the most often mentioned negative features, followed by customs issues and the high cost of air cargo shipping in Winnipeg. High cost and customs delays are not unique to Winnipeg but are common to the nature of air cargo.[3]

[3] One company also identified fast customs service as a positive quality of Winnipeg's airport. This company works in the global market and many of their shipments pass through customs in Toronto or Vancouver, where customs clearance can take longer than in Winnipeg. Therefore, Winnipeg seems fast in comparison. This company also put slow customs service on their negatives list because of customs delays at airports in general.



Overall, cargo service at Winnipeg International Airport received an average rating of 3.27 out of 5.00. While 3.0 was the most frequent response, more respondents gave service at YWG a rating of 4.0 or 5.0 than gave it a 0.0 or 1.0 or 2.0.

The company respondents were also asked about barriers to shipping by air between Manitoba and the US, Manitoba and Mexico, and Manitoba and overseas. The most frequent response in each case, again, related to customs issues.

Problems with customs accounted for nearly half of all responses regarding barriers to shipping by air to the US.[4] Respondents also indicated that if expedited customs service or cargo pre-clearance were implemented, more cargo would be shipped by air given that it would then be both easier and faster than surface transport. Presently, due to customs delays associated with air cargo transportation, it can be as efficient to truck goods to Denver, Minneapolis, or Chicago, despite direct air access to these markets from Winnipeg. Some

[4] However, more than half – in fact almost two-thirds at 14 out of 22 respondents – identified customs as a barrier. Again, the figures in the text refer to the proportion of total responses given. There were 33 total responses for this question.

companies indicated that they could increase their own competitiveness with a better ability to ship quickly and easily to the US.

The other top barriers to shipping to the *US* by air included a lack of local air cargo competition, a lack of desired flights, and excessive documentation (each with 12.1%). Some of these barriers would be positively affected if significant changes to customs clearance were to take place as well. Only 6.1% of responses indicated that there were no discernible barriers to shipping by air to the US.

Because fewer companies ship to *Mexico*, fewer companies responded regarding barriers to shipping by air to Mexico. Half of the responses named customs issues as a barrier. The Mexican customs bureau was criticized by one respondent as being archaic and overloaded. Respondents indicated their desire for a new customs agreement between Canada and Mexico to improve the flow of goods between the two nations. The companies that claimed to have no problems shipping to Mexico are, in general, rare cases with special customs agreements because of the comparatively large size of the companies and their shipments.

For *overseas* shipping by air, customs issues were still the most frequently mentioned barrier, but were less significant than it was for shipping within North America, accounting for 30.0% of responses.[5]

The next most significant barrier to shipping by air overseas was the limited cargo space out of Winnipeg (20.0%). Also mentioned were the lack of desired flights, excessive documentation and poor infrastructure, all at 10.0%.

[5] For example, a particular shipment would only be allowed to enter the country if it were carefully boxed with high quality wood. At the customs station, the packing wood was then incinerated because foreign lumber was not allowed to enter the country. Non-tariff barriers are significant problems in some countries and discourage international trade.

In total, almost 40% of responses regarding barriers to international shipping were customs-related (incorporating responses for the US, Mexico and overseas). Other frequently cited barriers were limited cargo space, the lack of desired flights and excessive documentation.

Barriers to International Shipping		
Barrier	**Responses**	**% Total**
Customs	23	39.0%
Limited Space	7	11.9%
Few Desired Flights	7	11.9%
Documentation	6	10.2%
None	5	8.5%
No Competition	4	6.8%
Poor Infrastructure	3	5.1%
No Heavy Lift	2	3.4%
Other	2	3.4%

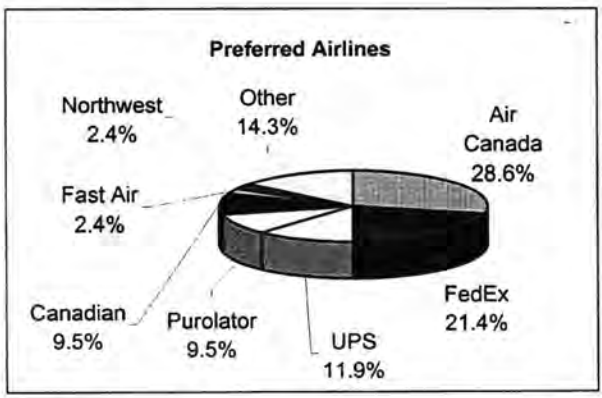
Most interesting to note at this juncture, is the fact that the survey has only asked for opinions on air cargo service at Winnipeg International Airport. To this point, no mention has been made about airlines or freight forwarders. The perceived impediments are noted as pertaining to the airport, regardless of which company or organization is responsible for setting policies and ensuring customer service.

The survey next asked companies about their own use of freight forwarding services. The vast majority of the companies, 86.4%, used a freight forwarder. When asked why the company chose to use the services of a freight forwarder, a wide variety of responses were elicited. The top reasons for using freight forwarders were because of convenience (26.1% of responses) and because forwarders could negotiate better rates from carriers than the shipper could on their own (21.7% of responses). Other significant responses were that forwarders can expedite paperwork (17.4% of responses) and ensure delivery to the final destination (13.0% of responses), a task that airlines carrying air cargo do not perform (with the notable exception of the integrators who do offer door-to-door service). In some cases, the shippers' customers – the end recipients – were responsible for

selecting the freight forwarder. In essence, freight forwarders helped some companies to alleviate perceived customer service problems associated with other organizations.

The companies surveyed used an extremely wide selection of freight forwarders. Of those forwarders used by more than one participating company, the most frequently utilized were GeoLogistics (16.1% of respondents) and Kuehne and Nagel International (9.7% of respondents). Other forwarders used by more than one respondent were Emery, Schenker, Cole and BAX Global.

Companies also named their most frequently used cargo airlines. Air Canada was the most widely used airline, followed closely by Federal Express. A number of other carriers were named as well, but in smaller proportions, including Purolator Courier, United Parcel Service, Canadian Airlines and Fast Air Cargo.[6]



Although Air Canada is the most preferred carrier in terms of usage, Federal Express and Purolator Courier received better ratings by the

[6] Companies were asked to name their overall first choice airline as well as others that the company prefers to deal with. Air Canada was the first choice of 45% of respondents.

companies. Even among those that preferred Air Canada as a carrier did not rate it very well (compared with FedEx and Purolator) because of bumped shipments, a lack of guaranteed cargo space, and a "non-courier frame of mind", meaning that although they do move cargo from city to city, they do not offer door to door service or verification of delivery. FedEx, on the other hand, was commended for delivering quickly, offering guaranteed service, and enabling shippers to track packages throughout the process. FedEx was rated the highest among the cargo carriers (although carriers receiving fewer than three responses were omitted from this analysis).[7]

4. The Blurred Lines of Customer Service

Perhaps the most telling part of this study is when respondents were asked to identify the positive and negative features of air cargo service at Winnipeg International Airport. These are the views of airport users on the customer service level they receive, regardless of who is actually providing the service.

To recall, the positive features were speed, quality of service, location, reliability, and competition, while the negative features were the high cost, limits on flights and space, lack of heavy lift, bumped shipments, customs problems, lack of international service and few carrier choices. Examining these elements of customer service individually reveals that many parties play a part in the overall customer satisfaction equation, and that it is difficult in many cases to assign customer service responsibility to any one participant in the transportation chain.

For example, time and speed are factors that are spread among several parties. Airlines, of course, play an important role in covering the most distance for air cargo movements, but that speed is

[7] A parallel study of freight forwarders – essentially targeting the same information – found that the top rated airlines serving Winnipeg were Royal Air Cargo and Federal Express. However, the preferred airline of the freight forwarders, by a wide margin, was KLM.

meaningless if the cargo is forced to spend too many hours – or even days – delayed on the ground. Responsibility there could lie with the airline, but could also lie with a ground handling company, trucking company, local courier, or even customs offices. In any event, for air cargo service at Winnipeg International, the parties are fulfilling their customers' expectations, as survey respondents praised speed as one of the positive features and did not name delays at the airport as a negative feature.

Cost of air cargo service is another example illustrating the blurred lines of responsibility. Exacerbating the situation in this case is the added influence in recent months of escalating fuel prices. This impacts both air carriers and trucking firms. However, airport fees and charges may also play a role, in addition to duties, taxes and freight forwarder fees. Shippers in this study found the cost of shipping by air to be high, but also expressed the sentiment that good value was generally received for that expense.

Rather than blurred lines of responsibility, all participants should share accountability with respect to safety. However, when multiple parties are involved, it can be difficult to separate out responsibility. Safety and security of a piece of cargo is perhaps most closely tied to the legal responsibilities mentioned later in this section.

Respondents also discussed the location of Winnipeg International Airport. This is certainly not something that can be altered in terms of achieving customer satisfaction. However, the location is clearly one of the airport's strategic advantages in terms of cargo operations, as it is only minutes from Winnipeg's central business district.

It is difficult to assign responsibility with respect to the perception that Winnipeg offers too few carriers and suffers from a lack of competition. These problems are largely due to the nature of Winnipeg's air cargo market. It is limited in size and there may not be room in the market for more carriers to enter and operate at a profit. Blame cannot be laid on carriers who choose not to serve a market for business reasons, nor can it be laid upon existing carriers. The airport

itself has to balance the needs of the shippers, who, according to this study, desire more choice among carriers, with the desires of its existing base of carriers, who may not want to see competition that will affect their own profitability in Winnipeg.

To a certain extent, the same comments apply to the issues of a lack of cargo space, too few cargo flights, inadequate flight frequency, and lack of heavy lift capability. These are also partly a function of the Winnipeg air cargo market. Again, it is difficult to blame the existing carriers for taking advantage, where possible, of economies of vehicle size and density. It makes economic sense to deploy larger aircraft in larger markets, particularly for combination carriers such as Air Canada. No airline will increase aircraft gauge or flight frequency unless it is financially viable. Customer service, while important, is not enough to justify such changes. However, there are opportunities for parties to work together to resolve issues such as these, provided that all are willing to reach a compromise.

Of course, it can also be difficult to assign responsibility for positive service features. For example, respondents discussed the reliability and "good service" offered by the Winnipeg air cargo industry. This is certainly a collaboration of all the players in the industry.

Another matter is regulatory issues, primarily made up of concerns relating to customs and documentation, but also including issues such as cargo pre-clearance and bilateral rights. It is somewhat easier to assign responsibility for customer service here, as these regulations are usually the domain of federal governments. However, it may be unfair to assume that these problems – as perceived by shippers – are unnecessary. For example, customs regulations exist for a variety of reasons, ranging from protecting domestic manufacturers to restricting the entry of dangerous or illegal goods. The industry is pressing for changes, but often in different directions.

For the shipper, the question remains: who is ultimately responsible? In some cases the answer may be easier than in others. For example, if a shipper is using a courier or integrator, that company generally

takes responsibility for the shipment from pick-up to delivery. If the shipper has a customer service issue, it can be taken up with the courier. Similarly, if a shipper uses the services of a freight forwarder, that forwarder may accept responsibility for ensuring customer service from pick-up to delivery. This is made more difficult for forwarders than for courier-express companies because freight forwarders rarely use their own equipment or personnel to move goods. Forwarders rely on the customer service level of contracted carriers. So even if a forwarder assures the shipper of adequate customer service, who is responsible for customer service in the forwarder's eye? The forwarder can use companies that have a good record, but this may not always be possible, nor is the customer service level entirely within the forwarder's control. If the contracted company makes an error, should the forwarder take responsibility in the eyes of their customer? Or should the forwarder claim innocence, passing on responsibility to the contracted carrier? Which scenario has the least negative impact on the existing relationship with the shipper?

There are, of course, points where legal responsibility and liability change hands. However, this does not always correspond with the shipper's perspective of who is responsible. It is that perception – accurate or not – that can have an impact on how shippers, and even the public, view some service providers. For example, a forwarder may contract a shipment with both an airline and a trucking company to move a piece of cargo. The trucking company may damage the cargo, and is legally liable for the damages. However, the shipper knows that the cargo was sent via air freight through a freight forwarder, and is more likely – instinctively at least – to blame the forwarder or an airline. This in unfair to both, but they cannot ignore a customer service complaint. Alternatively, consider an airline damaging a piece of cargo in transit, or bumping it to a later flight. If a shipper is picking it up at the airport, there can be the perception that the airport is somehow responsible for the damage or untimeliness.

Companies and freight forwarders want improved service. So what does improved service mean? The survey results point to a few key factors. First, in the opinions of the respondents, there are simply not enough flights with enough air cargo space serving Winnipeg International Airport at present. Also important is the lack of ability of the current service providers in Winnipeg to handle heavy-lift cargo or oversized cargo. Of course, it is difficult to balance both of these problems. Increased frequency is usually a trade-off for decreased aircraft size and vice versa. However, shippers and forwarders have indicated the desire for increased frequency of flights to key Canadian and US markets[8] and the addition of wide body aircraft to Winnipeg's air cargo community. Some respondents also indicated a desire for greater competition among carriers in Winnipeg, ideally leading to lower rates. This is an issue that is constantly being addressed, as evidenced by the recent entry of UPS to Winnipeg's transborder service. Survey respondents also identified customs clearance issues and the high cost of shipping by air as problems. Governments continue to address and refine international transportation regulations. Holding fuel prices constant, the cost of shipping by air is decreasing, making more goods eligible for air freight.

5. CONCLUSIONS

This paper finds that there is overall satisfaction with air cargo service at Winnipeg International Airport. However, there is clearly room for improvement with a rating of 3.27 out of 5.00. There is also a corresponding desire for better service among the users of air freight services.

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[8] These findings are detailed in the full study. Specific domestic markets identified in the study as showing promise for new and/or improved air cargo service are (in order of importance) Toronto, Montreal, Vancouver and Calgary. US markets identified by both the data and the survey analysis included (in order of importance) Los Angeles, Dallas-Fort Worth, Minneapolis-St. Paul and Chicago.

As mentioned, this paper suggests no solutions to the issue of air cargo responsibility, and indeed, there may not be any simple solutions. However, there are certainly trends in the air cargo industry that may lessen the importance of this issue altogether. Continued growth and expansion of the integrators/couriers, including the takeover of trucking companies and freight forwarders, ensures that these firms will have a greater degree of control over the pieces of cargo entrusted to them. Increasing consolidation in the freight forwarding industry means that there will be fewer forwarders, but that they will be larger, have greater reach and should be able to exert more control over shipments. New players, such as privatized national post offices are also changing the air cargo landscape. Even strategic partnerships between rivals are not uncommon anymore. As much as the lines of responsibility are blurred, the lines separating airlines from integrators, forwarders and post offices are becoming just as blurred. However, the latter blurring may have a positive impact on the former.

It is important to monitor trends, to revisit the data regularly and to maintain contact with shippers and forwarders, as the results of this study are dynamic. Both the actual cargo volumes and the issues raised by shippers will change over time and should be monitored to ensure that positive changes are being made.

Vertical Integration in Liner Shipping: Strategy and Status

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1. Introduction

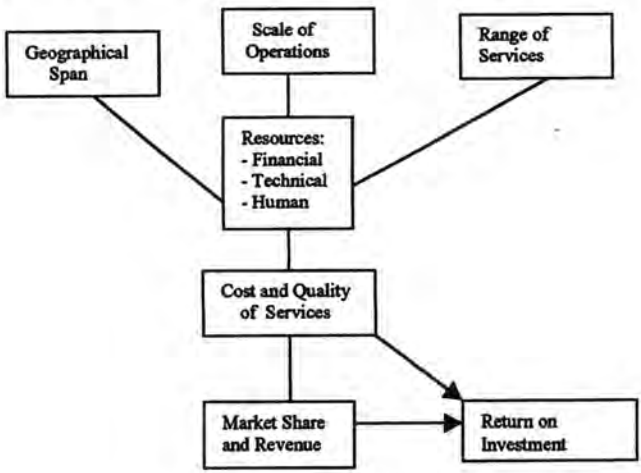
The liner shipping industry has been responding in various ways to the changing needs of shippers. The press has been filled with news of acquisitions, mergers, alliances, space sharing, slot-chartering arrangements and changes in liner service patterns. Most of these arrangements have affected liner operations themselves but some of them have concerned services beyond shipping such as port operations (P&O Ports, for example), of intermodal services (Intermodal Marketing Services of APL, for example) or other logistics services (the acquisition of GATX by APL Logistics, for example). Not surprisingly, these strategies have come under the scrutiny of industry analysts and of academics (Brooks *et al.*, 1993, Evangelista, Morvillo, 1999; Fossey, 2000; Heaver, 1996; Pontoppidan, 2000).

The purpose of this paper is to explore the implications of developments for the level of vertical integration in the shipping industry. This is approached under the framework set out in Figure 1. The Figure places the responses of shipping lines into three categories. First, to meet the needs of shippers' service expectations for access to global suppliers and markets while using a reduced number of carriers, shipping lines may increase

* The author has benefited from discussions with the following; Hilde Meersman and Eddy Van de Voorde, University of Antwerp, UFSIA-RUCA and ITMMA; Pietro Evangelista and Alfonso Morvillo, Research Institute on Service Activities, National Research Council, Italy; and Dr. Seok-Min Lim, Hanshin University, Korea. However, any errors or omissions are the sole responsibility of the author.

the geographical span of their services. Second, carriers are adopting strategies to integrate their services with those of other logistics service providers as shippers seek improved transportation services and better integration in their supply chains. One method is for carriers to expand the range of services they offer to meet shippers' logistics and supply chain management expectations. Finally, lines need to find ways to hold or reduce their cost levels which demands that they renew efforts to achieve economies of scale and scope.

Figure 1. A Framework for Service Development Strategies



Actions taken to achieve any one of these goals have implications for the attainment of the other goals. However, each of the goals can be associated with primary elements of strategies. The geographical span of services has been widened by the extension of their own services and through various forms of horizontal integration. Increasing the range of services provided requires strategies directed to the qualities of services and to their vertical relationships with other logistics services. In pursuing these goals, lines must consider the scale of their operations and its implication for costs. They may seek to reduce costs by acquisitions or other arrangements that create the potential for economies.

The pursuit of such goals places great pressure on the financial, human and technical resources of lines. It is not surprising, then, that the mix of strategies followed by shipping lines varies. The lines start from different bases in terms of their financial resources, the geographical extent of their services, their level of local market knowledge, the range and level of supporting services, especially in information technology, and the depth of human resources. Firms are also likely to differ in their interpretations of market developments and the best strategies to capitalize on them. The result is an expected variation among the strategies of shipping lines.

2. Ownership, control and integration

One of the purposes of this paper is to examine the implications for integration of ownership of a wider range of services by shipping lines. It is undertaken in part because of the experience in Canada with multi-modal ownership. Canadian Pacific (CP) at one time had an interest in all modes of transport but managed the modes as separate and often competing businesses (Heaver, 1971). (In February 2001, Canadian Pacific Ltd. announced that it is going to split off each of its remaining business units, of which only two are in transport, into separate public companies.) The lesson for the analysis of vertical integration in the shipping

industry is that common ownership or control of business units does not necessarily mean that they are managed in an integrated way. They may be managed almost as though they are completely independent firms.

Shipping lines are now involved in a wider range of services for international trade than just shipping. However, they have entered into the services in a variety of ways that have different implications for market structure, competition and the working of integration. By examining the ways that some lines are adding services, some conclusions on the nature of integration may be possible.

3. Strategies to extend the range of services

The framework of Figure 1 is used to allow concentration on developments oriented to extending the range of services. The developments are considered in four categories. They are shipping service quality and intermodal arrangements, port operations, information technology (IT) and logistics services.

3.1 Shipping service quality and intermodal arrangements

The need for improved transport service quality as shippers have shifted to reduced inventories in more responsive supply chains is well known. The qualities of high service frequency, same-day-of-the-week services, reliability of delivery and capacity available are expected of the transport system, not just the shipping service (Slack *et al.*, 1996). The needs have implications for route planning and vessel operations. For example, reduction in the number of ports on a route improves schedule reliability as does reserve speed beyond a vessel's planned sailing speed. However, the main impetus affecting vertical integration is the increasing provision of intermodal arrangements.

Facilitating intermodal arrangements for international trade was one of the early advantages seen by CP in multi-modal ownership. The freedom of CP and CAST to develop intermodal services with fully or partially owned carriers was one of the advantages that the Canadian routing had over competing US routes. The lines, now under CP Ships, follow the intermodal strategy in Europe. CP Logistics is responsible for making the intermodal arrangements through purchased transport services and a limited, but modestly expanding, amount of owned trucking. The role and organizational position of CP Logistics within CP Ships is comparable to Maersk Intermodal in Maersk Sealand.

With the greater commercial freedom in the US after 1984, the interest of lines such as Sea-Land and APL in greater responsibility to shippers for service quality led to the great development of intermodal services in that country. The arrangement of intermodal international movements as a part of through pricing by the shipping lines was and has remained the responsibility of the shipping lines. However, APL became involved through APL Logistics (APLL) with North American intermodal services, managed within the Intermodal Marketing Services unit (IMS). IMS was involved in the development of stack-train services but this was sold to Pacer Stacktrain in 1999.

The integration of shipping with inland services has largely been achieved through shipping lines managing the purchase of inland transport through a combination of long-term contracts, especially for rail service but some for trucking, and short-term purchases. The shipping lines have been in a better position than freight forwarders to commit for the volume of traffic necessary to make dedicated rail service viable. The same is now evident in barge systems in Europe. To a limited extent, the shipping lines' services have been supported by owned trucking but the common ownership of rail and shipping, confined to Canada until 1984 and of limited impact since then in the US, has been insignificant because of the role of contracting.

What are the consequences of the intermodal arrangements for integration? They have certainly resulted in great strides in through transportation quality but much remains to be done even in Europe and certainly in China and other countries. Common ownership has not played a significant role. The extent of shipping-owned trucking is limited. It gives the lines a better knowledge of truck costs, greater flexibility of service level and some security of capacity at peak times. These advantages may come at the cost of somewhat higher costs. The ownership in trucking does not have any effect on the level of competition in the trucking sector because of its small size and the fragmented nature of the trucking business. The main inroad into markets achieved as a result of better intermodal rail service has been to diminish the role that freight forwarders played in arranging inland transportation. Where markets are characterized by small shippers, either because of the nature of the industries or other factors, and the role of freight forwarders is strong, it is difficult to develop high-volume intermodal services.

3.2 Terminal management

The relationship of shipping lines with port terminals has come into attention because of the wider involvement of lines in dedicated terminals and through the management of terminals by subsidiaries of lines.

In the US, shipping lines such as Sea-Land have operated dedicated terminals since the 1970s when the introduction of container services was associated with the assumption of greater responsibility for the door-to-door movement of containers. The rationale for dedicated terminals has been to provide lines having a sufficient volume of traffic with better opportunities to integrate closely ship, terminal and inland transportation arrangements. In most other countries, concern about the provision of dedicated terminals by public port authorities and fewer opportunities for lines to ensure effective intermodal

services inhibited dedicated terminals. However, greater interest in intermodal developments, the shortage of capital available to port authorities and the general increase in privatization have resulted in an increase in the number of companies operating dedicated terminals and the number of countries accepting them. Recent examples are Evergreen in Taranto, Italy, Maersk in Rotterdam and Hanjin in South Korea. The management of these terminals becomes a separate unit of the shipping business, Maersk Ports in the case of Maersk Sealand.

The entry of separate corporations into the terminal management business is a part of a separate development. The worldwide trend of more private capital and management opportunities in port (and airport) businesses has resulted in a new business sector in which there has been rapid growth. Companies such as the Port of Singapore Authority, Hutchison Port Holdings and P&O Ports are using their specialized knowledge, including terminal information systems, to develop a global business. Two of the companies in the area are subsidiaries of major shipping firms; they are P&O Ports owned by P&O Steam Navigation Co. (P&OSNC) which has a 50 percent interest in P&O Nedlloyd, and Orient Overseas International Ltd. (OOIL) which owns Orient Overseas Container Line (OOCL). OOIL manages terminals in four ports through a Terminal Investment unit (the terminals are in Vancouver, New Jersey, New York and Venice) and has two container terminals operated as a part of and for OOCL. These are in Kaoshung and Long Beach (OOIL, 1999).

In the case of P&O Ports and the Terminal Investment ports of OOIL, the terminal management companies are in separate parts of the corporate group than the shipping businesses. There is no apparent management linkage with the shipping businesses as the terminals operated are often common user facilities. While it appears that the lines use terminals operated by the sister companies when they are available, there are no special working relationships between the companies. In each case, the expansion into terminal management appears to have been an opportunistic

response to a new business opportunity in an area where existing knowledge could be leveraged. It was not a strategy to achieve greater integration in transport processes.

Improvements in port terminal operations have been and remain an important source of potential efficiency in supply chains. The specialized terminal management companies bring new approaches and capabilities to the needed integration of terminals with inland as well as shipping services. However, the presence of P&O Ports and OOIL in the container terminal management business offers no more vertical integration, in practice, than the expansion of the Port of Singapore Authority or other terminal manager in the terminal management business. The operation of more dedicated terminals under the control of lines is associated with "ownership" (through the terminal contracts) and operational integration. However, there is not evidence that the expansion of dedicated terminals has offsetting anti-competitive effects where competition is active among terminals and ports. The level of competition has been increased by improvements in intermodal transport.

3.3 Information Technology

The development of improved IT is vital to performing existing processes more quickly, accurately and at lower cost and, more importantly, to doing things differently. Increased visibility of information along the supply chain allows processes and relationships to be redesigned. It is not surprising that improvements in IT capabilities are high on the agendas of all corporations.

Shipping lines seem to have been aided in the development of good IT systems by the central role they play in the generation of many documents. As a result, shipping lines such as APL and OOCL have been pioneers in IT developments. They have led web-driven systems and facilitated tracking and tracing capability at the purchase order (PO) and stock-keeping unit

(SKU) levels when others only had container-tracking capability. Other lines with fewer resources and with other priorities, such as developing a larger network of services, are now giving priority to advancing their IT capability. IT capability is particularly important for large global shippers. Many small shippers still lag behind.

The quality of the IT system is critical to the performance of a supply chain. It can be expected that deployment of a wide, common system is facilitated by common ownership or control. Therefore, it may be expected that an advantage in integrated IT systems exists with shipping lines that have owned or controlled logistics and shipping for some time. However, the advantages of the integrated enterprises may be diminished in the future by the development of community-based IT services such as the new portals being introduced collaboratively. For example, five lines are initial members of INTTRA, P&O Nedlloyd, Maersk Sealand, Mediterranean Shipping, Hamburg-Sud and CMA CGM – Hapag Lloyd has since joined - (Damas, 2001) and nine lines are members of the Global Transportation Network (GTN), APL, CP Ships, Hanjin, Hyundai, K Line, Mitsui OSK, Senator Yang Ming and Zim (APL Press release, Dec. 4, 2000). Numerous other firms and organizations are also developing e-commerce portals for international trade and shipping. Consequently, the advantage that some lines have in their advanced IT systems and, especially their extension into logistics service companies, may be a passing advantage. Whatever the ownership, the IT systems are crucial to effective systems integration. They pose no long-run threat to competition although by increasing the potential for shippers to communicate directly with lines, IT may be seen as a competitive threat to freight forwarders. However, the success of logistics service providers seems more likely to rest with their ability to design and manage services; IT capability will be widespread.

3.4 Logistics and supply chain management

The initial entry of lines into consolidation services was primarily by APL and Sea-Land enhancing their container services to meet the requirements of international manufacturers and retailers who sourced in regions such as Asia. Now, however, the lines are quite explicit about their reasons for being in the business. They see it as offering faster growth and better profitability than shipping. Statements of Neptune Orient Lines (NOL), P&O Steam Navigation Co. (P&OSNC) and A. P. Moller are cited as evidence. Their interests in logistics are the largest of the maritime enterprises but they are only of modest size compared with each of the major global freight forwarding companies.

APL Logistics (APLL) is the fastest-growing business unit in the NOL Group with a growth in revenues of 26 percent in 1999. The President of NOL has stated that he wants "the logistics business to challenge the Liner business as a major breadwinner of the Group" (NOL Press Release, June 20, 2000). The acquisition of GATX Logistics by APLL is evidence of NOL's objective to expand APPL rapidly as a separate business.

The Chairman of P&OSNC in his message to shareholders in the 1999 Annual Report notes that the company's logistics services are "high growth, high return businesses" and that "the ongoing P&O would focus on its high return logistics activities." In 1999, there was a return of 13 percent on net operating assets.

The A. P. Moller Group is less open about the role expected of Maersk Logistics (ML) within the Group. However, Soren Brandt, the head of ML, has noted, "the logistics activity could grow to outperform those of the liner, but it will take a while" (Le Lloyd, 2001). He also characterised the shipping and logistics businesses "as distinct businesses." Growth of ML will be geographic and by introducing new services.

Unlike intermodal services, which are managed within the shipping business, the conduct of logistics services is largely done in independent business units. The majority of the top 20 container lines in the world have such units, but they differ greatly in their scale. Here, information is provided on the major players. The organization structure is unambiguous in NOL and A. P. Moller but is less clear in P&OSNC.

Following its acquisition of APL, NOL established APL Logistics (APLL) to advance its strategy of rapid growth in the logistics area. APLL includes ACS (the consolidation service) IMS, the recently acquired GATX and other logistics units such as OCWS Logistics of Singapore. The company has offices in 55 countries and offers all elements of supply chain services as a carrier-neutral service provider. Its aggressive growth strategy is evident in its acquisition of the US-based GATX Logistics, the second largest warehouse-based contract logistics company in the US. The acquisition will increase APLL's revenue by 70 percent (APL Press Release, January 8, 2001). APLL views GATX as complementary, enabling APLL to serve customers more effectively through the primary (importing) and secondary (national) distribution phases of the supply chain.

With the acquisition of Sea-Land, A. P. Moller also re-branded its logistics services while leaving them independent of the shipping line. The previous Mercantile of Maersk and Buyers of Sea-Land have been re-branded as Maersk Logistics (ML). ML's mission statement is that it "is an independent organisation operating world wide through locally incorporated companies and is engaged in satisfying customers' expectations in respect of competitive, international export and import management services." (www.Maersk-logistics.com) It is largely a non-asset-owning company managing its quality through careful selection of subcontractors. It has offices in more than 70 countries. ML acts as a full-service freight forwarder and logistics provider fully independent of the shipping line. It is in markets which are dominated by traditional freight forwarding requirements as well

as those in which large clients such as large retail chains have special needs.

It is interesting that in their reorganizations, both A. P. Moller and NOL have re-branded their logistics operations with the names of the parent company although the management of the logistics and shipping businesses are still claimed to be quite separate. The sales activities of the businesses are still separate. However, NOL has been trying for some time to increase the awareness of its sales forces to the service range of its companies.

The logistics strategy of the P&OSNC, the senior company that holds the 50 percent interest in P&O Nedlloyd, is split. Most of the logistics services are in different businesses from P&O Nedlloyd but one is integral to the shipping business.

When P&O Nedlloyd was created after the merger of P&O and Nedlloyd, it brought together the previously separately identified Global Logistics and a variety of logistics services that had evolved as ancillary to shipping activities. The new group is named Value Added Services. It is intended to work with P&O Nedlloyd customers in providing advanced logistics or supply chain management services. Intermodal transport arrangements are not the responsibility of VAS; they are managed within shipping services. P&O Nedlloyd is attempting to bridge the gaps of different personnel skills and backgrounds among its own employees in shipping and VAS. It has one sales force but hopes to develop effective contact levels with clients to deal with shipping and logistics interests. It hopes to identify effectively those clients for whom an integrated approach of a line with its logistics service is practical and attractive.

P&OSNC is not following this model only. It has three other logistics service groups that operate quite separately from the shipping services. Damco is a separate but wholly-owned subsidiary of P&O Nedlloyd engaged in freight forwarding with

its own offices in nine countries in N.W. Europe and the Far East and represented through partnerships with local forwarding agents in a further 40 countries. This is a typical organization structure for a modest-sized freight forwarder. P&OSNC has two separate logistics service companies. They are P&O Trans European, a European-based logistics service company and Cold Logistics, which specializes in serving the cold product sector globally.

So how much vertical integration is there in the operation of the logistics and shipping businesses? With the exception of VAS, those businesses studied are organized to be separate. There are good reasons for this. There are substantial differences in the skills required in the design and management of trucking, shipping, warehousing and supply chain management functions. The points of interface of these services with clients – consignors or consignees - differ and the knowledge and skills of sales and service personnel need to reflect this. While the differences may be lessening as shippers and carriers move to more sophisticated approaches to logistics management, the differences are still significant and are likely to remain so. Substantial variations exist also in the structure of the various transportation and logistics markets. The more separate the markets and the different the businesses, the greater the probability that it will be beneficial to manage firms within them separately.

Shippers are wary of using a logistics service if they feel it is designed as a "feed" to another business rather than making choices among services that best meet their requirements. Such concerns affect the logistics services of shipping lines. (It also affects the business of global freight forwarders, as they tend to use their own offices in all regions.) The concerns of shippers may be met in various ways, including giving business units independence in their choice of service partners. This is the apparent choice of NOL and A. P. Moller but it leaves uncertain the level and ways of sharing resources and information. The approach of P&OSNC is to position VAS to serve only those

clients (sectors of the market) for which the integrated shipping and logistics services are welcomed, as long as they are 'best in class.'

Firms providing shipping and logistics/freight forwarding services may also find some disadvantages in dealing with other market participants. For example, independent freight forwarders may have a preference for dealing with shipping lines (and air lines) that do not have services competitive with them. It may also be that shipping lines may be less accommodating to forwarders and logistics services that are linked with other lines. The closer the relationships between the lines and the logistics service units, the greater such negative effects may be.

The potential disadvantages of common ownership of shipping and logistics services do not make it unattractive. Not only is the logistics business expanding but, also, the shipping lines with related logistics operations do enjoy some advantages. Major benefits are through the sharing of resources, particularly IT, through shared expertise and other synergies such as brand visibility and through a reduction of transaction costs. The firms may also benefit from increased market power, for example through the better knowledge of the costs of the various operations, the availability of more service options as a result of its vertical presence or, sometimes, as a result of the larger size of the more integrated firm.

The lines with established logistics services are expanding them rapidly and many other lines are developing more logistics services. How those services will develop is not yet clear. The comparative advantage of lines associated with logistics businesses of lines appears to be in the sophisticated services to major clients with global supply chains. Lines new to logistics will likely expand most in markets in which the carriers' penetration and experience has been greatest. It may be that for some lines concentration on shipping and excellence in

intermodal capabilities will be the most profitable strategy as full logistics service is a different business.

4. Conclusions

It is easy to exaggerate the amount of vertical integration that is taking place in international shipping and logistics. The extended ownership by maritime corporations of firms in various phases of the shipping and logistics business is modest compared with the size of major freight forwarding companies. It is also easy to reach conclusions on services patterns in North America and Europe, ignoring realities in India or South America.

Service improvements in shipping which are needed to improve the performance of logistics systems are taking place within the shipping business. They have ramifications for the operation of port terminals and inland transportation but they are only linked with vertical control through the increase in dedicated terminals.

Intermodal arrangements are made by freight forwarders and shipping lines although it is the latter that are leaders for volume movements by rail and, to a lesser extent, by barge. However, while the shipping lines are playing a more important role in intermodal transport, it is dominantly through contracted services. There is not vertical integration through ownership.

The greater presence of shipping companies in the terminal management business has two quite different reasons. The first is the involvement of lines with sufficient volume on routes that it is beneficial for the integration of operations to manage terminals dedicated to them. Integration of control and operations is present here. The other reason for their presence is investment in the new terminal operations business, done through business units quite separate from shipping. This has no apparent implication for vertical operational integration among the related companies.

The expansion of shipping lines into logistics services is leading shipping firms into another business area. Where the logistics requirements reach a scale that individually contracted services to meet specific shipper's needs are no longer adequate, separate business units are required. Once in the logistics service business, a unit is operated independently from shipping. The only sector of the market in which the logistics firms owned by shipping lines now seem to have a comparative advantage is in the service of large firms with global requirements. This, of course, is an important part of the logistics market but it is extraordinarily diversified. It is an unlikely market in which competition will be limited. It is market that is fiercely contested by the global freight forwarders that are much larger than the logistics subsidiaries of maritime firms.

Finally, the key to operational integration of shipping and logistics is the quality and availability of IT. While some lines have gained an advantage by being leaders in the development of IT systems, there is every indication that this advantage will diminish. The actions of individual lines, the collective actions of carriers and the contributions of third party IT providers all promise that the control of IT by large lines will not be a material factor in the integration of shipping and logistics in either a control or operational sense.

The historic pattern of development evident in the shipping business with the growth of door-to-door services and, then, expansion into logistics services is not a progression of the shipping industry through phases. In the future, shipping firms will be diversified among those that are in many phases of the maritime and logistics businesses and those that concentrate on a few. There will still be firms that specialize in liner shipping. That is unless that acquisition of logistics firms by carriers (in all modes) becomes a fad, in which case, in a decade I will write about the divestiture of logistics firms by carriers!

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The Future for Canada-US Container Port Rivalries

Doug O'Keefe, Statistics Canada

Introduction

"It is well to keep in mind that the several agencies of transportation, carriers by water, rail, road and air, are or should be, inter-related parts of an integrated whole and while the waterways of Canada are in no way articulated with other transportation agencies except in the private development of harbours by the railroads at certain points, nevertheless there exists a certain natural co-operation, even if not of a regulatory nature, which has played a large part in the development of the international and domestic commerce of Canada." – Excerpt from Waterways of Canada, 1935[1]

Canada's extensive geography and sparse population has necessitated the development of a strong transportation expertise. Canadians recognized the need for a national, modally integrated transportation system long before the invention of containers and the concept of intermodal transport and have spent years developing their system.

This system has well positioned Canada's ports relevant to U.S. ports to capture a significant share of North America's overseas container trade. In 1999, 20 Canadian ports handled 21.9 million tonnes (Mt.) of containerized freight exchanged with overseas countries or 14.1% of the North American (Canada & U.S.) total. In comparison, Canada had 9.9% of North America's population, 6.6% of its retail sales and 7.6% of its manufacturer's shipments[2].

However, this position is far from secure. The ocean container shipping industry is undergoing changes that will impact on their relationships with ports. Competition among ports for container traffic has been fierce as demonstrated by the Maersk Sealand selection process for an East Coast North American container hub[3].

This paper will attempt to explore how Canadian ports might fare in this increasingly competitive environment, based on their natural and man-made attributes, their competitive stance and their potential to meet the evolving ocean container industry environment. The assessment will include a review of the ocean container shipping industry, the North America container market and competing ports in the United States (U.S.).

This report uses data from two sources, Statistics Canada's marine international origin/destination (O/D) database and the U.S. Department of Transport Maritime Administration's (MARAD) Annual Import Export Waterborne Databank which is based on Journal of Commerce P.I.E.R.S. data. The units of measure are tonnes of containerized cargo and the Twenty-foot Equivalent Unit (TEU) for containers with cargo, that is the Laden TEU (i.e., no empty containers). The data cover a ten-year period from 1990 to 1999. There are some limitations with respect to the overall accuracy of the TEU data and the comparability of Statistics Canada and MARAD's data. These limitations might affect the reported totals but are not expected to significantly impact the comparative analysis. More detail is provided in the endnotes of this paper[4].

Trends in the Ocean Container Shipping Industry

Faced with chronic over-capacity on most trade routes and basement level freight rates, the ocean container industry responded by seeking economies of scale through mergers and alliances that produced larger companies and by building larger containerships.

The rate of mergers and alliances accelerated through the 1990s [5], considerably increasing the industry's concentration. The 'Top 20' liner operators controlled 76% of the world's cellular containership fleet in 2000, up from 70% in 1998, 50% in 1995 and 40% in 1990[6]. This concentration is not always visible to the market place, as some companies have engaged in brand proliferation by using the established trading names of their new acquisition and allowing autonomy on trades where they compete with the parent company[7].

The trend to larger containerships is more visible and dramatic. An analysis of the Fairplay Ship Register database for December 2000 (see Table 1) shows most of the world's active containership fleet had capacities of 200 to 3000 TEUs. These ships are generally older than ships over 3000 TEUs with the age increasing as capacity decreases. While the 200 to 3000 TEU containerships account for 83% of the world fleet they account for 57% of its total capacity. There were 540 containerships on order in December 2000 with 47 ships of 1000 TEUs or less, 383 with capacities of 1001 to 4,499 TEUs and 110 ships of 4500 TEUs or more. The largest ship on order had a capacity of 8700 TEUs. Since December 2000, the China Shipping Group announced intentions of ordering two 9800 TEU ships[8]

Table 1: World Container Fleet by Size, Capacity and Age

Size in TEUs	Share of Ships	Share of TEU Capacity	Average Age in Years
<501	19%	3%	16
501-1000	18%	8%	13
1001-2000	31%	26%	12
2001-3000	14%	20%	12
3001-4000	8%	17%	10
>4000	9%	26%	6

Source: Fairplay Ship Register, December 2000

The 4500 TEU threshold is significant as it roughly equates to a beam width of 32.32 metres, or the maximum size for the Panama canal.

The demand for larger ships can be attributed to 6 factors: economies of scale; competitive shipyard pricing for large tonnage ships; larger cargo volumes moved by carriers expanded by mergers/alliances[9]; growth expectations for containerized cargo; improvements in port infrastructure; and, the need to replace old tonnage[10].

A key caveat to the economies of scale is that these economies apply while the ship is at sea. In port, there can be some small diseconomies related to ship size. These sea-based economies of scale suggest that

the larger ships will first be deployed on routes with the longest sea voyages and most efficient ports. Cullinane and Khanna concluded there will be economies of scale for ships of up to 8000 TEUs on the Europe-Far East and transpacific liner routes. For the transatlantic route they found an optimal size in the 5000 to 6000 TEU range. They suggest that the industry concentration and trend to larger ships indicate the continued adoption of the load centre concept and a trend to hub and spoke port systems in the short to medium term[11].

The optimism of the ocean container shipping industry for the growth potential of container cargo has not been misplaced in recent years. Lloyd's Shipping Economist estimated that ocean container volumes increased 8-9% in 1999[12] and up to 10% in 2000 with freight rates up in most cases[13] as demand exceeded the available supply of container slots. This good news is tempered by significant directional imbalances in most trade routes that do not seem likely to change.

Drewy Shipping Consultants found that trade imbalances required the movement of 38 million TEUs (M TEUs) of empty containers in 1998 with associated direct/indirect costs of $12 billion (U.S.) up from $10.5 billion in 1997. While much of this imbalance involves intra-regional flows, there has been major growth in the imbalances on the 3 major east-west routes (Eastbound Asia/North America, Westbound Asia/North Europe and Westbound North Europe/North America). These 3 routes had gone from an estimated container imbalance of 1.4M TEUs in 1996 to 4.6M TEUs in 1998 despite more imports to Asia following their economic recovery. The expansion of this imbalance slowed in 1999 to an increase of 3.6%[14].

The outlook for the ocean container industry is one of guarded optimism. The pending admission of the Peoples Republic of China to the World Trade Organization after 13 years of negotiations is expected to increase demand in the liner trade by 1.6M TEUs a year through to the year 2005[15]. Short-term rates are buoyant as carriers with rate increases on transpacific and transatlantic routes in 2001. Clouds on the industry's horizon are potential regulatory changes that could eliminate the carriers potential loss of immunity from antitrust

laws in the U.S. and Canada and increase their liability for cargo loss and damages[16]. The industry experienced more confidential contracts under the 1998 U.S. Ocean Shipping Reform Act (OSRA). Large ocean carriers had to reorganize to deal with major trading companies seeking global confidential contracts over multi-trade lanes with volume price discounts on all trade lanes[17]. Lastly, is the concern that new containership tonnage will cause excess capacity on trade lanes

These trends in the ocean container shipping industry may have significant impacts on the ports that compete for container traffic. Container lines using the larger ships may reduce the number of ports at which they call. A handful of super-ports could handle almost all of the international containers for North America. The remaining ports would either opt out of the business, become spoke ports, or develop niche markets. Ports that attract the super post-Panamex ships will need significant financial resources to fund deep draught terminals and cranes. They will need inter-modal partners capable of moving extreme peak container volumes from the docks to inland clients while peak volumes of outbound containers await loading. The fewer, more powerful liners may insist on port productivity improvements for the carriers to achieve the scale economies of the larger ships while the ports assume the productivity investment risks.

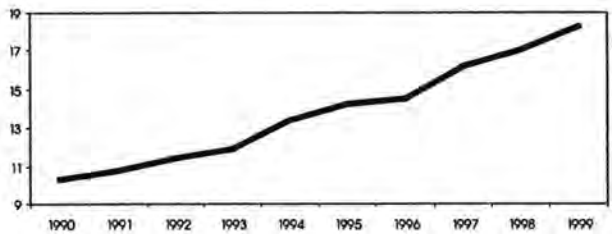
The North American Ocean Container Shipping Market

In 1999, North American ports (excluding Mexico & Alaska) handled 18.3 million laden TEUs (i.e., containers with cargo) in trade with overseas ports. In the 1990s, this market grew at an average annual rate of 6.6%. Asia and Oceania was the dominant trade route with 57% of the laden TEUs in 1999, followed by Europe with 24%.

Ports on the Pacific coast, which handled 92.6% of the laden TEUs originating in or destined to Asia and Oceania, accounted for 56.9% of the total traffic. Atlantic coast ports handled 44.0% of the laden TEUs because they dominated the traffic to and from Europe and South and Central America. Ports on the Gulf Coast handled almost

all of the remaining TEUs as Great Lakes ports handled just 302 TEUs from/to overseas ports in 1998.

Figure 1: Laden TEUs to/from Overseas Ports and Countries
(1990-1999, Millions of TEUs)



Source: MARAD Annual Import Export Waterborne Databank and Statistics Canada's International Marine Origin/Destination database

Growth rates for container traffic varied significantly among world regions in the 1990s. The South & Central America and the Middle East & Africa trade lanes led the world regions with average annual growth rates (A.A.G.R.) of 11.4% and 8.4%, respectively. Europe had the lowest A.A.G.R. at 4.1%, while the Asia & Oceania container traffic grew at an average annual rate of 6.6%.

Table 2: Millions of Laden TEUs Handled at North American Ports by World Region of Origin/Destination in 1999

	North American Coast			Total
World Region	Atlantic	Pacific	Gulf	
Asia & Oceania	1.94	8.41	0.04	10.39
Europe[1]	3.50	0.33	0.52	4.35
South & Central America[2]	2.08	0.28	0.52	2.88
Middle East & Africa	0.51	0.05	0.08	0.64
Total	8.03	9.08	1.16	18.27

(1) Include Greenland & Ste. Pierre
(2) Includes Mexico. Total may not add due to rounding.
Source: MARAD Annual Import Export Waterborne Databank and Statistics Canada's International Marine Origin/Destination database

Canadian ports handled 10.7% of the laden TEUs handled by North American ports in 1999. The share by world region varied from 2.4% of the rapidly growing South & Central American market to 23.1% of the European market. Canada's share of the Asia & Oceania and Middle East & Africa routes were 8.0% and 7.8%, respectively.

The combined Canada – U.S. TEU data confirm the imbalance in containers on routes discussed in the literature. In 1999, North America received 3.0 M TEUs more from overseas countries than it sent. This imbalance had risen 48.8% from 1998. Asia & Oceania had the worst imbalance with inbound containers exceeding outbound by 2.8M TEUs. Europe had an inbound surplus of 725 thousand TEUs (K TEUs). Containers bound for South & Central America and the Middle East & Africa exceeded inbound containers by 338K TEUs and 152K TEUs, respectively. These statistics suggest that 28.3% of the containers received in North America from foreign trades were sent back empty. For Asia & Oceania that number rises to 42.2%.

Surprisingly, the overseas container trade at Canadian ports was more balanced, and the imbalance that did exist was in the opposite direction from North America in general. Outbound laden containers from Canada's ports were just 2.7 K TEUs more than containers inbound from overseas for all routes except Europe. Outbound laden containers to Europe were less than inbound containers by 387 TEUs.

Competition with U.S. Ports

In 1999, North America's top 20 container ports handled 95% of the laden TEUs exchanged with overseas ports. During the 1990s, these ports experienced average annual growth rates (A.A.G.R.) ranging from –2.3% for Halifax[1], NS to 26.1% for Wilmington DE.

The southern California ports of Long Beach and Los Angeles were the busiest ports with 3.0M and 2.5 M TEUs respectively followed by

[1] The tonnage of Halifax's containerized cargo posted an A.A.G.R. of 1.2% from 1990 to 1999. The 1990 TEUs may have been overstated.

New York/New Jersey (NY/NJ) with 2.0M TEUs in 1999. Three Canadian ports were among the top 20 North American container ports in 1999. Montreal, Vancouver and Halifax held positions 7, 9 and 15 with 883K, 779K, and 256K TEUs respectively. Vancouver experienced a strong A.A.G.R. of 14.0% while Montreal's 7.4% A.A.G.R. exceeded the North American rate (see Table 3).

The order of the ports change slightly when the data are expressed in terms of tonnes of containerized cargo. All 3 Canadian ports move up in the standing and Vancouver overtakes Montreal (see Table 4).

In 1999, Montreal was the leading port on the European trade route with 21.2% of the containerized tonnage on that route. Europe accounted for 96.3% of Montreal's containerized freight. In contrast, the Asia and Oceania trade route was the most important route for Vancouver with 96.7% of its overseas container tonnage. While Vancouver handled the 3rd highest quantity of containerized tonnage on the Asia & Oceania trade route, its share accounted for just 10.4% of that route's total containerized freight.

Europe and Asia & Oceania were important routes for Halifax with 56.2% and 28.2% respectively of its 1999 containerized tonnage. However, Halifax was not a major contender in either market with just 5.0% and 1.2% respectively of the tonnage on these trade lanes. Nonetheless, Halifax was the 6th placed North American port on the Europe trade route and 11th on the Asia & Oceania trade route.

Vancouver, Montreal and Halifax handled 97.6% of the overseas containerized tonnage handled by Canadian ports in 1999, or 13.8% of the North American total. Other notable Canadian container ports were Saint John, NB which handled 33.8% of Canada's containerized tonnage on the South & Central America route and the Fraser River which handled mainly containers on the Asia & Oceania route.

Table 3: Top 20 North American Ports for Laden TEUs Exchanged With Overseas Ports 1999 Compared to 1990

Port	TEUs 1990	TEUs 1999	Average Annual Growth Rate (%)
Long Beach, CA	1,223,633	3,045,575	10.7
Los Angeles, CA	1,453,291	2,540,053	6.4
NewYork/NewJersey	1,203,778	2,025,104	6.0
Charleston, SC	558,102	1,168,704	8.6
Seattle, WA	767,668	959,920	2.5
Oakland, CA	579,685	914,774	5.2
Montreal, PQ	464,829	883,182	7.4
Norfolk, VA	495,622	828,545	5.9
Vancouver, BC	239,771	777,843[2]	14.0
Houston, TX	369,309	713,624	7.6
Savannah, GA	313,027	624,435	8.0
Miami, FL	295,087	615,694	8.5
Tacoma, WA	462,875	580,481	2.5
Port Everglades, FL	174,596	473,112	11.7
Halifax, NS	314,929	256,195	-2.3
Baltimore, MD	270,560	255,201	-0.6
New Orleans, LA	153,601	236,902	4.9
Portland, OR	111,588	210,217	7.3
Jacksonville, FL	106,776	148,054	3.7
Wilmington, DE	16,289	131,591	26.1
Other Canada	20,889	44,581	8.8
Other U.S.A.	701,632	834,768	2.0
Total	10,297,536	18,268,556	6.6

Source: MARAD Annual Import Export Waterborne Databank and Statistics Canada's International Marine Origin/Destination database

[2] Vancouver TEUs may be under-reported by as much as 15%.

Table 4: Containerized Cargo Handled at North American Ports in 1999 by Region of Origin/Destination

Port	Europe	Middle East & Africa	Asia & Oceania	Central & South America	Total*
	Millions of Tonnes				
Long Beach, CA	1.02	0.19	19.50	0.92	21.63
Los Angeles, CA	0.80	0.06	16.54	0.99	18.40
NewYork/NewJersey	7.38	1.44	5.64	2.66	17.11
Charleston, SC	4.61	0.80	3.15	1.79	10.35
Vancouver, BC	0.04	0.04	8.70	0.21	8.99
Montreal, PQ	8.51	0.24	0.06	0.03	8.84
Seattle, WA	0.13	0.06	7.41	0.17	7.76
Oakland, CA	0.95	0.08	6.57	0.12	7.72
Norfolk, VA	3.65	0.56	2.13	0.78	7.13
Houston, TX	3.88	0.69	0.43	2.11	7.11
Savannah, GA	1.36	0.45	3.22	0.66	5.69
Miami, FL	1.04	0.10	0.62	3.28	5.04
Tacoma, WA	0.02	0.06	4.50	0.00	4.59
Halifax, NS	2.01	0.30	1.01	0.25	3.57
Port Everglades, FL	0.27	0.01	0.01	3.28	3.57
Other U.S.A.	4.31	0.72	3.87	8.53	17.43
Other Canada	0.16	0.00	0.05	0.32	0.54
Total*	40.14	5.82	83.40	26.10	155.47

*Totals may not add up due to rounding and because they include Other North America (Ste. Pierre and Greenland) which accounts for about 10 kilotonnes.

Source: MARAD Annual Import Export Waterborne Databank and Statistics Canada's International Marine Origin/Destination database

The Future for Canadian Ports

Canadian ports have competed successfully for North American container cargo in the past but the past is not always a good predictor of the future. However, developments in North America's intermodal transportation network hold promise for Canadian ports.

Doug O'Keefe

North America increasingly appears to be a single continental market tied together by ribbons of steel and asphalt. Inland markets that were once the exclusive territory of U.S. ports are becoming contestable markets for Canadian ports. While Canada's two railways, Canadian Pacific (CP) and Canadian National (CN), were built to unite this country's west with the east, they recognize that their true growth potential is along north-south corridors to U.S. markets. CP was the first to recognize the importance of U.S. markets and created an integrated rail-marine conglomerate to offer rapid service between Europe and the U.S. Midwest with Montreal as the sole North American port of call. In 1984, CP partnered with government-owned CN to buy the Detroit-Windsor rail tunnel from Conrail[18].

Since privatization in 1995, CN has invested heavily in multimodal service to the U.S. including a high-cubed double-stack rail tunnel from Sarnia to Port Huron (1995) and a high-volume intermodal terminal just south of Chicago (1997). CN has pursued mergers and alliances including the purchase of all of the shares of the Illinois Central (IC) railway, the negotiation of haulage rights over U.S. rail track and a joint marketing and operating agreement with CSX Corporation. CN recently improved its access to the U.S. southwest through marketing deals with Burlington Northern and Sante Fe Railway (BNSF), despite a U.S. Surface Transportation Board imposed 15-month moratorium on rail mergers in the U.S. that was prompted by CN's proposed 1999 merger with BNSF[19].

The outcome of this rail activity has been the development of direct, seamless service between Canada's main container ports of Halifax, Montreal and Vancouver and most U.S. markets. These ports can now access markets that total 9 times the size of Canada's population with 14 times the retail sales and 12 times the manufacturers shipments (Table 5).

Table 5: Comparison of Canada to US Economic Regions[20]

	Resident Population (millions)	Retail sales ($billion)	Value of shipments ($billion)
United States	280	3,344	5,249
Northwest	21	274	320
Northeast	71	852	1,211
Midwest	39	499	1,035
Southwest	85	966	1,548
Southeast	63	753	1,136
Canada	31	238	435

Source: US Bureau of Census and Statistics Canada. Population statistics are for 2000, economic statistics are 1997 Canadian dollars at July 2, 1997 exchange rate ($0.7307).

The concept that Canadian ports might be able to offer service in all North American markets may seem a little far-fetched. The traditional wisdom is that a container port should be sited near a strong traffic-generating hinterland (centrality) or along the path between two pairs of distantly located traffic-generating regions (intermediacy). Canada's ports have trouble meeting the first criteria, but can meet the second criteria for most North American trades on the Pacific and Atlantic oceans. Already the concept of intermediacy seems at work. Table 6 shows North American inland markets for laden containers by coast for U.S. gateway ports. These data are based on the state of the shipper or consignee. Inland origin/destination states have been reported for about 80% of the database's records.

Table 6: Inland Region of Origin/Destination for Laden Containers by Coast of the US Gateway Port, 1999 ('000 TEUs)

Inland Region	Atlantic	Pacific	Gulf	Total
Northwest	176	652	25	853
Northeast	2,389	1,146	248	3,783
Midwest	377	765	56	1,198
Southwest	527	3,522	416	4,465
Southeast	2,056	526	193	2,775
Total	5,525	6,610	938	13,073

Source: MARAD 1999 Import Export Waterborne Databank

As might be expected, the U.S. Southwest and Northwest regions had most of their containers (78%) entered or cleared through centrally located Pacific ports in 1999. Similarly most containers (68%) for the U.S. Northeast and Southeast regions were cleared through Atlantic ports. Containers for the US Midwest market were handled at ports on the Pacific (64%), Atlantic (32%) and Gulf (5%) coasts. This suggests that in addition to the inland Midwest market, 24% to 32% of the containers the ports moved in 1999 were to markets beyond their hinterlands. The shaded portions of table 6 could represent potentially contestable markets that total 3.8 M TEUs or double the total volume for Canadian ports in 1999.

A further analysis of these data by world region for North America's leading container port, Long Beach, CA, revealed that just 61% of the containers handled in 1999 were for the U.S. Southwest region. The Northeast, Midwest, Southeast and Southwest markets accounted for 17%, 10%, 8% and 3% respectively or the equivalent of roughly 900K TEUs of the port's traffic with a known inland origin or destination. This distribution holds for containers from/to Asia & Oceania, which accounts for 93% of the containers. Containers from Europe account for 4% of the port's traffic with a known inland origin/destination or almost 96 K TEUs.

Canadian ports are well positioned to compete for this business based on their locations, deep-water facilities, intermodal connections and low cost. In terms of location, Halifax is the closest North American port to Northern European ports such as Rotterdam, with an ocean-distance (Great Circle) advantage of 1,081 kilometres (Kms) over NY/NJ the closest of its U.S. competitors. Even Montreal, which is approximately 1,600 Kms inland, is 167 Kms closer to Rotterdam than NY/NJ. On the Pacific coast, Vancouver is 1,092 Kms closer to Hong Kong than Long Beach[21].

Vancouver and Halifax are 2 of only a handful of North American ports with natural deep channel entrances and berth depths of 50 feet that can accommodate the super-post-panamax container ships (ships with over 6000 TEU capacity). The other ports are Long Beach,

Seattle, and Tacoma on the Pacific and Baltimore and Virginia on the Atlantic. Terminal operators in Vancouver and Halifax have built on this depth advantage by purchasing super-post-panamax cranes. Montreal does not have such deep draft but is a niche market, serving carriers that have designed ships specifically for the port[22].

Vancouver, Montreal and Halifax are well served by CN's Sarnia tunnel to the US Midwest market. CP provides direct service from the Montreal gateway to the U.S. heartland. BNSF links Vancouver's Deltaport to the US Northwest, Southwest and Midwest. All 3 major Canadian container ports have dockside links to the railways that service them. Vancouver and Montreal are also well served by major highways that directly access U.S. markets. These connections are crucial as Canadian ports have smaller local economies that cannot generate the large container volumes of their U.S. neighbors and must therefore rely on intermediacy for significant container volumes.

Canadian ports have traditionally been seen as low-cost alternatives to U.S. ports. The main cost advantage has likely been the Canadian dollar, which trended downward in the 1990s from a high of US$0.8873 on November 1, 1991 to a low of US$0.6326 on August 27, 1998[23]. This exchange rate gave the ports and their intermodal partners a 25% to 30% cost advantage for most of the decade.

Canadian ports seem to have less ability than their U.S. counterparts to finance expensive terminals and intermodal connections. Many U.S. port authorities are large organizations that own and manage other transportation infrastructure such as airports, toll bridges and tunnels. A study of U.S. ports' funding of intermodal facilities by Luberoff and Wider of Harvard's Kennedy School of Government found that they often pledge assets and revenues from those facilities to suport investments. The study states that some ports raise funds through property taxes, tax-exempt revenue bonds and assistance from municipal, state and federal governments. This prompted them to conclude that U.S. port administrations often did not exercise sound business practice in funding such facilities by routinely shifting the risk of such investments to tax payers[24].

In contrast, Canada's philosophy appears to be that ports should be more commercially oriented. The 1998 Canada Marine Act (CMA) governs major ports with an objective of "...making the system of Canadian ports competitive, efficient and commercially oriented". Ports are prohibited from using parliamentary appropriations to discharge liabilities and from pledging port lands that are vested in the federal government. However, they may be eligible for grants under other federal statutes such as regional development funds. Canadian ports are also required to pay an annual stipend to the Federal Government based on gross revenues and payments in lieu of property taxes to local municipalities.

The CMA's impact on a port's ability to raise project funds was demonstrated when Halifax Port Authority (HPA) arranged $550 M to build a new container terminal in its Maersk Sealand proposal. HPA secured lines of credit from banks based on its own revenue together with financial support from provincial and municipal governments and from federal economic development agencies[25].

Conclusion

Canadian container ports have successfully competed with U.S. container ports in the past for North American container traffic. The keys to their success have been a combination of natural endowments such as superior locations and deepwater ports, investments in intermodal facilities including good rail access to all U.S. markets and competitive pricing due to a favorable currency exchange. These factors are likely to continue into the future, however, the competition among container ports is likely to intensify in the future as industry consolidation continues and publicly funded U.S. intermodal terminal and corridor projects come to fruition.

Canadians should benefit from the success of our container ports. These gateways export transportation services to U.S. markets and in the process provide employment not only for port workers but also for Canadian railway employees and truckers.

[1] Canada, Department of Trade and Commerce, Dominion Bureau of Statistics, Transportation & Public Facilities Branch (1935). Waterways of Canada, (Federal Expenditures on Canals, Harbours, Lakes, Rivers, Aids to Navigation, Etc., Port Facilities, Traffic)

[2] Statistics Canada and U.S. Bureau of Census (USBC) population statistics for 2000. USBC 1997 US Economic Census and Statistics Canada's Monthly Retail Sales and Monthly Survey of Manufactures. All financial data expressed in Canadian dollars at the July 2, 1997 exchange rate of $0.7307 Can per $1.00 US.

[3] Cottrill, K. NY&NJ Bets $733 Million. *Traffic World* 25, January, 1999

[4] Statistics Canada derives TEU statistics from container counts by size of container reported on Custom's A6 General Declarations. These data are not reconciled with manifest data. MARAD's TEU statistics are derived from the weights of container cargo reported on ships' manifests. TEU origin/destination are the country of export/ import for P.I.E.R.S. while the Statistics Canada data use country of port of loading/ unloading. TEUs by world region for Statistics Canada data were derived by apportioning reported TEUs based on the weight of containerized freight by region.

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[20] US Regions are defined as **Northwest** - Washington, Oregon, Montana, Wyoming, Nevada, Colorado, Idaho, Utah, South Dakota; **Northeast** - New York, Vermont, Massachusetts, New Jersey, Maine, Pennsylvania, Maryland, New Hampshire, Rhode Island, Connecticut, Delaware, Ohio; **Midwest**- Michigan, Minnesota, Illinois, North Dakota, Wisconsin, Indiana; **Southwest** - California, Arizona, New Mexico, Kansas, Nebraska, Iowa, Oklahoma, Arkansas, Missouri, Louisiana, Texas; **Southeast** -Florida, Georgia, Virginia, West Virginia, South Carolina, North Carolina, Kentucky, Alabama, Mississippi, Tennessee, District of Columbia.

[21] All ocean distances are from the Fairplay World Ports Guide Distance Tables.

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An Assessment of North American Cabotage Laws: The Carriage of Goods in Containers

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Abstract

Cabotage describes a transport activity that was first applied to ocean vessel shipping, specifically the pick-up and delivery of goods along a coastline. These regulations have been a part of North American history from as far back as 1651 with the implementation of the Navigation Acts. Today, the Canada Customs Act regulates the carriage of all domestic cargo by the different conveyances available to shippers. The same is true in the U.S.; cabotage regulations are outlined in customs laws. While these laws are in place to protect domestic carriers from international competition, changes in the global market place, resulting from deregulation and shifting trade patterns, justify the need to revisit the effects of cabotage regulations on efficiency and economic growth.

(1) Introduction

The word cabotage comes from the French verb, *caboter*, which means to coast, and refers to ocean pick-up and delivery of goods along a coastline. In modern practical terms, it refers to the restriction of foreign carriers from entering into domestic services. Many centuries before the airplane was invented, sailors from northern Europe en route to the Mediterranean Sea would stop along

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the coast of Portugal to drop off and pick up cargo and passengers, making their trips more profitable. In an effort to protect their own sea trade, the Portuguese restricted this practice to vessels that were locally owned and operated. As a result, they were the first to develop cabotage laws.

Cabotage regulations have been a part of North American history from as far back as 1651 with the implementation of the *Navigation Acts*. These acts regulated the shipping of goods in Great Britain and its colonies by restricting this trade to British and colonial ships. It was justified in terms of ensuring a sufficient marine capacity in order to meet defence needs. While cabotage became a regulated activity in ocean vessel shipping through the restrictions of foreign flagged vessels on a particular coastline, the term came to be used in description of all forms of transport activity that took place on sovereign territory by a foreign conveyance. As alternative modes of transport developed, the same protections were transferred to them. Today, both Canada and the United States outline cabotage regulations in their respective *customs acts*.

The word "cabotage" does not appear in the *Customs Act* as administered by Revenue Canada. Cabotage activity is, however, duly addressed. The act treats a foreign-based container as an import, albeit a temporary one, under tariff item *9801.10.00*. Generally, the purpose of these cabotage regulations is to protect the domestic transportation industry from foreign competition. If domestic transportation were completely restricted to solely domestically owned equipment, shippers in Canada's interior would be plagued with higher freight costs and accessibility to intermodal equipment would be dismal. However some cabotage moves are acceptable. Current legislation permits carriers and container operators to reposition containers within Canada while carrying a payload, providing them with opportunities to generate revenues for their assets.

(2) Cabotage Regulations in the United States

Containers in the U.S. are designated as "instruments of international traffic" and are excepted from the application of customs laws as laid out in *Title 19* of the *United States Code (Customs)* in *section 1322 (a)*. Foreign-based containers that are designated as instruments of international traffic can enter the U.S. without payment of any duties or taxes and remain there for a period not exceeding 365 days from the date of their importation. The container is deemed to remain in international traffic during this time and may engage in unrestricted point-to-point domestic moves. If the container remains in the U.S. for a period exceeding 365 days it will be deemed to have been diverted from international traffic and the appropriate duty and taxes must be paid.

Containers must also follow the coastwise laws of the U.S. A U.S. flagged vessel must carry a foreign-based container loaded with domestic U.S. goods for point-to-point moves along a U.S. coast or river. The coastwise laws, in this case, regulate the carriage of the goods, not necessarily what is containing the goods. It is the MODE of transport moving the container that determines which regulations apply. The container simply "goes along for the ride."

In the case of failing to export the container after 365 days or of failing to report its diversion from international traffic, the penalty imposed is a sum equal to the value of the container plus the duties and taxes. Should the container be imported, the rates of duty are low – free for most countries. According to U.S. customs officials, the sheer number of containers moving goods into and out of and around the U.S. makes it impractical to track the movements of every container. Thus, there are no restrictions concerning cabotage moves the only real restriction is a 1-year time limit.

(3) Cabotage Regulations in Canada

In Canada, foreign-based containers, including any ancillary equipment, are provided for under tariff item *9801.10.00*. Containers imported under tariff item *9801.10.00* may enter Canada without payment of duties or taxes. This duty free status is conditional upon the following circumstances: (1) the container is owned or leased and imported by a person whose residence is not in Canada; (2) in the normal course of operation, the container leave from and return to the foreign country; (3) main control of the container is from the foreign country; and (4) the container must leave Canada within 30 days from the date of its importation. This 30-day grace period may be extended, under extraordinary circumstances and at the full discretion of the customs official, to up to 24 months. Extraordinary circumstances include adverse weather, equipment breakdown, legal action involving the conveyance and delays in the delivery of goods to be loaded into the container.

If a foreign container enters Canada for the purpose of import-export moves and fails to return across the border within 30 days, its duty-free status is forfeit. For integration into the Canadian economy, containers can be imported under tariff item *8609.00.90* and the appropriate duty and taxes paid. Each time it exits Canada, the container can re-enter Canada under tariff item *9814.00.00* duty free as long as it has not been advanced in value or improved in condition while abroad. Tariff item *9813.00.00* refers to domestically owned containers, originating in Canada, that are used for the international transportation of goods. These containers can leave and re-enter Canada duty-free at any time and move all goods throughout Canada freely and without restrictions.

A foreign-based container may engage in domestic "incidental" operations during its maximum 30-day duration in Canada. The domestic operation is incidental in the sense that it takes place totally within Canada's boundaries and the route is consistent with the

international route itself. Only minor deviations off the international route are acceptable. As well as being incidental to the international traffic of the goods, the transportation service of the domestic goods must not, at any time occur outside the territorial limits of Canada. Additionally, the container must not have entered Canada for the purpose of an in-transit movement through Canada to a point outside Canada.

The *Act* defines transportation "incidental to the international traffic of the goods" as the transportation of goods between points in Canada that occur immediately before or after the container is used for international commercial transportation. It must move in the general direction of the delivery point and follow a route that is similar and consistent with the international load. While "similar and consistent" is subject to interpretation, acceptable cabotage practices are at the full discretion of customs officials.

Since a cabotage move must occur immediately before or immediately after the transportation of the international load, only one point-to-point domestic move is allowed throughout the containers maximum 30-day duration in Canada.

A container entering Canada empty may be used in transportation incidental to the international traffic of the goods on the inward leg of an international journey, provided it enters Canada to pick up a load for export. The export load to be picked up, however, must have been scheduled prior to the time the container enters Canada. As well, the incidental domestic use must follow a route that is both similar and consistent with the destination of the container where the export load will be picked up. Again, the container will be restricted to one such movement during and international journey. The movement of an empty foreign-based container between two points in Canada is not considered transportation incidental to the international traffic of the goods and can be moved to any location in Canada freely and without restrictions.

Another type of cabotage move is the "sufferance warehouse pick-up" sanctioned by Canada Customs and Revenue Agency (CCRA). Carriers often operate terminals, warehouses, or drop yards in Canada as intermediate points to consolidate or deconsolidate shipments (break bulk) and to pick-up or deliver goods. After international goods have been delivered to one of these facilities to wait for customs release, any foreign-based container entering Canada in accordance with tariff *9801.10.00*, may be used to pick-up or deliver goods from that location, to any location, for the remainder of the 30-day period permitted in Canada. This is allowed provided the container is being used exclusively to complete deliveries of other international goods previously unloaded at the warehouse, or to pick-up and deliver export goods to the warehouse.

Canadian regulations also permit equipment switching for any reason. During transportation, international goods may be physically transferred directly from one conveyance to another. There are no limits to the number of times international goods may be transferred to other foreign-based containers. Additionally, there are no limits to the number of times domestic goods may be transferred to other foreign-based containers, so long as each container follows the cabotage regulations set out in the *Customs Act*. Meaning, during its maximum 30-day duration, the movement must be incidental to the international load and only one such movement is undertaken.

(4) The Customs Post Audit System & Container Pool Operators

All foreign goods entering Canada must be reported at the border and any relevant duties and taxes must be paid before the goods can proceed into Canada. To defer the payment of duties, carriers can apply for Customs Post Audit Carrier status. Several conditions must be met and a bond must be posted. Post Audit Carriers must still report the goods entering Canada at the border but the payment of duties and taxes can be deferred to a later date upon the arrival of the goods to an inland destination in Canada. The Customs Post Audit System allows qualifying companies to transport goods in bond under limited physical control as long as there exists suitable records for

audit by customs officials to ensure the cargo was disposed of according to the regulations set out in the *Customs Act*. The result is faster release times at the border.

A firm that maintains an inventory of containers for international service may be designated either as a post audit container operator or container pool operator, provided the company maintains records acceptable to CCRA of containers under its ownership or control from which CCRA auditors can track their movements in Canada.

A cargo container operated under the Customs Post Audit System may make one domestic move under load, en route to a repositioning of the container for export. That is, the domestic load must be incidental and must follow a route that is similar and consistent with the international load. This procedure will not apply to a transcontinental or other movement under which a container pool in one part of Canada is merely being supplemented by containers from another pool.

The repositioning of a container for export load pick-up, operated by a container pool operator, may take place over a route outside the territorial limits of Canada on condition that: (1) at the time the container entered Canada, it was being used to transport imported goods; (2) the container is being repositioned to pick-up an export load in Canada; (3) the route taken is directly incidental to the repositioning; (4) the transportation equipment used to move the container is either of Canadian origin or has been fully duty-paid in Canada; and (5) the container is under the control of the Customs Post Audit System. Containers in Canada under the control of post audit container operators and pool car operators may remain in the country for up to six months (but are still only allowed one point-to-point domestic move for each international load).

All containers are nevertheless subject to the coastwise laws of Canada as well as any other regulations that outline acceptable practices of foreign-based carriers operating in Canada. The origin-destination of the cargo, as determined by the bill of lading, is the

principle for cabotage regulations, rather than just the nationality of the container used in the transport.

(5) Penalties for Non-compliance

Currently, the maximum penalty for an illegal cabotage move is a fine of an amount equal to the market value of the container. However, CCRA is currently reviewing a proposal to increase penalties for contraventions of the *Customs Act*. A new Administrative Monetary Penalty System (AMPS) is being proposed as part of a modern sanctions program for customs. The purpose of this program is to promote compliance with Canada's tax, trade and border legislation. As a result, penalties for customs contraventions will increase through a graduated response to non-compliance. Additionally, increased penalties would apply to repeat violators.

(6) The Impact on Canadian Operations

Canadian shippers could benefit from a larger, more diverse pool of intermodal containers and a commercially competitive transportation sector. The lack of reciprocity between Canadian and U.S. legislation has fashioned an imbalanced playing field for the North American market. Where containers are needed and how they are moved as a means of international commerce is supported by landside positioning strategies. This may well require multiple movements over a period longer than 30 days[3]. As a result, current legislation dissuades foreign steamship lines from positioning their fleet of marine containers away from Canadian ports. Many firms may find it safer to reposition empty containers if international freight cannot be found, rather than face delays in terms of establishing legality or fines if the move were found to be in violation.

[3] Correspondence with a representative from a U.S.-based container pool operator, February 2001.

U.S. cabotage laws give foreign steamship lines more freedom in marketing services to the domestic market. This gives them increased opportunities for repositioning. As a result, shipping firms serving North America will position their fleet of containers in U.S. inland locations, while shippers in the Canadian interior suffer from a deficiency of available equipment. The closer the equipment supply can be made available to shippers, the better their cost-competitive access to international trade lanes will be. Container supply wouldn't have to be positioned from port locations if flows can take container equipment into the interior in order to serve rural and remote shippers[4]. As a result, U.S. shippers have better access to equipment than do Canadian shippers, giving them a competitive advantage. More immediate access to equipment in remote locations and improved mobility of the container for transport, impart a systemic reduction in costs. This can result in reduced spending on transportation services for shippers, thereby enhancing the competitiveness of their delivered goods.

Moreover, Canadian shippers are at a disadvantage in terms of logistics because of sparser population densities. "On domestic moves, Canadian firms generally pay 5 to 10 percent more in distributions costs than their American counterparts." (Modern Purchasing, 1995) This is further exacerbated when steamship lines charge, or build in their rates the empty repositioning moves[5]. According to International Asset Systems, ocean carriers spend close to $10 billion a year operating container assets, including ships, containers and trucks. It is estimated that about 16 percent of that gross expenditure is directly attributable to the cost of repositioning empty equipment (Bangsberg, 2001). In addition, repositioning empty containers squanders rail capacity, which puts further strain on freight rates.

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[4] ibid.

[5] Email correspondence by UMTI staff with industry official regarding container cabotage, September 2000.

As well as reducing rail capacity, repositioning empty containers uses up more fuel and energy. As a consequence, the Canadian transportation industry produces higher fuel emissions levels. This is an environmental concern and affects all Canadians.

The *Kyoto Protocol to the United Nations Framework Convention on Climate Change,* successfully negotiated in December 1997, establishes a commitment period between 2008 and 2012 in which industrialized nations are to reduce Greenhouse Gas Emissions (GHE's) on average to 94.8 percent of 1990 levels. Canada is to reduce its emissions by six percent. The *Kyoto Protocol* is just one of a series of promises made to reduce GHE's made by the federal government. "Unless steps are taken now to begin to coordinate municipal, provincial, federal and even trans-national matters in transportation, we will likely fall considerably short of the mark" (Brownstone and Butt, 1999). Reducing GHE's will almost certainly mean substituting to more efficient engines and improved fuel technology; there are, however, other avenues that could be pursued to the benefit of societies as a whole. One example is eliminating regulations that promote inefficiency.

(7) Conclusion

Canadian legislation limits the amount and type of cabotage moves that may be undertaken by a foreign-based container. Two specific types of cabotage moves are allowed: the repositioning move – domestic transport between an import move and an export move; and the sufferance warehouse pick-up – equipment switching at sufferance warehouse stations. The U.S., on the other hand, has no such restrictions on foreign-based containers. The only real restriction imposed by U.S. legislation is a 1-year time limit for completion of its services. These regulations are outlined in the *customs acts* of both countries. For Canada, a foreign-based container is considered a temporary import and no duty is charged during the first 30 days of cabotage activity. It is governed under tariff item *9801.10.00.* The U.S. also considers a foreign-based container a temporary import, but for a maximum period of 1 year.

No other restrictions are placed on foreign-based containers with respect to acceptable cabotage moves. In both countries, foreign-based containers are subject to their applicable coastwise laws.

The tight restrictions placed on foreign-based containers in Canada are a source of economic inefficiency that cannot be discounted. This policy causes containers to accumulate in certain areas of the country and to move empty, taking up rail capacity, burning fuel and costing shippers when carriers charge, or build in their rates, the empty repositioning moves. These policies may have been designed to reduce cabotage and protect Canadian carriers, but probably cost the Canadian importer / exporter community a fair amount of money.

Transportation facilitates trade and represents a transaction cost that exists regardless of the removal of tariff barriers on goods. Free trade has the effect of easing trans-border movements and has triggered Canadian trade volumes to rise to over 80% of GDP in 1999, up from 50% of GDP ten years earlier (Government of Canada, 2000). Canada has made great strides toward becoming a free trade zone; it has yet to achieve modes of trade that would reduce this transaction cost associated with the trans-border movement of goods[6].

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Heads Up! Enhancing the Safety Audit

by

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Abstract: Changes to the workers compensation system have encouraged British Columbia employers to work more diligently towards the achievement of safety-related goals. This paper describes how occupational health and safety audits can be enhanced in order to help firms achieve desired improvements.

Introduction

In the past, employers have sometimes viewed worker compensation systems as inexpensive insurance against accident and injury losses. Today, however, the costs associated with unsafe practices are increasing, a trend that is likely to continue. "Soft" costs that are difficult to measure include outcomes such as impaired morale or a poor industrial relations environment. A firm with a reputation for poor safety practices may find it difficult to attract new employees – a special concern in industries such as trucking, where labour shortages

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are already commonplace.[1] If services are disrupted, a loss of customer goodwill may occur.

"Hard" costs lend themselves more easily to measurement in dollars. These include costs such as overtime, equipment damage, reduced productivity and training costs for replacement workers. The firm may be exposed to legal liability if someone not covered by worker compensation is injured. Insurance premiums are also likely to rise. Also, under British Columbia law, managers found responsible for unsafe work practices face the possibility of heavy fines and even jail terms.

Another hard cost that has attracted more attention recently is Worker Compensation assessments. In many jurisdictions, authorities have re-tooled assessment formulas so that there is a more direct relationship between claims rates and assessment amounts. For example, under British Columbia's old classification system, many employers had a claims history that was 500 to 1000 percent worse than the average for their subclass. When it occurred to this extreme, cross-subsidization created poor safety incentives. "Unsafe" employers had little incentive to reduce their claims frequency (Workers' Compensation Board, 2000b).

Today, the assessment system in British Columbia is different in two fundamental ways. First, the way in which employers are classified has been reorganized into a more sensible typology: trucking and the sport fishing industries are no longer grouped together and charged the same base insurance rate, as was formerly the case. Second, an "experience rating" system is used to reward firms with better safety records (Workers' Compensation Board, 2000, 2000a).[2,3]

Why audit?

About 9% of Canada's reported on-the-job injuries (and about 15% of fatalities) occurred in the transportation sector (Shah, 1998: 246-7). Maintaining safe operations in this sector is a challenge because

employees often work without close supervision, in vast geographical areas. Too, profit margins are often "narrow", and it is not difficult to demonstrate that the savings associated with a modest reduction in injury and worker compensation cost are equivalent to a substantial increase in sales (Currie, Denault & Henriksson, 1998).

The occupational health and safety audit can be a sensible response to the increased costs of accidents and injuries. Formally, it is "a systematic, independent review to verify conformance with established guidelines or standards" (Petroleum Industry Training Service, 1996). In some jurisdictions, audits have become part of a process whereby better safety performers receive less regulatory scrutiny along with financial incentives.

An audit is conducted through the use of a "protocol", which is defined as "a document which organizes audit procedures into a general sequence of audit steps and specifies the actions taken by the auditor" (Cannon, 1998). The protocol includes in-depth examinations of specified safety system "elements". Data sources can include archival (document) review, interviews, observation, and survey questionnaires.

Besides cost control, there are two other reasons that can be cited as support for audits. One is that it can be a useful demonstration of due diligence: simple compliance with government regulations is often not enough (e.g. Currie, Denault & Henriksson, 1998). Moreover, while British Columbia's new *Occupational Health and Safety Regulation* is voluminous, the design standards it contains cannot replace site- and context-specific knowledge that exists at the level of the firm. Audits can evaluate the extent to which this knowledge is being applied.

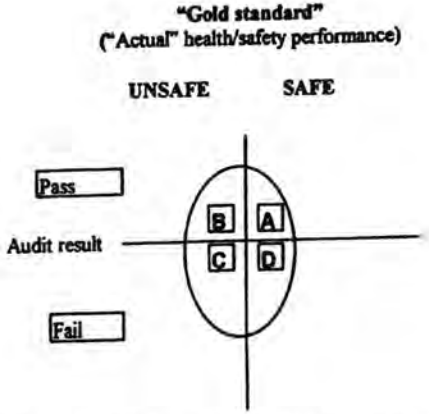
Criterion validity: or, getting better results

Anecdotal evidence suggests that employer interest in safety auditing is building. In order for this tool not to become an ineffective "fad",

however, it is important that *criterion validity* be understood and applied in protocol design and execution (e.g. Kerlinger, 1986). That is, as much as possible, audits must correctly discriminate between "safe" and "unsafe" workplaces.

Let us assume that a magical "gold standard" exists that correctly distinguishes between "safe" and "unsafe" workplaces 100% of the time. Further, assume that we find a sample of OH & S audits completed for a sample of firms in the trucking industry. The results are summarized in Figure 1.

Figure 1



The "gold standard" is shown on the horizontal axis of Figure 1. It shows that some of the firms are genuinely "safe", while others are "unsafe". The results of the audits for the sample are shown on the vertical axis. Some of the firms received a "pass", while others failed. Collectively, the results of the audits are summarized by the ellipse. That is, for any given audit, one of four situations hold. The audits in quadrant A are "true positives": they correctly identify "safe" firms. Similarly, the audits in quadrant C are "true negatives": these are "unsafe" firms that (appropriately) fail their audits.

It is the remaining two quadrants that give rise to frustration. In quadrant B, firms were "unsafe" but received passing audit scores. In quadrant D, "safe" workplaces were failed. Thus, there are *two* types of error in the audit process, but their costs are not the same. When a "false positive" occurs, the costs include a greater risk of accidents and injuries because of problems that have apparently gone unnoticed. When a "false negative" occurs, the costs may include "overkill" responses to improve a safety system that in reality is already working well. As Figure 1 shows, it is difficult to eliminate false results: if the "cutoff" (i.e. the horizontal axis) is raised, we see that the risk of one error falls, while the other increases.

The underlying goal is to maximize the "true positives" and "true negatives" (Quadrants A and C) and minimize the others. We now review several important ways in which this goal can be achieved.

Content validity. This term (not to be confused with criterion validity) refers to the extent to which the audit provides a *representative* overview of the work environment, and its associated health and safety risks. There are a variety of frameworks that have been used to categorize audit "elements". One that has been used in several industries is shown in Figure 2.

Figure 2
Audit elements

Written health and safety policy and work procedures
Training and supervision
Equipment inspections and maintenance
Physical plant inspections and maintenance
Hazardous materials
Medical examinations and First Aid services
Accident investigation procedures
Records management
Claims management

In conceptualizing elements, the objective is to make sure that the audit "covers all the bases", particularly those in which a clear relationship can be drawn with health and safety outcomes. For example, a transportation company that makes extensive use of contract employees (or subcontractors) would need to ensure that any particular risks that arise from the use of these workers are appropriately evaluated in the audit program.

Within elements, industry- or firm-specific safety concerns should be incorporated. For example, a trucking protocol would include an examination of operator recruiting and selection practices, the availability (and use) of written pre-trip inspection procedures, and the appropriateness of equipment and routings for the cargoes hauled. The need for a comprehensive, balanced "snapshot" is critical. Trucking firms often devote a great deal of time and resources on highway safety. However, a recent report revealed that only about 16 percent of driver injuries involve motor vehicle accidents. Consequently, effective protocols will include elements that focus on non-driving activities such as loading and unloading procedures, yards, loading docks and maintenance shops (Flatow, 2000).

Audit "grading system". Audits can use a variety of grading systems. Unfortunately, numerical scores, percentages, and letter-grades are often far less "scientific" than we might like to believe. Designers of protocols should ensure that a strong relationship exists between the weighting assigned to any given audit element and the importance of that element in achieving health and safety-related goals. If experience shows that certain elements have a stronger relationship with particularly valued or important outcomes (such as the incidence of accidents and injuries), they should be allocated a heavier weighting.

Other issues that should be addressed include the need to identify "fatal flaws" that will trigger a failing score. Also, designers should ensure that the grading system rewards good performance and motivates needed improvement.

Reliability. Reliability is an important way to improve criterion validity (e.g. Kerlinger, 1986). When an audit is "reliable", it means that the results do not vary as a function of the person who is doing the auditing.

Reliability can be improved by making sure that audit protocols specify data-collection techniques when appropriate. For example, the auditor might be instructed to select a predetermined percentage of First Aid kits on vehicles and determine by manual inspection that each kit has the required contents. As another example, a structured interview protocol could be used to evaluate the effectiveness of the firm's health and safety committee.

Data quality. As noted earlier, data sources for OH & S audits can include documents, observations, surveys and interviews. All of these have potential pitfalls. For examples, people are sometimes unable (or unwilling) to respond accurately and honestly in survey or interview situations. Moreover, workers sometimes change their behaviour if they know that they are being watched.

Careful training of auditors is a good way to encourage good data quality. Additionally, it is useful to employ all four of the data sources. In this way, when conflicts surface between sources, the discrepancy can be investigated further. Soliciting top management and employee/Union support for the audit programme are also good ways to enhance the quality of the data that are collected.

Data quantity. How much data to collect in an OH & S audit? Part of the answer can be derived from our colleagues in the accounting field. The amount of audit evidence that is considered sufficient to support the end evaluation is a matter of professional judgment (e.g. Meigs, 1983). Further, elements that bear a strong relationship with safety-related outcomes require greater amounts of data.

While the risk of "false" results can never be eliminated altogether, there are a number of situational characteristics that, if present, suggest that more data than usual will be needed. Examples include:

high injury risk, high staff turnover, unsound financial condition in the firm, or unreliable management.

Looking ahead: the E-audit?

More and more, information technology is helping large organizations manage all manner of business processes more efficiently and efficiently. The possible applications for OH & S auditing are not difficult to see. For example, employees might receive safety audit questionnaires by e-mail. The content could be "tailored" to reflect the risks associated with each employee's particular job.

Information technology may facilitate more thorough, comprehensive audits than what has been feasible in the past, particularly if linkages can be established with other information systems, notably in the human resource area. One possible pitfall, however, is that of information overload. Without clear thinking ahead of time – and input from persons who will supply and use the information – the results of "E-audit" efforts are likely to be disappointing. Another issue that will require attention is that of employee privacy.

Conclusion

Controlling health and safety costs is an important way to maintain competitiveness in Canada's transportation industry. This is particularly true given our country's changing demographic structure, and the increasing demand for health care services.

When administered carefully, OH & S audits can be a useful way for firms to achieve cost savings. The issue of criterion validity is an important one. Expanded use of information technology will bring more opportunities to optimize health and safety performance in transportation firms.

Endnotes

[1] As the workforce ages, it bears noting that while more experienced workers generally have fewer injuries, injuries of older workers tend to be more severe and require a longer healing period (Spieler, 1994).

[2] For example, consider a manufacturing firm with 39 workers, a payroll of $1.5 million and a base Workers Compensation insurance rate of $4.00. The company's injury costs are lower than the average in the rate group. If this company had injury costs of $9,000 in 1996 and decreased its claims by $1,000 each year until 2002, it would save $75,000 in premium costs (Workers' Compensation Board, 2000b).

[3] The extent to which experience rating influences health and safety is not known conclusively. In an interesting article, Ison (1986) argued that the effect is probably negative. Nonetheless, it is probably reasonable to claim that experience rating systems increase employer interest in health and safety matters.

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Designing Programs for Reducing Aggressive Driving, Beyond Law Enforcement

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1. Introduction

The term "aggressive driving" has been defined in a variety of ways by researchers and operating agencies. Definitions run the gamut from highly restricted ones involving use of a vehicle as a weapon to those that include almost every conceivable violation of the motor vehicle code. Media concern about "road rage" has further confused matters. At least in the serious literature, road rage is viewed as a serious form of criminal behavior employing a car as a weapon or assault arising from driving confrontations. Many of the documented cases of road rage, however, appear to have arisen from earlier acts of aggressive behavior, the focus of the present paper.

Frustration Aggression theory (Dollard *et al.*, 1939) views aggression as being the inevitable response to the blocking of a desired goal. Further, if the frustrating agent is unavailable the aggression will be displaced to a more suitable (weaker) target. The link between frustration and aggression provides a theoretical bridge between environmental conditions and driver behavior. It moves us to seek the causes of aggressive driving within the environment rather than the psychology of the particular aggressive driver. For example, frustration can be seen as the consequence of the environmental condition of congestion. As congestion worsens, the probability increases that drivers will respond to it by displaying aggressive driving behavior.

Our review of definitions from various sources have found a wide variation in definitions. Drivers in focus groups held by Northwestern University Center for Public Safety (NUCPS) saw behaviors as aggressive that were unfair, dangerous, and did not follow the rules. Former Secretary of Transportation (U. S.) Rodney Slater called it "a combination of unsafe and unlawful driving actions that demonstrate a disregard for safety" (in Goehring 1997, p. 6). A number of states have specified that aggressive driving occurs when drivers commit multiple traffic violations including at least one "dangerous" violation, e.g., speeding. Colorado adds that other motorists must be present for the driving to be aggressive. Some police consider all flagrant violations as aggressive. Finally, New York State defines an aggressive driver as one

who "operates a motor vehicle in a selfish, bold, or pushy manner, without regard for the rights or safety of the other users of the streets and highways" (New York State Department of Motor Vehicles 2000).

A need for, at least broad agreement on the elements of a definition is evident if programs directed toward reducing the incidents are to be measured. This would be the case both for programs aimed at identifying and changing aggressive drivers, as well as aggressive driving. Identifying individuals most likely to drive in an aggressive manner could be determined from driving records, clinical behavior, or observation. Focus on aggressive driving would lead to programs which are based on enforcement, engineering, or other environment or educational countermeasures. Another way of looking at this distinction is to compare the likely goals of these programs. Emphasis on drivers would result in retraining or removing certain drivers from the road. (The clear parallel with attempts to curb impaired driving can be seen.) Reducing the frequency and severity of aggressive driving would be done at selected locations. Approaches for given locations could be generalized and employed on a wider scale.

In order to identify an underlying consensus as to the elements of a definition of aggressive driving, a set of driving scenarios was designed and presented to highway safety experts for their responses. The survey was administered at a workshop concerned with reducing fatalities sponsored by the National Cooperative Highway Research Program. Other responses came from members of several Transportation Research Board Committees. This approach allowed for the inclusion of highway safety experts representing engineering, enforcement, and driver behavior orientations.

This paper, after examining the general issues related to aggressive driving, discusses how the survey provided some guidance in arriving at a consensus definition and how this consensus suggests corrective actions.

2. General Description of the Problem

The problem of aggressive driving appears to be increasing in seriousness. While there is great variance in the estimates of the problem, perceptions of both law enforcement and drivers is that the phenomenon is becoming more frequent. As a result of this, people believe the road to be increasingly dangerous and a problematic area.

According to a NHTSA survey on aggressive driving attitudes and behaviors, more than 60 percent of drivers see unsafe driving by others, including speeding, as a major personal threat to themselves and their families. More than half admitted to driving aggressively on occasion. Some common characteristics of the aggressive driver from the survey included:

- High-risk drivers, more likely to drink and drive, speed, or drive unbelted.
- Run stop signs, disobey red lights, speed, tailgate, weave in and out of traffic, pass on the right, make unsafe lane changes, flash lights, blow horns, or make hand and facial gestures.
- Frustration levels are high; concern for other motorists, low.
- The vehicle provides anonymity, allowing drivers to take out their frustrations on other drivers.
- Vehicles are objects and drivers fail to consider the human element involved or consider the consequences of their actions. (NHTSA, May 1999)

A study performed in the U.S. (AAA Foundation for Traffic Safety 1997) reported incidents of violence that involved traffic altercations and the use of vehicles as weapons. These were only the most violent incidents that resulted in a police crime report. They do not represent all the violent incidents that occurred. In the period January 1, 1990, through September 1, 1996, 10,037 extremely violent incidents were reported to researchers conducting the work. Given the distinction made at the beginning of this paper, these incidents probably would be classified as "road rage."

In two studies conducted in the United Kingdom several elements of aggressive driving were discussed. A survey of British motorists found that 88% reported at least one of the behaviors listed below being directed at them:

- Aggressive tailgating
- Lights flashed at them because the other motorist was annoyed
- Aggressive or rude gestures
- Deliberately obstructed or prevented from moving their vehicle
- Verbal abuse
- Physical assault

Since an observable definition of aggressive driving has not been adopted in the United States, it is not possible to document attributes of the problem, such as age, gender, and socio-economic status. Where

anger and displays of aggressive driving behavior occur, however, it is more likely to be exhibited by younger drivers and males. Certainly, experience gained from focus groups and driver improvement classes operated by the Center for Public Safety (Wark 2000) indicate an especially high probability for younger male drivers to express feelings of anger related to driving. Additionally, the enrollment in the driver improvement classes indicates that young male drivers have the highest probability of being ticketed for aggression-related offenses.

The frustration-aggression approach suggested by researchers such as Shinar (1998) has the advantage of allowing for a conceptual relationship between the driving situation and the expression of anger by the individual driver. The basic assumption here is that drivers when exposed to congestion and other frustrating situations will experience increasing levels of aggression. The approach has received much support (as examples, Hauber 1981; McDonald and Wooten 1988; and Novaco 1992).

Another important attribute of the problem is the specific characteristics of the type of driving done by the individual. Ultimately, the probability that a given individual will display aggressive driving is a joint probability of their personal characteristics and the characteristics of the particular driving situation. Thus, a driving situation could exist that is so non-stressful that it would likely engender aggressive driving only in a person with a great amount of personal anger; and another so congested and frustrating that even the calmest person might begin to display aggression.

Aggressive driving is a "contextual" violation. The two major components of context are the driver's background and the environment in which the person is traveling. The psychological state of the driver has already been discussed.

The type of aggressive driving displayed in a given area will, in part, also be a function of the setting. Most examples of aggressive driving have occurred on expressways and perhaps that is why the role of speeding has been emphasized. It is clear that an extension of the concept to driving on surface streets is required. Urban areas with high periodic traffic and heterogeneous mixes of vehicle sizes, pedestrians, and bikes are especially important. In such an environment, the operational definition of aggressive driving may not include speed but would include violations such as turning, yielding, traffic control devices, and lane maintenance.

2.1 Objectives

There are two basic objectives for addressing the issue of aggressive driving: preventing drivers from driving aggressively, and minimizing elements of the driving situation and environment that increase the probability of the behavior. These approaches are mutually reinforcing. The first general approach, focusing on drivers, has two basic behavior modifying measures:

- Those individuals who engage in aggressive driving
- Population group or in a geographic area identified as having an aggressive driving problem

Both make use of the legal system surrounding driving. Identifying target individuals can be accomplished in two ways:

- Using driver and crash records to identify individuals displaying a propensity to aggressive driving
- Using crash records and observations to identify populations or geographic areas for which aggressive driving seems to be over represented

The second general approach is to examine the driving environment in a search for "triggers" that tend to set off aggressive driving. The efforts aimed at traffic calming discussed below are good examples of this approach.

2.2 Discussion of Objectives

Change the behavior of drivers with a history of aggressive driving. The drivers require intervention at the individual level. Programs aimed at them would first require a process for identifying the target persons. While information could be gained from driving records, care would have to be exercised. As noted, aggressive driving is not the same as bad or dangerous driving. Thus, a record containing many moving violations would not necessarily indicate an aggressive driver. The person might drive fast but does so only on roads with minimal congestion, therefore, not causing problems for other drivers. If violation records were employed, it would have to be done with a classification system that could distinguish between aggressive and non-aggressive violations.

Change the behavior of populations, or in an area identified as having aggressive driving. The general procedure consists of identifying a series of violations exemplifying the particular problem of aggressive driving in a particular area, or by a specific subset of drivers, and then

instituting an intensive program aimed at changing the undesirable behaviors.

Change the environment to eliminate triggers, or mitigate their effects. A large-scale approach to aggressive driving is to determine aspects of the driving environment that increase the probability that such driving will be demonstrated. As noted, a prime example of this is the relationship between congestion and aggression, mediated by frustration. Programs of this type would be concerned with the identification and modification of these environmental variables.

3. Survey of Driving Behaviors to Identify Aggressive Driving

Developing a definition for aggressive driving, in part, also requires an understanding of how persons perceive this behavior. For this reason, individuals representing a wide range of traffic safety disciplines were surveyed to determine which of a set of scenarios represented aggressive driving and which did not. The survey use 25 driving scenarios. It asked the respondent to indicate if he or she believed that a scenario represented aggressive driving. If the answer was "yes," the respondent then was asked to indicate which *one* solution was most likely to be effective in the long-term at reducing the aggressive driving represented by the scenario. Respondents were told they should assume that enforcement probably represented short-term remediation, but it might not be effective in the long term. There were four categories of solutions:

- Education
- Enforcement
- Engineering
- Other

Driving scenarios were developed based on experience of the researchers and incidents addressed in the literature. They were grouped into actions occurring on limited access roads, urban arterial roadways, and within the central urban area. There were three additional scenarios not linked specifically to a roadway type. Two were related to construction zones, and one to a person who has had a delaying incident unrelated to current driving and is late for an appointment. Scenarios for the limited access roadways (with a speed limit of 90 km/h) ranged from drivers passing traffic on the shoulders to a driver traveling at a high rate of speed but with little or no traffic. On the urban roadway, several scenarios related to running red traffic signals.

Additionally, respondents also were asked to check which of five classifications best described their work: Enforcement, Engineering, Education/Research, Government/Planning, and Other/Not Specified. These classifications were used to examine how different work perspectives may have influenced the answers given, both as to aggressive scenarios and to solutions.

3.1 Responses to the Scenarios

There were 107 respondents. Exhibit 1 presents those scenarios for which 70% or more of the respondents chose "aggressive driving." The most frequently chosen scenario of the six highest was that of a driver passing stopped traffic on the shoulder. Next most frequently chosen was the driver who refuses to allow another to change lanes.

On the other hand, only 19% of the respondents selected the scenario where a driver is traveling well above the 90 km/h limit and is changing lanes frequently, but does not appear to be interfering with other drivers (Exhibit 2). Two other scenarios also had less than 30% of the responses. One scenario represented a driver traveling at excessive speeds, but again not apparently interfering with other traffic. In the other, the driver pulled into a painted median to reach the left-turn lane because the entrance to that lane was blocked by through traffic. What is interesting is that the same action, but on a limited access roadway where the driver uses the shoulder to reach the exit lane, was more frequently considered to be an aggressive act.

Finally, several scenarios had interesting responses. The two related to merging behavior in construction zones, for example, had 50% of the respondents agreeing that using a open merge lane was aggressive, and approximately the same percentage agreeing that actions (usually by truck drivers) to prevent such passing also were aggressive. In at least one state, Pennsylvania, driving in the merge lane to the merging point is encouraged (Byrd, *et al.* 1999). Differences also appeared regarding how persons viewed speeding. In light traffic, speeding is not aggressive, but it is in heavy traffic.

3.2 Responses by Respondent Profession

Exhibit 3 shows the distribution of respondents into one of the five work classifications. The distribution between engineers and researchers (educators) was fairly well balanced.

Exhibit 1
Most Frequently Selected Aggressive Driving Scenarios
(107 Respondents)

Question	Percent Yes
Traffic congested on a freeway and very slow. Driver A pulls onto the shoulder and advances many car lengths before returning to the traffic stream.	92.5%
On an urban arterial, a driver signals to move to the left lane. Driver A in that lane speeds up to prevent the lane change.	87.9%
Driver A seeing the traffic signal turning red speeds up but still enters the intersection after the light turns red.	81.3%
Driver A has had to stop for two traffic signals in succession because they turned red just prior to approach. Driver speeds up and enters the third intersection just after the signal turns red.	76.6%
On an urban arterial, a driver signals to move to the left lane. Driver A in that lane speeds up to prevent the lane change, but Driver A signals and then forces his way into the lane causing the other driver to slow abruptly.	76.6%
Traffic is heavy on the freeway. A driver pulls into the inside lane to pass at less than the prevailing speed. The driver cannot return to the original lane, but accelerates to the prevailing speed. Driver A, who is following, continues to flash her lights.	73.8%

Exhibit 2
Least Frequently Selected Aggressive Driving Scenarios

Question	Percent Yes
Traffic is light on the freeway, mostly in the outside lanes. Driver A is traveling at least 130 km/h in the inside lane.	29.9%
At the intersection, left turns can be made only on the left arrow. Cars in the through lane block entrance to the left turn lane. Driver A enters the painted median to reach the left-turn lane.	27.1%
Traffic moderate on the freeway, many drivers moving above the limit. Driver A is traveling at 110km/h; signals and changes lanes frequently; does not appear to interfere with other drivers.	18.7%

Exhibit 3
Distribution of Respondents by Discipline

Discipline	Number	Pct.
Education/Research	35	32.8%
Engineering	33	30.8%
Government/Planning	17	15.9%
Enforcement	8	7.4%
Other	14	13.1%
	107	

Responses were examined by the profession of those who completed the survey. Exhibit 4 displays all scenarios in which at least 90% of the members of any profession selected a scenario as aggressive driving. They are shown in order by scenario number (those numbered 1 through 11 occur on limited access roadways with a speed limit of 90 km/h). Only on scenario 9, the driver passing on the shoulder, were the respondents in agreement. For the remainder, each discipline tended to select a different one.

Exhibit 4
Highest Rated Scenario by Discipline of Respondent

Question	Profession
7. Driver A pulls into inside lane to pass but at less than prevailing speed. He cannot return to the original lane but continues to drive at the lower speed, and the following driver flashes his lights.	Enforcement
9. Traffic congested and very slow. Driver A pulls onto the shoulder and advances many car lengths before returning to the traffic stream.	All
12. Driver A seeing the traffic signal turning red speeds up but still enters the intersection after the light turns red.	Research/ Education
15. A driver signals to move to the left lane. Driver A in that lane speeds up to prevent the lane change.	Engineering; Enforcement
16. Driver A signals changing to the left lane. When the other driver speeds up to prevent the action, Driver A forces his way into the lane.	Engineering

The greatest divergence in responses was from law enforcement personnel. While they agreed with scenario 9 (passing on the shoulder), they chose scenarios that represented inconsiderateness more frequently than other respondents.

Those in education were more likely to select the driver increasing speed then running a red traffic signal as the most aggressive scenario. Engineers agreed and added drivers either failing to let someone change lanes or someone forcing the lane change as aggressive behavior.

3.3 Corrective Action

The final question posed was, what one long-term solution might help reduce the aggressive driving described by the scenario. Exhibit 5 shows the scenarios for which 60% or more of the respondents indicated that it was representative of aggressive driving. It also shows how those responding believed the situation could be corrected over the longer term.

Enforcement represented the best potential solution for scenario 9, shoulder riding, with 78% selecting this solution. It also was seen as the best solution for scenario 2, driving faster than the prevailing traffic and frequent lane changes when traffic was heavy. Although enforcement also was selected more than 70% of the time for scenario 12, increasing speed and running a red light, 17% of the respondents believed that this might be treated by engineering intervention. For scenario 13, which was similar, except that it more likely represents frustration, 43% suggested that engineering might prove to be a better solution. Shinar has suggested that for red signal running, engineering solutions may be most appropriate.

The scenario where education was selected most frequently (74%) as a solution was number 21, a driver impatiently waiting for pedestrians to cross. It also was frequently chosen for the scenario where pedestrians were delaying traffic when walking against the "don't walk" signal. Finally, approximately one half also selected education as a solution for scenario 8, where the aggressive driver flashed his lights at a driver who was traveling the prevailing speed but would not move from the inside lane.

When examining the responses by the type of work done by the respondents differences also appeared. Those who indicated their work as law enforcement were also more likely to select enforcement as a solution. They selected this solution more than 63% of the time, followed by respondents who indicated "other" work classification. Those in governmental or planning function chose this solution 37% of the time. This latter group selected education 47% of the time. Education also represented the second most frequent choice of solutions

Exhibit 5
Proposed Long-Term Corrective Action

Question Number	Aggress. Yes	Percent Choosing*		
		Enforce	Engineer	Education
9. Traffic congested and very slow. Driver A pulls onto the shoulder and advances many car lengths before returning to the traffic stream	92.5%	78.4%	10.3%	10.3%
15. A driver signals to move to the left lane. Driver A in that lane speeds up to prevent the lane change.	87.9%	30.9%	2.1%	53.2%
12. Driver A seeing the traffic signal turning red speeds up but still enters the intersection after the light turns red.	81.3%	71.3%	16.1%	9.2%
13.Driver A has had to stop for two traffic signals in succession because they turned red just prior to approach. Driver speeds up and enters the third intersection just after the signal turns red.	76.6%	37.8%	42.7%	11.0%
16. A driver signals to move to the left lane. Driver A in that lane speeds up to prevent the lane change, but Driver A signals and then forces his way into the lane causing the other driver to slow abruptly.	76.6%	44.3%	1.3%	45.6%
8.Traffic is heavy. A driver pulls into the inside lane to pass at less than the prevailing speed. The driver cannot return to the original lane, but accelerates to the prevailing speed. Driver A, who is following, continues to flash her lights.	73.8%	45.1%	1.4%	50.7%
2. Traffic very heavy; speeds are less than 70 km/h. Driver A changes lanes frequently, generally moving faster than the other traffic.	66.4%	66.2%	4.2%	23.9%
21. At a busy intersection, a driver turning left waits for pedestrians to cross. Driver A in following vehicle blows his horn.	66.4%	18.8%	2.9%	72.5%
1. Traffic relatively heavy; drivers traveling at or above the limit. Driver A goes faster than speed limit and changes lanes frequently	64.5%	77.9%	0.0%	19.1%
22. Driver A cannot complete a left turn on the protected left-turn arrow because pedestrians are crossing against the "no walk" sign. He blows his horn and shouts at the pedestrians	63.6%	27.8%	9.3%	74.1

* The values may not add to 100%; there also was a choice of "other," but responders hand no opportunity to suggest a solution.

for engineers, 38% of the responses compared to 46% for enforcement. Those who indicated they came from education or research chose engineering more frequent than any other group. The differences in choice were statistically significant at the 0.001 level in chi square test with a chi square of 49.8 at 12 degrees of freedom.

When individual scenarios were examined, even more striking differences emerged. For scenario 9, for example, engineers selected law enforcement as the solution 84% of the time; police 100%. On the other hand, only 62% of those in education and research and 69% of those in government selected enforcement as the solution. The latter group suggested that engineering was part of the solution 23% of the time as opposed to only 4% of the time for engineers.

In selecting solutions for the red signal violations, all except those in education considered enforcement as the solution for the driver who speeds up and then runs the red signal. For the other two traffic signal related scenarios, both of which also suggested that drivers might be frustrated, all except persons representing government or planning disciplines selected engineering as a solution at least 50% of the time. The government group still was more likely to select enforcement for running a red traffic signal regardless of the conditions.

4. Discussion of the Responses to the Scenarios

Attempts to arrive at a common definition generally have not been successful because of the many viewpoints attempting to be accommodated. As the discussion of the results has shown, even when scenarios are presented, a consensus is difficult to find. How one viewed aggressive driving often depended upon one's job. However, in two cases, driving on the shoulder to pass other vehicles and failing to allow someone to change lanes were considered aggressive acts by at least nine of every 10 responders. On the other hand, there were no scenarios which were excluded. Given this overall consideration, some conclusions can be drawn. Aggressive driving is an act which normally exhibits:

1. selfishness or impatience
2. may violate a traffic law, and
3. is directed against and affects other drivers (or in the case of traffic signals, objects)

Probably the most important one is that for most of the top 10 scenarios, the actions represented were selfish, impatience, or

aggressive using the definition of "bold or pushy." Simply breaking one or more traffic laws without the added selfish behavior was not necessarily aggressive driving. On the other hand, scenarios representing behavior arising from frustration (a person who is frustrated because of external events and another where a driver uses aggressive verbal or non-verbal actions, e.g., the extended finger) were considered aggressive driving by less than one halfof the respondents.

The suggestion that selfishness or impatience are key elements of aggressive driving may argue against the current trend of labeling this driving as breaking several traffic laws including "dangerous" driving violations such as speeding. This step has been taken in several states (Arizona, Colorado, and Delaware as examples). However, the most frequently selected scenario, 9, is a driver passing others on the shoulder. This is a violation of just one law. Furthermore, while there is some risk to other drivers (the one who needs to pull to the shoulder in an emergency), this driver is not placing other motorists in direct jeopardy of a collision. He or she is simply trying to get ahead. More importantly, the second most frequently selected scenario was strictly an uncivil act. In most states, the police probably would not even cite the action.

Placing others at immediate risk also does not readily appear in scenarios 12 and 13, both of which related to running red traffic signals. Some of the more serious collisions occur at intersections. However, the action of running the signal appears to be one formed of frustration or the need to get one's way regardless of others.

Another common thread among the most frequently selected scenarios was that the actions directly affected other drivers (although, violating traffic signals appears to be an action directed against an object, the signal, rather than another motorist. Other frequently chosen scenarios did represent situations where another driver might be at risk or, more importantly, have to take some action, e.g., a driver in heavy traffic trying to drive above the prevailing speed and changing lanes frequently. Even here, the circumstances dictated the choice. When traffic was moderate and the driver was speeding and changing lanes, respondents did not appear to believe this affected others. They did not choose the action as aggressive driving.

The point made above concerning the role of social "rules" also appears to be an influence on the ascription of the label "aggressive driving." While these rules often reflect traffic laws, as was noted

above, sometimes they don't. Thus it is clear that while driving any amount over a posted speed limit, is a violation of statute, speeding is not considered a violation of social rules unless it exceeds the amount considered normative in a particular location under particular conditions. The cultural structure underlying driving is, of course, socially constructed. As Berger and Luckmann (1967) pointed out in their classic work, we build the social world we live in through the process of social interaction, that world in turn appears to us to be "natural" but of course is not. An important part of this construction is the shared beliefs about "proper" behavior. Traffic law has always been problematic because it often does not reflect general beliefs about proper behavior. For this reason, it appears that people's judgments about aggressive driving, may often function independently of the legal structure.

Even where there was agreement that a specific action was aggressive, there was disagreement on how to resolve the problem. Traffic law enforcement was selected most frequently overall. However, for some of the scenarios, respondents believed that engineering actions or better education might be more beneficial. Whether the choice of using law enforcement arose because there is a belief that it is the only way to control "improper driving behavior," or because other avenues for solutions were not explored. Perhaps the most interesting differences arose from how respondents look at solutions for several scenarios in which some minor engineering changes might be appropriate. For example, running red signals as a result of frustration over poor timing or excessively long waits for a red signal suggest solutions for which enforcement may never be effective in the long term. A good comparison is the argument made for posting speed limits appropriate to the roadway. A limit which is far below that which is reasonable for the facility is likely to be disobeyed even where enforcement is constant.

Education also frequently arose as a potential long-term solution. However, the education suggested is not the form now most commonly directed toward aggressive driving; how to avoid escalating an apparent threat. On the other hand, the scenarios where education was selected most frequently, e.g., the driver who fails to yield room to the merging driver, is one where courtesy is lacking. Likewise, a large percentage of respondents chose education as the response to pedestrians improperly crossing and preventing motorists from making a left turn.

While enforcement is an important component of preventing the action, education related to pedestrian behavior and pedestrian laws could be beneficial.

Although the survey of aggressive driving did not set out to provide a definition, it has provided some guidance toward reaching that solution. It suggests that several behaviors must come together and that those behaviors generally directly have to affect others. Most importantly, it shows that there is agreement as to what actions are aggressive. Not only is there agreement, but these acts can be observed and immediate corrective action taken.

It is clear that we will never achieve a single definitive definition of aggressive driving. Ultimately all definitions are arbitrary and questions of correctness are not really relevant. Further, aggressive driving programs occur within specific situational contexts and the definitions employed in them must relate to the specific needs of that situation. Also, while aggressive driving has been compared to DUI, there is no physical referent that is in any way equivalent to a blood alcohol level. However, the findings of this study can be very useful in suggesting general parameters concerning the meaning of aggressive driving. These general parameters will be very helpful in developing a comparative research literature from which a series of best practices will emerge as a guide to program development. Eventually, this will also allow states to develop consistent legal structures around the concept of aggressive driving.

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Allocating Emergency Response Facilities to Mitigate Risks of Dangerous Goods Transportation

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ABSTRACT: This paper presents a mathematical model for locating emergency response facilities (units) that are specifically for handling dangerous goods incidents on a highway network. Different from conventional methods, the proposed model adopts a risk-based approach that allows explicit consideration of both population distribution and emergency response time. This approach provides a practical platform for evaluating the trade-offs between system costs (number of facilities allocated), total network risk and individual node risk and response time thresholds. The model is applied to an example network representing the southwest region of Ontario to illustrate its applications.

INTRODUCTION

The transportation of dangerous goods (DG) poses special risks for population and the environment. Each year an unacceptably high number of people are killed or injured in North America as a direct result of incidents involving the road transportation of DG. One way to mitigate these risks is to provide effective emergency response capability throughout the road network, especially at those locations where the risk of DG incidents is deemed to be unacceptably high.

A critical factor in the provision of effective emergency response capability is the response time. This is the period from the start of the incident to the time when response is initiated. Response to DG incidents can involve several tasks, such as, containment of release and/or fire, evacuation and sheltering, redirection of traffic and cleanup. During the response period, the damage associated with an initial DG release or fire can escalate significantly, resulting in significant loss of life and personal injury and environmental degradation.

The relationship between risk and response time depends on a number of inter-related factors, including the type of DG involved, location of the incident, weather and atmospheric conditions (e.g. wind direction and speed), etc. For any DG incident, risk can be defined simply in terms of the product of the likelihood of the incident taking place and its consequent damages. As noted in Rhyne (1994), this risk is expressed as an expectation (such as the expected number of fatalities) obtained by summing risk over all likely incidents and possible damages for different factors (such as, DG type, transportation scenario, weather conditions and location).

A major aspect of the risks associated with DG releases is the "hazard area". This refers to the area surrounding each incident that is associated with a given potential threat (e.g. the area within which we can expect that say 50% of the population will be killed if exposed to a given DG concentration level for a given period of time. Damage thresholds can be obtained empirically for different DG types based on established dose-response models. An in-depth discussion on how various hazard areas are estimated for different DG types is given in OECD/ PIARC/EU 1999 and HSC 1991. Table 1 provides a summary of some basic events and how the hazard areas are calculated for different types of DG incident (OECD/ PIARC/EU, 1999).

We note that the "emergency response time" is an important input variable in all these expressions. It directly influences the hazard areas associated with different DG threat potentials.

A judicious allocation of emergency response units on a highway network that takes into account the risks of transporting DG can have a significant effect on the potential risks involved (List, 1993). This paper presents a model for locating specialized emergency response units on a regional road network. Emergency response units generally provide a range of services of which response to DG incidents is a relatively small component. In this paper, we consider a specialized level of emergency response units (DG-ERU) that addresses the specific needs of DG incidents.

Given the cost of providing such services, we restrict the allocation of DG-ERU to existing permanent fire stations. Hence, within the context of this paper DG-ERU consists of the subset of existing fire stations that would have the necessary equipment and training to respond to DG incidents. DG-ERU are essentially a secondary stratum of emergency response juxtaposed on existing fire station capabilities.

Given the link between DG-ERU and fire stations, we would expect that demand for service is closely associated with population. Unlike demand for service at fire stations, demand for DG-ERU can take place at any point on a regional road network, particularly where DG movements take place (near industries, major truck corridors, etc.). When allocating DG-ERU on the regional road network, we need to be cognizant of the trade-off between locating DG-ERU near major population concentrations and locating DG-ERU close to sites where the potential for transport-related DG incidents is high. In many cases, these objectives are counter to each other. In Ontario, for example, much of the population is found in the southern part of the province near Toronto, whereas the bulk of the regional highway mileage is in the sparsely populated and remote northerly regions.

In developing our DG-ERU allocation model, we will consider the objective function to minimize total network risk subject to two important constraints:

Table 1 Basic events in case of DG incident (OECD/ PIARC/EU, 1999)

Event	Effect	Modeling Methodology
Boiling Liquid Expanding Vapor Explosion (BLEVE)	Heating, Pressure, Projections of fragments	2 phase fire ball analysis
Vapor Cloud Explosion (VCE)	Mechanical, Heating	TNT equivalent models Multi-energy models
Torch fire	Flame	Turbulent jet model Flame shape Radiation level
Toxic and flammable clouds	Toxic and/or Heating	Gas dispersion models: Gaussian models Dense Gas dispersion models
Pool fire	Heating	Calculation of volume occupied by the flames Calculation of incidental flow

- Maximum risk at the marginal node does not exceed some pre-set threshold
- Maximum response time at the marginal node does not exceed some pre-set threshold.

The purpose of this paper is to apply this model to a common DG transport problem, and to compare the results for different transportation scenarios and assumptions. A few critical issues that will be addressed include: how does the number of DG-ERU affect the total network risk? How does it affect risk at the marginal nodes?

What is the relationship between risk and response time? How does the number of DG-ERU affect the number of feasible solutions?

MATHEMATICAL FORMULATION

Consider a regional highway network represented by a directed graph G(N,A), where N is a set of n nodes and A is a set of m links, as shown in Figure 1. The nodes represent population centers (municipalities) as well as highway intersections. Without loss of generality, we assume that both populations and highway activities (incidents) are concentrated at (or can be aggregated to) individual nodes. The links represent highway connection between nodes with known average travel time.

Over the network, there exists a set of p fire stations, denoted by F. The fire stations are assumed to exist only at network nodes (i.e., F is a subset of N), and are the *only* sites that can host a DG emergency response unit (DG-ERU). Our objective is to allocate a given set of k DG-ERU to the p fire stations ($1 \leq k \leq p$) so as to minimize the total network risk and at the same time ensure that the risk and the response time at any given node do not exceed their pre-set threshold values (R_{max} - maximum allowable risk and T_{max} - maximum allowable response time).

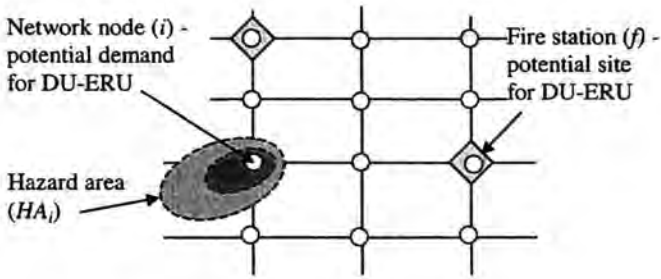


Figure 1. Highway Network Model for DG-ERU Allocation

To formulate this problem, we first need to define the risk at individual nodes. The risk associated with each node i, denoted by R_i, is defined by Equation 1.

$$R_i = Pr_i \cdot C_i \tag{1}$$

where Pr_i the probability or frequency of DG incidents at the highway sections surrounding node i, which can be derived from historical highway incident database; C_i represents the consequent damages that could potentially result from a DG incident at node i. Both incident probability and potential damage depend on DU type and incident type, in this paper, we will consider only a single DU type and a single incident type. The consequent damages associated with node i can be expressed as:

$$C_i = Pop_i \cdot HA_i \cdot V_{nrb} \tag{2}$$

Where Pop_i the population density of the population center represented by node i; HA_i is the hazard area that could result from a DG incident at node i.; V_{nrb} is a measure of vulnerability reflecting the fraction of population exposed to a given concentration level that is expected to sustain a specific injury (or death).

The hazard area (HA_i) depends on many interrelated factors, including response time, weather conditions, DG type and accident severity. To realistically model these factors and at the same time keep the formulation at a manageable level, we introduce the following function to model the hazard area:

$$HA_i = \beta \cdot t_i^{\alpha} \tag{3}$$

where β and α are model parameters used to capture factors such as weather conditions, DG type and accident severity, and t_i is the

emergency response time. The emergency response time is the minimum travel time to the closest DG-ERU and therefore should be a function of how the DG-ERU are allocated. To develop an explicit expression for t_i, we introduce a decision variable z_f in association with each fire station f ($f \in F$). If a fire station f is allocated with a DG-ERU, then $z_f = 1$; otherwise $z_f = 0$. With this definition, we can express t_i as

$$t_i = \min_{f \in F, z_f = 1} \{T_{if}\} \tag{4}$$

where T_{if} is the minimum travel time from fire station f to node i, which can be calculated using a shortest path algorithm.

The location problem of our interest can now be formally stated as

min. Total Network Risk =

$$\sum_{i \in N} Pr_i \cdot \beta \cdot \left(\min_{f \in F, z_f = 1} \{T_{if}\} \right)^{\alpha} \cdot V_{nrb} \tag{5}$$

subject to

$$R_i = Pr_i \cdot \beta \cdot \left(\min_{f \in F, z_f = 1} \{T_{if}\} \right)^{\alpha} \cdot V_{nrb} \le R_{max} \tag{6}$$

$$t_i = \min_{f \in F, z_f = 1} \{T_{if}\} \le T_{\max} \tag{7}$$

$$\sum_{f \in F} z_f = k \tag{8}$$

The above problem is similar to the known P-median problem with maximum cost constraint (Hansen et. al. 1983). The problem has been proven to be NP hard, which means no exact polynomial algorithm is known yet to solve this type of problem. The problem of interest in this study is expected to be relatively small as the number

of potential locations is limited to the existing fire stations, we will therefore solve it through complete enumeration. The following section uses a simple network problem to illustrate the application of this model and associated solution method.

CASE STUDY

The sample network used to demonstrate the proposed DG-ERU allocation model has been extrapolated from an actual highway network in southwestern Ontario, as shown in Figure 2. The assumed link-node network for this region is also shown in the same figure, which consists of 15 links and 12 nodes. The link distances (km) given in Figure 2 are used to estimate the travel time with an assumed operating speed of 80 km/h.

The population densities and DG incident frequencies for individual nodes are given in Table 2. The population estimates were extracted from values reported in the 1996 census. Note that nodes 10 and 4 have the highest population concentrations corresponding to the cities of Mississauga and Hamilton, west of Toronto. Node 1 on Highway 403 represents the most isolated location on the network. This could be regarded as the marginal node on the network, where we would like to ensure that some minimum level of ER coverage is provided. DG incident frequencies per year were assigned based on the approximate exposure reported for different route segments. We emphasize that this was done for demonstration only and should not reflect accurate estimates of incident potential on the network. Estimates on these incident values can be improved using DG incident/release/fire prediction models.

To apply the proposed allocation model we have assumed the following parameter values: $\alpha = 0.01$, $\beta = 1.5$ and $V_{nrb} = 100\%$. With these parameter values, risks at individual nodes can be evaluated under any given allocation scenario using Equation 5-8. In locating DG-ERU, we begin by assuming $k=1$ DG-ERU and then progressing to higher numbers of units until a solution is found that satisfies the

network and individual node objective functions under the desired constraints. Obviously, at lower numbers of DG-ERU there may not be a feasible solution to the problem, since it may not be possible to cover all nodes on the network with a minimum level of service.

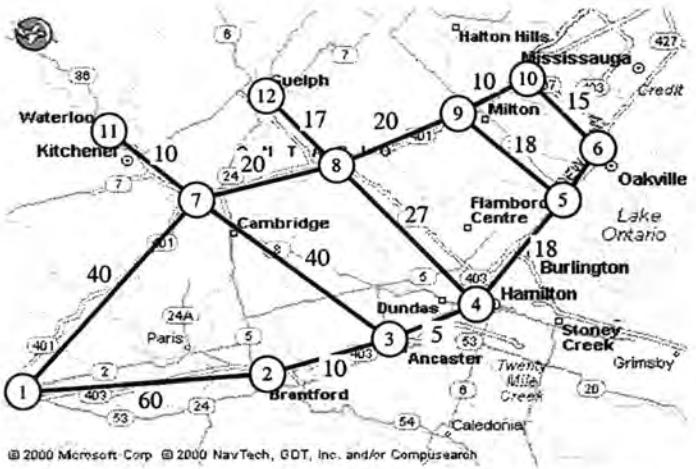


Figure 2: Southwest Ontario Region and the Associated Network Model

Table 2: DG incident frequencies and population densities

Node #	1	2	3	4	5	6	7	8	9	10	11	12
DG incident frequencies ($x10^{-3}$ /year)	*20*	*10*	*10*	*10*	*10*	*10*	*20*	*20*	*20*	*20*	*5*	*5*
Population ($100/Km^2$)	*2.5*	*2.5*	*20*	*60*	*20*	*20*	*12*	*2.5*	*12*	*60*	*12*	*12*

DISCUSSION OF RESULTS

The model was first run for the objective of minimizing total network risk subject to a maximum risk threshold of 5 units and a maximum response time threshold of 40 minutes. We began by locating DG-ERU one at a time until a maximum number of 12 units have been allocated (all nodes have a DG-ERU). Estimates of total risk and risk reduction (%) are summarized in Table 3 for different numbers of DG-ERU.

For a minimum of 3 DG-ERU facilities, our allocation ensures coverage at nodes with the highest population (nodes 4 and 10) and coverage in terms of acceptable response time at the marginal location (node 7). If we relax the restriction on maximum acceptable

Table 3: Optimal allocation of DG-ERU (R_{max} = 5; T_{max} = 40 min)

DG-ERU (k)	Location Nodes	Min. Total Risk	% Decrease in Total Risk
1	*Unfeasible*		
2	*2,10*	*15.43*	
3	*4,7,10*	*5.88*	*61.9*
4	*4,5,7,10 or 4,6,7,10*	*4.66*	*7.9*
5	*4,5,7,10,12 or 4,6,7,10,12*	*3.88*	*5.0*
6	*1,4,5,7,10,12 or 1,4,6,7,10,12*	*3.21*	*4.4*
7	*1,4,5,7,9,10,12 or 1,4,6,7,9,10,12*	*2.69*	*3.4*
8	*1,4,5,6,7,9,10,12*	*2.25*	*2.8*
9	*1,3,4,5,6,7,9,10,12*	*2.02*	*1.5*
10	*1,3,4,5,6,7,8,9,10,12*	*1.81*	*1.4*
11	*1,3,4,5,6,7,8,9,10,11,12*	*1.68*	*0.8*
12	*1,2,3,4,5,6,7,8,9,10,11,12*	*1.62*	*0.4*

risk (threshold R_{max}) and response time (threshold T_{max}), a single DG-ERU would be allocated to node 8. This node does not contain the highest population, but is a compromise between the node with the highest population (node 10) and the provision of minimum coverage at the marginal location at node 1. For the network considered in this case study, the highest population node is located too far from the marginal location node1. This suggests a significant departure from the conventional wisdom of allocating DG-ERU facilities to more highly populated centres. Had we followed this wisdom, individuals residing in more remote areas would not be covered, notwithstanding the significant risks assumed by these individuals.

We note that for the assumed risk and response time thresholds, an allocation of fewer than 2 DG-ERU would not be feasible. From Table 3, a significant reduction in total network risk when a 2nd and 3rd DG-ERU is added to the network (a reduced risk of about 62% from 2 DG-ERU to 3 DG-ERU). This reduction in total network risk from adding more DG-ERU becomes less significant after 4 DG-ERU are added. The total risk tends to level off between 2 and 3 units (risk expectation value used in this exercise). These results suggest that locating 3 units at nodes 4, 7, and 10 yields a good solution, that will satisfy the system constraints and result in about 6 units of total risk on the network. We note that above 3 DG-ERU, nodes 4, 7 and 10 are included in all solution sets as candidate locations for DG-ERU facilities.

SENSITIVITY ANALYSIS

In emergency response to DG incidents, the issue of maximum acceptable response time and maximum acceptable level of risk are not always well defined. In this section, a sensitivity analysis has been carried out to test how variations in maximum response time and risk thresholds affect the number and location of DG-ERU.

The model was run for different maximum response times and tolerable risk levels. The results are summarized in Figures 3 to 4.

In Figure 3 we note that for a maximum risk threshold of 5 units and an allocation of 2 DG-ERU network-wide, increasing response time threshold from 40 min. to 45 min will result in a reduction of about 22% in total network risk. This takes place because potential sites for DG-ERU facilities better reflect risk concentrations. If we wish to maintain a given total network risk and reduce the maximum response threshold from 40 to 20 minutes, we will need to allocate a minimum of 4 DG-ERU instead of 3 DG-ERU to the network. (Figure 4). For lower response time thresholds (i.e. 20 min), a minimum 6 DG-ERU are required.

CONCLUSIONS

This paper has presented a single objective, dual constraint model for allocating dangerous goods emergency response units (DG-ERU) over a regional network. The model is intended to provide a practical platform for evaluating the trade-offs between system costs (number of facilities allocated), total network risk and individual node risk and response time thresholds. The model was applied to an example network problem, which has led to the following important findings:

- For the same network risk, we can trade-off fewer DG-ERU against longer response times (i.e. favor more highly populated nodes against more remote nodes with low population concentrations). We can also favor the remote sites at the expense of coverage at the more highly populated centers for the same emergency response budget.
- There appears to be a critical point at which a small increase in number of DG-ERU would result in a significant reduction in total network risk. For the given example, the total risk was reduced by approximately 62% when the number of DG-ERU increased from 2 units to 3 units.
- The total risk tends to level off after a certain number of DG-ERU has been allocated to the network. This suggests that adding more units to network may not always be cost-effective.

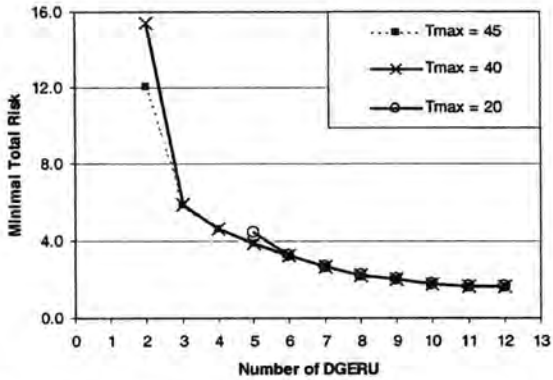


Figure 3: DG-ERU Allocation Under Different Maximum Allowable Response Time (R_{max}= 5)

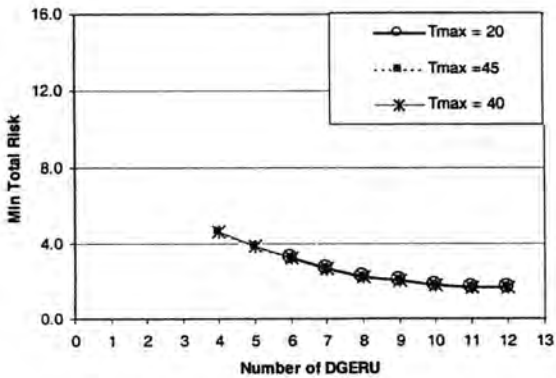


Figure 4: DG-ERU Allocation Under Different Maximum Allowable Response Time (R_{max}= 1)

The presented work represents the initial effort toward our ultimate goal of developing a risk-based decision-support tool for DG-ERU allocation. Our future work will focus on refining and extending the proposed model for more realistic cases such as multiple DU types and incident types.

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Global Airline Alliance Network: Traffic Routing Patterns, and Impacts on Airports

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Abstract

Global networks are created via strategic alliances between major carriers in different continents (and/or sub-continents). Over the last few years, the competition between global alliance networks has been intensifying. As a result, we have seen increasing traffic concentration on routes between alliance partners' continental gateway airports, and increasing hub dominance, at the expense of some secondary airports losing direct intercontinental traffic. This paper examines the changes in traffic routing patterns of the major airline global networks, and how they affect hub, secondary and small airports.

We also examine the impact of AC+CAI merger and Global Alliances on Canada, and the policy implications.

Simulating airline alliances in an international context

J. Nolan, P. Ritchie and J. Rowcroft*

In a recent paper, the authors examined the effects of alliance formation in a simulation model of a domestic market with a single international link. These results were found to complement the results obtained from econometric studies.

It has been suggested that a significant aspect of the current airline market is the use of domestic routes to subsidize operations on more competitive international routes. In the present paper, the simulation model is expanded to include carriers based at either end of an international link competing domestically and internationally.

In its initial configuration the model consists of two countries, each having a smaller carrier flying domestic routes only and a larger carrier with access to the international link and its own domestic routes. This scenario is modified to consider code-sharing and full alliance between the airlines within each country as well as the possibility of an international alliance within a limited or full open-skies situation.

An extension of the model allows for a domestic monopoly at one or both ends of the international route. This generates some preliminary results on the contestability of the domestic markets within a simplified international environment.

In each case the costs and benefits are examined in terms of consumer and producer surplus for each country as a whole and in terms of domestic and international passengers separately.

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Des alliances stratégiques à la desserte des Îles-de-la-Madeleine : les enjeux de la déréglementation du secteur aérien au Canada

Introduction

Le secteur du transport aérien mondial ne cesse de se transformer dans un contexte de déréglementation internationale. La plupart des politiques nationales de transport aérien tendent à s'harmoniser avec des mesures assouplies sur le contrôle des droits d'entrée sur les marchés, l'approbation des pratiques tarifaires ou sur l'allocation des droits de décollage et d'atterrissage sur les grands aéroports internationaux. La hiérarchisation et l'organisation des réseaux aériens se modèlent de plus en plus au gré du jeu de l'offre et de la demande de transport (Feldman, 1998). En outre, le décloisonnement des marchés nationaux a révélé la capacité financière et opérationnelle des transporteurs à s'adapter aux exigences de la globalisation des services (Hill, 1999).

La constitution ces dernières années de grandes alliances met en lumière les nouvelles stratégies d'expansion des transporteurs dans ce contexte en cours de libéralisation avec des intérêts perçus à une échelle plus mondiale que nationale (Flint, 2000). Au début de l'année 1998, plus de 500 alliances étaient recensées dans le monde avec les regroupements Oneworld et Star Alliance comme entités dominantes (Brooks, 2000). Cette concentration croissante de l'activité aérienne mondiale aux mains des grandes compagnies privées pose de nouveaux défis aux politiques en matière de réglementation du transport aérien. Un juste équilibre entre la promotion d'une saine compétition et les mesures de sanction face aux positions dominantes abusives reste à formuler avec l'imbrication complexe des réglementations nationales et les pratiques internationales (Day, 2000).

Ces changements en cours dans l'industrie du transport aérien n'épargnent pas le Canada. La concurrence pluri-décennale entre la compagnie Canadien International et l'ancienne compagnie nationale Air Canada s'est terminée par l'absorption de la première par la seconde à la fin de l'année 1999 (Gauthier – Look, 2000). De fait, 80 % des capacités de transport aérien au Canada et 90 % des revenus sur les liaisons intérieures sont dorénavant aux mains d'Air

Canada. Le spectre de ce quasi-monopole a poussé les autorités fédérales à une révision de ses prérogatives en matière de transport des passagers au Canada. Les ajustements institutionnels ont été promulgués dans l'optique de protéger les consommateurs canadiens tout en n'interférant pas dans la stratégie de développement d'Air Canada. Il n'en demeure pas moins que la pérennité des dessertes régionales et des segments moins lucratifs tout comme la qualité des services et la latitude des opérateurs de second rang à s'aligner sur les services d'Air Canada sont autant de questions en suspens.

Cet article vise à faire la lumière sur les nouvelles prédispositions politiques nécessaires pour encadrer le quasi-monopole d'Air Canada avec une emphase sur les modifications des relations entre les organismes officiels de réglementation et la compagnie dominante canadienne. Une étude des conditions physiques et économiques de la desserte régionale est ensuite développée avec les Îles-de-la-Madeleine comme cadre de référence. Les conditions tarifaires, la protection des consommateurs, les garanties d'une libre et saine concurrence tout comme les positions politiques vis-à-vis des considérations des opérateurs privés sont alors discutées.

Les réalités du monopole national d'Air Canada et la politique fédérale canadienne

La situation du secteur aérien canadien à la fin de l'année 1999 s'avère symptomatique de la complexité à gérer les processus de déréglementation de secteurs restés pendant des décennies sous le contrôle public[1]. D'un côté, le gouvernement fédéral cherche à ajuster sa législation dans le but déclaré de protéger l'intérêt public. De l'autre, Air Canada persiste dans sa stratégie de conquête pour assurer l'augmentation nécessaire de la taille de la compagnie (Moorman,1999).

Dès le lendemain de l'annonce de la réussite d'Air Canada dans ses tractations avec les actionnaires de Canadien, le pouvoir fédéral s'expose au retrait potentiel de la compagnie privée avec ses volontés de réglementer le secteur aérien dans le contexte d'un monopole[2] (Pustay – Kaduck, 2000). Les mesures favorisant le jeu de

la concurrence, le contrôle des politiques tarifaires, l'abandon obligatoire des filiales régionales ou encore les restrictions sur les aires d'atterrissage dans les aéroports achalandés font partie des points de divergence entre le pouvoir politique et Air Canada. La liberté opérationnelle d'un acteur économique privé se confronte aux exigences de réglementation que s'engage à assurer le pouvoir fédéral dans le respect du droit des consommateurs canadiens. Ce dernier, pour soutenir sa *Politique-cadre pour la restructuration de l'industrie du transport aérien au Canada,* dépose un texte officiel le 17 février 2000 où la protection des consommateurs, le service aux régions et la pérennité d'une saine concurrence se trouvent complétés par un accroissement des pouvoirs de l'Office des transports du Canada (OTC) afin de prévenir les tarifications abusives et les mesures d'éviction. Le projet de loi prévoit également la nomination d'un observateur indépendant pour surveiller et évaluer les répercussions de la restructuration de l'industrie du transport aérien pour une période de 18 à 24 mois. Après avoir été mis sous silence dès l'engagement du processus de restructuration aérienne, le Bureau de la concurrence se voit conférer de nouveaux pouvoirs d'intervention pour sanctionner les comportements anticoncurrentiels.

Cet affermissement de la politique réglementaire canadienne face à l'évolution du secteur du transport aérien national soulève plusieurs commentaires. Tout d'abord, l'exemple canadien met en lumière toute la difficulté des pouvoirs de réglementation à s'adapter à la rapidité des changements en cours dans l'industrie du transport aérien. Légiférer à une échelle nationale un secteur qui se conçoit dans une dynamique globale avec le poids croissant des grandes alliances transnationales pose un véritable problème (Larson, 2000). Les processus de fusion et d'acquisition dans le secteur aérien sont limités par le manque d'harmonisation et d'ouverture des systèmes de réglementation tant à une échelle nationale qu'internationale (Brooks, 2000). En outre, les pouvoirs politiques se doivent de trouver un juste équilibre entre la stimulation d'une concurrence profitable aux consommateurs et la prévention des positions dominantes qui risquent à terme de nuire à l'activité du secteur au complet. Les ajustements progressifs du gouvernement canadien dans le cas de la cession des activités de Canadien illustrent toute cette

complexité. De l'échelle nationale à l'échelle régionale et locale, la législation en vigueur a pour ambition de statuer afin de garantir un niveau de services suffisant dans une industrie aux mains d'opérateurs privés.

La desserte régionale au Canada : responsabilité politique et engagement des acteurs privés

Le regroupement des transporteurs régionaux par la compagnie dominante Air Canada annoncé dès le 20 janvier 2000 met l'accent sur le problème de la restructuration aérienne nationale canadienne[3]. Air Nova, Air Ontario et Air BC forment une nouvelle entité intégrée qui compte plus de 80 appareils, 3 000 employés, 84 destinations régulières et 880 millions de dollars de revenus annuels. Le Bureau de la concurrence justifie rapidement les nouveaux pouvoirs qui lui sont conférés par le gouvernement fédéral en exigeant la mise en vente officielle des filiales régionales de Canadien pour assurer la saine concurrence sur de nombreuses dessertes régionales[4].

L'initiative résume toute la complexité de négocier entre les ambitions économiques de la nouvelle entité aérienne canadienne et les pouvoirs publics qui se placent comme les derniers garants de la protection des consommateurs et des citoyens de tout le pays. En effet, la desserte aérienne des régions éloignées et/ou peu peuplées du Canada se trouve au cœur d'une problématique complexe qui confronte des intérêts tant politiques qu'économiques ou sociaux (Gauthier – Look, 2000). D'un côté, l'accès à un transport aérien pour des populations disséminées sur des espaces éloignés pose la question de l'engagement politique à soutenir la pérennité de services réguliers pas nécessairement rentables. De l'autre, les compagnies à capitaux privés cherchent en premier lieu à garantir la validité d'un investissement sur des segments aériens moins achalandés.

Air Nova et Air Alliance, les deux transporteurs régionaux de l'Est canadien d'Air Canada ont déjà fusionné leurs activités en mars 1999. La nouvelle organisation des services et le déploiement de nouvelles capacités permettent à la filiale d'Air Canada de proposer un total de 143 vols quotidiens réguliers au Québec! Cette

omniprésence fait craindre un abandon progressif des services réguliers de compagnies de moindre taille qui éprouvent des difficultés à se positionner sur des créneaux régionaux[5]. La compagnie Inter-Canadien qui mettait en relation plusieurs villes du Québec annonce à la fin de l'année 1999 la suspension de ses services suite aux difficultés financières de son principal partenaire, la compagnie Canadian International. Inter-Canadien cesse de manière officielle l'ensemble de ses activités début avril 2000 avec une créance totale de 68 millions de dollars[6]. Le même mois, la compagnie Air Montréal mettait un terme à ses activités après avoir desservi les marchés éloignés du Québec depuis 1993. La concurrence directe de Air Nova est mise en avant pour justifier en partie les difficultés du transporteur régional qui avait pourtant investi dans quatre nouveaux appareils Embraer de 26 places chacun afin de fidéliser une clientèle d'affaires[7].

La récurrence de ces cessations d'activité conduit à s'interroger sur la menace de la nouvelle puissance d'Air Canada sur les opérateurs plus modestes proposant des services réguliers adaptés aux conditions spécifiques des marchés régionaux. Sur quelle base s'opère l'exploitation de liens avec les régions éloignées et quels sont les relations entre les opérateurs ? L'analyse économique réalisée avant l'achat de Canadian par Air Canada dans le contexte géographique des Îles-de-la-Madeleine révèle les réalités opérationnelles inhérentes au transport régulier de passagers vers un espace insulaire éloigné. Elle pose la problématique de la viabilité économique d'une concurrence obligatoire dans un marché régional restreint et les risques de dérive, notamment en matière tarifaire, qui se profilent pour les usagers.

Le cas de la desserte aérienne des Îles-de-la-Madeleine

L'archipel de 202 kilomètres carrés, 13 802 habitants en 1996, se trouve dans le Golfe du Saint-Laurent à 215 kilomètres de la péninsule gaspésienne et près de 1 100 kilomètres de Montréal. La desserte aérienne de cet espace insulaire éloigné répond tout d'abord aux aspirations de mobilité et de déplacements rapides des populations locales et d'affaires. Elle agit également comme un

facteur stimulant de l'économie locale en assurant au meilleur coût et dans les meilleurs délais la circulation des produits depuis et vers un espace en discontinuité avec le continent. Enfin, la disponibilité de liaisons aériennes avec l'unique aéroport de Havre-aux-Maisons permet de supporter le développement de l'industrie touristique - 25 millions de dollars de retombées économiques en 1998 - deuxième secteur d'activité après l'exploitation et la transformation des ressources halieutiques.

En terme de capacités de transport pour l'année 1999, les services réguliers étaient assurés à 75 % par la compagnie Inter-Canadien avec deux vols quotidiens en semaine à destination de Montréal avec des escales à Québec, Gaspé et Mont-Joli. Inter-Canadien utilisait des ATR-42 de 44 sièges et assurait aussi des liaisons avec les Maritimes (deux vols sur Halifax) et les provinces de l'Atlantique (Moncton). La fréquence des services s'accommodait des exigences de la demande estivale avec des rotations supplémentaires étalées entre fin juin et fin août.

La compagnie Air Alliance, filiale de Air Canada positionnée sur le marché madelinot en 1988, apparaissait comme le concurrent direct d'Inter-Canadien avec des services réguliers qui reliaient les Îles-de-la-Madeleine à Montréal avec un appareil plus modeste de 18 sièges. Québec et Gaspé se connectaient au marché des Îles via des escales d'Air Alliance. La modularité des services permettait également de supporter la croissance des volumes de passagers pendant la courte saison touristique avec une deuxième liaison sur Montréal et sans escale à l'aide d'un appareil de 37 places. La troisième compagnie régulière arrivée en 1993 sur le marché des Îles est Air Montréal. Deux vols quotidiens d'une capacité de 14 sièges mettaient en relation les Îles-de-la-Madeleine avec Montréal via des escales sur Québec, Mont-Joli et Bonaventure. La compagnie se différenciait des deux premières par une politique tarifaire agressive reposant sur un minimum de services. Il venait s'ajouter à ces trois principaux transporteurs un ensemble de services aériens nolisés qui cherchait pour l'essentiel à tirer profit de la manne touristique estivale. SAS Air, les Ailes de Gaspé, Confortair, Prince-Edouard Air, Régionair et Air Satellite complétaient l'offre de transport aérien pour la desserte des Îles-de-la-Madeleine pour 1999.

C'est dans ce contexte de concurrence que le calcul de la tarification réelle des services aériens depuis les Îles-de-la-Madeleine a été opéré. D'un point de vue méthodologique, l'utilisation exclusive d'une base de données inédite mise à disposition par l'ancienne compagnie dominante Inter-Canadien soutient le développement des résultats sur les politiques tarifaires. L'analyse pour la desserte aérienne des Îles-de-la-Madeleine a été entreprise en deux temps.

Tableau 1
Comparaison des tarifs aériens pour différentes villes canadiennes à destination de Montréal, 1999

Régions/villes	Distance (km)	Tarif de base (aller-simple)	Coût/ Kilomètre
Québec			
Bagotville	433	318 $	0,73 $
Val-D'or	465	300 $	0,65 $
Rouyn-N	548	300 $	0,55 $
Baie-Comeau	672	378 $	0,56 $
Sept-Îles	883	406 $	0,46 $
Gaspé	913	442 $	0,48 $-
Mont-Joli	630	378 $	0,60 $
Havre St Pierre	1104	486 $	0,44 $
Blanc Sablon	1596	782 $	0,48 $
Îles-de-la-Madeleine	1 089	458 $	0,42 $
Maritimes			
Frédéricton	657	428 $	0,65 $
Saint-Jean (N.B)	720	518 $	0,72 $
Moncton	824	478 $	0,58 $
Halifax	939	531 $	0,57 $
Sydney	1235	696 $	0,56 $
Charlottetown	1122	586 $	0,52 $
Saint-John (T.N)	1891	759 $	0,40 $
Ontario et Ouest canadien			
Toronto	570	324 $	0,57 $
Sault-St-Marie	967	586 $	0,61 $
Windsor	943	531 $	0,56 $
ThunderBay	1422	616 $	0,43 $
Winnipeg	2074	806 $	0,38 $
Calgary	3441	1217 $	0,35 $

Source : Centre québécois de la logistique appliquée

Tout d'abord, une étude à partir des tarifs de base disponibles en 1999 positionne la desserte des Îles parmi 23 services aériens en vigueur avec un départ depuis Montréal (tableau 2). Les services au tarif régulier depuis les Îles vers Montréal sont inférieurs à ceux enregistrés depuis Sault-Ste-Marie, Havre Saint-Pierre ou même Gaspé où les conditions de marché rencontrées sont relativement semblables à celles de l'archipel. Le meilleur rapport coût/kilomètre au Québec se retrouve même au départ de l'aéroport madelinot (0,42 $/km). Cette lecture permet de constater que la desserte insulaire se compare avantageusement avec des services sur des villes ayant des volumes de marché nettement supérieurs. A titre indicatif, la ville de Halifax présente un coût supplémentaire de 0,15 $ par kilomètre parcouru pour un service régulier sur Montréal. L'insularité ne représente pas un argument pour une tarification abusive dans des conditions de concurrence rencontrées en 1999. Ces résultats somme toute positifs pour la desserte régionale des Îles se nuancent à travers une approche pluriannuelle (tableau 2).

Tableau 2
Évolution du tarif de base (aller simple) pour quelques services aériens au Québec, 1981-1998

Année	Îles-Mtl	Gaspé-Mtl	M-Joli-Mtl	Rouyn-N-Mtl	Saguenay Mtl	Sept-Îles-Mtl	B.C.-Mtl
1981	119$	116$	92$	98$	72$	99$	92$
1984	167$	164$	133$	127$	108$	137$	133$
1988	208$	207$	177$	138$	145$	182$	177$
1991	311$	299$	242$	191$	205$	262$	242$
1994	336$	323$	276$	217$	233$	297$	242$
1998	423$	409$	349$	277$	294$	375$	349$
Variation 1981-1988	74.8%	78.4%	92.4%	40.8%	101.4%	83.8%	92.4%
Variation 1988-1998	103.4%	97.6%	97.2%	100.7%	102.8%	97.5%	97.2%
Variation 1981-1998	255.5%	252.6%	279.3%	182.7%	308.3%	278.8%	279.3%

Source : SNC Lavallin.

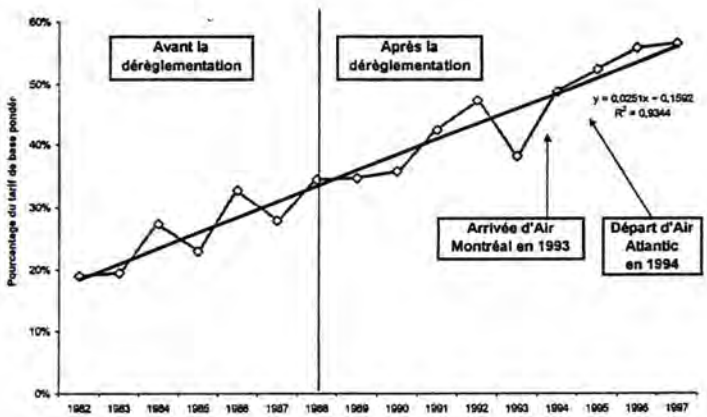
De prime abord, les variations générales sur la période 1988-1998 apparaissent plus homogènes que celles observables entre 1981 et 1988. Cela s'explique en priorité par la transformation de la structure de l'offre de transport. La fragmentation du marché régional aérien entre plusieurs petits transporteurs s'atténue progressivement pour laisser place à la fin des années 1980 à la domination de deux puissants opérateurs (Air Alliance et Inter-Canadien).

Sans pour autant établir de corrélation, force est de constater que les tarifs n'ont cessé d'augmenter sur toutes les destinations au Québec avec une hausse plus sensible encore dès 1988. La variation la plus élevée sur la dernière décennie est enregistrée pour les Îles-de-la-Madeleine (103,4 %), soit près de 4 points supérieurs à la moyenne (99,5 %) pour un aller simple supérieur à 400 $ dans des conditions régulières vers Montréal en 1998.

Cette première lecture tarifaire présente des limites. Les pratiques de réservation des passagers et la systématisation des procédures de réduction des tarifs sur des bases promotionnelles sont ignorées. En effet, la croissance des coûts réguliers de transports se trouve pondérer lorsque l'on utilise les tarifs réels que paient les consommateurs sur les liaisons aériennes au Québec. Les informations recueillies auprès des transporteurs et des agents de voyage permettent d'affirmer qu'environ 80 % des voyageurs aériens aux Îles-de-la-Madeleine ont profité de réduction (MRC des Îles-de-la-Madeleine, 2000). Selon les formules[8], un billet aller-retour oscille entre 233 $ et 433 $ avant taxes. A ces réductions que l'on peut qualifier de « régulières » s'ajoutent les formules saisonnières et promotionnelles qui fixent le coût moyen d'un vol aller-retour sur Montréal aux alentours des 300 $.

Les informations transmises par l'opérateur dominant qu'était Inter-Canadien ont permis de mesurer la moyenne en pourcentage des rabais dont profitaient les voyageurs ainsi que le niveau de l'escompte moyen alloué depuis 1982 (figure 1).

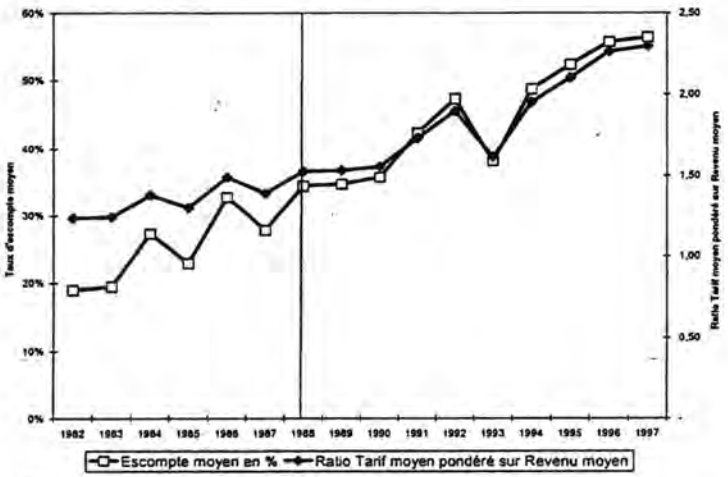
Figure 1
Évolution de l'escompte moyen accordé aux voyageurs des Îles-de-la-Madeleine sur Inter-Canadien
(en % du tarif de base pondéré, 1982-1997)



Source : Centre québécois de la logistique appliquée

L'analyse des données révèle que l'augmentation réelle des prix réguliers des liaisons aériennes sur les Îles-de-la-Madeleine s'accompagne d'une hausse quasi-constante du niveau d'escompte. En clair, le pourcentage d'escompte sur un tarif aller-retour est passé de 19 % en moyenne pour l'année 1982 à 56 % en 1997. Il est intéressant de constater que l'arrivée du concurrent Air Montréal aux côtés d'Inter-Canadien et d'Air Canada a eu pour effet de relancer le processus d'escompte alors que celui-ci tendait à fléchir (1993). Les informations du transporteur aérien dominant offre la possibilité de calculer l'évolution du ratio entre le tarif moyen pondéré (tarif de base) et le revenu moyen par passagers avec celle du taux d'escompte moyen sur la période 1982-1997 (figure 2).

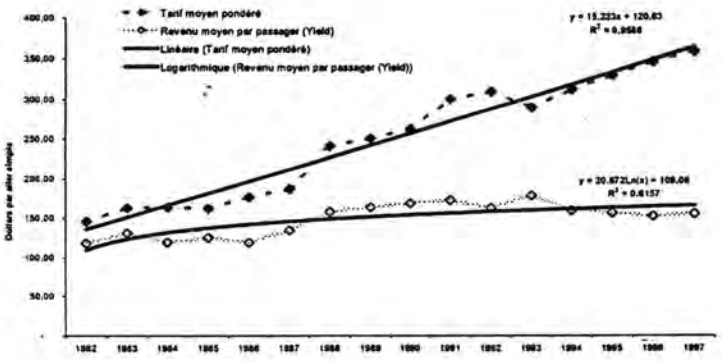
Figure 2
Évolution du tarif moyen pondéré sur revenu moyen par passager au départ des Îles-de-la-Madeleine et taux d'escompte moyen. 1982-1997



Source : CQLA à partir des données d'Inter-Canadien

Avant 1988 et la déréglementation, le ratio oscille entre 1 et 1,40 ce qui signifie que peu d'escomptes sont alloués aux passagers. Les recettes de la compagnie aérienne pour le transport d'un passager correspondent sensiblement au tarif de base régulier. A partir de 1990, l'écart entre le tarif de base et les prix payés par les passagers progresse de façon régulière. Le ratio du tarif moyen pondéré sur le revenu moyen approche 2,4 en 1997 ce qui tend à démontrer que le poids économique des escomptes progresse. Le revenu moyen du transporteur par passager n'augmente pas au rythme du tarif de base publié régulièrement revu à la hausse. Pour confirmer cette tendance, les évolutions du revenu moyen et du tarif de base moyen pour le service aérien sur les Îles-de-la-Madeleine ont été calculées entre 1982 et 1997 (figure 3).

Figure 3
Évolution du revenu moyen et du tarif de base moyen d'Inter-Canadien sur la desserte des Îles-de-la-Madeleine. 1982-1997



Source : Centre québécois de la logistique appliquée

Le tarif de base montre une croissance constante sur l'ensemble de la période considérée alors que la courbe du revenu moyen par passager se stabilise à partir de la fin des années 1980. L'écart entre les deux courbes matérialise l'accroissement des escomptes accordés aux voyageurs. Toutefois, les données à disposition montrent une limite puisque le revenu par passager d'un transporteur et le tarif de base ne sont pas fonction d'une liaison précise mais d'une moyenne générale pour toutes les destinations en partance des Îles. D'un point de vue méthodologique, le revenu moyen pondéré généré par le transport d'un passager devrait être calculé tout comme le tarif moyen pondéré en faisant abstraction des destinations finales.

Néanmoins, il est possible de conclure qu'entre 1982 et 1998 et malgré les nombreuses restructurations subies sur la desserte aérienne avec les Îles, le prix moyen d'un billet aller simple est

demeuré relativement stable. Cela signifie que la hausse des prix réguliers affichés ne s'est pas effectivement répercutée dans les faits sur les tarifs réels payés par les passagers voyageant sur les Îles-de-la-Madeleine.

La concentration des actifs aux mains des transporteurs dominants canadiens ne s'est pas directement traduite dans les faits par une hausse réelle du prix payé par les consommateurs. Cette analyse met en lumière le fait que dans des conditions spécifiques de marché, la faible concurrence entre transporteurs aériens n'est pas synonyme nécessairement d'une hausse des tarifs. Inter-Canadien, Air Alliance et Air Montréal se livraient une concurrence active avec une fréquence élevée de services (5 vols quotidiens réguliers au total) et une capacité supérieure aux exigences mêmes de la desserte madelinienne. La complémentarité des services des trois grandes compagnies, supportée par les connexions depuis les aéroports de Québec et surtout de Montréal, permettait une ouverture aérienne régionale, nationale et internationale aux Madelinots. D'un point de vue qualitatif, Inter-Canadien, qui contrôlait 75 % du marché, persistait à se démarquer par des services fiables et ponctuels puisque seulement 2 % des vols avaient subi un retard sur les années de référence 1996 et 1997. L'analyse tarifaire a replacé également le niveau réel déboursé par les voyageurs des Îles situé en moyenne à 400 $ pour un aller-retour sur Montréal. Le contrôle du marché par quelques grands opérateurs relayés par des transporteurs nolisés pendant la période estivale n'a pas altéré la qualité générale des services aériens. La forte saisonnalité d'un trafic total estimé à environ 40 000 passagers ces dernières années demeure une contrainte économique à ne pas négliger pour les transporteurs réguliers (MRC des Îles-de-la-Madeleine, 2000). Les taux de remplissage, qui dépassent les 60 % entre juillet et septembre, sont inférieurs à 50 % pour l'ensemble des autres mois de l'année. Le coefficient de remplissage moyen à l'année sur la période 1982-1997 s'établit à 45,1 % malgré les presque 90 % de remplissage enregistré chaque mois d'août.

Air Canada dorénavant seul depuis quelques mois, il reste à attendre ses décisions en matière de déploiement aérien sur les Îles et

surtout observer comment les tarifs et les services vont évoluer sans la présence d'une concurrence restreinte... mais stimulante.

Conclusion

Une décennie après sa privatisation, Air Canada est devenu l'unique grand transporteur de lignes régulières de passagers au Canada. Sous la surveillance d'un pouvoir de réglementation conscient de son rôle de garant des intérêts des consommateurs canadiens, Air Canada développe des services dominants autant sur les grands segments entre les métropoles canadiennes que sur des marchés régionaux moins porteurs et plus difficiles à gérer. Les habitants des Îles-de-la-Madeleine, desservies à 75 % par la défunte Inter-Canadien jusqu'en 1998, se retrouvent avec uniquement la compagnie Air Nova, filiale de Air Canada pour voyager depuis les Îles. L'analyse des données fournies par Inter-Canadien a démontré que malgré une position largement dominante, les tarifs réels payés par les voyageurs n'avaient pas augmenté. La pérennité d'une concurrence active entraînait une saine stimulation et l'arrêt des activités d'Inter-Canadien en 1999 et de Air Montréal en 2000 pose dorénavant le problème de la situation à venir et des éventuels recours du pouvoir fédéral en cas d'abus.

Le Comité consultatif des transports de la MRC des Îles faisait déjà état de récriminations à l'encontre de services proposés par Air Nova devenu l'unique transporteur aérien régulier sur les Îles-de-la-Madeleine[9]. Des hausses tarifaires ont déjà été constatées alors que le Comité permanent des transports de la Chambre des communes avance que les services d'Air Nova s'établissent à 630 $ pour un aller-retour sur Montréal contre 350-400 $ pour le même vol avec la défunte Inter-Canadien. Des problèmes de flexibilité sont dénoncés notamment pour le transport des petits groupes de personnes ou le transport fragile des homards vivants. Ces premières critiques émanent-elles déjà de la dérive monopolistique générée par la conservation des actifs d'Inter-canadien par Air Canada et sa filiale Air Nova ? La situation de monopole d'Air Nova signifie-t-elle de manière irréversible une dégradation de l'offre de transport ? Dans quelle mesure le gouvernement fédéral peut-il garantir ses

engagements vis-à-vis de la protection des consommateurs ?[10] Ces questions restent ouvertes afin de ne pas voir se dégrader la desserte aérienne d'un espace insulaire de plus en plus prisé des touristes.

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Truck Safety and Safety Regulations

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Introduction

This paper examines differences in truck collision rates among provinces and territories and between Canada and the United States. Collision rates are one objective measure of highway safety. They indicate how one jurisdiction is performing compared to another or how one jurisdiction is performing over time. What they do not reveal, however, is why one jurisdiction has more or fewer collisions than another. Many factors are involved and it has not been possible to develop highway safety models sufficiently robust to explain these differences.

One factor that (presumably) explains highway safety is the large number of truck safety regulations. This is the interest of this paper. Canadian jurisdictions have spent more than a decade implementing the National Safety Code. They still have some way to go to finish the process. It is time to begin to think how the effectiveness of these safety regulations can be evaluated.

Background

An earlier paper[1] compared truck collision rates among Canadian jurisdictions. This is difficult to do without a good measure of exposure (vehicle kilometres of travel). A number of proxy measures were used: collisions per registered trucks (where registration numbers themselves may not have been accurate), collisions per capita; collisions per litre of diesel fuel sold (even though some trucks are powered by other fuels and even though fuel sold in one place

may actually be used in another); and collisions per tonne of for-hire freight (even though the denominator only covers the activity of roughly one in six trucks). None of these rates, or other measures developed, was good enough to reach strong conclusions. However, it is interesting that some jurisdictions—most notably Québec—consistently showed up poorly in these comparisons while other jurisdictions—Prince Edward Island, Nova Scotia, New Brunswick, Manitoba, Saskatchewan and (to a more limited extent) British Columbia and the two territories—showed up rather well. Many factors could account for these (apparent) relative rankings and it is not possible to conclude that they have much to do with differences in truck safety programs.

The earlier paper compared collision rates in Canada and the United States. There are qualifications about the quality of data, particularly the estimate of Canadian vehicle kilometres of travel and, to a lesser extent, the available Canadian information on the number of trucks. Nevertheless, four rates, each calculated as the fatal rate and the total collision rate, showed little difference between the two countries: (1) trucks involved in collisions per capita, (2) trucks involved in collisions as percent of all vehicles involved in collisions, (3) trucks involved in collisions per registered truck, and (4) trucks involved in collisions per kilometre of travel. For example, the total collision involvement rate per 100,000 people in 1996 was 150.7 in Canada and 148.9 in the United States. Assuming collisions are defined in the same way in both places, this is probably an accurate comparison as, in both countries, accurate data exist for both the numerator and the denominator. ("Accurate" in terms of data available in the earlier paper. As a measure of collision rates it has a number of flaws, the most important of which is that it does not take into account the relative intensity of truck activity.)

The puzzle is that (1) Canada has heavier trucks than the United States (some allege that safety is compromised as truck weight increases and Canada's national 62.5 tonnes is considerably heavier than the US 80,000 lb); (2) Canadian roads are probably not as good as those in the United States (there is more travel on two-lane roads

and collision rates are much lower on high-class, divided freeways than they are on two-lane roads); (3) Canada presumably has worse weather (snow and ice); (4) Canada does not have drug and alcohol testing (the United States has had such regulations in place for over a decade); (5) Canada is behind the United States in some areas of safety regulations (eg, assigning safety-ratings or measuring relative levels of safety performance); (6) Canada allows longer hours of work for truck drivers than does the United States; (7) Canada probably has a worse record on safety audits ("compliance reviews" as they are known in the US) as not all provinces are doing such audits vigorously.

Despite these differences, the apparent truck collision rates are not much different. It seems odd that all these regulatory, road design and climatic differences seem to have so little impact.

Since this earlier paper was prepared, Canadian jurisdictions have continued to implement the National Safety Code (most particularly, NSC #14 which specifies how carriers are given a safety rating based on their performance), a new survey has appeared that develops estimates of truck travel, and there is now a more accurate count of truck registrations. All of this suggests that the issue of truck safety, and how truck safety regulations affect on-highway safety, needs revisiting.

Data

Transport Canada collects truck collision information from the provinces and territories and there now are consistent statistics from all jurisdictions for the period 1991 to 1998. "Consistent," in this case, means common definitions of a truck and of severity (fatal, injury, property). The latest information is shown in Table 1.

Statistics Canada's new survey[2] allows, for the first time, estimates of kilometres of travel. It also allows an estimate to be made of the fleet. Prior to this, registration statistics were available[3] but there were problems. Registration numbers were only a summary of provincial and territorial summaries and it was suspected that there were

inaccuracies. Things like duplicate registrations (a vehicle registered in two jurisdictions), lapsed registrations (vehicles taken off the road) and different definitions (eg, in some provinces a fire truck was a truck, in others it was something else) contributed to these problems. Second, "truck" in these statistics (all 3.4 million of them in 1995) included anything the province or territory registered as a truck. This meant that most were small pickups and panel vans. Under the National Safety Code, a truck is only a truck if it has a registered weight of more than 4,500 kilograms. This is roughly the point where a two-axle truck goes from four to six tires (ie, dual tires on the drive axle). It roughly coincides with how a truck is defined in US data sources[4] and it coincides with the definition used by Transport Canada in compiling collision data.

Table 1: Trucks Involved in Collisions, 1998

	Fatal	Injury	Property	Total
Nfld	2	72	219	293
PEI	4	29	56	89
NS	7	151	471	629
NB	18	180	490	688
Que	121	2,272	13,065	1,5458
Ont	126	2,783	11,559	1,4468
Man	15	282	867	1164
Sask	26	258	1,082	1366
Alta	78	1,251	6,001	7,330
BC	51	969	1,541	2,561
Yukon	3	10	38	51
NWT	1	12	34	47
Canada	452	8,269	35,423	44,144

Source: Transport Canada, TRIAD

However, even with these new estimates on the number of trucks and vehicle kilometres of travel (vkt), there are still problems. The first, for this paper, is that at the time of writing only two quarterly surveys —fourth quarter of 1999 and first quarter of 2000—were available. To provide an initial look at what collision rates in Canada may be, these data are used as follows: (1) the average number of "in-scope"

trucks for the two quarters are used to estimate vehicle populations, and (2) total vkt for the two quarters is doubled to give an estimate of annual travel. Results are shown in Table 2. If travel peaks in the summer, the estimate of annual vkt may be lower than the true number. There is some indication that this is, in fact, the case. Statistics Canada used to produce a quarterly survey of for-hire carriers that included estimates of total travel. In 1993, of the 6.1 billion kilometres of travel, 48.7% occurred in the first and fourth quarters.[5] Presumably, then, collision rates developed here are over-stated as—assuming for-hire truck activity is indicative of all truck activity—the denominator is 2%-to-3% smaller than it should be. However, the use of vkt information for the period October 1999 to March 2000 along with collision information for the year 1998 presumably has the opposite effect. That is, with a growing economy, it is likely that truck vkt is increasing by 2%-to-3% per year.

Table 2: Truck Populations and Exposure, 1999-2000

	Trucks	Annual Vkt (millions)
Nfld	5,899	108.8
PEI	4,157	74.6
NS	14,453	739.4
NB	10,515	230.8
Que	74,477	4,320.6
Ont	163,802	11,999.2
Man	19,061	910.6
Sask	67,987	1,223.0
Alta	139,654	5,391.0
BC	63,089	2,333.4
Yukon	2,164	79.0
NWT	1,746	62.0
Canada	567,002	27,472.4

some, (3) Estimate of annual activity is based on information from Statistics Canada for 6 months.

The second problem is that both the fleet numbers and the vkt are estimates and some numbers shown for vkt on Table 2 are not reliable. There is either missing data (for one of the two categories of trucks used in the survey or for one of the two quarters) or the estimates have coefficients of variation above 25%. The only estimates of vkt that may be considered reliable (if doubling six months of information to estimate annual activity is acceptable) are those for Québec, Ontario, Alberta, British Columbia and Canada.

Third, there are still questions about the reliability of the numbers on truck populations. The jurisdiction where the problem appears most severe is Québec and this may be because it is the only province that does not register trucks on a gross weight basis. (The new survey classifies trucks on the basis of registered weight.) Consider the following three numbers: (1) the registration agency (SAAQ) itself showed 100,718 registered trucks in the province in December 1996[6], (2) a 1995 estimate, based on R.L.Polk data obtained by Transport Canada, showed 125,408 trucks (at the time, it was thought that the difference between 100,718 and 125,408 was accounted for by farm trucks), and (3) the "in scope" trucks—registered trucks that, on the basis of Statistics Canada's new survey, exist during the survey period—for the first quarter of 2000 numbered 66,201. There is quite a difference in these three numbers and there has to be some suspicion about the accuracy of Statistics Canada's latest ones.

Truck Crash Involvement Rates

Collision rates on Table 3 have been calculated in a number of ways. Note the warning about reliability at the bottom of the table. In particular, estimates of vkt used in the first column are known to be problematic except in the four largest jurisdictions (plus Canada). It is suspected that there is a problem with the estimate of the fleet in Québec used for the denominator in column two (and, if this is the case, this means there is a problem with the vkt for Québec in the first column). Collision rates per capita are not good indicators of the relative safety performance of different jurisdictions (they do not account for different levels of activity) but they have been included in columns three and four because it is known that the numbers in both

the numerators and denominators are accurate. The last column is included to provide an indication of where truck safety has improved (or, in one case, worsened) over the eight-year period.

With these caveats, then, there is not much to say about the relative safety performance of different jurisdictions. Five that ranked high in the earlier paper, using a different mix of measures, also rank fairly

Table 3: Truck Collision: Rates and Trends

	1. Collisions per 100 million km	2. Collisions per 1,000 trucks	3. Collisions per 100,000 people (1991)	4. Collisions per 100,000 people (1998)	5. Change in Collision Rate per capita, 1991-1998
Nfld	269.3	49.7	85.3	54.0	-36.8%
PEI	119.3	21.4	88.5	65.4	-26.0%
NS	85.1	43.5	94.6	67.2	-29.0%
NB	298.1	65.4	159.1	91.5	-42.5%
Que	357.8	207.6	219.4	210.8	-3.9%
Ont	120.6	88.3	137.3	126.9	-7.6%
Man	127.8	61.1	131.0	102.0	-22.1%
Sask	111.7	20.1	160.7	133.1	-17.2%
Alta	136.0	52.5	191.6	251.6	+31.3%
BC	109.8	40.6	174.3	63.8	-63.4%
Yukon	64.6	23.6	279.3	159.4	-42.9%
NWT	75.8	34.5	147.5	69.1	-53.2%
Canada	160.7	77.9	166.1	145.7	-12.3%

Warning: Some estimates are not reliable
Note: all rates shown are the number of trucks involved in collisions

high on Table 3: Prince Edward Island, Nova Scotia, Manitoba, Saskatchewan and Northwest Territories. Two that ranked low in the earlier paper also rank low on Table 3: Québec and Alberta. Admittedly it is suspected there is a problem with the numbers for Québec

in columns one and two (collision rates well over double the national average?). There are no problems, however, with the numbers in columns three and four and, in both cases, the rate for Québec is significantly higher than it is in other jurisdictions. In the case of Alberta, it appears odd that the performance indicated in the first two columns is relatively good (better than the national average) but that the performance in the last three columns appears so poor. Part of the explanation is the relative level of truck activity. There are 4.7 trucks per 100 people in Alberta compared to a national average of only 1.9 and annual truck travel per capita amounts to 2,559 kilometres compared to a national average of only 897 kilometres.

Canada/United States Collision Rates

Table 4 contains a comparison of Canada and the United States.[7] In considering road safety, it is the total occurrences of collisions that are important. However, because there may be different definitions used, comparisons of total trucks involved in collisions on both sides of the border may be slightly inaccurate. Therefore, fatal and injury collision rates are also shown.

There are qualifications about the accuracy of the information shown. Important ones about Canadian data have already been mentioned (collision data for 1998 and vkt estimated from Q4-1999 and Q1-2000 surveys; reservations about the number of trucks included in the survey in at least one province). The impact may be to make the rates shown in the last two lines (per registered truck and per kilometre) slightly higher than they should be (the denominators may be too small). In the United States, information on trucks involved in fatal collisions is considered accurate. But the numbers for total collisions are an estimate and information on total trucks and total vkt may not be entirely accurate. Considering both countries, the definition of a truck is slightly different in these numbers (it is believed that this difference is not serious). What is not known, and this may be serious, is whether the definition of a collision in both countries is similar. Presumably, definitions of "fatal" and "injury" are the same but the precise definition of "property only" is not known in either country.[8]

Table 4: Canada-United States Comparison, 1998

		Can	US
Truck Activity			
	Trucks/100 people	1.9	2.7
	Truck vkt/person	906.7	1,172.5
Trucks Involved in Collisions			
	Total	44,144	412,000
	Fatal	452	4,935
Change in # Trucks Involved (1991-1998)			
	Total	-5.2%	+24.7%
	Fatal	-14.9%	+13.5%
Trucks Involved in Collisions per 100,000 population			
	Total	145.7	153.1
	Injury	27.3	33.1
	Fatal	1.5	1.8
Trucks Involved in Collisions per 1,000 registered trucks			
	Total	77.9	61.3
	Injury	14.6	12.3
	Fatal	0.8	0.7
Trucks Involved in Collisions per 100 million kilometres			
	Total	160.7	130.6
	Injury	30.1	28.2
	Fatal	1.7	1.6

As in the previous section, then, only cautious observations are possible. The first is that there is more truck activity in the United States than in Canada. (There is a concern that Statistics Canada's new survey may not have captured all activity. But, even if some activity is missing in the first row of the table, there is no possibility that the missing amounts could make the ratios shown for Canada as high as the ratios in the United States.) This higher relative level of truck activity probably accounts for part of the higher collision rates in the United States when population is used as the denominator.

The second observation is that, while the absolute number of collisions has been falling in Canada, the opposite is true in the United States. Presumably, this has something to do with the faster pace of economic activity in the United States during the 1990s.

The third and potentially most significant observation is that the last two lines (collision rates per truck and per kilometre) seem to indicate a somewhat higher rate of collisions in Canada than in the United States. Admittedly, given the possible weaknesses in the data, this has to be labelled a tentative observation.

Truck Collision Causality

Many factors contribute to the cause or severity of a collision—the road design; the design of the vehicle; the load-securing devices and the characteristics of the freight; the weather; the skill of the driver, the size, weight or configuration of the truck; traffic levels; compliance with safety regulations; etc. The phenomenon is so complex that it is difficult to sort out cause and effect. This gives regulators a problem when it comes to designing or implementing new or revised regulations, or enforcing existing ones. They are put in the position of having to say how many collisions will be avoided, or how many lives will be saved, if, for example, the specifications for rear bumper guards on trailers are changed or if, as another example, allowable hours of work for truck drivers change.

Regulators and road agencies in both Canada and the United States have ambitious goals to improve road safety. The new US Federal Motor Carrier Safety Administration has announced a goal of reducing truck-related fatalities by 50% by 2010 and the number of persons injured by 20% by 2008. The baseline, in both cases, is 1998. In Canada, regulators have set a target of reducing by 2010 the number of persons killed or seriously injured in collisions related to commercial vehicles (trucks or buses) by 20%. The baseline is the average numbers for the years 1996 to 2001.

It is difficult for regulators to set such goals when the understanding of how regulations affect road safety is so weak. With the exception

of the occasional research effort in the United States, there has been little effort put into trying to understand the effectiveness of safety regulations—the implementation of, the enforcement of, or the compliance with.

Research on the Effectiveness of Regulations
The limited research in this area includes the following:

Moses and Savage test the effectiveness of the US Department of Transportation's safety audit program. For the period considered (1980s and early 1990s), auditors made two types of visits to a carrier's office. The first, a Safety Review (SR), was relatively short and mainly educational. Based on the answers to 75 questions and other information (roadside inspections, violations and collisions), the carrier was rated Satisfactory, Conditional or Unsatisfactory. Any carrier found to be Unsatisfactory was visited a second time. This second audit, or Compliance Review (CR), is far more detailed than the SR audit. To test the effectiveness of this program, Moses and Savage take the complete dataset from the FHWA (about 85,000 motor carriers) and look at the 5,961 rated Unsatisfactory after their initial SR. Of these 5,961 firms, 91% received a higher rating after their CR audit, leading to the conclusion that the results of the first audit, and the Unsatisfactory rating, have led management to improve safety-management practices. Further, for these 91% of the 5,961 carriers, the collision rate falls by 42.7% after the initial audit but before the second CR audit. This is strong evidence that the audit program, including the rating, is having its desired effect on management practices.[9]

In a 1995 analysis, the Office of Motor Carriers computes the number of trucks involved in fatal crashes for the years 1988 to 1993 under two headings: interstate and hazardous material carriers (subject to federal safety regulations), and intrastate carriers (not all subject to federal regulations). Whereas the number of trucks involved in fatal crashes under federal regulations fell (24.3%) over the six-year period, the number of intrastate trucks involved in fatal crashes rose (12.2%). The authors conclude, "the overall impression . . . is that

vehicles subject to Federal safety regulations are becoming increasingly safer than those that are not subject."[10] (The omission here is some indication that the relative level of activity of the two groups of carriers did not change.)

In a more complex 1998 analysis, Madsen and Wright develop a model of the impact of CRs.[11] During a CR, the auditor records all reportable crashes during the previous 12 months and the total vehicle miles of travel (vmt). From this, a crash rate can be calculated. Madsen and Wright select all carriers that have received two or more CRs from April 1993 to June 1997. From this group, they then select the 1,738 with CRs from one to two years apart (ie, so the crash rates do not overlap). The analysis shows that, at the time of the initial CR, carriers had a crash rate of 0.750 (0.75 crashes per million vmt). At the time of the second CR, carriers had a crash rate of 0.661, a 12% improvement. Madsen and Wright conclude: ". . . CRs do have a positive effect on carriers by lowering their crash rates."

The US system relies on an audit (CR) to produce a rating. Since resources are not available to audit all carriers (>450,000), the regulators developed another means of assessing on-going performance of carriers—the SafeStat (the Motor Carrier Safety Status Measurement System) which is now used to help auditors target carriers most in need of a CR. The details on how a SafeStat is calculated are not important here.[12] What is important is that Madsen and Wright assessed the effectiveness of this tool.[13] Note, then, that this is an assessment of a tool, not an assessment of a program in terms of its ability to improve safety. The analysis is complex but, and at the risk of over-simplifying, it can be summarized as follows: assuming that SafeStat is, in fact, a good measure of on-going safety performance, there ought to be a correlation between a SafeStat score and a carrier's collision rate. Indeed, this is found to be the case. Carriers with the worst SafeStat score have a collision rate 169% of the rate for carriers with the best score.[14] This may seem a tautology as the SafeStat score itself is heavily influenced by the collision rate. But, in the analysis, it is the SafeStat score at one particular time

(April 1, 1996) that is compared to the collision rate 18 months after that date.

While all of the above (albeit, limited) research confirms that the safety regulations evaluated are effective, there is other research suggesting the opposite or, at least, raising questions. The work by Moses and Savage raised questions about the effectiveness (or, more accurately, the benefit-cost ratio) of roadside inspections. A more recent study in Illinois[15] looked at all trucks stopped for an inspection in the state over a number of years (almost a million trucks), and then the crashes those vehicles were involved in during a 12-month period after the inspection. There was no significant statistical relationship between those trucks found with an out-of-service defect and crash rates. One would suspect that carriers that allow vehicles or drivers out on the highway with defects serious enough to be classified as out-of-service would tend to have more crashes than other carriers. Apparently not. And this possibly raises a question about the point of roadside inspections.

There may be more research available on the effectiveness of safety regulations but the above paragraphs give some idea as to what exists and what conclusions have been reached. All the research cited is from the United States. There has been no recent research on this subject in Canada.

Safety Regulations

The most important truck safety regulations in Canada are those of the National Safety Code. And the most important standard in the code is NSC#14 as this is where, in effect, a carrier's compliance with other safety regulations is judged. Provinces and territories are at various stages of implementing NSC #14 and the federal government is planning to amend current legislation such that any jurisdiction that has not implemented this safety-rating regime will have its power to issue operating rights to extraprovincial carriers removed.[16] (It is difficult to believe Ottawa would ever exercise this power but, and this difficulty aside, this is the current plan.) The problem is that provinces and territories are all implementing NSC

#14 in somewhat different fashions with the result that there is no nationally consistent safety-rating regime emerging.[17] And this is where the lack of research into safety regulations becomes critical. In assessing the different procedures now being developed, it is almost impossible to determine which safety-rating regime is better or worse (more or less effective) than any other. It may be that it will take some years to make this determination. But, such a determination can only be made in those jurisdictions where procedures are established to assess the effectiveness of the regulations.

Even if all jurisdictions were implementing a completely uniform safety-rating regime, there would still be a need for research into the effectiveness of these regulations. The tax-paying public and the industry, which bears much of the cost of this regulatory burden, have the right to know if the money is being spent wisely.

Summary

The understanding of truck collision causality is weak. Nevertheless, regulators put great store in improving on-road safety by developing elaborate truck safety regulations. Little effort, particularly in Canada, is put into trying to understand the effectiveness of these regulations. It may be that three-quarters of all collisions involving a commercial truck and a passenger vehicle are caused by the driver of the smaller vehicle. This cannot be proven, but there is evidence from the United States suggesting this may be the case.[18] If it is true, it is legitimate to raise this question: Is all the effort spent on truck safety programs misplaced? This paper does not have the evidence to answer such a question and, indeed, given the political pressures, it is impossible to believe that (whatever the answer) it would ever be possible to dismantle the current basket of truck safety regulations. But it is at least possible to ask that truck safety regulators attempt to evaluate the effectiveness of their programs. A good place to start (in Canada) would be research on the impacts of safety-rating regimes.

Endnotes

1 Nix, F.P., 1999, "Truck Safety: Assessing the Impact of the National Safety Code," *Proceedings*, CTRF meeting, Montréal, pp 278-290.

2 Statistics Canada, Transport Canada and the Canadian Council of Motor Transport Administrators, *Canadian Vehicle Survey*, Statistics Canada cat #53F0004-XIE.

3 Statistics Canada, *Road Motor Vehicles – Registrations*, cat #53-219

4 The Americans, for safety regulations, define a truck as a vehicle with a manufacturers' gross weight rating of 10,000 lb or more. In US collision data, a truck has at least two axles and six tires.

5 Statistics Canada, *Service Bulletin: Surface and Marine Transport*, cat #50-002, Vol 10, no. 4, August 1994

6 "Orientation du Ministère des Transports du Québec Concernant les Charges et Les Dimensions des Véhicules Lourds," Rencountre de Presse, 12 décember 1996, p 3.

7 Sources for US data: (1) collisions from the FMCSA's publication "Large Truck Crash Profile: The 1998 National Picture", (2) number of trucks and vkt are from the FHWA's "Annual Vehicle Distance Traveled in Kilometres and Related Data – 1999 1/ By Highway Category and Vehicle Type" and (3) population is as reported in OECD "Labour Force Statistics 1979-1998"

8 As far as is known, "police reported" is used in both countries to define a collision, at least in the data used here. What is not known is whether the requirement to report a collision is the same in all states, provinces and territories.

9 Moses, L.N. & I. Savage, 1997, "A cost-benefit analysis of United States Motor Carrier safety programs," *Journal of Transport Economics and Policy*, 31(1), pp 51-67. The complete analysis is considerably more complex than as described here (it was a benefit-cost analysis).

10 Office of Motor Carriers, 1995, "The State of Motor Carrier Safety," *MCSAFE*, Vol 1, no ii, November 1995

11 Office of Motor Carriers, 1998, "Compliance Review (CR) Impact Assessment Model, Version 1.0," *MCSAFE*, Vol 3, no iii, March 1998

12 SafeStat evaluates the relative safety status of individual carriers with respect to the rest of the carrier population in four areas (SEAs) - Accident, Driver (moving violations or OOS events), Vehicle (OOS events or violations detected during a CR), and Safety Management (factors determined during a CR or other enforcement action). SafeStat uses up to 30 months of carrier safety data to develop measures and indicators in the four SEAs. The four SEA values are then combined into

an overall safety status assessment known as a SafeStat Score. Time markers are used to weight more recent events more heavily than more distant events and weights are also used to give more importance to the accident SEA than other SEAs.

[13] Madsen, David G & Donald G. Wright, 1998, "An Effectiveness Analysis of SafeStat (Motor Carrier Safety Status Measurement System)" TRB paper 990448, Washington DC.

[14] Strictly, the statement in the text is not quite accurate, as the "best" carriers do not have a SafeStat score. Also, the collision rate is more complex than implied as there is some weighting that is applied to the numbers. But these inaccuracies and complexities are not important here.

[15] Thakuriah, P., G. Yanos, Jung-Taek Lee and A. Sreenivasan, 2001, "Motor Carrier Safety: An Assessment of Enforcement Strategies" TRB Paper 01-2426, Washington, DC.

[16] Transport Canada, 1998, *Review of the Motor Vehicle Transport Act: Position Paper*, TP 13612, Ottawa.

[17] Nix, F.P., 2000, *National Safety Code Standard #14: Description and Analysis of Procedures*, Road Safety & Motor Vehicle Regulations, Transport Canada, Ottawa.

[18] Office of Motor Carriers, 1995, "The State of Motor Carrier Safety," *MCSAFE*, Vol 1, no ii, November 1995. The FARS database suggests that in 71% of two vehicle fatal crashes involving large trucks, police report one or more driver factors (eg, "driving too fast") for the driver of the other vehicle and none for the truck driver. The authors of this piece, however, suggest that this does not necessarily prove the driver of the non-truck vehicle was at fault. In a more recent publication, the FMCSA writes as follows: "In two-vehicle fatal crashes involving a large truck and a passenger vehicle, driver-related crash factors were coded for 26 percent of the truck drivers involved. In contrast, driver-related crash factors were coded for 82 percent of the passenger vehicle drivers involved." (*Large Truck Crash Profile: The 1998 National Picture*, January 2000)

Titre :Évolution des conditions économiques des conducteurs –propriétaires, 1991-1998

Par Gilles Paré

RÉSUMÉ –

À titre de travailleurs autonomes, les conducteurs–propriétaires produisent près de 15 % des recettes annuelles totales du secteur du transport routier des marchandises au Canada, soit près de 6 milliards de dollars en 1997. Ce secteur de l'industrie du transport est largement dominé par les entreprises de transport pour compte d'autrui de longues distances. Dans la structure financière de certaines entreprises de transport routier le coût des conducteurs propriétaires se compare aisément au plus important poste des dépenses tels les salaires et traitement. De ce fait, les conducteurs propriétaires deviennent un enjeu important dans les prises de décisions commerciales et d'exploitation des grandes entreprises de camionnage qui les engagent et ce, surtout au cours des périodes de haute compétitivité.

Les données de l'enquête annuelle de Statistique Canada – *Petits transporteurs routiers pour compte d'autrui et chauffeurs–contractants* révèlent, pour la période 1991 à 1998, les performances financières des conducteurs propriétaires..

Au cours des années 1990, plus de 40,000 camionneurs artisans ont évolué dans un marché en pleine effervescence favorisé par des échanges commerciaux transfrontaliers grandissants. La dynamique du secteur du camionnage n'a cessé d'être au diapason de l'économie au sortir de la récession, vers des années de forte croissance économique allant jusqu'à la veille du mécontentement et des blocus routiers vers la fin de cette décennie. Les camionneurs artisans ont dû s'ajuster à des fortes tendances à la rationalisation des coûts, le juste à temps et ils ont dû s'adapter à des nouvelles conditions dictées par les entreprises qu'ils desservent tout en acquérant la nouvelle technologie.

L'étude qui suit dresse un portrait financier réparti sur huit années pour ce groupe de camionneurs indépendants tout en apportant des comparaisons avec les transporteurs pour compte d'autrui de taille et d'activités similaires. Elle offre, en outre, un aperçu des contraintes reliées à l'enquête ainsi qu'à la difficulté de mesurer un groupe aussi grand de travailleurs et autant volatile que sont les conducteurs propriétaires.

SOURCE DE DONNÉES – Des données tirées de l'«Enquête annuelle sur les petits transporteurs routiers pour compte d'autrui et les chauffeurs-contractants » serviront à présenter une image pertinente de la situation financière des conducteurs propriétaires entre 1991 et 1998.

Economic Impact of For-Hire and Private Trucking in Manitoba: 1998 Results and Methodology

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Dr. Barry E. Prentice, Director
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Introduction

The trucking industry presents an interesting dichotomy. On the one hand it is the most ubiquitous form of freight transportation and the largest source of male employment in every province of Canada (Statistics Canada, 1998). On the other hand, few people appreciate the true size and scope of the trucking industry, or its importance to the general economy. Most of the time, the trucking industry is simply taken for granted. Only when an unusual event occurs, such as the recent protests over rising fuel costs, does the significance of the trucking industry become obvious. The absence of an accurate economic indicator for trucking and its related activities has led to an under-appreciation of its importance.

The structure of the trucking industry helps to explain its lack of public profile. Unlike some sectors of the economy that are dominated by a handful of giant corporations, the trucking industry is incredibly diverse. While many large trucking firms exist, a great number of very small trucking firms compete in the same market. Moreover, the market is highly segmented. Each trailer type represents a sub-market that could be considered an industry in its own right.

Finally, trucking is an industry that by definition is "on the move". It is difficult to get an appreciation for the size of the trucking industry because all the equipment is dispersed. Only at the trailer compounds of the large carriers is it possible to gain some measure of the physical magnitude of the trucking industry.

The analysis contained in these pages sets a new standard for the estimation of economic impacts. In addition to an aggregate measure of the for-hire and private trucking sectors, this study ties the economic impact to a structural profile of the industry. To our knowledge, the economic impact of trucking has never been measured as accurately or comprehensively in any jurisdiction of North America.

The Economic Impact of Trucking Approach

The economic impacts of the Manitoba trucking industry are reported in several different ways. First, the impacts are reported as direct and total. The difference is that direct impacts are those created by trucking activity, while the total impact considers the re-spending of money generated by the trucking activity. Second, the impacts are reported in regional and national dimensions. Economic activity that stays within provincial boundaries is measured as GDP (Gross Domestic Product) at factor cost. This excludes imported inputs like petroleum and equipment whose economic impact occurs outside Manitoba. At the same time, Manitoba trucking creates further economic activity in the services provided and goods purchased beyond its borders. The national impact of the Manitoba trucking industry is captured as gross expenditures.

The Manitoba trucking industry employs both residents and non-residents of Manitoba, and it purchases goods and services from both within and outside Manitoba. Direct economic activity creates a "ripple effect" on employment as re-spending occurs in the Manitoban and the Canadian economies. The provincial impacts of the trucking industry are calculated in terms of employment numbers and labour income.

Economic Impact of Manitoba Trucking Results

Motor carriers in Manitoba are a major generator of economic activity within the province, generating $1.18 billion in 1998. As a result, trucking is responsible for 5 percent of the 1998 GDP of $26.19 billion.[1] **Table 1** presents a summary of the total economic impact on Manitoba from the Manitoba trucking industry carriers.

Table 1 Total Economic Impacts on Manitoba of For-Hire & Private Carriers, 1998

Classification	Net Contributions to Manitoba GDP ($'000)	Manitoba Employment (Person-Years)	Manitoba Labour Income ($'000)
MB For-Hire			
Total Direct	**502,492**	**10,641**	**278,363**
Multiplier	1.86	1.95	1.77
Indirect & Induced	432,143	10,109	214,340
Total MB For-Hire	**934,635**	**20,750**	**492,703**
MB Private			
Total Direct	**131,258**	**6,261**	**91,656**
Multiplier	1.86	1.95	1.77
Indirect & Induced	112,882	5,948	70,575
Total MB Private	**244,140**	**12,209**	**162,231**
Total			
Total Direct	**633,750**	**16,902**	**370,019**
Indirect & Induced	545,025	16,057	284,915
Total Economic Impact	**1,178,775**	**32,959**	**654,934**

Source: TI/MTA/H&T Survey

note: the above figures have been rounded to the nearest thousand.

Total direct impacts account for approximately $633.8 million in trucking-related GDP, 16,902 full-time equivalent jobs and over $370 million in labour income. Including indirect and induced economic activity, the total economic impact generated by the Manitoba trucking industry is approximately $1.18 billion in output, full-time employment of approximately 33,000 and $654.9 million in salaries, wages and benefits.

[1] Manitoba Bureau of Statistics (1999), *Manitoba Industry Profiles*, 1988–1998.

Table 2 Trucking Industry Economic Impacts on Canada
For-Hire & Private Carriers, 1998

Classification	Gross Expenditure Impact on Canada from Manitoba Trucking Expenditures in Manitoba ($'000)	Gross Expenditure Impact on Canada from Manitoba Trucking Expenditures outside Manitoba ($'000)	Total Gross Expenditure Impact on Canada from all Manitoba trucking expenditures** ($'000)
MB For-Hire			
Total Direct	**959,584**	**272,014**	**1,231,598**
Multiplier*	2.5	2.5	2.5
Indirect & Induced	1,439,376	408,021	**1,847,397**
Total MB For-Hire	**2,398,960**	**680,035**	**3,078,995**
MB Private			
Total Direct	**250,657**	**31,391**	**282,048**
Multiplier*	2.5	2.5	2.5
Indirect & Induced	375,986	47,087	**423,073**
Total MB Private	**626,643**	**78,478**	**705,121**
Total			
Total Direct	**1,210,241**	**303,405**	**1,513,646**
Indirect & Induced	1,815,362	455,108	**2,270,470**
Total Economic Impact	**3,025,603**	**758,513**	**3,784,116**

Source: TI/MTA/H&T Survey

Note: the above figures have been rounded to the nearest thousand.

* Expenditure multiplier is estimated to be between 2.5 and 3.5. We used the lower end.

** Some leakage could occur through international trade and trucking activity outside Canada, but this cannot be estimated.

Economic impact within Manitoba has many spillovers. **Table 2** shows the gross expenditure impact on Canada from Manitoba trucking activity, inside and outside of Manitoba borders. For-hire carriers direct spending in Manitoba had an impact on the Canadian economy of $959.6 million. When Manitoba's for-hire carriers spent outside of Manitoba, they contributed another $272 million in direct expenditures, for a total of $1.23 billion on the Canadian economy. By adding the spin-offs benefits from suppliers to the trucking industry and the subsequent rounds of consumption spending throughout Canada (the indirect and induced impact), another $1.85 billion is generated. In total, Manitoba's for-hire carriers have a total gross-expenditure impact on Canada of $3.08 billion.

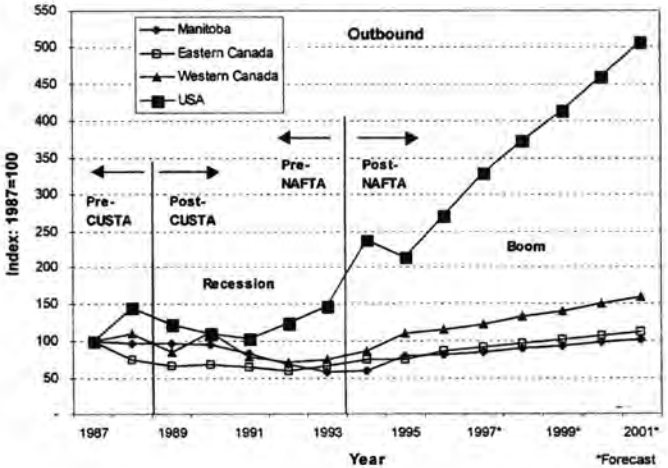
Private trucking in Manitoba has less impact on the total Canadian economy; contributing direct gross expenditures of $282 million, with roughly 90 percent of this coming from trucking activity in Manitoba. Private carriers in Manitoba generate total indirect and induced economic activity of $423 million and give a total gross expenditure economic impact for Manitoba private trucking on Canada of $705 million. Together, for-hire and private trucking in Manitoba have a total gross expenditure economic impact on the Canadian economy of $3.78 billion.

Trade and Trucking Trends

Manitoba's trade pattern has changed dramatically since deregulation (MVTA 1987) and freer trade (CUSTA 1988, NAFTA 1994). Truck movements have grown slowly on Canada's east-west corridor and grown rapidly north-south. **Figures 1** and **2** present an index of growth based on 1987 volumes. In order of growth rate, north-south is far ahead of east-west or intra-provincial (Manitoba) trucking. The impacts of institutional change and macroeconomic events are evident in the pattern of trucking activity. At the same time, the economic impact of the trucking industry is a function of the larger economy that it serves. When the economy is subject to recession, the trucking industry grows slowly, and vice versa.

The United States accounts for the greatest increase of outbound and inbound freight movements, with most of these gains occurring after the signing of NAFTA in 1994. Freight movements in Canada generally declined up to 1993; Manitoba intra-provincial freight movements dropped 43 percent compared to 1987. Post-NAFTA, Manitoba truckers experienced increases to all regions. Truck movements to the U.S. by 2001 are forecast to be five times greater than in 1987. By comparison, inter-provincial movements increase by only half to Western Canada (58 percent) and marginally to Eastern Canada (12 percent). Trucking activity within Manitoba is only expected to recover its former size. This is shown in **Figure 1**.

Figure 1 Trucking: Relative Regional Changes in Outbound Freight



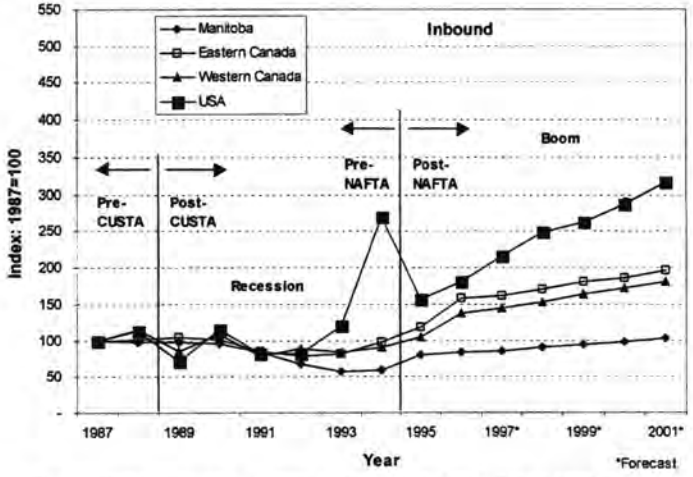
Source: Statistics Canada, Trucking in Canada (53-222); for years 1992-1996, data obtained on a special run and directly from Statistics Canada.

Turning to inbound truck freight movements, all traffic declined between 1987 and 1993. Since 1994, import growth has exceeded the rate of increase within Manitoba. The spread between the regions with inbound activity is less than outbound activity. Trucking activity only tripled from the United States (216 percent), followed by Eastern Canada (197 percent), and Western Canada (181 percent). This can be seen in **Figure 2**.

The market focus of the Manitoba trucking industry has become more outward looking. In 1987, Manitoba's transborder truck movements to the United States were roughly 0.65 million tonnes. Movements to and from the rest of Canada in 1987 totaled 4.2 million tonnes. Prior to NAFTA (1994), that gap had been reduced by half but

interprovincial movements were still 3.3 times transborder movement. By 2001, the U.S. will have surpassed Eastern Canada as a destination for truck freight and is gaining on Western Canada. Overall, trans-border and inter-provincial trucking had grown significantly relative to intra-provincial trucking in Manitoba. From roughly half of the market in 1987, extraprovincial trucking (interprovincial plus transborder) has grown to 70 percent of total tonnage.

Figure 2 Trucking: Relative Regional Changes in Inbound Freight



Source: Statistics Canada, Trucking in Canada (53-222); for years 1992-1996, data obtained on a special run and directly from Statistics Canada.

Significance of Manitoba Trucking as a Service Export

By 2001, 70 percent of Manitoba's trucking revenues will be obtained from extraprovincial services. In fact, almost the entire growth of Manitoba trucking depends on the export of services. Given

estimated total revenues of $1.2 billion, the export of trucking services in 1998 equals $840 million. By comparison, the $840 million of trucking services exports is greater than Manitoba's three largest commodity exports: wheat ($515 million), aircraft parts ($453 million) and canola oil ($407 million). In terms of industry classification, the Manitoba trucking industry would be the fourth largest source of export earnings following agriculture ($1.8 billion), food industries ($1.0 billion) and transportation equipment ($1.0 billion).

Structural Aspects to Manitoba Trucking

The base data of this study has been gathered in the midst of a longer term expansion. Consequently, the current estimate of the economic impact in 1998 is conservative in light of the trucking industry's recent continued expansion. At the same time, this study serves as a benchmark that can be used to calibrate the longer term trend, providing the structure (firm size, etc.) remains constant. This study makes that next step by documenting the structural profile of the trucking industry. A capsulization of the findings are presented below:

Equipment:

- For every straight or small truck, approximately 6 tractors are operated by for-hire trucking in Manitoba.
- For every tractor, approximately 2 straight or small trucks are operated by private trucking in Manitoba.
- For every tractor, roughly 2 trailers are kept in inventory by for-hire trucking in Manitoba.
- For every tractor, roughly 1.4 trailers are kept in inventory by private trucking in Manitoba.
- Owner-operator and leased operator use is most prevalent with tractors, followed by straight trucks and then followed by trailers.

Costs:

- For every $10 spent on variable costs, approximately $8 is spent on fixed costs, and roughly $7 is spent on owner-operator costs by for-hire trucking in Manitoba.
- For every $10 spent on variable costs, approximately $4 is spent on fixed costs, and roughly $2 is spent on owner-operator costs by private trucking in Manitoba.

Labour:

- For every 15 drivers, approximately 10 non-driving personnel are required to ensure that for-hire trucking activity takes place in Manitoba.
- For every 15 drivers, approximately 40 non-driving personnel are associated with private trucking activity in Manitoba.
- For every 10 for-hire carrier drivers, approximately 11 power units are provided by Manitoba for-hire trucking.
- For every 10 private carrier drivers, roughly 25 power units are provided by Manitoba private trucking.
- 82 percent of for-hire carriers' labour force has a grade 12 education, or less.
- 89 percent of the private carriers' labour force has a grade 12 education, or less.

Freight Rates:

- 13 percent of all Manitoba-based for-hire carriers increased their freight rates since 1994 compared to 33 percent of out-of-province for-hire carriers. Another 20 percent of Manitoba-based carriers lowered their rates with 50 percent leaving their rates unchanged.
- About one quarter of all Manitoba-based for-hire carriers expect no change in freight rates by 2004. Out of province carriers are even more optimistic, with about 1 in 10 anticipate no change in freight rates by 2004.

Revenues:

- 46 percent of all Manitoba-based for-hire carriers expect company revenues from Western Canada to increase by 2004 compared to 43 percent of out-of-province carriers.
- 21 percent of all Manitoba-based for-hire carriers expect company revenues from Eastern Canada to increase by 2004 compared to 44 percent of out-of-province carriers. Another 5 percent foresee a decrease with 30 percent foreseeing no change.
- 47 percent of all Manitoba-based for-hire carriers expect company revenues from within Manitoba to increase by 2004 compared to 66 percent of out-of-province carriers. No for-hire carriers foresee a decrease with 26 percent foreseeing no change.
- 39 percent of all Manitoba-based for-hire carriers expect company revenues from the United States to increase by 2004 compared to 66 percent of out-of-province carriers. No for-hire carrier foresees a decrease, and 14 percent foresee no change.
- 3 percent of all Manitoba-based for-hire carriers expect company revenues from Mexico to increase by 2004 compared to 22 percent of out-of-province carriers. No for-hire carrier foresees a decrease with 32 percent foreseeing no change.

Appendix: Trucking Economic Impact Methodology

Economic Impact Study Method

The economic impact of the Manitoba trucking industry is based on an exhaustive survey of their activity in the 1998 fiscal year.

Direct Economic Impact

The direct economic impact is defined as the economic benefits (i.e., employment, income, GDP valued at factor cost, and gross-expenditures) generated by those working in the Manitoba trucking industry or in direct support of the industry's work. Those engaged in for-hire and private carrier operations generate the direct impact. Activities that produce these impacts entail employment of trucking personnel and the purchase of locally produced goods and services.

The distinguishing feature is that the direct impact is the immediate consequence of trucking activity.

For the purposes of this study, Manitoba's trucking industry has been disaggregated into for-hire and private carrier activity classifications. This breakdown allows economic impact analysis to account for the different types of activities that take place across various sectors engaged in trucking.

Indirect and Induced Economic Impact

Indirect economic impact of the Manitoba trucking industry is attributable to firms that supply services (i.e., fuel, maintenance, repair, etc.) materials and other inputs to the organizations involved in the direct economic activity. Trucking-related expenditures (net and gross) from direct trucking activity becomes the revenue of indirect activity. For example, trucking firm spending on tires becomes the revenue of a tire supplier. A part of these revenues represent a portion of the profits accruing to the tire supplier, which can be used to increase the supplier's warehouse space and distribution network, among other things. The spending of trucking-related firms on goods and services represents output for other firms further down the production chain, bringing about indirect employment, income and tax activity.

Induced economic impact is the effect of successive rounds of spending which begin with the spending of income received by individuals involved in the direct and indirect economic activities. These "trickle-down" impacts represent the multiplier effects of the direct and indirect impacts. The result is increased employment, income and spending over and above the levels for which the direct and indirect economic activities are responsible.

Regional Economic Leakages of Direct and Indirect Economic Impacts

Economic activity does not occur in a vacuum: economies are not insulated from the rest of the world, and are interdependent on each other. As established earlier in this report, Manitoba's economy is dependent on trade activity that occur both domestically and beyond its borders. With trucking being the primary mode by which most goods are transported inside and outside of the province, it is important to account for economic activity in the form of *leakages* and *injections* in the provincial region, especially if production takes place across borders.

Gross expenditure, as a measure of economic impact, has advantages and disadvantages. Gross expenditures are easier to collect, but include the double-counting of intermediate goods and services. They also capture the import activity that occurs between jurisdictions. In order to measure the net direct impact on Manitoba of trucking at factor cost, the gross expenditure have to be adjusted in two stages. First, an intensity ratio is used to convert gross expenditures into net expenditures, exclusive of imported outputs. Second, the economic multiplier is used to derive the direct economic impact on the GDP at factor cost.

Intensity Ratios and Economic Multipliers

Indirect and induced effects of trucking-related activity are difficult to measure directly. Data collection to measure indirect effects would require surveying a large number of firms for which trucking activity may account for only a small portion of their overall business. Similarly, measuring the induced effects would require surveying the entire economy. Instead, economists use economic multipliers to estimate the indirect and induced impacts. A multiplier is defined as the change in the total impact to gross domestic product (based on the direct impact to GDP) that results from the initial change in trucking

industry output that brings it about.[2] Similarly, multipliers are used in calculating the total impact to labour income and the total impact to employment.

If all leakages are excluded, direct impacts can be transformed by economic multipliers to add indirect and induced impacts. In this study, the employment numbers and labour income are simply multiplied by the appropriate economic multiplier because only employment within Manitoba is counted. Expenditure data must be modified, as described above, to account for leakages, because we wish to obtain a measure of the impact that occurs exclusively in the Manitoba economy.

Intensity ratios and economic multipliers are provided by the Manitoba Bureau of Statistics (MBS)[3]. These multipliers are derived from a statistical model of input-output data that trace Manitoba inter-industry flows of goods and services.[4] The MBS multipliers are widely accepted for conducting impact analyses and are recognized as being comprehensive and accurate. As a result, the indirect and induced employment and labour income impacts can be measured by applying the appropriate multiplier to the direct impacts. Traditional industry multipliers are broken down for forty-five industry classifications. Although the industry classifications are very broad and make it difficult to identify multipliers to specific trucking activities, the "transportation" industry multipliers were deemed appropriate to calculate the total economic impact per unit of direct impact.[5]

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[2] Technically, we mean autonomous, exogenous, or pre-determined (out-of-model) expenditure.

[3] Manitoba Bureau of Statistics, "*1998 Manitoba Economic Multipliers*", 1999.

[4] The multipliers are derived from MBS's Economic Impact Assessment Model. The data in the MBS model are further derived from Statistics Canada's Inter-Provincial Input-Output Tables for 1990. Any significant structural changes in Manitoba's economy since 1990 will invalidate the indirect and induced impacts calculated in this study.

[5] Transportation multipliers of 1.86, 1.77 and 1.95 were applied to the impact measures (i.e., GDP at factor cost, employment and labour income) for both for-hire and private carrier classifications.

Proper use of the MBS economic multipliers requires that they be applied only to the *value-added* component of output in Manitoba's economy. Value-added (or GDP at factor cost) is a firm's net value of output (value of a firm's output minus the value of their inputs).[6]

The calculation of GDP at factor cost is a two step process. The first step is to apply the MBS's *intensity ratios*[7] to the gross-expenditure data that was gathered from survey respondents. The intensity ratio converts the gross-expenditure data into net-expenditures (or the total economic impact on Manitoba, exclusive of leakages).

The second step is to divide the total economic impact in Manitoba by the economic multiplier to sort out the direct impact from the indirect impact and induced impacts. The quotient is the direct economic impact of trucking to the Manitoba GDP measured at factor cost.

Gross expenditures of Manitoba firms do not have to be adjusted to obtain a measure of the impact on the national economy, if one assumes that imports and exports of trucking inputs are roughly equal. Of course, some leakage could occur through international trade and trucking activity outside Canada, but this could not be estimated. The gross expenditure multiplier used for Canada's trucking industry is estimated to be between 2.5 and 3.0.[8] In order to avoid over-estimating this impact, the Transport Institute chose the multiplier with the lower value.

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[6] Since one firm's output is another firm's input in a production process, only the net contribution from that process is counted towards Gross Domestic Product (GDP).

[7] An intensity ratio is a multiplier. For the transportation industry in Manitoba, an intensity ratio of 0.974 was applied to all direct gross expenditure values to arrive at total GDP value at factor cost.

[8] Upon discussion with the Manitoba Bureau of Statistics, a multiplier range of 2.5 to 3.5 is their reasonable estimate of spin-offs and respending from Manitoba trucking activity in the Canadian economy.

Units of Measurement

Four measures of the economic impact of the Manitoba trucking industry were assessed. Included are estimates of Gross Domestic Product (GDP) at factor cost, gross-expenditures on goods and services, as well as estimates for employment and labour income. These units of measurement are defined as follows:

i. **GDP at Factor Cost (Net-Expenditures)** – represent the sum of all value added in the economy (plus indirect business taxes minus subsidies), or equivalently, the value of all final goods and services produced in the provincial economy. It is equivalent to gross-expenditures once adjusted by an intensity ratio, and the removal of indirect and induced economic activity.

ii. **Trucking-related Expenditures** – represent the actual purchases of goods and services that are spent locally that have an impact beyond the local region. In this study, the scope of this economic area is from activity occurring within Manitoba that is affecting Canada as a whole.

iii. **Employment** – employment totals are reported in terms of person-years of trucking-related employment. One person employed full-time for a period of one year represents one-person year of employment. Alternatively, two part-time employees who work twenty hours per week are considered to be equivalent to one full-time employee.

iv. **Labour Income** – measures the total annual wages, salaries and benefits received as a result of trucking-related employment. This also includes any overtime paid to local employees.

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Private Airports and Public Needs: There is a Connecting Flight

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Introduction

Airports worldwide are trending towards privatization. Analysts see this phenomenon as ranging from the contracting-out of specific airport services, to the provision of long-term leases, and through to the full private ownership and operation of airport facilities. The economic analysis in this paper speculates on the full private ownership and operations aspect of privatization. However, this paper focuses on the specific case of airport privatization in the US, where both leasing and full private ownership are possible.

Airport operations are being recognized as a non-core function of government, and have been turned over, in various degrees, to the private sector. This has occurred in over 20 countries, including the UK, Australia, Canada, and Mexico.

In the United States, the Airport Privatization Pilot Program was created in 1996 to test the concept through the sale or lease of particular airports. Section 149 of the *Federal Aviation Authorization Act* of 1996 gave the US Department of Transportation the authority

to grant up to five airports the right to participate in the Pilot Program.

Stewart International Airport (in Newburgh/New Windsor, NY) is the first US airport to be privatized under the Pilot Program. A subsidiary of British company National Express Group leases Stewart from the State of New York.

Proponents of airport privatization cite benefits such as: increased capital infusion, efficiency gains, revenue windfalls (to governments from sale or leasing of airports, and because some high-value land is put back on the tax rolls), passenger friendliness, increased airline service and competition, increased operating revenue, and transfer of risk (Poole 1999, Advani 1999). This view supports the notion that privatization leads to improved marketing efforts and capabilities, and speedier adaptation to community needs.

Opponents – though few in number – raise some serious concerns. The main concern is that as a monopoly service-provider in a for-profit environment, there is an incentive to maximize wealth (shareholder value) by diverting funds away from the airport and/or providing sub-quality services. Airlines and airport officials have not supported some privatization efforts out of "the fear of the airport becoming a cash cow for the municipality, at the expense of airport users", and having a "sluggish satisfaction with the status quo" (Advani 1999, p.5). In general, airlines predict higher costs will be associated with private airports – costs that will be passed on to the passengers.

Some supporters of privatization agree that the Pilot Program is one step in the right direction, but criticize it because too much control is left in the hands of the airlines.

This paper provides an overview of the US Airport Privatization Pilot Program including a brief examination of the privatization of Stewart Airport, and a discussion of the merits and shortcomings of airport privatization in general.

Privatization: Definition

In this paper, privatization is taken to mean private ownership with no special regulations beyond those such as the requirement to hold liability insurance and maintain minimum construction standards. Of course, Federal Aviation Administration (FAA) grants for infrastructure, such as runways, require adherence to certain safety standards.

The *airport owner* and *airport entrepreneur* are taken to be the same entity in our definition of privatization. The airport entrepreneur is considered to be the airport operator who is economically driven, meaning profit-seeking and, at the same time, motivated by enhancing customer service. While these two phenomena can be mutually exclusive in a pure monopoly environment, we argue below that such will not be the case when the airport entrepreneur is given a free hand.

Airport Authorities: A Public-Benefit Corporation

A middle-ground between privatization and direct government control is the lease option. The government as lessor issues an airport lease to a private management team acting as the lessee. Since the lease stipulates the lessee's management obligations and may be revoked under causes set forth by the lessor, "public needs" may be seen to be preserved. Of course, the longer the duration of the lease the greater the incentive the lessee has to undertake capital formation.

In Canada, Transport Canada owns the major airports and maintains overall authority over airports. Meanwhile in the United States, state or municipal bodies are in charge of direction, despite funding and regulation from the federal government (viz., the FAA). Particularly useful in the US arrangement is the incentive for state and municipal governments to secure funds as an agent for the airport authority. Property taxes are not assessed when the airport is municipally

owned. However, a private airport is a source of municipal revenue and necessitates direct valuation of the property.[1]

In terms of the dispersal of federal funds the *Airport and Airway Improvement Act* (AAIA) of 1982 specifies how airport revenues are to be dispersed. In particular, all public airport revenues are to be spent only on capital and operational requirements of that airport (49 USC Appx. Section 2210 [a] [12]). Authorities running several airports may cross-subsidize. While not fully mitigated, the AAIA provision does give less of an incentive for a municipal government to milk the airport of revenues for other urban developments. Certainly a considerable portion of the airport's users may be non-residents of the city and thus have little political recourse to a municipal government intent upon capturing economic rents.

US airport authorities may issue revenue-bonds to finance development (as opposed to government-issue bonds which are less costly to offer and do not carry the obligatory risk premium). However, such bonds are tax-exempt since the authority is, in effect, developing government property. A private airport has no such exemption. But in terms of the privatization it would be more efficient to define the tax-exempt status of the bond on the basis of *use* of the proceeds and not simply based on the identity of the overseer. Nonetheless, private airports would be able to deduct interest payments as does any other business.

Consider two examples of lease arrangements (taken from Bogan 1996):

- Morristown Municipal Airport in New Jersey was leased for 99 years in 1981 as a means for the city to off-load its long-term debt to a New York developer. At the time the airport was

[1] Again, the Canadian case is somewhat different. Under federal ownership, airports pay a grant in lieu of taxes to municipal authorities. Canadian airport authorities do, in fact, pay municipal taxes.

rundown and survived only through traffic transferred from Newark International Airport;

- Grand Canyon National Park Airport was leased for 25 years in 1984 simply as a means of securing more capital for the airport. The Arizona Department of Transportation (ADOT) would not, however, cede control over development projects, rates and fees. After 4 years, ADOT exercised its power to revoke the lease when the lessee could not meet development expectations (particularly the building of a new hotel). This was in the face of the state's unwillingness to lift an 8-year freeze on applicable airport rates. The tourism industry had relatively more clout with the state government than the airport authority and it opposed a rise in user fees.

Under a lease arrangement, politics may creep into the authority's ability to set rates and fees applicable to parking, tenants, passengers, and airlines.[2] The government is sensitive to political pressure from several directions. Of course, off-loading debt obligations can be viewed as a political quick-fix. If the setting up of airport authorities has merit, the government ought to have the foresight to allow for it when times are economically sound.

The U.S. Federal Aviation Authorization Act

Section 149 of the 1996 *Federal Aviation Authorization Act* establishes an Airport Privatization Pilot Program. The US Department of Transportation (USDOT) is empowered to grant the statutory and regulatory exemptions necessary to carry out the privatization of a public use airport. A maximum of five airports is to be allowed participation in the program. At least one of the five must be a general aviation airport and no more than one airport may have more than 1% of total passenger boardings within the US (classified

[2] In Canada, airport authorities have discretion to set charges at airports, but the government maintains some degree of control over many other aspects of airport management.

as a large hub airport by the FAA).[3] Beyond this there are no size, geographical, or financial restrictions placed on applicants. However, it is important to note that it is the public sponsor (i.e., government agent or airport authority) that files the application and makes the case for privatization – not any proposed private party.[4] Significantly, any *domestic* airline, its holding company or affiliate operating at the airport in question is not barred from responding to a request for proposals (RFP) issued by the public sponsor in search for a private party to purchase/lease the airport. However, that airline cannot take part in the vote required among the airline tenants as is part of the approval process.

The FAA, through USDOT, has the latitude (under Section 47134 of Title 49 of the US Code) to grant exemptions to a private party along the following lines:

- lease or sale to the private party;
- partial or full exemption from the requirements specifying that all revenues be used at the airport in question. In other words, revenue may be diverted to non-airport activities;
- relinquish an amount of unused federal grants and/or properties at the airport under title of the federal government.

"The statute authorizes FAA to exempt an airport sponsor from its obligations to repay federal grants, return property acquired with federal assistance or use the proceeds of the sale or lease exclusively for airport purposes" (FAA 2000).

In general, a condition for continued receipt of federal funding is that the private party uphold all of the terms, conditions and assurances that the public sponsor adhered to. However, this may be modified by

[3] The FAA restricted any large hub airport participating in the program from being sold; it may only be leased (FAA 2000).

[4] As part of the application process, the public sponsor must issue a request for proposals (RFP), which is approved by the FAA, and secure a private party that is willing to purchase or lease the airport.

the FAA if the alternative provisions in the application achieve the following:

- the airport will continue to be available for public use on reasonable terms and conditions without unjust discrimination;
- the operation of the airport will not be interrupted if the private operator experiences bankruptcy or other financial difficulty;
- the private operator will "maintain, improve, and modernize" airport facilities through capital investments, and submit a plan for these actions;
- airport fees imposed on air carriers will not increase faster than the rate of inflation unless a higher amount is approved by at least 65 percent of the *domestic* air carriers using the airport and the *domestic* air carriers having at least 65 percent of the landed weight of aircraft at the airport;[5]
- the percentage increase in fees imposed on general aviation operators will not exceed the percentage increase in fees imposed on air carriers;
- safety and security will be maintained "at the highest possible levels";
- adverse effects of noise from airport operations will be mitigated to the same extent as at a public airport;
- adverse effects on the environment from airport operations will be mitigated to the same extent as at a public airport;
- any collective bargaining agreement that covers airport employees and is in effect on the date of the sale or lease of the airport will not be abrogated by that sale or lease.

[5] This 65 percent rule also applies to the vote required by the airport's airline tenants to approve an application made to the Pilot Program. Note that an air carrier will not be included in the approval process at any stage if it has either: (1) discontinued service during the year in which the landed weight statistics were established; or (2) discontinued service within the current year. Foreign-owned air carriers cannot be included in the approval process.

Any subsequent sales or subleases, etc. require FAA approval. Notice that the first, sixth, seventh, and eighth points are subjective and require value judgments to be made on the part of the FAA.

As to rate of return on investment the FAA retains its oversight on a case-by-case basis to ensure "reasonableness". There is still too much subjectivity in that regard since the FAA may evaluate rates and fees on either an aggregate revenue basis or on an individual basis. Certainly, congestion costing requires that rates and fees be set on an individual basis. Furthermore, the benchmark used by the FAA for its rate of return calculation could be the actual price paid for the purchase or lease. Alternatively, the calculation could be based upon an agreement reached between the equity owner, the airlines and the other retail tenants of the airport.

More to the spirit of privatization and the incentive to keep private sources of capital unimpeded, the 65 percent airline-approval rule within the Pilot Program does not apply to any new-capital investment undertaken at the airport. Furthermore, both private and public airports also have equal access to FAA grants under the Airport Improvement Program. Privatized airports also have the right to collect Passenger Facility Charges (PFCs – known in Canada as Airport Improvement Fees, or AIFs).

Thus far, only Stewart International Airport, San Diego (Brown Field) Airport, Lakefront Airport (near New Orleans, LA), Rafael Hernandez Airport (Aguadilla, PR) and Niagara Falls (NY) International Airport are preparing to file an application under the Pilot Program. As for Stewart International Airport, the public sponsor (the New York State Department of Transportation - NYSDOT) found that it could not secure 65 percent approval unless it agreed to, as one might suspect, keep all revenues re-invested within the airport. Of course, with hub dominance a reality at several major airports it is unlikely that a hub airport will come forward with an application since, in effect, the dominant carrier has veto-power under the 65 percent rule. Furthermore, under the FAA's oversight, it is

unlikely that an airport would be able to institute a gate/landing rights auction mechanism and eliminate "grandfather rights".

Currently, and likely due to the shortage of applicants to the Pilot Program, the US Senate is considering lifting both the five airport cap and the 65 percent rule. Both of these actions are more to the spirit of privatization but it is by no means clear at this point that the amendments will be made.

Stewart International Airport: Testing the Waters

Stewart International Airport (SWF) was once considered as a fourth regional airport for New York City. The airport is located 60 miles north of New York City and 90 miles south of Albany. Stewart sits at the junction of two interstate highways (I-84 and I-87) and has a 12,000-foot runway, long enough to handle all aircraft in operation today. Passenger service is provided by American Airlines, Midway Airlines and the regional carriers affiliated with Delta Airlines, US Airways and United Airlines. Handling between 0.05% and 0.249% of US air passengers, SWF is classified by the FAA as a small hub regional airport.

Even before the official privatization of the airport, Stewart was one of the first privately managed airports in the US (Mid-Hudson Pattern for Progress (2000). Further privatization was thought to be able to enhance the airport's economic development potential through greater private sector involvement.

There has been criticism of airport management under NYSDOT. The State was accused of being "bogged down in bureaucratic red tape", leading to the abandonment or delay of many airport improvement projects (MidHudson News 2000).

National Express Corporation (NEC) – the American subsidiary of National Express Group (NEG) – was selected by NYSDOT to manage and develop the airport under a 99-year lease. NEG's

experience includes ownership and operation of two British airports. NEC took control of the airport on April 1, 2000.

Immediate priorities for NEC include:

- reinstating direct service to key leisure and business destinations;
- generating new concessions in the terminal;
- providing an executive lounge for frequent flyers;
- adding further seating;
- handling oversized, hard, perishable and time sensitive cargo;
- international entry for live cargo;
- business park development; and
- ongoing infrastructure and transportation improvements (National Express Corporation 2001).

Would NYSDOT have undertaken the same projects? If so, why had it not done so to date? The market demand existed for these improvements, but it took private management to instigate them. To be fair, NEC has not implemented all of these new programs yet, so it is difficult to assess their success and the overall success of the FAA Pilot Program. If Stewart receives an infusion of capital; becomes more efficient; experiences increased passenger and cargo service; and improves customer service, NEC will be considered successful. Alternatively, if NEC uses the airport to extract revenue, simultaneously providing sub-standard service, NEC and the FAA Pilot Program will have failed. However, there is no reason to suspect NEC will do anything but try to expand and improve the airport, given its parent company's successes at regional airports in the UK. For example, East Midlands Airport – owned until recently by NEG – has grown, under private ownership, to achieve record passenger volumes and high customer satisfaction, while investing capital in airport infrastructure (National Express Group 2001).

Privatization: All or Nothing?

Is the airport authority model less efficient than a privately run airport? In other words, can partial operational regulation of a private

management team be inefficient? Consider the control of rates and fees by the government as part of a lease or as a result of some political interference. If the "fair rate of return" is set higher than the true cost of capital, investment in capital-intensive projects will increase airport profit. This is a common response in regulated industries known as the Averch-Johnson effect based on Averch and Johnson (1962). In other words, rather than employ congestion pricing, the airport would merely expand runway and terminal capacity in order to increase the rate base. Reilly (1996) notes that a peak-load pricing scheme was applied to smaller aircraft using Logan International Airport in Boston. However, a federal judge found the practice to be discriminatory. And for smaller, uncongested airports, any requirement forcing re-investment back into the airport would necessarily lead to capital expansion and over-development.

Landing fees are typically calculated as an average cost (AC):

$$AC_{Airfield\ Operation} = \frac{TC_{Airfield\ Operation}}{\sum_{i=1}^{n} W_i}$$

where: TC is total cost and W is the weight of landed aircraft (i).

The weight-based landing fee does not calculate for congestion cost. In fact, it encourages congestion as a means to increase fees and perhaps lead to an Averch-Johnson response.

Airlines should not be allowed to own airports because an airline could set up barriers to entry for its competition. And no entity should be allowed to own airports in proximity so as to create a regional monopoly. A single-owner of several airports covering a large area can, however, refrain from acting as a monopoly if the market is shown to be contestable. What is needed are alternative airports and/or modal substitutes.

Are airports natural monopolies? Congestion mitigates the decreasing cost argument required for natural monopoly. Costs may, in fact, be increasing. Congestion costing merely rations scarce landing slots and spills over any traffic priced-out of that airport to other airports within a reasonable distance. In other words that market would be contestable.

Is revenue diversion to off-airport projects something to worry about under privatization? In an efficient market, investment capital tends to go where it can obtain the highest return. Thus, a fear might be that an airport's owner will milk it of its revenues in order to finance alternative investments. While this is always possible, recall that the definition of privatization employed in this paper links airport owner with airport entrepreneur. It is possible that, within such an entity, the revenue diversion concern can be mitigated. There are endless possibilities once entrepreneurial spirits are released.

Airports could be constructed where airline services are rivaled in their revenue generating ability by other retail establishments. In effect, the airport can be considered to be more of shopping center with airline passengers as potential customers. Certainly, airports *qua* shopping-centers is a well-developed trend at several US airports (e.g., Newark International Airport, Minneapolis-St. Paul International Airport and Seattle-Tacoma International Airport). The airport entrepreneur may further recognize in-transit passengers as "captive customers" and provide more attractive amenities for them. This is increasingly the case at most major airports – public and private.

For example, airport privatization in Europe has led to less dependency on airline revenues. Non-aviation activities account for 50% of revenue at Schiphol Airport in Amsterdam and 40% for the British Airports Authority (Barnard 2000). Vancouver International Airport provides innovative retail outlets and services, including regional native art and specialty restaurants, and spas for waiting passengers (Ovenell-Carter 2001). Hub airports in the US are also experimenting with spas, but also with name-brand, upscale retail

outlets. Some, like Newark International, offer portable DVD players for passengers (Crain's New York Business 2001). There is certainly room for the airport entrepreneur to expand upon these ideas.

Consider, for example, providing a set of movie theatres for audiences made up of both airline passengers and non-passengers. Hypothetically, gate areas could have all entertainment amenities removed thereby giving incentives for passengers to enter a centralized entertainment center built for airport users as well as the surrounding community. For passengers who dislike leaving the gate area for fear of missing their flight, Newark has also contemplated offering a pager system to inform passengers that their departure is coming up (Crain's New York Business 2001).

If airline passengers are herded around to validate a significant retail presence, the effect could be that airport profits may increasingly come from *resident* retail operations which raises the opportunity cost of revenue diversion. Furthermore, since it is the airline passengers in tandem with non-passengers that are the key to the new retail focus, there is an argument to lower landing fees for the airlines so as to ensure continued or increased gate usage. As such, this mitigates the airlines' fear of rising user charges under privatization.

The problem with enacting privatization is that the number of losers would be small but their losses would be large. Airlines, unionized employees[6] and airport managers who are used to government oversight would be the losers. The winners would be the airport's consumers in the form of passengers and retail shoppers. They are large in number but their gains would be small. In an environment with several winners possessing diverse interests and a few losers having sharper ones, the political response tends to be in favor of the *status quo*.

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[6] Union-to-government bargaining is often easier than union-to-business bargaining. Leases and transfers will usually include collective bargaining provisions by which the new operators must abide.

Conclusions

It is too early to assess the success of the US Airport Privatization Pilot Program. However, it is not impossible to foresee that the program is very likely to result in greater investment at airports and a greater entrepreneurial spirit among airport operators.

This should not only result in better airports for passengers, but could also result in better airports for the airport entrepreneur, the local government, and even for airlines.

Increased investment by the airport entrepreneur will lead directly to better service for passengers, both in the airfield and in the terminal. Infrastructure enhancements mean safer, more efficient air operations, less fuel wasted, and fewer delays. Terminal enhancements provide more amenities to the passenger, enabling them to be more productive with their time spent in the airport. The airport entrepreneur believes this will lead to an increase in spending in the terminal, thus an increase in non-aeronautical revenue. With a greater proportion of revenue coming from non-aeronautical sources, the airport entrepreneur can re-invest in even more improvements and amenities, or lower aeronautical fees. Either case should lead to an increased demand for air service at the airport, particularly in a contestable market where traffic can be drawn from competing airports and/or modes. More service means more choice for the travelling public and more competition means lower fares. In short, a mechanism for increased profit *and* customer service is possible.

Lower aeronautical fees benefit the airlines that serve the airport, as they can provide the same level of service for a lower overall cost. Lower fees also make it more likely for airlines to expand operations and for new airlines to begin service. Privatization can be expected to indirectly expand air travel.

For the government that is turning over control of the airport, the transfer means an increase in revenue from the proceeds of the sale or from the lease agreement. Furthermore, the government does not have

to invest its funds or resources into the airport and its management. Those funds can be used elsewhere for the benefit of the citizens.

The Pilot Program is careful a step in the right direction in terms of allowing entrepreneurs to consider developing airports in a for-profit environment. Industry observers should expect to see innovations in airport management under private control. Though not likely, given the current market structure, it would be interesting to see one large-hub airport successfully apply to the Pilot Program. In such a case, the incentive for revenue diversion on the part of the private operator is at its strongest. At the same time the opportunities to appeal to a large, urban consumer base for its disposable income are most pronounced. In such an environment, the imagination of an airport entrepreneur, as well as the merits of airport privatization, would truly be tested.

A full analysis and comparison of small-market and large-market airport entrepreneurial behavior, through the incentives they face, are a basis for further research within the confines of any particular privatization program. Given the extent of privatization efforts taking place globally, such research will become ever-more necessary.

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Transports Canada's Delegation to New Commercialised Entities: the Cases of Montréal Airports and Port

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We intend in this presentation to describe and to analyse two different cases of delegation done by Transports Canada during the nineties. The first one refers to the Montréal Local Airport Authority, a natural monopoly because of its location. The second is Montréal port authority that operates in a relative competitive North American environment. A hierarchical bureaucracy previously managed both and the decision centre was located in Ottawa, far away from daily operations. My intentions are to analyse first of all how efficient is their respective transfer and then how is their actual performance as providers of transportation infrastructures to stakeholders.

The theoretical approach used is the agency theory, where the principal, Transport Canada, delegates activities to an agent, a new private commercialised entity. We mainly focus on the delegation process from a bureaucratic hierarchy to a not-for profit institution. We insist on the necessary conditions to a good delegation, namely

that the agent's interests must be aligned through incentives and monitoring expenditures to those of the principal.

We successively analyse and evaluate these two delegation processes undertaken by Transport Canada. Our main objective is to show why the check and balance mechanism put in place for the Montréal Local Airport Authority did not work well and why the other transfer was generally a success. In short, the principal did not invest enough in monitoring expenditures to restraint the discretionary power of the agent in the Montréal airport case whereas Transports Canada did it well for the Montréal port. The principal has moved along its learning curve.

The economic performance per se of both commercialised not-for-profits entities is then assessed by mainly focusing on how efficient is their price determination and how sustainable is their capability of self-financing their investments in the long run.

My conclusions suggest some remedies to overcome the deficiencies of the actual delegation process, mainly for local and Canadian airport authorities.

A COMPARISON STUDY OF MEDIUM AIRPORT MANAGEMENT IN DIFFERENT COUNTRIES

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1. INTRODUCTION

The last decade has been of great changes in the air transportation industry. The majority of these changes are consequences of the liberalized regulatory environment in the European Union, airline global alliances, open skies policies and multilateral agreements. Contributing to these profound changes are airport privatization processes and the consequent enhancing of airport competition.

The liberalized environment has brought new challenges not only to government regulatory agencies, but also to airport authorities; the latter can no longer be considered merely infrastructure providers for the airlines. This put, in order to allow its aviation infrastructures to be more flexible and prepared for a whole new set of scenarios, many governments have privatized some airports or are considering some kind of airport privatization. In Argentina, Australia, Chile, Great Britain, Honduras, Mexico, Peru, Thailand and some other countries this process has already taken place. According to Roland Berger & Partners (1999), until 2004 more than 120 airports throughout the world will be at least partially privatized (Brazil, Poland, Portugal, Romania, Spain, and in other countries).

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In Europe, North America, Asia and Oceania, in order to estimate the potential of a to-be-privatized infrastructure, Airport Economic Impact (AEI) reports are viewed as essential tools for enhancing management performance and for guiding the privatization process itself. At the same time, in order to monitor the overall efficiency and performance of the new concessor(s)/lessor(s), and also to evaluate if they are meeting the obligations stipulated under the concession/lease contract, sets of productivity goals are defined and then should be routinely checked by aviation authorities, academics and community representatives. As examples of these commitments airports are expected to improve their neighborhood area, enhance job creation, improve economic activities, monitor environmental issues, and multiply taxes paid at its area of influence. Regarding their management procedures, some qualitative efficiency indicators can be found such as the number of employees of the airport authority in comparison to the total annual passengers and total annual aircraft movements, the percentage of the staff costs in total airport expenditure, and non-aeronautics activities in comparison to the total airport revenues, among others.

Brazil is currently considering some kind of privatization for its major airports. Meanwhile, some state-managed airports have already been privatized. But in all cases, there seems to be small, if any, attention towards elaborating AEIs to estimate the economic potential of these major airports (and consequently the minimum price to be set for the international bidding) and establishing efficiency indicators to monitor the winning consortium's activities.

In view of the above, the main objective of this paper is to compare the overall management efficiency of 12 of the world's 5-15 mppa [million passengers per annum] airports with private and public managements (*Australia* – Brisbane, Perth and Melbourne; *UK* – Stansted; *Canada* – Vancouver and Calgary; *USA* – San Diego; *New Zealand* – Auckland) in relation to the four major Brazilian airports within this group (*São Paulo* - Guarulhos and Congonhas, Rio de

Janeiro Galeão and Brasilia) through some of the before mentioned qualitative performance indicators.

2. CURRENT AIRPORT MANAGEMENT MODELS

This section briefly presents the management models of the airports herein pictured. For a more detailed description of the public and private managements in Brazil and the types of privatization processes being considered for the country's major airports, refer to Espirito Santo Jr. *et al.* (2001).

2.1 The INFRAERO (Brazilian Federal Airport Authority) and Its Four Major Airports

The Infraero – *Empresa Brasileira de Infra-estrutura Aeroportuária* or Brazilian Airport Authority – manages 67 airports, from the very major ones (i.e. São Paulo/Guarulhos and Rio de Janeiro Internationals) to general aviation airports. It is a centralized federal government-owned company under the Ministry of Defense since 1999. From its creation in 1972 until 1999 it was directly under the Ministry of Aeronautics (Air Force Ministry), thus it has been a military-run and military-structured organization for its entire life. In 1999, the company had 9,990 organic employees, plus another 13,007 employees from different companies working for Infraero. The Brazilian Airport Authority is divided into seven "business centers" (CNs), each responsible for a certain region of the country and its airports. Control is totally centralized in its headquarters in the country's capital, Brasília. This centralized structure prevents any independent management decisions from the CNs: for instance, each CN is not independent to set individual/particular terminal and landing fees for its airports. As an example of its importance, in 1999 Infraero processed 64,569,761 passengers, corresponding to 95% of the passenger traffic in Brazilian airports. This same year Infraero processed nearly 1,160 million tones, representing 99% of the airport cargo volume in the country.

The four airports considered in this study are those with passenger movement between 5–15 mppa in 1999. These are: São Paulo/Guarulhos International (SBGR), São Paulo downtown Congonhas (SBSP), Rio de Janeiro Galeão International (SBGL) and Brasília (SBBR). These airports, plus Rio de Janeiro's downtown Santos Dumont (SBRJ) airport are the most important in the country. Except for the latter, all are classified as international airports.

São Paulo/Guarulhos International Airport is the largest airport and can be considered as the main hub for all major Brazilian airlines (Varig, Vasp, TAM and Transbrasil). According to Fernandes *et al.* (1997) it links São Paulo to 36 countries, serving passengers from 106 cities – 57 foreign and 48 Brazilian. A new third terminal is under the final stages of conception/planning in order to expand the passenger handling capacity at the airport. São Paulo Congonhas Airport is the downtown airport for the city of São Paulo and its main traffic is derived from the Rio de Janeiro-São Paulo and Brasília-São Paulo shuttles (called "pontes-aéreas", or air-bridges).

In the 80's, Rio de Janeiro Galeão International Airport used to be the main Brazilian international gateway. However, in the last decade it has lost this position to the ever-growing São Paulo/Guarulhos. The second passenger terminal of SBGL was opened in 1998, increasing the airport handling capacity to 15 mppa. Unfortunately, despite Rio being famous for its charisma, beautifulness, music and weather, the airport has been unable to overcome the 6-7 mppa mark since 1995.

Brasilia International Airport is the country's capital airport and one of the most modern in Brazil. Located 13 km from the Federal Government headquarters, the airport's two terminals primarily serve the politicians, officials and executives from the Federal Government Ministries and agencies, and the Brazilian Congress.

2.2 The Canadian Airports

On July 1st, 1992, Transport Canada transferred the operation of the Vancouver International Airport to the Vancouver International Airport Authority (VIAA) under a 60-year lease agreement. According to YVR (2000), *"Vancouver International Airport Authority is an independent, non-governmental not-for-profit corporation"* and for this it has no shareholders. Its assets belong to the Federal Minister of Transport and annually VIAA pays a type of rent to the federal government, which, again according to YVR (2000), *"includes both base rent, and a percentage of gross revenue earned by the Airport Authority"*.

The Calgary Airport Authority is a not-for-profit corporation, incorporated under the Regional Airports Authorities Act (Alberta). It is responsible for the maintenance, development and operation of the Calgary International Airport in a long-term lease of airport lands and improvements. Moreover, the corporation is responsible for all operating and capital costs, since it does not receive any government funding. Its Board of Directors includes members appointed by the City of Calgary.

2.3 The Privatization Process of Australian Airports

In 1988, the Federal Airports Corporation (FAC) was formed and the administration of Australia's major airports passed from a Government department to a corporatised entity (Hooper *et al.*, 2000). In July 1997, the three airports considered in this study, Brisbane, Melbourne and Perth, were transferred to the private sector. Brisbane Airport is now owned and operated by Brisbane Airport Corporation Limited (BACL) that paid AUS$ 1.397 billion for a 50-year lease of the airport, with an option to extend that lease for a further 49 years (ACCC, 1999a). BACL's shareholders include Port of Brisbane, Commonwealth Investments Pty Ltd, Schiphol Australia Pty Ltd, Commonwealth Custodial Services Ltd and other financial institutions.

Melbourne Airport is owned and operated by Australia Pacific Airports (Melbourne) Pty Ltd (APAM), who took over its operation from the FAC for a 50-year lease. Its shareholders are: AMP, Deutsche Asset Management, BAA plc and Hastings Funds Management (ACCC, 1999b).
Perth Airport, is owned and operated by Westralia Airports Corporation Limited (Westralia). This is a consortium consisting of Airport Group International, Hastings Fund Management and Infratil Australia Ltd. It paid AUS$ 639 million for a 50-year lease of the airport, with an option for an extension of 49 years after that period (ACCC, 1999c).

2.4 Other Important Medium-Size Airports Around the World
Stansted airport is one of the 7 airports that were included in the first part of the 1986 Airport Act established by the UK under the Thatcher administration. Following the UK privatization policy, the government-owned British Airports Authority was transformed into a private company. Since then, these airports had to survive without subsidies (Humphreys, 1999). Stansted airport opened in 1953 and since 1986 its passenger traffic has grown from 545,000 to nearly 9.4 million, representing more than a 1,700% growth. According to BAA (2000), it is the Europe's fastest growing airport and the fourth busiest airport in the UK. Stansted's success is related to the unique set of strategies for the airport, which is to increase operations by low-cost airlines such as easyJet, Go!, Ryanair and Virgin Express. These carriers have about 53% of the total passenger traffic registered for Stansted.

Auckland International Airport has been operating since 1965. The company was corporatised in 1988 when Auckland International Airport Limited (AIAL) became a limited liability company, with the majority of shares owned by the New Zealand Government and the balance by local City Councils. Following the successful public offering of the New Zealand Government's 51.6% shareholding, AIAL was listed on the New Zealand Stock Exchange in July 1998 and on the Australian Stock Exchange six months later.

Finally, the San Diego International Airport is operated by the Port of San Diego, which is a special government entity, created in 1962 by the San Diego Unified Port District Act. The California legislature established the Port of San Diego in order to manage San Diego Harbor, operate Lindbergh Field and also to take care of the public lands along San Diego Bay.

Table 1 presents some operational data for the above-mentioned airports, such as passenger traffic, aircraft movements and total airport authority staff. The 12 listed airports are divided in three groups, according its passenger (pax) traffic: *group 1* encompasses those with more than 10 mppa; *group 2* between 5 to 10 mppa; and *group 3* includes the mentioned airports with less than 5 mppa.

Table 1: Passenger Traffic, Aircraft Movements and Total Airport Authority Staff (AAS) – 1999.

Group	Airport (*ICAO code*)		Pax Traffic	Aircraft Mov	Total AAS
1	Vancouver	*CYVR* [1]	15,806,499	367,249	300
	San Diego [2]		15,131,497	217,495	97
	Melbourne	*AMML* [3]	14,583,346	156,802	187
	Guarulhos	*SBGR* [4]	13,627,289	238,226	1,389
2	Brisbane	*ABBN* [5]	10,712,829	158,760	116
	Stansted	*EGSS* [6]	9,419,612	122,324	730
	Congonhas	*SBSP* [4]	8,297,594	145,420	230
	Calgary	*CYYC* [7]	7,800,362	248,315	130
	Auckland [8]		7,665,974	140,044	268
3	Galeão	*SBGL* [4]	5,349,865	104,960	1,713
	Perth	*APPH* [9]	4,969,318	98,480	94
	Brasília	*SBBR* [4]	4,769,519	83,384	310
	Total		**118,133,704**	**2,081,459**	5,564
	Average		***9,844,475***	***173,455***	***464***

[1] YVR 2000 and YVR 1999; [2] Information obtained directly from San Diego Airport; [3] ACCC, 1999c; [4] Information obtained directly from INFRAERO; [5] ACCC, 1999a; [6] Information obtained directly

from BAA/Stansted; [7] Calgary Airport Authority Annual Report 1999; [8] Auckland Int'l Airport Ltd 1999 Fact Book; [9] ACCC, 1999b.

3. AIRPORT MANAGEMENT DATA COMPARISON

One of the main difficulties when comparing airport management data is due to the different attributions that an airport authority may encompass. For example, some airports such as Düsseldorf and Paris are responsible for handling activities while others like Gatwick and the Brazilian ones are not (Pacheco, 2000).

More than identifying a *default* airport in order to make possible some comparisons among its counterparts, this study aims at presenting major airport management indicators of Brazilian airports in relation to similar sized facilities in other countries. In view of this, apart from airports' attributions and the differences of accounting systems between the countries involved (some 1999 airport's data are related to July 1998-June 1999, while for others are from Jan-Dec 1999) and if the pictured facilities are managed by a public or private entity, this section will look at some of the main management efficiency/productivity indicators of the listed foreign airports, comparing them with the four mentioned Brazilian airports.

Regardless of the staff size and traffic volume herein shown on Table 1, it clearly points those airports having the largest contingent of employees: Stansted, Guarulhos and Galeão. All of these have more than 700 employees, with SBGL (Rio's Galeão) listing more than 1,700 and SBGR almost 1,400. Observing these results it is interesting to question what set of reasons could explain both Infraero and BAA airports having its AAS above the average of the 12 listed airports. Could it be attributed to a centralized-type of management, as in place in Brazil, via Infraero, and partially in BAA, as it manages a set of major British airports? In any way, BAA's performance on this issue is very much better than Infraero's: the former, to operate its 7 airports throughout the UK, with a total

passenger traffic closing 112.5 mppa in 1999, needed 7,355 employees (BAA, 2000), in other words, 15,295 pax/employee [ppe]. On the other side, Infraero and its 7 largest airports accounted for 4,137 direct employees and had a traffic of 42.2 mppa in 1999, thus 10,200 ppe. This brief comparison regarding passenger-per-employee of two airport corporations with a centralized management and their 7 largest facilities shows that BAA has an efficiency of about 50% more than Infraero. Still in this regard, it is important to observe that BAA is responsible for several activities not performed by Infraero. On the other hand, Infraero has a very long list of contracted, non-Infraero employees that performs several activities in support of airport operations. In the case of Rio's SBGL and SBRJ airports, these include personnel performing the roles of safety and security, cargo handling, parking, cleaning, facility and equipment maintenance, law firms, waste incineration and disposal, water treatment, and others. Data provided by Infraero headquarters reveals 302 outsourced personnel for SBRJ and 2,323 for SBGL. Including its own employees, Infraero is thus responsible, directly and indirectly, for the payroll of 501 people at SBRJ and of 4,289 at Rio's International SBGL. In view of the above, if just referring to the Infraero personnel directly involved in each listed airport, another question arises, now within the airport community in Brazil: What would be the fate of this contingent in the case of a future privatization of these airports?

In order to expand this issue, four performance indicators will now be considered, as shown on the Table 2: passenger traffic per AAS (pax/AAS), aircraft movement per AAS (mov/AAS), percentage of non-aeronautics revenues (*nar*) in relation to the total airport revenue (*nar-tar*) and the percentage of the staff cost (*sc*) in relation to the total airport expenses (*sc-tae*).

3.1 Passenger Traffic per AAS

The current performance indicator for the previously listed airports range from the very best rate of San Diego (115,994 pax/AAS) to the

least efficient of SBGL with 3,123 pax/AAS, a level six times below the average pax/AAS of the pictured airports (21,232) and 37 times worse than the rate calculated for San Diego.

Table 2: The four indicators considered for the 12 airports – 1999

Airport	pax/AAS	mov/AAS	nar-tar	sc-tae
Vancouver	52,688	1,224	48.00	22.45
San Diego	155,994	2,242	41.00	n.a.
Melbourne	77,985	838	65.52	17.85
Guarulhos	9,811	171	26.17	23.06
Brisbane	92,351	1,368	70.00	15.03
Stansted	12,903	167	58.75	29.45
Congonhas	36,076	632	43.71	20.21
Calgary	60,002	1,910	38.22	13.57
Auckland	28,604	522	38.36	16.77
Galeão	3,123	61	20.50	30.25
Perth	52,865	1,047	71.18	19.52
Brasília	15,385	269	31.75	28.49
Average	***21,232***	***374***	***46.10***	***23.66***

Sources: Same listed on Table 1

Notes: AAS = Airport Authority Staff; nar-tar = non-aeronautical revenues in relation to the total airport revenue; sc-tae = staff cost in relation to the total airport expenses; n.a. = data not available.

In *group 1*, São Paulo/Guarulhos (SBGR) has the worst rate of the pictured airports, with nearly 9,810 pax/AAS, twice below the average. Again approaching via a direct comparison in this particular indicator, San Diego shows an employee productivity 11 times higher than the registered for SBGR. Comparing this Brazilian airport with the two others of *group 1* (Vancouver and Melbourne), it will again show an employee productivity at least five times lower.

On the other hand, São Paulo's downtown Congonhas airport (SBSP), the Brazilian representative in *group 2*, has a remarkable

employee productivity level of 36,076 pax/AAS, being the only Brazilian airport above the calculated average for this indicator. Indeed, this represents a productivity much higher than registered at Stansted (12,903 pax/AAS) and Auckland (28,604 pax/AAS). In its group, concerning the current indicator, Congonhas falls behind only to Calgary and Brisbane.

In *group 3*, which includes Galeão (SBGL) and Brasília (SBBR), Perth airport (APPH) may be referred to as the *default* in this indicator. Although all the three airports are very near the 5 mppa traffic volume, SBGL has an employee productivity rate 17 times lower than Perth, while SBBR, being much more efficient than the other Brazilian airport can be said to having 3 times less efficiency in man-power productivity than APPH.

3.2 Aircraft Movement per AAS

This other performance indicator reveals again San Diego as the top reference, with 2,242 mov/AAS. Meanwhile, with its more than 1,700 direct Infraero employees, and its very low volume of passenger traffic and aircraft movement, Rio's Galeão could not place itself anywhere else than in the last position of all the listed airports, with 61 mov/AAS.

Unfortunately, São Paulo/Guarulhos also registers the last position in its group in this second employee productivity indicator, with 171 mov/AAS. This is twice as low as the average for the airports in *group 2* (374 mov/AAS), and 5 times lower than Melbourne and 13 times lower than registered for San Diego.

Again marking an extraordinary performance, São Paulo downtown Congonhas with its 632 mov/AAS, is the top-most of the pictured Brazilian airports, being the only one above the average. Moreover, with its superb performance, Congonhas could well teach its experiences to BAA's Stansted (167 mov/AAS) with its more than 3 times worse productivity than of the Brazilian airport.

In *group 3*, Perth is again the top reference for this second employee productivity indicator, with 1,047 mov/AAS. Meanwhile, Galeão registers the worst of all in its group and within all the listed airports (61 mov/AAS) and Brasília performs better only than São Paulo/Guarulhos, Galeão itself and the low-productivity Stansted.

3.3 Non-Aeronautics Revenues

Regarding the proportion of non-aeronautical revenues over the total revenues generated by the pictured airports (*nar-tar*), the Australians could be referred to as the role-models, with all their three representatives above the 65% mark. Within this performance indicator, no Brazilian airport was able to position itself above the average of 46,1% nar-tar. But, again Congonhas can be mentioned as the role-model for its country counterparts, with 43,7% of non-aeronautical revenues over total airport revenues. This number is the top-most performance of all the 15 largest Infraero-managed airports. Another role-model in Brazil can be referred to as well: Rio's downtown Santos Dumont airport (SBRJ) has also an outstanding 41,8% nar-tar for the year of 1999. These extraordinary performances registered by these two downtown airports in the country's largest and most important cities can be greatly explained by their business traffic profile: more than 80% of the passengers are the high-yield executives. Taking advantage of this, both airports sell the great majority of their advertising spaces at a much higher price if comparing to other less-business-oriented airports in the country. Moreover, the concessions located at these two airports also generate more revenues, thus reverting higher fees to be paid to Infraero.

Comparing São Paulo/Guarulhos with its group partners, we may observe it has a *nar-tar* performance almost 15% lower (26.17%) than Vancouver (48%) and San Diego (41%), and almost 40% lower than Melbourne (65.5%). These differences may very well include the millions of dollars urgently needed to build the third terminal for the most important Brazilian airport. But, unfortunately, as the

centralized resource allocation policy done by Infraero would prompt the allocation of the entire non-aeronautical revenues generated by SBGR for its own third terminal construction, it seems clear that there is a *lack of stimuli* for a greater effort towards maximizing non-aeronautical in this and other Brazilian airports (Espirito Santo Jr. *et al*, 2001). To revert this situation, a *major decentralization* of the current airport management policy in the country could and should be pursued.

Within *group 2*, São Paulo downtown Congonhas registers superior *nar-tar* performance than of its group counterparts of Calgary and Auckland. It is interesting to observe that all three airports fall behind the total average of the pictured airports (46%). As referred before, an Australian representative (Brisbane) tops this group with an outstanding 70% non-aeronautical revenue percentage.

As for *group 3*, Galeão and Brasília airports with 20.5% and 31.7% *nar-tar*, respectively, are far away from the performance indicators registered not only for the direct-comparable airport (Perth, with more than 71%), but to all listed airports. Rio's Galeão, despite its great potential of being *the* gateway for international inbound travel to Brazil, seems to be unable to set consistent and efficient strategies in order to elevate its non-aeronautical revenues. This is a consequence of multiple internal (Infraero) and external factors, mainly translating on its continuously low passenger traffic numbers. As mentioned before, a *lack of stimuli* may count in favor of not pushing forward any kind of non-aeronautical revenues strategies enhancement for the majority of the Brazilian airports.

3.4 Staff Cost

Staff costs refer to a simple yet very much used employee-and-financial management performance indicator: the percentage of staff costs over the total amount of airport expenses (*sc-tae*). For all the 12 pictured airports, only three fell behind the average of 23.6%: Rio's Galeão (30.2%), BAA's Stansted (29.4%) and Brasília

(28.5%). The top performers for this *sc-tae* indicator were Calgary (13.5%) and Brisbane (15%).

Encompassing only the Brazilian airports pictured in this study, Congonhas again performs very well in this last indicator (20%). This is almost 1/3 less than the *sc-tae* registered for Rio's Galeão and the country's capital Brasília airports. Meanwhile, we may find São Paulo/Guarulhos to be just at the average, with 23% *sc-tae*. Moreover, data obtained from Infraero reveals that the overall average for its 67 airports is of 24,8% *sc-tae*. But there are examples that completely fall behind this: Val de Cães airport (SBBE, with 1.17 mppa in 1999), located in the capital of the state of Pará, Belém, is an international airport where staff costs represents more than 42% of the total airport expenses.

4. CONCLUSIONS

As seen before, three of the four Brazilian airports analysed in this article (Guarulhos, Galeão and Brasília) may be considered with having an overall management with low efficiency/productivity. In terms of employee and non-aeronautical revenue performance their results are, in most of the cases, significantly below of the other listed airports. In fact, within the mentioned indicators, Rio de Janeiro's Galeão airport revealed itself in a very poor situation. On the other side was São Paulo downtown Congonhas airport, which has shown a very good performance, even overcoming highly praised airports such as Stansted, Calgary and Auckland in some indicators.

Meanwhile, in view of the current airport privatization models being considered in Brazil, it is possible to ask: *"How could these performance and productivity indicators be used by the Brazilian airport authority or the Brazilian government as a tool to study the privatization processes in consideration?"* To try to start answering this question, we should first have in hands multiple studies and official reports on these indicators. But neither one nor the other exist in Brazil. Very few, isolated academics elaborate these studies

and Infraero does not seem to elaborate any either, as nothing is officially released to the public, even when there are very good results, as here exemplified by São Paulo downtown Congonhas and Rio's downtown Santos Dumont airports. In view of this, consulting firms and the academia may well be called upon to elaborate detailed studies on the aforementioned and other sort of indicators. But, again, this depends on what kind of *decentralization policy* will be pursued (if it will!) by the Brazilian government for its major airports.

Another question often referred when employee productivity indicators are mentioned is "*What will happen to all the Infraero personnel with a possible-future privatization process?*" Infraero is currently under a downsizing "voluntary retirement program" (PDV), while it has already retired the great majority of military advisors it had until 1999. The PDV is set to retire about 15% of Infraero directly employed personnel. Unfortunately for Infraero, many of the retirees are excellent professionals that could very much collaborate with a smooth and positive decentralization and/or privatization process. As in any privatization policy, this is an issue that will certainly concentrate several concerns within the Brazilian government for its social and political implications. Any possible winner of a future privatization bidding should also look at this particular matter in close detail.

In view of the results herein contained, not only Infraero and the Brazilian aviation authority must consider enhancing the overall productivity and efficiency of the nations airports; the now-observing future contenders, and then the winning groups must also start their detailed studies in order to obtain the maximum possible return of these so relevant economic infrastructures.

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Tender Evaluation - Quality-Price Trade-Off Method

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ABSTRACT

In the pursuit of increased value for money, some public sector agencies are beginning to use innovative competitive pricing procedures when tendering. One such method is by evaluating tenders submitted for physical work by what is termed the quality-price trade-off method. In effect, these methods use attributes in addition to price in determining the winning tender. Weighted attribute methods have been used for many years by most agencies for evaluating professional service proposals. However, it is only recently that these methods are beginning to be used in the evaluation of tenders for physical work. Two such recent applications are in the evaluation of build-operate-transfer projects and long term (i.e. 10 year) road maintenance contracts. Given that these types of projects often involve contracts in the $100's of millions, agencies must formalize the quality-price trade-off evaluation procedure and ensure that the methods are rational, defensible, and auditable if they are to be used.

This paper presents the quality-price trade-off method of tender evaluation within the context of a multi-attribute probabilistic decision framework.

Introduction

The quality-price trade-off method uses attributes in addition to price in determining the winning tender. In Canada, as in many other parts of the world, these multi-attribute methods have been used in the past by public sector agencies to evaluate tenders for consulting services. Recently agencies in some parts of the world have begun to use these methods for evaluating tenders for physical work. Given that these types of projects often involve contracts in the $100s of millions, agencies must formalize the quality-price trade-off evaluation procedure and ensure that the methods are rational, defensible and auditable. In short, it is one thing to use informal methods to evaluate tenders from consultants involving contracts for a few tens or even a hundred thousand dollars, it is quite another situation when hundreds of millions of dollars are involved.

Traditionally, physical work has been tendered on what is known as the "low bid" or more formally, the lowest conforming price method. In this method, the minimum requirements for the project are specified in the tender call, and the contractor submitting the lowest bid price while meeting or exceeding the minimum specified requirements is awarded the contract. This type of tendering/award method is typically very competitive and encourages contractors to target "just exceeding" minimum specified requirements and to lower costs (thereby maximizing margins and profits) by increasing efficiencies (i.e. doing more for less) and/or "cutting corners". This type of tender/award method works well in situations where the work that is required and/or the end product are well defined with little if any room for innovation in terms of methods and/or materials. An earth work contract might be an illustration of such a project.

The Quality-Price Trade-Off Method

The advocates of the quality-price trade-off method argue that contractors should be encouraged to be innovative and be rewarded when their innovations succeed. This is particularly true when there are potentially alternative ways (i.e. methods and materials) to accomplish the desired end result, and where there is value from the purchasers perspective if the contractor were to exceed the minimum specified end results. In short, the advocates of the quality-price trade-off method argue that this method focuses on "value" whereas the low bid method focuses on "price".

An Example

The quality-price trade-off method and the issues related to the use of this method might be illustrated by considering an example.

The first issue in applying the quality-price trade-off method is that of identifying attributes in addition to price that are deemed important relative to the delivery of a quality end product. Some such attributes might include:

1. **relevant experience** in terms of previous experience in technical areas comparable to those of the current project,
2. **track record** in terms of meeting or exceeding the quality standards required, on schedule and within budget on previous projects,
3. **technical skills** in terms of the competence of the personnel proposed to be used on the project with particular regard to their skills and experience in technical areas comparable to those of the current project,
4. **management skills** in terms of available personnel with appropriate management skills and experience along with effective management systems and methods appropriate for successful management of projects, and

5. **methodology** in terms of the appropriateness of the proposed methods in achieving the specified end results.

The attributes above are typical of those that would be identified as important in evaluating tenders from alternate suppliers, but there are numerous others that might also be considered equally important. Agreeing upon the attributes against which alternative tenders should be judged, is the first major hurdle which must be overcome in applying the quality-price trade-off method. Needless to say, this debate could be rather protracted because of the subjective nature of this task.

The second major issue to address is that of assigning the relative weights to be applied to each of the attributes during the evaluation process. As one might imagine, this assignment of relative importance for the agreed upon attributes may also involve considerable debate. For our purposes, at least at this stage, let us assume that it is possible to get agreement on these relative weights. (This matter will be revisited later during the sensitivity analysis sections of this paper.)

For the purposes of this illustration, let us assume that three tenders have been received in response to an invitation (i.e. Tenders 1, 2 and 3), and that three individuals (i.e. Raters 1, 2, and 3) have rated each of the tenders against each of the attributes on a scale of 0-100 and the results are summarized as illustrated in Table 1. (Tables and Figures are at the end of the paper.)

One last issue that must be resolved is to translate differences in tender price on to some type of scale relative to the 0-100 scale used by the raters for the other attributes. Again in the interest of brevity, let us assume that price is rated on a 0-100 scale with the highest tender rated zero and the lowest tender rated 100, with others rated proportionally between 0 and 100. The results of three raters, rating three tenders 1, 2 and 3, are illustrated in Table 1. For our purposes, the actual ratings are of little importance other than that they be realistic relative to

those that could be expected in a real world tendering situation. (In fact, the ratings summarized in Table 1 are those obtained for an actual project, the identity of which is not disclosed for obvious reasons.) It is sufficient for our purposes to note that the general characteristics of each firm submitting tenders were as follows:

> Tender 1 - submitted by an established firm that has specialized in the type of work tendered for about 10 years. The senior people proposed for the project have extensive relevant experience with a good reputation and track record. The methodology proposed is tried and proven. They submitted the highest bid.
>
> Tender 2 - submitted by a firm with some experience in related work over the last 6-7 years. The senior personnel offered have experience managing similar sized projects, but none managing projects of this particular type. One of the project staff proposed has some intermediate level experience on projects of the nature tendered. The track record of the firm is reasonable and the firm is recognized for on-time completion of work. The details of the proposed methodology are somewhat lacking. The firm submitted the second highest tender.
>
> Tender 3 - submitted by a recently formed company comprised of highly qualified technical people that offer a highly innovative but untested solution. The proposed methods are highly unique. While the record and qualification of the technical experts are impressive, they have little practical experience and no track record because the firm is relatively new. They submitted the lowest bid price.

In effect, the three tenders might be summarized as (1) the tried and true by the old guard, versus (2) an experienced firm

trying to get into other markets, versus (3) a new innovative "technical" upstart.

Analysis

For analysis purposes, the problem was formulated as a multi-attribute decision problem within the context of an Influence Diagram [1] as illustrated in Figure 1.

As illustrated in Figure 2, when the numbers are "crunched", Tender 3 is the marginal winner (at 71.81) over Tender 2 (at 71.40) with Tender 1 (63.37) in last place.

As is the case so often with this type of analytical evaluation approach, the results leave the decision makers with an uneasy feeling. First, because of the all two often minor differences that end up separating winners from losers, along with the subjectiveness of the ratings as well as the assignment of the relative weights for price and non-price attributes. In actual fact, the uneasiness of decision makers is, as will be illustrated later, totally justified. This decision environment is in fact highly complex (i.e. lots of variables) and highly uncertain. As such, one would expect some uneasiness in making important decisions.

In such situations, sensitivity analysis can be a very useful tool in assisting the decision maker in more fully understanding the "sensitivity" of the end results to changes in the values of the individual input variables (i.e. ratings assigned by raters as well as the weights assigned to the individual attributes).

Since, because of the structure of this particular problem, the results are most sensitive to the relative "weights" assigned individual attributes, this is a good spot to start a sensitivity analysis.

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[1] For details related to constructing Influence Diagrams, see *Making Hard Decisions* by Robert Clemen

Sensitivity Analysis

A sensitivity analysis designed to provide insight into how each of the three tenders would fare, relative to each other, if the weighting factors assigned individual attributes were adjusted was undertaken.[2] This deterministic sensitivity analysis involved changes to the weighting factors for each attribute from the initial value of .15 (in Table 1) to .10, and then evaluating the model, and then substituting .20 for the weighting factor and re-evaluating the model. This systematic evaluation of the model for varying values of weighting factor was completed for each of the weighting factors.[3] See Table 2 for values used and the resulting expected values for the tender index. The results are summarized in a Tornado Diagram in Figure 3.

The width of the bars in Figure 3 indicate how the score for Tender #3 would change as the values for the individual weighting factors are varied from .10 to .20. (See the numbers on the bars in Figure 3) The bars with shaded ends indicate that these variations in values assigned the weighting factor for that attribute result in a change in the winning tender if the weighting factors are so adjusted. In short, the results in Figure 3 indicate, as might have been expected, the results (i.e. which tender wins) are sensitive to small (i.e. .05) variations in weighting factors.

Further insight might be gained by examining what is called the "Risk Profiles" associated with each of the tenders due to variations in the ratings assigned by individual raters. Risk

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[2] This analysis was undertaken using DPL, a Decision Analysis software package available from www.adainc.com

[3] The weighting factor assigned Price was: Price = 1 - weighting factors assigned other attributes. As such, if for example, the weighting factor for technical skill is increased from .15 to .20, then the weighting factor assigned to price is decreased by .05.

Profiles for the base case (as per Table 1) are illustrated in Figure 4. (These Risk Profiles might be thought of as cumulative probability distributions over tender index as indicated along the horizontal axis of Figures 4, 5 and 6.)

As illustrated in Figure 4, Tender #3 has the highest expected value (to the right of all others and at 71.815. See Table 2 for expected values of tender index for various weighting factors.) However Tender #2 is very close not only in terms of expected value (at 71.40 Table 2) but also in terms of Risk Profile. In fact, the Risk Profiles of Tenders #2 and 3 cross at the top. (This indicates that Tender #3 is NOT stochastically dominant over Tender #2) [4].

If the Risk Profiles for Tenders #2 and 3 in Figure 4 are thought of as cumulative probability distributions for tender index, it is clear in a statistical sense, that Tenders #2 and 3 ARE NOT statistically significantly different from each other. This lack of statistically significant difference might be thought of as one justification for the unease in the feelings of decision makers selecting the winning tender. That is, from an analytical (i.e. probabilistic) perspective, Tender #2 and Tender #3 are not different. In this same perspective, Tender #1 in Figure 4 is stochastically dominated by both Tenders #2 and #3, as well as appearing to be statistically significantly different than Tenders #2 and #3.

The sensitivity of this tender evaluation process to assigned weighting factors for each attribute is further illustrated by the Risk Profiles in Figures 5 and 6. (See Table 2 for values.)

As noted in Figure 5, increasing the weighting factor assigned to Technical Skills from .15 as it was in the base case to .20 resulted in making Tender #3 stochastically dominant over Tender #2 (i.e. the Risk Profiles no longer cross) and reducing

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[4] For an explanation of Stochastic dominance, see *Making Hard Decisions* by Robert Clemen

the expected value for Tender #2 (from 71.40 to 69.38 (see Table 2)). From a statistical perspective, however, as can be seen in Figure 5, Tender #3 is still not statistically significantly different from Tender #2 at any reasonable level of statistical significance. A similar observation can be made for Tender #2 relative to Tender #1 in Figure 5.

The sensitivity of the tender results relative to weighting factors might be further illustrated by increasing the weight assigned management skill (from .15 to .20) as illustrated in the Risk Profiles in Figure 6. (See Table 2 for values.) It is noted from Figure 6 that Tender #1 is now the winner (with an expected value of 70.22 relative to 68.60 for Tender #2 and 68.66 for Tender #3 - see Table 2). While the winning tender from an expected value of tender score perspectives has changed, it is noted from a review of the Risk Profiles in Figure 6 that here is not a statistically significant difference between any of the three tenders.

Summary

A sensitivity analysis of the results of a typical quality-price trade-off tender evaluation process indicates that, as might have been expected, the results (i.e. which tender wins) are highly sensitive to the weighting factors assigned (i.e. .05 or 5% shift in weighting factor can easily change which tender wins).

Further, if the quality-price trade-off process is formulated as a multi-attribute decision process and modeled probabilistically, even Tenders that might be considered on review as being quite different (i.e. experienced old guard versus experienced but new to the area versus new "techie" upstart) end up not being statistically significantly different!

This leads to the conclusion that most veterans of the bidding game probably feel in their gut and know in their hearts, that in

the end, the bidding process is a "crap shoot" at best, independent of the tender evaluation process.

TABLE 1 TENDER EVALUATIONS

		TENDER RATINGS [2]											
		TENDER 1				TENDER 2				TENDER 3			
ATTRIBUTE	WEIGHT [1] Base Case	1	2	3	Av [3]	1	2	3	Av [3]	1	2	3	Av [3]
Relevant Experience	.15	100	100	100	100	58	63	65	62	45	50	55	50
Track Record	.15	80	87	95	87	70	77	78	75	35	34	42	37
Technical Skills	.15	57	62	67	62	46	51	53	50	100	100	100	100
Management Skills	.15	72	74	79	75	69	75	78	75	40	36	35	37
Methodology	.15	100	98	96	98	60	59	70	63	87	87	90	88
Price [4]	.25	-	-	-	100	-	-	-	86.7	-	-	-	0
	1.00	63.37				71.40				71.81			

1. Pre-determined and included in the call for tenders
2. Each tender is evaluated against the attributes by each of three raters on a scale of 0-100, with an average score of at least 35 required on each attribute other than price for the tender to be considered.
3. The average of three ratings by each of three independent qualified raters
4. Grade for price - 100 awarded to the lowest qualifying tender, 0 to the highest, with other assigned scores proportional between the highest (0) and lowest (100) based on relative price. The relative tender price where Tender 1 (64.3); Tender 2 (50.6) and Tender 3 (48.5)
5. Tender Index = Tender rating by attribute x weight/100

TABLE 2 SUMMARY OF PARAMETERS FOR THE SENSITIVITY ANALYSIS AND EXPECTED VALUES OF TENDER INDEX

ATTRIBUTES	SITUATION ANALYZED			
	Base Case	Tornado Diagram	Figure 5	Figure 6
Relevant Experience	.15	.1 - .2	.15	.15
Track Record	.15	.1 - .2	.15	.15
Technical Skill	.15	.1 - .2	.20	.20
Management Skills	.15	.1 - .2	.15	.20
Methodology	.15	.1 - .2	.15	.20
Price	.25	.20 - .30	.20	.15
Total	1.00	1.00	1.00	1.00
Tender Index - Expected Value				
Tender 1	63.37	See Figure 3	66.47	70.22
Tender 2	71.40	See Figure 3	69.38	68.60
Tender 3	71.815	See Figure 3	71.815	68.66

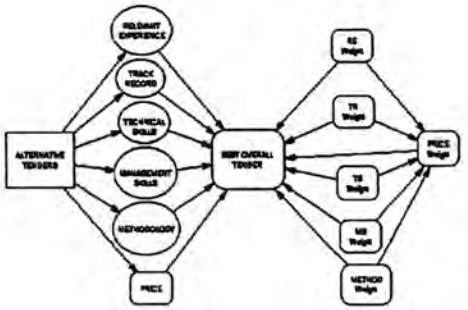


Figure 1 Influence Diagram

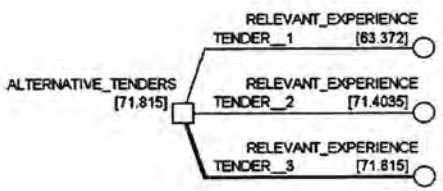


Figure 2 Model Results

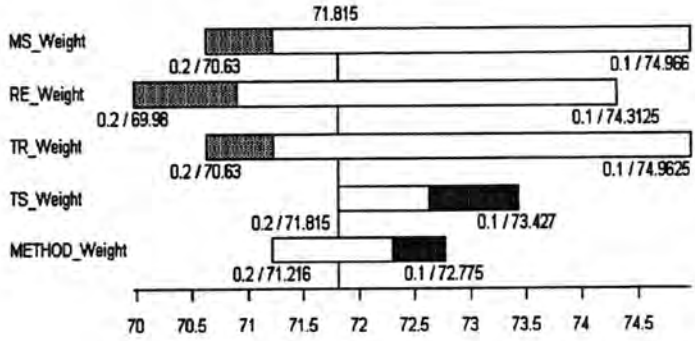


Figure 3 Tornado Diagram – Base Case

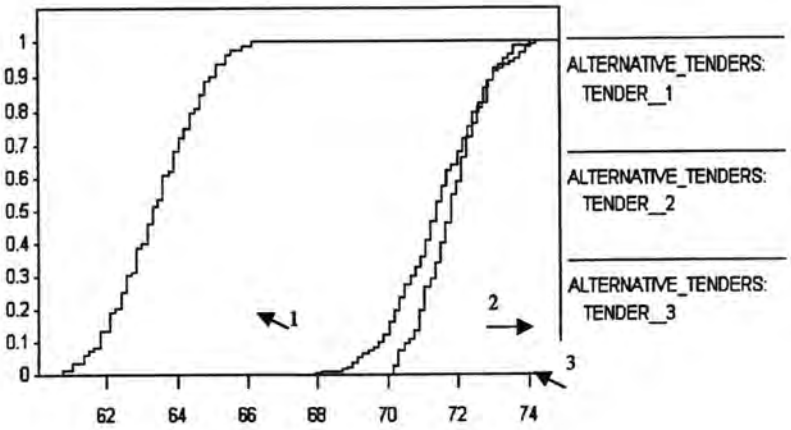


Figure 4 Risk Profiles – Base Case

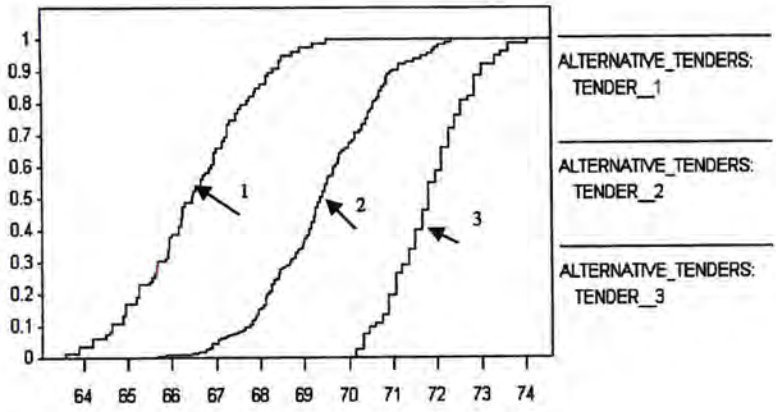


Figure 5 Risk Profiles Technical Skill (.20)

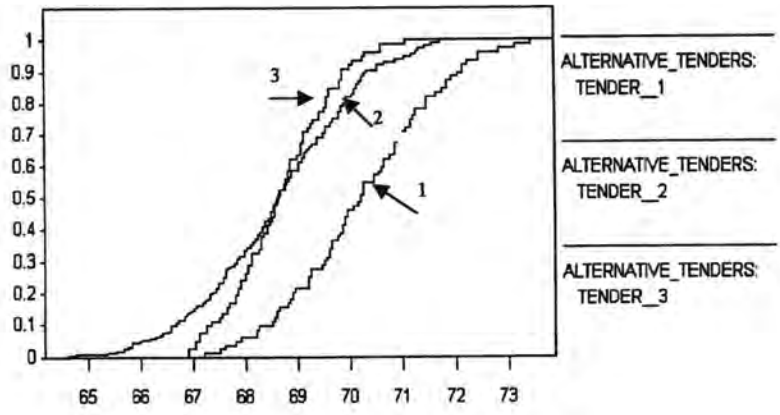


Figure 6 Risk Profiles Technical & Management Skills (.20)

The Impact of Transportation on Local Economies: Two Case Studies

Tom Kearns

I. Introduction

One of the major challenges to transportation planning is understanding the link between a specific transportation investment and local economic development. Understanding this link is essential to deriving optimal investments.

Recently, the Transportation Research Board organised two conferences and the link between economic development and transportation was viewed as a major research requirement for transportation planning (Transportation Research Board, 2000).

Over the last decade beginning with Aschauer, macroeconomists have also focused efforts to determining the link between transportation investment and economic growth (Aschauer, 1989). As new econometric methods are employed, more sophisticated approaches are required to better understand and model the impact and causality of transportation investment on the economy (Waters, 2000).

One advantage to studying this issue at a provincial or national level is the availability of existing data. At the local level the necessary data is not available to determine causality. This makes analysis of local economic impacts of transportation difficult without primary research.

An effective and simple case study methodology was outlined in a study conducted in the State of Mississippi (U.S. Department of

Transportation, 1995). In this report the impact of transportation investments were highlighted by using trends in socio-economic data and anecdotal expert opinions. The only element missing from this case study approach was conventional benefit/cost analysis.

As part of the Strategic Highway Improvement Program (SHIP), a set of two case studies were conducted on highway projects in British Columbia. One study involved the construction of the Castlegar-Robson Bridge completed in 1994, while the other involved the realignment of the Highway 3/97 intersection at Osoyoos completed in 1995 (British Columbia Ministry of Transportation and Highways, 2000a, 2000b).

SHIP is a partnership of the federal and provincial governments involving cost sharing arrangements on various highway projects. These case studies are jointly sponsored under this program by the British Columbia Ministry of Transportation and Highways (MoTH) and Transport Canada.

In addition to managing the case study process, MoTH was responsible for preparing the socio-economic analysis and an overall report summarizing the findings of these separate studies. Two independent consultants were hired to complete the benefit/cost analysis, Apex Engineering Ltd., and community/business impact study, JB Clark & Co. Inc..

The benefit/cost analysis for both projects used actual construction costs and MicroBENCOST software with provincial default values. Community/business surveys were based on an open ended questionnaire with the purpose of not confining responses.

II. Castlegar-Robson Bridge

Castlegar, is located in the southeast corner of British Columbia in the Kootenay region approximately 37 kilometres north of the Paterson BC-US Border Crossing. The city is situated along Highway 3, which

is the major east-west directional highway in the southern portion of the province. Castlegar is also on the north end of Highway 22 and the south end of Highway 3A. Highway 22 extends southward to Trail and the BC-U.S. border while Highway 3A connects to Nelson 43 kilometres northeast of Castlegar and further east to Creston.

The Community

Castlegar was incorporated as a village in 1946 but settlement in the area dates back to the end of the previous century. Mining, and in particular gold prospecting, led to the first permanent settlement of the area and development continued with the establishment of the Canadian Pacific Railway and logging and milling activities.

Most of the settlement of Castlegar including the downtown commercial core is located on the west side of the Columbia River while other smaller communities including Robson are situated on the east side. The link between the two areas was initially supported by the Robson Ferry, which began service in 1919.

The Robson Ferry was one of the busiest in the province until the mid 1960s when the Columbia River Bridge and new Brilliant Bridge re-routed traffic towards the south end of Castlegar and away from the downtown core. The ferry service continued near the current site of the Castlegar-Robson Bridge at the northern end of Castlegar until 1988. The construction of the Castlegar-Robson Bridge, though, was not being considered at the time this ferry service was discontinued.

By the end of the 1960s, the Celgar Pulp Co. Ltd. pulp mill and a lumber mill now owned by Pope & Talbot Ltd. were operating on the west side of the Columbia River further north of the downtown core. In 1989 Celgar Pulp announced that it would expand its pulp mill. The expansion cost approximately $700 million and was completed in June 1994 and increased capacity at the mill.

On June 30, 1994 the Castlegar-Robson Bridge was opened to the public. As part of the project, improvements were made to Columbia

Avenue, the main street through Castlegar and its downtown core. This supported a $5.3 million downtown revitalization program that was completed in 1995.

The Project

The Castlegar-Robson Bridge project involved the construction of a 478 metre bridge structure at the north end of Castlegar across the Columbia River. In addition to the construction of the bridge the project also included:

- Improvements to three kilometres of roadway along Columbia Avenue and Arrow Lakes Drive in Castlegar;
- Upgrade to the Robson Access/Highway 3A (Brilliant) Interchange;
- Improvements to 1 kilometre of roadway along the Robson Access Road Between Highway 3A and Robson; and,
- Construction of a 100 metre overpass above the Canadian Pacific Railway line.

The bridge was opened to the public in 1994 although expenditures on the project related to environmental monitoring, settlement of property claims and final improvements, continued to 1999.

The total expenditure for the project was $27.30 million. Using the BC Consumer Price Index, Table 1 presents the costs in 1994 dollars.

Table 1: Bridge Project Expenditures by Fiscal Year

	Actual Expenditure (in millions)	1994 Value (in millions)
1990/91 to 1992/93	$5.95	$6.33
1993/94 to 1994/95	$19.92	$20.17
1995/96 to 1998/99	$1.43	$1.36
Total	**$27.30**	**$27.86**

Source: Province of BC, Ministry of Transportation and Highways

The Castlegar-Robson Bridge carries a heavy volume of industrial traffic and provides an alternate link between nodes on the west and east side of the Columbia River including:

West Side	East Side
Downtown Castlegar	Robson and Raspberry
Celgar Pulp Mill	Brilliant
Pope and Talbot Lumber Mill	Highway 3A and Nelson
Hugh Keenleyside Dam	Salmo

Without the bridge, all traffic destined for the mills or downtown Castlegar had to travel through the center of Castlegar on Columbia Avenue resulting in frequent congestion and traffic conflicts.

Benefit/Cost Analysis

The benefit/cost analysis was conducted over a 25 year horizon from the 1994 base year using an 8% discount rate. This analysis included modeling network traffic flows with or without the bridge in place.

Although the bridge likely induced additional travel, the potential benefits and costs of these additional trips were not analyzed. Table 2 summarizes and compares user benefits to incremental costs that are net of rehabilitation, maintenance and salvage values.

Table 2: Summary of the Bridge Benefit/Cost Analysis

Incremental Costs	**$24.9 Million**
Incremental Benefits	
Travel Time Savings	$25.5 Million
Accident Cost Savings	$19.4 Million
Vehicle Operating Cost Savings	$8.6 Million
Total Incremental Benefits	**$53.6 Million**
Benefit/Cost Ratio	**2.2**
Net Present Value	**$28.7 Million**

Source: Apex Engineering Ltd.

The bridge acts as a shortcut across the Columbia River reducing overall vehicle kilometers of travel by approximately 17%. There are also reductions in accident costs resulting from decreased amounts of traffic on higher accident urban arterial roads. The vehicle operating cost savings result from the reduction in vehicle kilometres traveled.

Sensitivity analysis of the results indicates that the project would be found to be positive even if traffic growth or the discount rate varied from the initial assumptions.

Socio-economic Analysis
Although the benefit/cost analysis shows positive user benefits, it does not indicate where these benefits may be realized in the local economy. For the socio-economic analysis, Smithers, having similar population and economic dependency characteristics, was used as a benchmark for comparison with Castlegar. Table 3 provides a summary of the comparison of Castlegar and Smithers.

The bridge created approximately 175 person years of direct employment and 100 person years of indirect employment during the life of the investment.

Manufacturing, tourism and mining have all shown more considerable growth in the benchmark community of Smithers. With growth in these basic sectors, commercial growth should also have grown more rapidly in Smithers but in fact the opposite occurred. It should also be pointed out that the manufacturing sector and in particular forest products manufacturing did not appear to grow even though the bridge in many ways was tied to the pulp mill expansion.

Community/Business Impact Study
Impacts cited by survey respondents largely focussed on the virtual elimination of heavy industrial traffic through Castlegar and the increased convenience, safety and access offered by the new route created by the bridge.

Table 3: Summary of the Bridge Socio-economic Analysis

	Results of Analysis
Population Growth	Less in Castlegar than Smithers
Labour Force (1991 to 1996)	Less overall growth in Castlegar Growth in construction and retail services in Castlegar Decline in manufacturing
Employment Assistance	Similar trends in both communities More reliance in Castlegar Lowest reliance in Castlegar occurred in 1998
Room Revenues	Lower growth rates in Castlegar
Building Permit Value	Higher total values in Castlegar in 1990 and 1991 and similar in both communities from 1992 to 1998 Higher commercial building values in Castlegar
Incorporations	Less in number in Castlegar Number peaked in Castlegar in 1994
Assessed Property Values	Higher growth in total values in Castlegar before and during bridge construction but less growth after Higher business property value growth in Castlegar

Some businesses in Castlegar had increased revenues after the bridge was constructed and many of the respondents felt that downtown Castlegar businesses would have had a significant loss of revenues resulting from the congestion, noise, pollution and safety issues on Columbia Avenue had the bridge not been built.

At least one business in Robson was negatively impacted by the construction of the bridge. The bridge also provided incentive for some Robson area residents to shop in Castlegar rather than Nelson.

Respondents indicated that the bridge reduced travel times including that of school buses and commuters. The bridge made residents on the east side of the Columbia River feel more a part of Castlegar and the community as a whole. The bridge was seen to provide a safe and efficient access into Castlegar for walking as well as vehicular travel.

The bridge re-routed traffic away from the downtown core improving the safety and cleanliness of the area. At least one respondent felt that without the bridge the downtown revitalization, completed in 1995, would not have been as much of a success. The bridge was also seen to have reduced traffic through Castlegar and Robson resulting from the recent Keenleyside Dam expansion.

Summary of Case Study Findings

In all three aspects of the case study the Castlegar-Robson Bridge appears to be an important factor contributing to the economic development of the community. The bridge provided substantial benefits to users with a 2.2 benefit/cost ratio.

The bridge reduced travel time across the Columbia River benefiting residents and businesses in the Castlegar area. This along with the downtown revitalization program provided an incentive for area residents to shop locally. Some of these residents would have previously traveled 43 kilometres to Nelson to shop.

Most of the initial commercial and retail sector growth occurred in the downtown core where the bridge offered a new gateway into downtown Castlegar from Robson and other communities along the east side of the Columbia River.

There is no evidence to indicate that the Celgar pulp mill expansion would not have gone ahead without construction of the bridge.

However, in the absence of the bridge the increase in related traffic along Columbia Avenue and through the downtown core would have caused congestion, safety issues, noise and debris that would have no doubt deterred local shoppers and business investment.

More recently, commercial and retail development has occurred at the south end of Castlegar. Perhaps this development would have occurred regardless of the downtown core development. More likely, though, the expanded downtown core and retention of local shoppers improved the viability of businesses located elsewhere in Castlegar.

It appears that the Castlegar-Robson Bridge was a good investment in the economy at the right time. The construction of the bridge was one of the key factors integrating private sector manufacturing and commercial investment with public sector capital.

III. Highway 3/97 Intersection Realignment

Osoyoos is located four kilometres north of the BC-US border in the Okanagan region of the province and situated along Highway 3 and Highway 97. Highway 97 is the major north-south provincial highway extending from the United States to the Yukon border.

The Community

Osoyoos is nicely placed on both sides of Osoyoos Lake where the lake narrows. Historically, the area was used by First Nations for fishing and seasonal camps were established. The fur trade led explorers to the region and the Fur Brigade Trail was created between what is now Kamloops, BC and Brewster, Washington.

Gold discovered at Rock Creek in the early 1860s brought people into the area and a customs house was established in 1861. However, by 1862 miners were leaving the area for better prospects in central BC. Other than the Dividend Mine, mining played a limited role in the further development of the area.

Agriculture has always been a primary industry. By 1890 commercial orchards had developed and are currently one of the major economic drivers for the region. Wineries have become important to the economy with several established between Osoyoos and Oliver.

Based on its proximity to Osoyoos Lake, favourable climate and location along a natural trade route, tourism has always been an important industry. Osoyoos is also a popular retirement community. One-third of its residents in 1996 were over the age of 64. This compares with a provincial average of just under 13%.

The Project

Highway 3 intersects with Highway 97 on the west side of Osoyoos, forms Main Street, and extends through the community. From Highway 97, Highway 3 is the best route into the downtown core and major commercial areas of Osoyoos.

Prior to the realignment, the western portion of Highway 3 intersected Highway 97 at 92nd Avenue while the eastern portion connected with Highway 97 further south near 86th Avenue. Both intersections had stop signs with the right of way given to Highway 97 at the northern intersection and Highway 3 at the southern intersection.

The realignment project included:

- Reconstruction of the intersection of Highway 3 and 97 with each leg having four lanes;
- Water and sewer utilities relocation and site preparation for a new weigh scale;
- Construction of new accesses to commercial properties, a retaining wall and an asphalt walkway on top of the wall and traffic islands; and,
- Landscaping and installation of curbs, gutters a drainage system and signals.

The weigh scale has not yet been built at the site and for purposes in this report is considered outside the scope of the realignment project.

The design work for the realignment began in 1990 but was halted in 1993 due to funding considerations. Cost sharing between federal and provincial governments under SHIP led to a re-examination of the project, continued design and eventual project construction. The realignment was essentially completed in June 1995.

The total expenditures of the project (net of weigh scale costs) are $5.59 million or the equivalent 1995 dollar value of $5.79 million.

Table 4: Realignment Project Expenditures by Fiscal Year

	Actual Expenditure (in millions)	1995 Value (in millions)
1990/91 to 1993/94	$1.64	$1.80
1994/95 to 1995/96	$3.94	$3.98
1996/97	$0.01	$0.01
Total	**$5.59**	**$5.79**

Source: Province of BC, Ministry of Transportation and Highways

Benefit/Cost Analysis

The benefit/cost analysis was conducted over a twenty-five year horizon from the 1995 base year using an 8% discount rate. Capital costs net of salvage values, rehabilitation and maintenance were $6.3 million after converting annual expenditures to base year expenditures using the 8% discount rate. Table 5 indicates that a slight net cost is expected to be incurred as a result of relatively high capital costs.

The major sources of benefits result from accident and travel time savings. The number of accidents at the intersection has dropped by 27% since the intersection was realigned which is equivalent to 145 accidents per 100 million vehicles entering the intersection.

Table 5: Summary of the Realignment Benefit/Cost Analysis

Incremental Costs	**$6.3 Million**
Incremental Benefits	
Travel Time Savings	$2.2 Million
Accident Cost Savings	$1.0 Million
Vehicle Operating Cost Savings	$2.4 Million
Total Incremental Benefits	**$5.6 Million**
Benefit/Cost Ratio	**0.9**
Net Present Value	**($0.7 Million)**

Source: Apex Engineering Ltd.

The time savings result from the intersection being signalized in comparison with the two way stop controlled base case, additional lanes and a more direct alignment. If the intersection were not signalized, large delays to minor street traffic would occur.

Sensitivity analysis indicates that with a 6% social discount rate the project has a positive benefit/cost ratio. With an 8% discount rate the project has a slightly negative net present value even if there was an additional 0.5% growth in traffic volumes.

Socio-economic Analysis

The realignment project supported the local economy by creating an estimated thirty-five person years of direct and twenty person years of indirect construction-related employment.

In the socio-economic analysis, Oliver was used as a benchmark for comparison with Osoyoos. These communities are about the same size and located along Highway 97 only twenty kilometres apart. Oliver is more agriculturally based, however, while Osoyoos has a more developed tourism industry.

The socio-economic analysis summarized on Table 6 indicates that in general Osoyoos has enjoyed stronger economic growth and

development than Oliver since 1995, the year the intersection was realigned. This also reflects new tourism related investment in the community and increased trade along Highway 97.

Table 6: Summary of the Realignment Socio-economic Analysis

	Results of Analysis
Population Growth	Lagged behind Oliver until 1995
Labour Force (1991 to 1996)	Slightly more growth than Oliver Growth in agriculture, tourism, retail trade and manufacturing in Osoyoos Decline in construction, wholesale trade, logging and forestry
Employment Assistance	Similar level in both communities Less reliance in Osoyoos since 1995 Lowest reliance in Osoyoos in 1998
Room Revenues	Not available by community
Building Permit Value	Values in Osoyoos were declining from 1991 to 1995 Significantly higher commercial building values in Osoyoos 1996 to 1998
Incorporations	Greater in number in Osoyoos and peak in 1994
Assessed Property Values	Similar growth in total values before and during project construction Stronger growth in Osoyoos after the realignment was completed

Community/Business Impact Study

Impacts cited by those interviewed largely focussed on the improved traffic flows, increased safety and enhanced image of the town. The

realignment was an integral part of the infrastructure improvements required to support the community economic development strategy.

There were 38 to 51 jobs created at the three businesses that established near the new intersection after the realignment was completed. The range of jobs is based on seasonal fluctuations. In addition to the realignment, the prospects of a new weigh scale also factored into the decision of the business owners to establish operations at this location.

Three businesses closed permanently when MoTH acquired the property on which they operated. These businesses were a small repair shop, a service station and a farm albeit much of the farm land was not purchased by MoTH. Although job loss statistics cannot be confirmed the type and size of the businesses indicate that less than ten permanent jobs and additional seasonal jobs would have been lost.

One business has had reduced access and another reduced visibility which, in turn, have impacted negatively upon business revenues. Overall, local respondents indicated that there has been a significant net increase of jobs near the intersection since the realignment.

Given the nature of the businesses, it is quite possible that some of the new development may have occurred at the expense of other areas of Osoyoos. The new development at the intersection, though, was not considered by respondents to have impacted downtown businesses.

Summary of Case Study Findings

The Highway 3/97 intersection realignment appears to have had a significant impact on the economy of Osoyoos. However, the project may not have occurred or at the very least would have been delayed some years without the necessary funding partnership.

The benefit/cost ratio of 0.9 indicates that the costs of the project exceed the projected user benefits. However, both the socio-economic analysis and the community/business survey indicate that

the project supported economic growth and was a positive factor in the development of the Osoyoos economy.

The Highway 3/97 intersection is a major gateway into the community. As a result of the realignment, motorist confusion dissipated and first impressions of the community improved.

The realignment supported the increasing value of trade along Highway 97 and growing regional tourism industry and the local economy seemed to expand after 1995 when the realignment was completed. At least three community survey respondents indicated that the realignment created awareness of the community and attracted outside investment.

V. Conclusion

The Castlegar-Robson Bridge supported commercial growth in Castlegar and the Highway 3/97 intersection realignment supported business growth especially at the new intersection although from a business perspective the major factor, location, really did not change.

When retail business activity increases, the new activity is often considered a redistribution. Because the data and scope of the case studies are both limited, the offsetting losses to other commercial areas are not fully known. However, there are always cost and productivity considerations with the establishment of any commercial business and, at the very least, growth in the commercial activity of Castlegar and Osoyoos would be expected to result in marginal gains.

In both case studies anecdotal evidence suggests that there was capacity for additional development within each community at the time the transportation investments were made. Still the investments appeared to have played a major role in community development and further understanding this role will lead to more effective transportation planning in the future.

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Addressing Infrastructure Maintenance Issues Through Management Innovations

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ABSTRACT

This paper describes a systematic methodology for addressing road infrastructure maintenance by integrating engineering and economic concepts. The management framework recognizes road infrastructure as an asset. The methodologies encompassed emphasize the preservation, upgrading, and timely replacement of the components of the road infrastructure asset through cost-effective planning and resource allocation decisions. A decision-theoretic approach is used to take into account the uncertain nature of infrastructure service quality loss over time.

THE ROAD MAINTENANCE PROBLEM

Infrastructure is once again the subject of much discussion (Canadian Civil Engineer 2000). The construction of the road network is virtually complete and the challenge now is to preserve and operate the system. It is recognized that without acceptable quality infrastructure, the economy will be severely hampered. Another reason for according special attention to the road network is that it is a major capital asset (Federal Highway Administration 2001). For example, in Ontario, it is valued at an estimated $27 billion in terms of replacement (Ministry of Transportation of Ontario 2000).

At the outset of the new millennium, it is expected to be a time of significant change in the planning and management of transportation infrastructure. Due to continued expansion of the road network since

1960s, the need to maintain and rehabilitate a mature system is high indeed. In Ontario, $500 million is spent each year on road maintenance and rehabilitation (Ministry of Transportation of Ontario 2000). While there is a high demand for maintaining and even renewing the facilities, severe resource constraints are in effect.

Maintaining the road infrastructure is a major challenge, given the lack of a technical and financial framework in most jurisdictions. In the past, despite the enormous magnitude of the maintenance task, the approach followed was limited to the application of technical know-how (Khan and LaFontaine 1989). Presently, there is recognition that due to the broad nature of the maintenance issue encompassing technical as well as financial factors, it is essential to develop a management framework for properly addressing the infrastructure maintenance problem.

Means are required for the efficient management of the network. This calls for a process of renewing the service as well as the structural integrity of the highway infrastructure. While much progress has already been made in enhancing the technology of materials and construction, advances are required in the management of the highway infrastructure maintenance and rehabilitation process.

This following parts of the paper describe the methodology for planning and programming infrastructure maintenance works by using a decision-theoretic perspective.

THE MANAGEMENT FRAMEWORK

Maintaining the road network has many facets. To begin with, even newly constructed roads require routine maintenance on a yearly basis. Next is the type of maintenance that can prevent major rehabilitation after a number of years. For roads that are experiencing structural deterioration, corrective type of maintenance becomes necessary. The next level of maintenance involves major rehabilitation and reconstruction. In order to provide the best possible road service

quality under constrained budgets, planning and management activities are essential.

These approaches are integrated into a management framework that looks at the entire asset from engineering, user, and financial perspectives.

The management perspective is to find an answer to the question: How can we manage the asset in order to minimize the inconvenience to the road users and yet achieve cost-effectiveness in completing the maintenance program. As a part of the analyses, the consequences of not maintaining the asset are studied as well.

In order to maintain the road infrastructure at a steady level of performance, systematic management activities are required. Key steps to be carried out are noted below.

- Collection and monitoring of information on current pavement conditions.
- Forecasting future conditions.
- Evaluation of alternative maintenance and rehabilitation strategies.
- Prioritization of the investments.

Figure 1 presents a more detailed overall framework for road network maintenance planning. The following sections describe the components of the framework.

Socio-Economic Environment

At the outset, a close appreciation of the socio-economic and political environment of the road network is to be obtained which in turn would enable problem definition to be realistic and meaningful. This calls for the examination of the functions that the road system serves. Also, the attributes of the transportation environment are to be defined. For examples, heavily travelled roadways that serve commuter and commercial traffic would be viewed somewhat differently than secondary roads that serve low volumes of traffic.

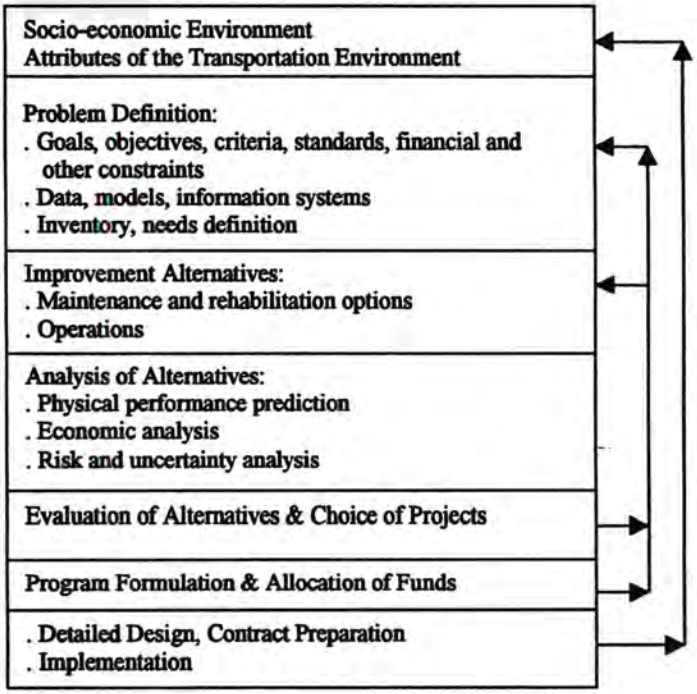


Figure 1: The Framework for Infrastructure Improvement Planning and Management

Problem Definition

The problem definition in the context of highway maintenance is multifaceted. It consists of the definition of goals, specific objectives, criteria for design and evaluation, and service quality and technical

specifications (standards) for maintenance alternatives. Also, constraints including resource (monetary) constraints are to be defined. As a part of goals and objectives, two distinct concerns are addressed. One is to maintain service quality for road users. Second is to preserve the road network asset. In order to address the second concern, the value of the asset is to be estimated. At present, asset valuation is receiving attention in transportation departments in North America (Ministry of Transportation of Ontario 2000, Federal Highway Administration 1999, 2000).

Another facet of problem definition involves data acquisition, model development and person-machine interfaces for compiling/updating inventory of the highway network and estimating improvement needs. These activities include the tasks of estimating future traffic states (i.e., levels and composition) and the states of other service environment conditions. This refers to the severity of climate-environmental effects on infrastructure. Both traffic and climate-environmental factors affect roadway performance over time.

Maintenance Alternatives

The next step is the identification of the maintenance options (including rehabilitation). Here, guidance is received from inventory data characterizing each section of the highway network in terms of the suitability of alternatives for that section. The maintenance options are characterized in terms of design, materials, processes, construction and cost.

For example, maintenance alternatives can be defined in terms of treatment, durability and cost. Rehabilitation alternatives are defined on the basis of thickness of overlay of specified durability and cost, reconstruction, upgrading and surface treatments (Transportation Association of Canada 1997). In the case of reconstruction, logically, designs can vary for different levels of expected traffic. Also, improvements to geometrics and shoulders may be included in the specification of rehabilitation alternatives.

Also, related operations and administrative efficiency improvements are to be defined. For example, in some contexts, alternative rehabilitation and maintenance strategies may include shutting down a road section completely for repair work. On the other hand, work zones and detours may be used (Federal Highway Administration 2000).

Analysis of Alternatives

In the analysis of alternatives, the following three activities are carried out: physical performance prediction, economic analysis, and risk & uncertainty analysis. The performance of alternatives is predicted, including the "do-nothing" alternative. The "do-nothing" alternative receives only yearly maintenance. Analysis of alternatives also involves the estimation of capital costs, salvage value, maintenance costs, and operations costs (to road users) for each alternative over a predefined period (say 5 to 20 years). The analyst may choose to work with constant dollars or actual dollars.

Models of pavement deterioration can be used as a basis to predict performance of a given alternative (Transportation Association of Canada 1997). In order to account for risk and uncertainty, the pavement deterioration and its effects on user costs can be considered as stochastic (Federal Highway Administration 1994). By treating the inputs as uncertain (i.e., traffic and deterioration causes other than traffic), uncertain "states of pavement deterioration" can be defined.

For each pavement deterioration state, the economic performance (over time) of any maintenance and rehabilitation alternative can be estimated. Savings in operating and maintenance costs owing to improvement vis-à-vis the "do-nothing" case can be regarded as benefits. Thus for each alternative, following the performance analysis, present worth of all capital costs, salvage value, operation costs and maintenance costs can be calculated. These can be used as the basis of estimating benefits and costs in the evaluation step of the framework.

Evaluation of Alternatives

In the evaluation step, the balance of the present worth of benefits and costs results in the net present worth for each alternative. For the various projects/sites, alternatives are assessed and the best one is chosen for the program development step.

Program Development

The next activity is program formulation and allocation of funds. Here, projects are ranked on the basis of their Return on Investment (ROI) also called the Present Worth Index (i.e., (NPW divided by Investment)x100). If the yearly budget plus tolerance cannot cover all projects, some projects are deferred to year 2 of the program. If year 2 budget is not sufficient, projects are considered as candidates for year 3, etc.

Detailed Design, Contract and Construction

Finally, program investments move to the detailed design and contract preparation step. These lead to implementation of the program and related administrative monitoring activities. It should be noted that feedback opportunities are available at almost any step in framework shown in Figure 1.

DECISION-THEORETIC FORUMATION

The structure of the maintenance problem can be described by the following elements. Here constant dollar analysis is assumed.

Optimal Improvement Alternative for a Project/Site

1. For each project/site, define maintenance alternatives: $a_1, a_2, \ldots, a_n$
2. Define a period for analysis. This normally includes at least one rehabilitation cycle.
3. Define states of pavement service environment: $S_1, S_2, \ldots, Sm$
4. Define probabilities for the occurrence of uncertain states S: P'(S)

5. Find total cost of a given maintenance alternative, in present worth terms.
6. Find expected benefits.
7. Compute Net Present Worth for each state: NPW(a,S).
8. Compute Expected NPW for each alternative and select the best alternative for each project/site.

The serviceability of a pavement can be predicted, by available models, in terms of pavement condition rating (PCR) over time. Due to traffic and weather effects, the PCR of pavement drops over time. The weather effects on the pavement structure are difficult to predict accurately. Likewise, impacts of traffic cannot be predicted with certainty. Although much emphasis is being placed on truck weight monitoring, it is far from completely reliable. A 10% overload increases pavement damage by 40% (Kishore and Klashinsky 2000).

Owing to uncertainty of the drop in pavement serviceability deterioration, it is appropriate to treat the performance curves as probalistic (Figure 2).

Major strides have been made in technical aspects of pavement maintenance (Zimmerman et. al. 2000). Also, pavement management systems have become sophisticated owing to automation in data collection on axle loads, pavement performance measures, including serviceability, deflection, and deterioration (Byrd 1996).

As the PCR drops below the acceptable level, the pavement becomes due for maintenance or rehabilitation. The improvement alternatives are defined on the basis of the nature of pavement distresses. Guidelines are available for use by engineers in defining treatment options.

For the estimation of benefits arising from investment in infrastructure, savings in vehicle operating cost (VOC) are to be estimated that are attributable to pavement improvement. Figure 3 presents an illustration of vehicle operating costs of non-improved and

improved cases. The probabilistic VOC functions reflect the uncertainty in estimating pavement serviceability loss over time.

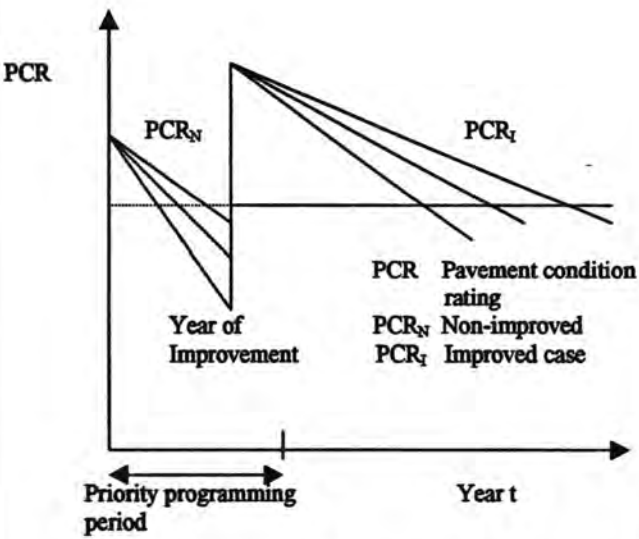


Figure 2: Probabilistic Performance Curves for One Pavement Section

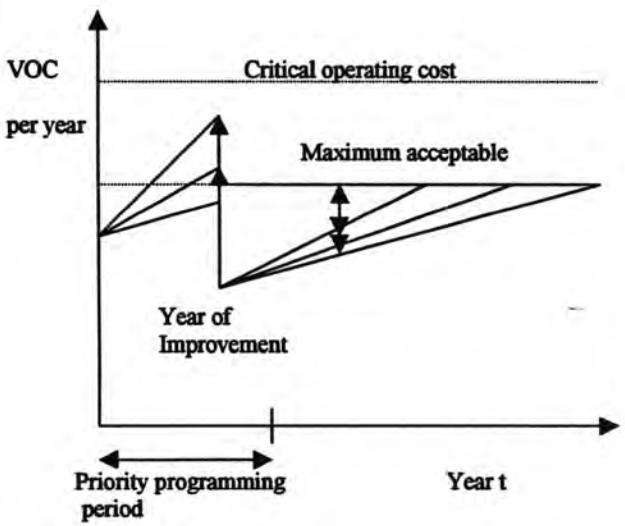


Figure 3: Change in Vehicle Operating Cost Due to Improvement

Economic Evaluation of Projects

1. Find the Expected NPW for each project (see step 8 in the previous section).
2. Find present worth (PW) of investment.
3. Calculate Return on Investment (ROI) or
   Present Worth Index (%): [(Exp(NPW)/(PW of Investment)]x100

Program Formulation and Allocation of Funds

1. Rank projects according to their Present Worth Index.
2. Compile cummulative investment requirements (in constant dollars)
3. On the basis of yearly budget plus tolerance, establish if all projects can be funded with year 1 allocation. If not, develop a multi-year program.

ILLUSTRATIVE EXAMPLE

Here, an illustrative example of the application of the infrastructure management framework is provided. A pavement management case is described that involves the definition of alternatives, analysis and evaluation of alternatives on the basis of cost-effectiveness, ranking of projects, and choice of a program within a specified budget.

The pavement network under consideration has seven distinct sites that have to be studied for improvement. For each site, alternative treatments were defined and analyzed and on the basis of Expected NPW, the best alternative for each project/site has been found. Table 1 shows these for sites 1 and 7. These are now called "projects". Each project belongs to a site.

For projects 1 and 7, the NPW under various states are noted in Table 1. The use of subjective probabilities enables the computation of Exp. NPW. The PW of initial plus subsequent investments is found for each project. The NPW and the PW of investment enable the

computation of the PW Index – expressed in percentage terms. This index is also known as Return on Investment (ROI) (i.e. the return on each dollar invested in road improvement). It is basically an indicator of the productivity of investments.

Table 1: Economic Evaluation of Projects: Examples of Projects 1&7

Project	NPW For S_1 ($)	NPW For S_2 ($)	NPW For S_3 ($)	Exp. NPW ($)
1	126,699	30,756	-1,754	46,614
7	216,810	61,345	18,777	89,570

Note: $P(S_1)=0.25$, $P(S_2)=0.5$, $P(S_3)=0.25$

Table 1: Economic Evaluation of Projects: Examples of Projects 1&7 (Continued)

Project	PW of Investment ($)	PW Index (%)
1	1,350,490	3.45
7	327,389	27.36

Note: PW Index = [(EXP(NPW)/(PW of Investment)]x100

On the basis of the PW Index, the projects are assigned ranks. Table 2 presents the projects in their rank order. Also, for each project, initial investment requirement is noted. The last column of Table 2 presents the cummulative investment requirements.

Table 2: Ranking of Projects and Investment Requirements

Rank	Project and Present Worth Index (%)	Initial Investment Requirement (Constant Dollars)	Cummulative Investment (Constant Dollars)
1	Project 7 (27.4%)	$150,000	150,000
2	Project 3 (10.9%)	1,000,000	1,150,000
3	Project 4 (10.9%)	100,000	1,250,000
4	Project 1 (3.5%)	1,000,000	2,265,000
5	Project 6 (2.5%)	15,000	2,265,000
6	Project 5 (2.5%)	150,000	2,415,000
7	Project 2 (0.4%)	100,000	2,515,000

Note: Present Worth Index figures are rounded.

Table 3 presents program development scenarios. Budget Scenario 1 can accommodate all seven projects in year 1 of the program period. According to Budget Scenarios 2 and 3, projects have to be deferred to subsequent year(s). Given that all analyses were carried out in constant dollars, the estimates of investment funds do no require modification.

Table 3: Program Development Scenarios

Budget Scenario	Yearly Budget + Tolerance	Program
1	$2.5M+10%= $2.75M	Projects 1 to 7 in Year 1 of the program ($2.515M)
2	$1.25M+10%= $1.375M	Year 1: Projects 7,3&4 ($1.25M) Year2: Projects 1,6,5&2 ($1.265M)
3	$1.0M+15%= $1.15M	Year1: Projects 7&3 ($1.15M) Year 2: Projects 4&1 ($1.2M) Year 3: Projects 6,5&2 ($0.265M)

CONCLUSIONS

1. Given the importance of road transportation to society, it is highly beneficial to keep roads at an acceptable service quality level through systematic maintenance and rehabilitation activities.
2. Since large sums of money are invested in roads, it is necessary to protect this asset by timely maintenance and rehabilitation works.
3. For systematic maintenance of roads, technical as well as economic factors have to be included in decision making. The methodological framework and constituent methods described in this paper are suitable for use in road maintenance studies.
4. Given the probabilistic nature of pavement performance deterioration, it is appropriate to use the decision-theoretic approach illustrated in this paper.
5. The concepts and methods described in the paper can assist organizations responsible for maintaining road infrastructure in developing cost-effective maintenance and rehabilitation programs.

ACKNOWLEDGEMENTS

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Rail freight competition and efficiency gains in Australia

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INTRODUCTION: THE MAJOR CHANGES IN THE 1990S

In July 1996, rail freight services were offered by six Government and several private operators. The Government rail systems were then as follows.

* The four State systems of Queensland (Queensland Rail or QR), New South Wales (Freight Rail Corporation (FR) operating over tracks owned by a Rail Access Corporation),Victoria (V/Line Freight), and, Western Australia (Westrail or WR).
* The Commonwealth (Federal Government) system, the Australian National Railways Commission (Australian National or AN) formed in 1975 to operate, inter alia, rail services in South Australia and Tasmania.
* National Rail Corporation (National Rail or NR), formed in 1991 to provide interstate rail freight services, and jointly owned by the Federal, NSW and Victorian Governments.

The main private operators, with freight tasks in excess of 10 btkm per annum in 1996, were two iron ore railways in the Pilbara region of WA. These were BHP Iron Ore and Hamersley Iron (HI). There were several smaller private rail freight operators.

Following Adelaide - Melbourne gauge standardisation in 1995, a new Melbourne - Perth rail freight service was offered by a private company (SCT) using, in part, AN locomotives, and track access provided by AN, WR and the Victorian authorities. This

change was in part due to a 1995 national Competition Principles Agreement that, inter alia, provided conditional third party access rights to government rail track. The present arrangements include a National Competition Council (NCC) and a 'one shoe fits all' type approach to various entities including electricity grids, gas pipelines and railways. Further rail competition was introduced in 1997 when Toll (initially TNT) commenced Melbourne - Perth rail freight services.

In 1997, the South Australian and Tasmanian freight operations of AN were sold by the Federal Government to two different companies, each owned by United States interests (Genesee and Wyoming, and, Wisconsin Central who also owned, in part, New Zealand Railways which was sold in 1993). The interstate track in South Australia under the control of AN was transferred to a new Australian Rail Track Corporation (ARTC) in 1998. The ARTC is owned by the Federal Government and offered track access at posted rates to all train operators, and assumed responsibility for arranging track maintenance with some limited upgrading. Following intergovernmental agreements signed in late 1997 at a historic 'Rail Summit' of Australia's Transport Ministers (the Australian Transport Council), the ARTC entered into an agreement that year, and renewed in late 2000, with the Victorian Government to provide access to interstate tracks in that State, and to maintain these tracks. The ARTC was able to reduce freight train transit times by undertaking deferred track maintenance and basic upgrading. However, by February 2001, none of Queensland, NSW or WA had reached agreement with the ARTC.

In 1999 V/Line Freight was sold to Freight Australia, in part owned by Freight America. Westrail was sold by the WA Government in late 2000, when enabling legislation finally gained passage in the Upper House in WA. Access rights to, and pricing of, the interstate standard gauge track in WA remains an issue.

The Commonwealth, as the major Government shareholder in National Rail, had proposed privatisation in November 1996. However, the former Victorian Government raised problems with the Dynon terminal in 1997-98, and, in 1999, new problems arose. One such problem was whether other State Governments, such as Queensland or NSW, could bid for NR. In April 2000, the Commonwealth moved to exclude State Governments from buying NR, but a sale had not occured by February 2001.

The NSW Government stated in 2000 that its rail freight operator FreightCorp would be sold, and this was subject to an inquiry of an Upper House Committee in late 2000. The Committee recommended in part that the sale of FreightCorp proceed in tandem with the sale of National Rail, and that half the sale proceeds be applied to improving regional track in NSW. Queensland Rail is currently not for sale.

The Australian road freight industry also has sectors that operate at world best practice. During the1990s, truck operators have taken advantage of relaxation of mass limits, and increased expenditure on roads by all levels of Government, which in 1997-98 exceeded $7 billion (Bureau of Transport Economics (BTE), 1999a).

The Sydney – Canberra Speedrail proposal that was under examination by the Government and the private sector up to late 2000 and is now abandoned, and the long proposed Alice Springs - Darwin railway, will not be considered in this paper.

The growing land freight task

The growing rail and road freight tasks in Australia are shown in Table 1, in billion tonne kilometres. The complete 1998-99 rail data set has not been made available by Government agencies to date. There are severe limitations on the quality and quantity of data publicly available on land freight in Australia. Land freight data deficiencies were ackowledged by the Productivity Commission

(1999), and a Senate Committee (2000) recommended that improvements be made to transport data, and related energy use and greenhouse gas emissions.

TABLE 1 AUSTRALIAN LAND FREIGHT TASKS

	Billion tonne kilometres		
	1990-91	1994-95	1998-99
Rail Govt coal	*23*	*28*	*32-34*
Subtotal 'Govt.' rail *	*52.9*	*61.6*	*67.4*
Iron Ore – Pilbara	34.5	47.3	49-51
*Subtotal Non-Govt. rail***	*35.3*	*48.2*	*58-62*
Total rail freight	**88.3**	**109.8**	**125-129**
Road B-Doubles		9	19
Road trains		15	20
All articulated trucks	63	89	99
Total road freight	**88**	**119**	**127**
Interstate rail	14.4	16.6	19-21
Interstate road	22	26	28-32

References include: For rail, SCNPM, BTE (Transport Indicators and 1999b), Annual Reports, some estimates.
For road. Australian Bureau of Statistics Survey of Motor Vehicle Usage
* Includes QR,FR, NR and WR andV/Line Freight up to 1994-95
** Includes SCT, Toll and V/Line Freight in 1998-99

In 1998-99, the Australian rail freight task was approximately 127 billion tonne kilometres (btkm), and the road freight task for articulated and rigid trucks along with light commercial vehicles was estimated (ABS, 2000) at 127 btkm. For the rail freight task, up to 10 btkm is regarded as being subject to transfer from rail to road. This could occur with the conditional relaxation of mass limits for heavy trucks now under way in

Australia, if international oil prices return to lower levels, National Road Transport Commission (NRTC) second generation charges introduced as of 1 July 2000 are not appreciably increased for heavier long distance trucks, and, if current Federal land transport funding levels continue. These levels are generous for the National Highway System and poor for national rail track upgrading programs.

The road freight task includes over 40 btkm for freight movements in urban areas which may be regarded as captive to road. At least 5 btkm of line haul interstate road freight, and a further 5 btkm of intrastate road freight is regarded as being subject to potential transfer to rail; if the NRTC charges for heavier trucks were replaced by mass distance charges at a level to ensure competitive neutrality, interstate mainline rail track infrastructure was upgraded to improve the speed - weight performance of freight trains, and, some extensions were made to intrastate track.

TURNING RAIL FREIGHT DEFICITS INTO PROFITS

Australia's Government rail systems had an annual freight deficit of some $525 million in 1989-90 (Industry Commission, 1991). Of this amount, over $300 million was due to losses in interstate rail freight. By the mid 1990s, the aggregate rail freight loss had been reduced to the order of $200 million (Bureau of Industry Economics - BIE, 1995). In 1998-99, QR, FC and WR showed combined freight operating profits of $224 million (down from $294 million in 1997-98 due in part to the problems with the Asian economy). This profit far outweighs ongoing NR losses (reduced from over $300 million a year to below $30 million a year in the face of freight rates falling some 16 per cent from 1991-92 to 1996-97 with increasing rail - rail and severe rail - road competition), and, Community Service Obligation payments for the haulage of some intrastate rail freight including $80 million in NSW.

Accordingly, the 1990s saw aggregate Government rail freight deficits turned into rail freight profits. This has made rail

privatisation a more attractive prospect. From Table 1, in 1990-91, private rail freight accounted for about 40 per cent of Australian rail freight.

With the changes outlined above, the percentage of private rail freight operations had reached about 52 per cent by 1998-99. When Freight Corp and National Rail have been sold, about 75 per cent of the Australian rail freight task will be private.

AUSTRALIAN RAIL FREIGHT PERFORMANCE

All rail systems gained major improvements in productivity with the aggregate productivity of former Government railways rising from 1.2 to 2.2 million net tkm (ntkm) per freight employee between 1990-91 and 1994-95 (Steering Committee on National Performance Monitoring - SCNPM data). Rail freight productivity gains have been recorded by various Government agencies such as the SCNPM, BIE and BTE and the Productivity Commission (1999). Other references include this writer (Laird, 1998).

Performance at or near world best practice

The iron ore railways in the Pilbara operate at world best practice with respect to operating costs and energy efficiency, and their track was given an A+ rating in the National Report Card on Infrastructure released December 1999 by the Institution of Engineers, Australia. The high efficiency is due in part to world class track which has the characteristics of good alignment, excellent formation, along with sleepers and a weight of rail capable of high axle loadings. Efficient operations are also assisted by updated locomotive fleets including Dash 8 locos and new AC traction locos with BHP Iron Ore, and Dash 9 locos with Hamersley Iron (HI), plus well maintained wagon fleets.

The unit cost of the Pilbara iron ore rail operations is understood to be appreciably less than one cent per ntkm, with high

aggregate energy efficiency of at least 8.77 ntkm per MJ (this being the aggregate 1994–95 energy efficiency of all non - Government rail operations in Australia noted by Apelbaum, 1997). This energy efficiency has since increased. For BHP Iron Ore, it now takes less than one litre of diesel to move one tonne of iron ore a distance of 426 km from Mt Newman to Port Hedland, with an energy efficiency of at least 12 ntkm per MJ.

The development of the Pilbara iron ore railways in the 1960s and escalating tonnages are of interest. Here, the HI mainline to Mt Tom Price was originally intended for 4.5 mtpa and by 1978 had been substantially upgraded and extended to Paraburdoo, and was operating at 47 mtpa (Vanselow, 1989). The BHP iron ore mainline was also initially built for 5 mtpa, and then substantially upgraded for growing tonnages. Iron ore tonnages continued to grow throughout most, but not all, of the 1990s. During the 1990s, the BHP and HI track was further extended. Access issues in the late 1990s also posed interesting legal questions, with the prevailing view to date being that HI's railway is part of their production process, and, that 'normal' third party access rights to their track do not apply.

Queensland's sugar railways, operating on a 610 mm gauge, also show characteristics of world best practice, including innovation in track work, safeworking, and intermodal operations. During June to December of each year, they now move over 35 million tonnes of sugar cane.

Queensland Rail's export coal haulage, mostly in Central Queensland under electric traction (25,000 volts AC) on narrow gauge is also regarded as approaching world best practice, and was given an A- rating in the IE Aust Infrastructure Report Card. This system moved about 100 million tonnes of coal in 1998-99 at roughly 5 ntkm/MJ. There is scope for increasing train length on the Blackwater - Gladstone system to the heavier trains used in the Goonyella System, which will require further grade easing near Blackwater.

NSW Hunter Valley coal operations also operate at good practice (Infrastructure Report Card Rating B+), with rail freight rates falling 16 per cent in real terms (Senate Select Committee on NCP, 1999, p80) but along with recent resignalling works, there is scope for grade easing on Whittingham Bank. However, rail haulage of coal to Port Kembla remains a textbook example of difficult working with a combination of rail congestion in Sydney, and track with steep ruling grades and excessive curvature.

Adelaide - Perth freight trains are Australia's best interstate operations, and allow for double stacked containers. As noted (Senate Select Committee on National Competition Policy, 2000) rail freight rates have fallen some 40 per cent on the Melbourne - Perth corridor between 1991-92 and 1996-97. Along with rail competition, a major factor in this reduction was Adelaide - Melbourne gauge standardisation completed in 1995 which removed the need for a bogie exchange in Adelaide for Melbourne - Perth freight trains. Improved National Rail performance with new locomotives and a better wagon fleet have also helped. Without Adelaide - Melbourne gauge standardisation, the likelihood of rail competition on the Melbourne - Perth corridor would have been remote; also, sea provides some competition on this corridor.

Queensland Rail's Brisbane - Cairns $590 million Mainline Upgrade (MLU) Project has significantly improved axle loadings, increased loads and reduced transit times. However, further realignment at locations such as Aminungo is required to realise the full benefit of the proposed resleepering programme between Rockhampton and Townsville. Infrastructure Report Card Rating B-.

The 1992 - 1997 MLU included 120 km of high quality rail deviations with easy grades and curves between Brisbane and Cairns. The MLU improved rail freight services including livestock trains which are now unique to Queensland. It also allowed a NQ Direct service operated jointly with NR to bring fruit and vegetables from

North Queensland to Sydney and Melbourne markets. The track upgrade was also needed for the tilt train passenger service that commenced regular Brisbane - Rockhampton services in 1998. The new Queensland tilt trains have been well received by the travelling public, and carried 600,000 people within the first 20 months. By the end of their first year, patronage levels had doubled from that of the former Inter City Electric trains. During a trial on 23 May 1999, a Queensland tilt train broke the Australian rail speed record when moving at 210 km per hour.

Performance below world best practice

Much attention has been focussed on National Rail's financial performance, which has failed to reach the initial expectations of making an outright profit within five years of commencement of operations in February 1993. As predicted by this writer (Laird, 1994) such a goal was unlikely given Australia's extensive 'highway subsidisation' and relatively poor standard of interstate mainline track. The impact of competition policy has further eroded NR's ability to make a clear profit, despite the progress made towards improvements in productivity, as outlined by Ernst & Young (1998 - who noted fuel use at 4.04L/000gtkm which is somewhat higher than USA Class I railroad aggregate use at 3.5L/000gtkm). In respect of track condition, the IE Aust Infrastructure Report Card noted, inter alia, *Melbourne to Sydney to Brisbane - poor track condition, steam age alignments [and some signalling] severely impact on transit times and make the running of a rail operation almost non viable. Rating F –*

The National Transport Planning TaskForce (1995) considered that an investment of about $2 billion was necessary to bring the Melbourne - Sydney - Brisbane rail corridor towards US Class I railroad standards. This is appreciably less than the $4 billion outlaid in today's terms on the Hume Highway linking Melbourne and Sydney over the last 25 years (Laird 1999), and, the $3 billion now being invested to upgrade the Pacific Highway.

Severe speed weight restrictions on this corridor coupled with rail congestion within the Sydney metropolitan area are two factors resulting in rail having a low modal share of about 20 per cent on this corridor. A potential source of more rail freight is the Melbourne – Brisbane land freight market, which in view of its length should be dominated by rail. A further track infrastructure problem requiring attention is residual gauge standardisation.

SIX RAIL INQUIRIES

No fewer than six government rail inquiries have been undertaken between 1997 and 2000 in Australia, as follows.

1. The House of Representatives Standing Committee chaired by Mr Paul Neville, MP. This inquiry received 117 submissions, and made 16 recommendations consistent with its 1997 report on roads 'Planning not Patching' and the NTPT (1994,1995) reports.
2. The Rail Projects Task Force (1999) whose report was released in May 1999 with 30 recommendations.

3. The Productivity Commission's inquiry into progress in rail reform. A draft report, was released in March 1999 and the final report completed in August 1999 had its release delayed to April 2000.

4. The NSW Public Works Committee inquiry into the Tilt Train that reported in November 1998, with 14 recommendations.

5. The 1999 inquiry of the Environment, Resources and Development Committee of the South Australian Parliament into Rail Links with the Eastern States, with 9 recommendations.

6. A NSW Legislative Committee (2000) inquiry into the proposed Privatisation of Freight Corp with 15 recommendations.

The government response time to these reports varies from less than a month (South Australian Government) to over 28 months (no response to the NSW 1998 inquiry by 2001). A formal response to the Neville Report was delayed to April 2000, when a response was also made to the Rail Projects Task Force and Productivity Commission reports. The three Federal rail inquires agreed that there is a need for a national integrated transport policy, to upgrade *'...substandard national track'*, lift Federal rail track investment from $250 million, and harmonise rail operating standards.

The response of the Federal Government to its land transport inquiries was very limited. The response included formation of a National Transport Secretariat and Australian Rail Operations Unit in place of a National Land Transport Commission. The response also confirmed ongoing generous treatment for the National Highway System, but denied additional funding to improve national rail track. The Productivity Commission recognised that rail reform will also require road reform, and to this end, recommended an inquiry into road provision, funding and pricing. However, this was rejected by the Federal Government in its April 2000 response.

PRESENT OVERVIEW

Despite the rail reform of the 1990s, including improved efficiency, the formation of the ARTC in 1998, and part privatisation, as noted by the government inquiries:

A. Government's rail freight unit costs remain above USA World Best Practice costs. However, the cost of running freight trains over substandard national track is expected to be higher than running freight trains over US Class I high standard railroad track.

B. The energy efficiency of 'Government' rail freight trails that of US Class I railroad operations, and, improvements in track infrastructure and competitive neutrality have the potential to save over 250 million litres of diesel a year by 2015 (Laird, 1998). A

transfer of some interstate road freight to rail was noted as one of five 'no regrets' measures to reduce greenhouse gas emissions by the BTE (1996).

C. The 'surprising incursion' of road into land freight tasks well suited to rail in the 1980s (Nash, 1985) still persists in intercapital city land freight. It was also present until the late 1990s with the movement of some coal to Newcastle and Port Kembla in NSW.

D. In the absence of a National Land Transport Commission, the desirability of a National Rail Transport Commission to promote rail reform.

E. Low government investment (Federal and all States except Queensland) in rail track when compared with either main highways or secondary roads. Some antiquated safeworking, and in 1999, too many train accidents, is also of concern.

F. Australia now has the highest road freight per capital in the world (nearly 7000 tkm per person per annum). This gives an opportunity for rail to lift freight traffic, however, given a long standing culture in Australia, this is a real challenge.

THE ROLE OF ROAD REFORM IN RAIL REFORM

There is growing recognition that moves to effect rail reform will achieve an unsatisfactory result, unless Government firmly addresses road reform. During the 1980s, a series of Government agencies found under recovery of road system costs from the heavier long distance truck operations. The highest aggregate estimate was due to the BTE (1988) that found all articulated truck operations failed to cover their fully allocated road costs when offset by all registration charges and all fuel taxes by some $1283 million in 1985-86. Both the BTE (1998) and the ISC (1990) noted the option of mass - distance taxes.

The NRTC (1992) determined annual charges, comprising $4000 for six axle articulated trucks and $5500 for 8 axle B-Doubles, and, a notional road user charge of 18 cents per litre of diesel. In commenting on the NRTC charges, which abolished mass-differential charges then in place in NSW and Victoria and halved NSW annual fees, the Industry Commission (Annual Report, 1991-92, p197-198) noted in part that *"...the heaviest travelling long annual distances - will meet less than 20 per cent of their attributed costs. . . . The charges, as recommended, will therefore potentially distort the long-haul freight market as rail reforms take effect."*

Other external costs of road freight include road crash risk, road congestion, noise and air pollution. The ISC (1990) estimated the total 1989-90 cost in Australia for noise and air pollution as some $1264 million, and, noted that whilst such estimates should be treated with caution, *"... it is increasingly important that an attempt be made to include these costs in road cost allocation".*

In the late 1990s, the Federal excise rate for diesel was about 43 cents per litre including about 8 cents per litre collected for the States. This level of taxation had received ongoing objections from the road freight industry, and was reduced to 20 cents per litre as of 1 July 2000 as part of a New Tax System. This effectively put truck external cost charges to zero. As part of the New Tax System, rail was exempt from diesel fuel excise as of 1 July 2001. There is a good case for externality charges for road and rail, with the road charge appreciably more than the rail charge.

The issue of the cost of road crashes involving heavy trucks has demanded more attention, with the NSW Government holding in 2000 an inquiry into the Long Haul Trucking Industry and Terms of reference including: the extent of proper enforcement in the industry of driving hours, speeding and drug use, and whether a self-regulation or external regulation model is most appropriate for the road transport industry and what forms this should take. The NSW inquiry supplements an inquiry by a House of Representatives

Committee (2000) into fatigue in all modes of transport. Most of the 41 recommendations in the inquiry report related to road transport, with some interest shown in a national operator accreditation scheme being developed for the road transport sector.

Although the incidence of trucks involved in road crashes has fallen, the BTE (2000a) has revised the cost of road crashes. Based on BTE data on the cost of road crashes, and NSW road crash data, an estimate of 0.5 cents per net tonne km road crash risk for road freight is now considered appropriate.

The issues of competitive neutrality were agreed to be addressed '...without delay' by the Australian Transport Council in 1997. Progress to date has been very slow.

SCOPE FOR CHANGE

Australia has many rail freight operators - with 17 in 1999 listed by the Productivity Commission (1999, p10). Their combined freight task at some 127 btkm in 1998-99 is less than Canadian Pacific's 1999 freight task of about 160 btkm. Thus, there is scope in a post privatisation phase for merger activities.

The major constraints to rail assuming more of Australia's rail freight task is considered to be the severe speed weight restrictions imposed by the track linking Australia's three largest cities, and, lack of competitive neutrality.

On the Sydney - Melbourne corridor, there is a need for major rail deviations to reduce the point to point distances, and provide easier grades and less curvature so as to allow for heavier and faster trains. There is also an urgent need to reduce growing rail congestion within Sydney by improving the separation of freight and passenger trains. The ARTC and NSW authorities completed a 'Project 11' study in 2000 with a view to reducing Sydney - Melbourne rail freight transit times from about 14 to 11 hours.

The potential for an inland route between Melbourne and Brisbane via Parkes has long been recognised (see for example, Laird et al, 1998), and gained increasing attention during 1999 with a $300,000 Federal grant to an Australian Transport and Energy Corridor Company (ATEC). Such a route could use the existing secondary lines in NSW west of the Great Divide with minor upgrading, and major new works in South West Queensland. This would include a new tunnel under the Toowoomba Range with standard gauge capability, and overhead clearances high enough to allow for passage of double stacked container. An ATEC commissioned pre-feasibility study conducted in 2000 with the support of the Commonwealth and three State Governments suggested that an inland Melbourne - Brisbane route showed some promise (BTE, 2000b).

A standard gauge could be later extended through an inland route towards Gladstone and its deep water port, and possibly onto Darwin. A Queensland rail connection to Darwin has long been advocated, with more recent proposals by Endersbee (1994) and ATEC.

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THE ECONOMIC AND ENVIRONMENTAL BENEFITS FROM VEHICLE SPEED REDUCTION

by F. R. Wilson, A. M. Stevens, A. Ambo

Abstract

The Kyoto Protocol in December 1997established a negotiated agreement among industrialized nations to reduce their greenhouse gas (GHGs) emissions which is becoming a threat to the survival of humankind. Accordingly, Canada has committed itself on the Kyoto Protocol to reduce its GHGs emissions by 6 percent below the 1990 level during the five-year period of 2008 to 2012.

Many studies have corroborated that carbon dioxide (CO_2) is the largest portion of GHGs. CO_2 is released to the atmosphere through various means; however, the most important contributor in modern road transportation activities is the burning of hydrocarbon by internal combustion engine of vehicles.

This research was directed toward an analysis within the province of New Brunswick on the impact of reducing two speed limits, 100 kilometre per hour (kph) and 110 kph to 90 kph.

Costs and benefits were projected for ten years between 2006 and 2015 and were discounted to year 2005. It was found that a total of about $1.6 billion Cdn can be saved over ten years if the speed reduction were implemented. The benefit-cost ratio was calculated at 3.0. The research demonstrated that a speed reduction policy decision could yield environmental and financial benefit to the study area and to Canada if the strategy were adopted at the National level.

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1 INTRODUCTION

Emission of Greenhouse gases (GHGs) has been a global concern for many years. Smith (1988) stated that carbon dioxide (CO_2) concentration in the atmosphere has continued to rise from about 315 parts per million by volume (10^{-6}) (ppmv) in 1958 to about 343 ppmv in 1984. The average increase during the last decade has been 1.5 ppmv/yr or 0.44%/yr. Smith further stated that the combustion of fossil fuel is the major cause of increasing CO_2 to the atmosphere and motor vehicles are the largest source of hydrocarbon (HC).

The GHG concern resulted in a number of international conferences being held in different parts of the world to devise measures to control/reduce GHGs emissions. The 1987 Montreal Protocol, the 1992 Rio Summit, the 1995 Berlin Mandate, the 1997 Kyoto Protocol and the 2000 United Nations Meeting in Hague were all the reflections of the concerns on GHGs.

In December 1997, Canada, together with other developed countries negotiated the Kyoto Protocol under the United Nations Framework Convention on Climate Change (UNFCCC). Presently, Canada is committed to reduce its GHGs emissions by 6 percent below the 1990 level. Canada is also active in supporting international climate change research and actions under UNFCCC.

The major components of greenhouse gas emissions in Canada are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluoromethane (CF_4), hydrofluorocarbons (HFC_5), perfluoroethane (C_2F_6) and sulphur hexafluoride (SF_6). According to Environment Canada in 1995, there was emitted in Canada 619 Mt of GHGs comprising 501.4 Mt (81 percent) of CO_2, 74.3 Mt (12 percent) of methane, 31.0 Mt (5 percent) of nitrous oxide and 12.3 Mt (2 percent) of other greenhouse gases. In the province of New Brunswick, the study area for this paper, the amount of CO_2 emissions was 19.25 Mt (3.11 percent of the output in the nation) during the same year, and 6.1 Mt (31.5 percent) was from transportation, and road vehicles contributed 4.2 Mt or 70 percent of the 6.1 Mt.

The focus of this paper is to examine the economic and environmental benefits from CO_2 reduction by lowering speed limits on sections of the highway network in the province. The speeds selected for reduction to 90 kph were 100 kph and 110 kph. In the province, there will be 485 km and 800 km of roads with speed limit of 100 kph and 110 kph by 2006 respectively. During 1999, the average annual daily traffic (AADT) flows over the two speed zones were 5,200 and 6,380 respectively.

2 DATA ACQUISITION

2.1 Vehicle Fleet

The New Brunswick Department of Transportation (NBDoT) and the Maritime Road Development Corporation (MRDC) were the major sources of data for traffic and the road network configuration. In 1999, there were 572,830 vehicles in the province comprising 349,225 (61.0 percent) passenger vehicles; 126,389 (22.0 percent) light commercial vehicles (LCVs); 36,514 (6.4 percent) large commercial vehicles; 44,251 (7.7 percent) utility trailers; and 16,451 (2.9 percent) semi trailers.

Currently, there are a total of 2,222 km of roads under the posted speed limits of 90, 100 and 100 kph with respective percentage of 45, 38 and 17.

2.2 Speed Survey

Vehicle speed surveys were carried out by the University of New Brunswick Transportation Group (UNBTG) at different locations and times within the study zones. In addition, speed surveys conducted by the NBDoT and MRDC were examined and analyzed. The UNBTG surveys yielded three counts in each of the 110, 100 and 90 kph zones and the number of vehicles recorded at each site were sufficient to meet acceptable error levels. The NBDoT data was from surveys carried out in the 100 kph zones on the TCH and a total of 2,780 vehicle speeds were recorded. The MRDC conducted speed surveys of more 2.5 million vehicles.

2.3 Fuel Consumption

Fuel consumption data for the nation were acquired from Environment Canada (EC). The EC 1990 data categorized vehicles in respect of fuel consumption and annual kilometere coverage and showed that the major consumption of gasoline was by automobiles. In addition, a sample of 1,625 small cars out of the total 4,081automobiles, were selected from the Fuel Consumption Guide of Natural Resources, Canada (2000), and it was found that 95 percent of the cars used gasoline; 3.5 percent used other fuels like natural gas, ethanol, propane and methane; 1.5 percent used diesel as a fuel.

The EC (1990) data showed that heavy duty vehicles which consumed gasoline traveled only 20,117 km per year which does not seem to be long-distance journeys but, rather deliveries in restricted areas. These vehicles have not been considered in the study since they do not appear to be involved in intercity transportation activities. In addition, 91.8

percent of light duty vehicles consume gasoline whereas 8.2 percent consume diesel. Based on these data, it was considered that all automobiles and 90 percent of light duty vehicles consume gasoline, whereas, all remaining vehicles consume diesel fuel.

3.0 ANALYSIS

3.1 Period of Analysis

The extensive highway network upgrading currently underway in the study area, including a 190 km 4-lane divided facility, resulted in the date of January 1, 2006, being selected for the start of the 10-year analysis period to 2015. A five-year period is also considered for purposes of comparison.

3.2 Average Annual Daily Traffic (AADT)

A map showing AADT on each section of the roads in the Province was provided by NBDoT. Based on these data , AADT were estimated for the 110 kph and 100 kph speed limit zones. As stated in Landers (1988), 57.3 percent of the vehicles on the Trans-Canada Highway (TCH) were passenger cars and passenger cars with trailers, 18.2 percent were light trucks and vans and recreational vehicles, 23.2 percent were trucks, 0.3 percent were buses, and the remaining 1.0 percent were motorcycles and tractor units. Similarly, Leore (1999) estimated the truck volumes on intercity highway system (IHS), national highway system (NHS), and on the Trans-Canada highway in the province of New Brunswick to be 19.0, 21.0 and 28.0 percent respectively.

Using these data, it was estimated that 57.5 percent of the AADT on the TCH was automobiles, 18.5 percent light trucks (including vans and recreational vehicles), 23.5 percent heavy trucks, and 0.5 percent buses. The volume of AADT differs on different sections of TCH.

Accordingly, the study sections were divided into three; Quebec Border-River Glade, 460 km; River Glade-Nova Scotia Border, 110 km; and River Glade-St. Stephen/US Border, 230 km. The 1999 traffic on the three sections were estimated at 5,800, 9,200 and 6,200 respectively. Similarly, the 1999 AADT on 100 kph zone was estimated at 5,200. Table 1 lists the estimated AADT by fuel type and speed limit zones.

Table 1
AADT By Speed and Fuel Consumption Type, 1999

Vehicle Type	Speed Limit Zone (kph)							
	110						100	
	Quebec Border- River Glade		R. Glade - NS Border		R. Glade - St. Stephen			
	G*	D⁰	G*	D⁰	G*	D⁰	G*	D⁰
Car	3288	--	5216	--	3515	--	2992	---
LCVs	951	104	1509	167	1021	113	858	103
Trucks	--	1427	--	2264	--	1521	---	1222
Buses	--	30	--	44	--	30	---	25
Total	4239	1561	6725	2475	4536	1664	3850	1350

G*= Gasoline D⁰= Diesel LCVs = Light Commercial Vehicles

3.3 Vehicle Growth Rates and Projected AADT

The future traffic on the study network depends on the economic activities of the nation as a whole, and within the Atlantic Region and province of New Brunswick. The study network sections are along the Trans-Canada Highway (TCH) rendering transportation services primarily between six provinces: Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland. Thus, the socio-economic development of Canada in general and the six provinces in

particular impact on traffic levels on the TCH in the province.

Gross domestic product (GDP), wholesale and retail trade activities, motor vehicle sales, gasoline and diesel sales, and population growth of the provinces were accounted for to in order to estimate annual average growth rates and they were found to be 3.5 percent for trucks and light commercial vehicles, and 2.5 percent for passenger cars. The projected AADT levels in the 100 kph speed zones for years 2006, 2011 and 2015 were 6290, 7195 and 8030 and the corresponding AADT in the 110 kph zone were 7720, 8835 and 9860.

3.4 Vehicle Speed

As previously described, vehicle speed surveys were conducted at various sites at different times of the day. The 85 percentile and mean speeds, variances and standard deviations were calculated. In addition, maximum and minimum speeds and the ranges between the two were observed and calculated. The data shows that the 85-percentile speeds are higher than the posted speeds in almost all cases.

3.5 Fuel Consumption

3.5.1 Factors Determining Fuel Consumption

There are a number of factors affecting fuel consumption including; specific gravity of fuel, engine efficiency, wind drag resistence, drag coefficient, density of air, frontal area of vehicle, vehicle velocity, vehicle mass, highway geometry, etc.

In the study, two types of fuel were considered, gasoline and diesel. Specific gravity and calorific values were estimated. High heating values at constant volume are generally recommended for liquid fuels in estimating calorific values. The temperature recommended for estimating specific gravity are 60^{0}F (15^{0}C) for gasoline and 40^{0}F (4^{0}C) for diesel. The values for kerosine has been used for diesel in these

calculations. Based on Avallone (1987), specific gravities were estimated for gasoline and diesel at 0.8000 and 0.8500 respectively. Similarly, calorific values for gasoline and diesel were estimated at 48,000 and 46,000kJ/kilograms. Similarly, data on engine efficiencies were acquired from vehicle dealers. Engine efficiencies used in the study were 0.45 for cars and LCVs and 0.50 for buses and trucks. The masses of vehicles used in the study were 1,200 kg for cars, 1,500 kg for LCV,12,000 kg for bus and 30,000 kg for trucks.

3.5.2 Fuel Consumption Rates

Fuel consumption differs between urban and intercity operations. In 2000, Natural Resources Canada (NRC) estimated annual fuel cost and consumption estimates for cars based on annual travel distance of 20,000 km, with 55 percent city and 45 percent highway driving. In addition, NRC estimated fuel consumption per 100 km. A total of 254 samples of fuel consumption rates were taken from NRC data i.e. liters per 100 km for both city streets and highways from 30 dealers in respect of three types of fuel consumption: premium unleaded, regular unleaded and diesel with respective sample sizes of 52, 163 and 39. Correlation coefficients between consumption rates for city and highway operations were also calculated. Statistical coefficients were also calculated and the analysis indicated that regular unleaded is the most efficient fuel followed by diesel while, premium unleaded being the least efficient. Correlation coefficients between city and highway driving are high in all three cases. Consumption rates of cars were observed between 1995 and 2000. The change in fuel efficiency of cars was the greatest in the case of diesel followed by regular unleaded. There is no change in the case of premium unleaded.

In the study, a single formula was developed based on different components of fuel consumption determinants, as provided by the Department of Chemical at UNB. Using Equation 1 below, fuel consumption were calculated for speeds of 90,100 and 110 kph. Savings attributed to speed reduction were also calculated. The data

showed that fuel savings due to speed reduction were significant. On average there was a 14 percentage savings by reducing from 100 kph to 90 kph and 26 percent by reducing from 110 to 90 kph. However, the calculation was based on the assumption that the vehicles would travel through the network without idle time. In this respect, it was confirmed by a truck transport industry in the province that there must be an idle time adjustment. Therefore, a 15 percent idle time has been accounted for in the study.

$$FC = \frac{1.8V(C_D \rho v^2 A + 2\mu mg)}{CV \times ef \times SG} \quad (1)$$

Where:

FC =	Fuel consumption (lts/100km)	m	= Mass of vehicle
V =	Velocity/Speed (mt/sec)	μ	= Rolling friction
ρ =	Density of air (kg/m^3)	SG	= Specific Gravity
g =	Acceleration due to gravity	A	= Frontal Area of vehicle (m^2)
CV=	Calorific value of fuel(kJ/kg)		

3.6 CO_2 Emission

Fuel consumption normally results in emission of gases. The amount of gases released to the atmosphere depends on air-fuel ratios during the burning of hydrocarbons. Air-fuel ratio during combustion of fuel plays a very important role in the release of GHGs. High air-fuel ratio results when there is an excess of air in the engine and thus, some oxygen passes through unreacted. On the other hand, low air-fuel ratio is the deficiency of air in the engine resulting in the release of carbon monoxide (CO) in the exhaust gases. As stated by Singer (1981), in general, 12 kg of carbon combines with 32 kg of oxygen to form 44 kg of CO_2. The assumption of the same ratio during fuel combustion is known as stoichiometric conditions. The octane of gasoline is C_8H_{18} with a mass of 114. The mass balance during combustion of gasoline is:

$$114\text{kg } C_8H_{18} + 400 \text{ kg } O_2 + 1316 \text{ kg } N_2 \rightarrow 352 \text{ kg } CO_2 + 162 \text{ kg } H_2O + 1316 \text{ kg } N_2$$

From the above mass balance, it can be seen that 352 kg of CO_2 is

released from the burning of 114 kg of gasoline at stoichiometric conditions. This means that, 3.0877 kg of CO_2 is released from burning 1 kg of gasoline. Since the specific gravity of gasoline is 0.8000, one kg of gasoline is equivalent to 1.3 liters resulting in 2.4 kg of CO_2 being released during the burning of 1 liter of gasoline. The same analysis was completed for combustion of diesel fuel. The results showed that 2.55 kg of CO_2 is released for each one litere of diesel that is burned.

As stated in Environment Canada (1990), although carbon monoxide is an incompletely oxidized material from during combustion and discharged to the atmosphere, it however undergoes complete oxidation fairly rapidly. For these reasons, the fraction of liquid fuel that undergoes combustion each year and remains in the environment unoxidized has been estimated at 1.5 percent.

The results of the analyses show that fuel consumption and CO_2 emission decrease with a reduction in speed. For example, the reduction from 100 to 90 kph results in the reduction of 1.4 liters of gasoline per car per 100 km and 2.2 liters of gasoline per LCV per 100 km. In the case of diesel, the reduction is 11.1 liters per bus per 100 km and 11.2 liters per truck per 100 km. In respect of CO_2 emission reduction, the corresponding figures are 3.3, 5.4, 28.3 and 28.5 kg per 100 km. Similarly, savings in fuel due to speed reduction from 110 to 90 kph are 2.9 litres for cars, 4.8 for LCVs, 23.1 for buses and 22.4 for trucks. The CO_2 savings were 7.0, 11.5, 58.8 and 57.2 kg respectively.

4.0 RESULTS

4.1 Reduced Fuel and CO_2 Emission

By the year 2006, there will be 485 km of highway in the province of New Brunswick operating under a posted speed of 100 kph and 800 km of roads posted at 110 kph. For this network, the total reduction in the amount of CO_2 over current speed limit were estimated by vehicle type.

Table 2 lists the amount of fuel and CO_2 reduction. Using the projected AADT and the per vehicle savings in the total reduction in fuel and CO_2 for the two speed reductions, the total reduction in fuel and CO_2 consumption for the study section of the highway were estimated. The results are presented in Table 3.

4.2 Reduced Driving Time

With a decrease in operating speed, there will be a corresponding increase in driving time. Operating over the entire section of 485 km of the highway network at 90 kph, instead of 100 kph, an additional 0.54 hours of driving time is encountered. Similarly, when driving along the 800 km of 110 speed zone at a reduced speed of 90 kph, an additional driving time of 1.62 hours would be required. As mentioned above, a 15 percent idle time adjustment was made resulting in an adjusted reduced driving time of 0.62 and 1.86 hours. Considering the speed surveys data for the study section, the increase in driving time would be even higher since most of the vehicles were found to be operating above the posted speed limits. Table 4 lists the total increased travel time as a result of the speed reduction.

4.3 Cost-Benefit Analysis

4.3.1 General

A comparison of costs and benefits from the proposed speed reduction was part of this study. Costs are incurred due to increased driving time and from increased policing. in order to monitor speed and enforce speed compliance. Benefits are envisaged to be realized as a result of reduced fuel and tire consumption, and also as a result of reduced CO_2 emission. Each of these factors envisaged to result from a speed reduction have been treated separately in the next sections.

Table 2
Reduced Fuel and CO_2 with Speed Limit Zones

Vehicle Type	Fuel (lt)				CO_2 (kg)			
	100 To 90 kph (485 km)		110 To 90 kph (800 km)		100 To 90 kph (485 km)		110 To 90 kph (800 km)	
	G	D	G	D	G	D	G	D
Car	7	--	23	--	16	--	56	--
LTVs	11	11	38	38	26	27	92	96
Buses	--	50	--	169	--	126	--	432
HVs	--	103	--	344	--	262	--	878

G = Gasoline D = Diesel

Table 3
Total Amount of Reduced Fuel and CO_2 (millions)

Year	Reduced Fuel (lt)			CO_2 (kg)
	Gasoline	Diesel	Total	
2006	65	295	360	909
2007	67	305	372	939
2008	69	316	385	970
2009	70	327	397	1,002
2010	72	338	410	1,036
2011	74	350	424	1,070
2012	76	362	438	1,105
2013	78	375	453	1,142
2014	80	388	468	1,180
2015	82	401	483	1,220
Total	733	3,457	4,190	10,573

Table 4
Increased Driving Time Due To Speed Reduction (million hours)

Year	100 To 90 kph			110 To 90 kph		
	Car	Buses	HVs	Car	Buses	HVs
2006	1.07	0.01	0.35	3.92	0.03	1.30
2007	1.09	0.01	0.36	4.02	0.03	1.34
2008	1.12	0.01	0.38	4.12	0.03	1.39
2009	1.15	0.01	0.39	4.22	0.03	1.44
2010	1.18	0.01	0.40	4.33	0.03	1.49
2011	1.21	0.01	0.42	4.44	0.03	1.54
2012	1.24	0.01	0.43	4.55	0.03	1.60
2013	1.27	0.01	0.45	4.66	0.03	1.65
2014	1.30	0.01	0.46	4.78	0.03	1.71
2015	1.33	0.01	0.48	4.90	0.03	1.77

4.3.2 Cost Factors

(a) Driving Time

Opportunity costs are lost by vehicle operators as a result of speed reduction. Bus and truck operators would accrue less benefit/income because of time lost in driving at a reduced speed. Similarly, drivers of small cars and vans would face less productive time as a result of speed reduction.

According to Statistics Canada (1999), the average weekly wage in the truck transport industry was $ 669.37 for 35.3 working hours at $19.0/hr. Similarly, weekly wages were $ 644.07and 610.4 for public transit operators and other industries respectively. The average wage for other industries was considered as proxy for car drivers. Accordingly, wages per hour were calculated at $18.2 and $17.3 for public transport and car operators respectively. Based on these hourly wage rates, total losses incurred by vehicle drivers as the result of speed reductions were estimated and presented in Table 5.

Table 5
Increased Costs Due To Reduced Driving Time ($ millions)

Year	Cars & LCVs	Buses	HVs	Total
2006	86	0.6	31	117.6
2007	88	0.6	32	120.6
2008	91	0.6	34	125.6
2009	93	0.6	35	128.6
2010	95	0.7	36	131.7
2011	98	0.7	37	135.7
2012	100	0.7	39	139.7
2013	103	0.7	40	143.7
2014	105	0.7	41	146.7
2015	108	0.7	43	151.7

(b) Enforcement Costs

Additional levels of law enforcement will be required to monitor and enforce vehicle drivers' compliance with the new speed limits. As observed during the speed survey, the 85 percentile speeds were violated in all cases. The lowering of the existing speed limits would similarly involve serious traffic violations unless strictly enforced. Enforcement should include a strong component aimed at orienting drivers toward the safety benefits of controlled speed rather than strictly being concentrated on enforcement penalties. However, surveillance would have to be strengthened.

Police forces were contacted to obtain estimates of speed enforcement costs. Enforcement cost estimates of $135,500 per year per 200 km patrol-crew were quoted. This value includes costs of crew, vehicle, equipment, fuel, etc. A total of 6 crews would be required to monitor the entire 1,285 km of highway. Higher enforcement costs are envisaged during the first three years to reduce speed levels. Therefore, $1.2 million per year were used between 2006 and 2008 and $0.8 million per year for the rest of the analysis period. Table 6 shows projected enforcement costs.

4.3.3 Benefits

(a) Fuel Consumption

The benefits accrued from less fuel consumption as a result of speed reduction were estimated. In June 2000, the market price of a litre of gasoline in Fredericton, New Brunswick was 75.9 cents and the price of diesel was 73.9. These prices were used to estimate benefits from

reduced fuel consumption. The fuel prices include Provincial Tax, Federal Tax and Harmonized Sales Tax (HST or GST). The Provincial Tax on gasoline is 10.7 cents per litre and 13.7 cents per litre on diesel. In the case of Federal Tax, the corresponding figures are 10 and 4 cents per litre respectively. A 15 percent HST is added in addition to the Provincial and Federal Taxes. Table 6 lists total benefits and costs.

Table 6
Summary of Benefits and Costs from Reduced Operating Speeds
($ millions)

	$ Benefits			$ Costs	
Year	Fuel	CO_2	Tire	Wages	Enforcement
2006	267	11	69	118	1.2
2007	276	12	72	122	1.2
2008	285	12	74	125	1.2
2009	295	12	77	128	0.8
2010	304	13	80	132	0.8
2011	315	13	80	132	0.8
2012	325	14	85	139	0.8
2013	336	14	88	143	0.8
2014	347	15	91	147	0.8
2015	358	15	94	151	0.8

(b) CO_2 Emission Reduction

A reduction in CO_2 emission would benefit the livelihood of human beings in a multitude of ways. Jepma and Munasinghe (1998) stated that the aversion of greenhouse gas emission would lessen primarily, "the loss of agricultural productivity and forest loss; sea level rise; species loss; suffering in terms of human health, morbidity, amenity, and life; local pollution; adjustment costs involved with infrastructure, migration, and water supply". They further stated "secondary benefits include local or regional air quality improvements, fewer traffic accidents or less congestion, preservation of biodiversity and wildlife, and the creation of employment and safety".

Jepma and Munasinghe (1998) further stated " the magnitude of CO_2 damage is projected to be in the order of 1.4 to 1.9% of world gross domestic product (GDP), the same range would apply to the OECD region". The article indicated 1.5 percent for OECD America in 1995. The Authors stipulated USD 69.5 and 74.2 billions of annual CO_2 damage costs in the United States of America (USA) in 1995. During this year, USA's CO_2 emission was 5,189 million tones. Based on the above, damage cost per ton was calculated at USD 14.0.

Canada emitted 498.914 Mt of CO_2 in 1995. The GDP of Canada in 1995 was $ 663,082 million. Thus, the estimated 1.5 percent of GDP becomes $ 9,946 million. Based on this, CO_2 damage cost was estimated at $ 20.0 per ton. The CO_2 emission in the province of New Brunswick in 1995 was 15.52 Mt and the GDP during the same period was $ 12,823 million. Accounting for1.5 percent of the GDP of the province and a CO_2 emission of 15.52 Mt, the damage cost was calculated at $12.4 per ton. Using the above estimates, a damage cost of $ 12.4 per ton has been used for this study. The reduction in CO_2 emission damage costs was taken as benefits in this study and are presented in Table 6.

(c) Reduced Tire Costs

As stated by Archondo and Faiz (1991), tire consumption will rise as a result of higher speeds. Natural Resources Canada (1998) also stated that "High speed driving reduces tire life. Traveling at 110 kph can reduce tread life by 20 percent as opposed to traveling at 90 kph". Dawson (1972) stated that tire costs can be assumed to vary with speed in the same way as fuel costs. Hilliard and Springer (1984) have also stated "As a rule of thumb which seems to be generally true for passenger car vehicles is that a five-to-one-ratio exists between improvements in tire rolling resistance and improvements in fuel economy, i.e., a 10% improvement in tire rolling resistance will yield a 2% improvement in fuel consumption".

Data from the American Automobile Manufacturers Association (1997) showed that tire costs of automobiles were in the range of 13.4 and 23.8 percent of fuel consumed between 1991 and 1997, with an average of 18.7 percent. In general, fuel efficiency of vehicles has been increasing in recent years. In the study, 10, 20 and 30 percent of costs from fuel savings have been accounted for tire consumption savings in the case of cars, buses and heavy vehicles respectively. Table 6 lists reduced tire consumption costs.

4.3.4 Cash Flows

Costs and benefits were developed for ten years, 2006-2015. Costs were subtracted from benefits and the net cash flows were discounted at 10% discounting rate to calculate the net present value (NPV). In addition, cash flows of costs and benefits were discounted separately to calculate benefit-cost ratio (B-CR). Table 7 presents the discounted cash flows and the benefit-cost ratios. As shown in Table 7, NPVs for ten and five years were $1,612 and $ 925 million respectively. Correspondingly, BCRs were calculated at 3.0 and 2.9 in both cases.

Table 7
Cash Flows ($ m)

Year	Undiscounted			Discounted		
	Benefit	Cost	Net	Benefit	Cost	Net
2006	348	119	229	316	109	207
2007	360	123	237	297	101	196
2008	372	126	246	279	95	184
2009	384	129	255	262	88	174
2010	397	133	264	246	82	164
2011	410	136	274	232	77	155
2012	424	140	284	217	72	145
2013	438	144	294	204	67	137
2014	453	148	305	192	63	129
2015	468	152	316	180	59	121
10 Years		Total		2,425	813	1,612
		B-C Ratio		2.98		
5 Years		Total		1,400	475	925
		B-C Ratio		2.94		

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Mason and Zub (1981) carried out a fuel consumption study. They focused on fuel consumption changes attributed to speed reduction and compliance with the 55 miles per hour (MPH) limit. They estimated a total fuel savings of 160,000 barrels per day (BPD) comprising of 70 percent from passenger cars, 13.8 percent from light trucks and 16.2 percent from commercial vehicles.

Natural Resources Canada (NRC) has recently completed a study on the effect of speed reduction on fuel consumption and CO_2 emission. The conclusions and recommendations of NRC study were not available to the authors of this study except for a summary of projected vehicle-kilometer, fuel savings, and cost of lost time by vehicle operators, enforcement costs and lastly, discounted costs and benefits.

The research described in this paper dealt with the envisaged economic and environmental benefits of speed reduction from 100 and 110 kph to 90 kph in the province of New Brunswick. By 2006, there will be 485 km of roads posted at a speed limit of 100 kph and 800 km posted at 110 kph. This is a small part of the national road network.

However, the benefits that resulted from the proposed reduction in speed are significant and encouraging. The total amount of reduced fuel for the ten-year study period was calculated at about 730 million liters of gasoline and 3,450 million liters of diesel. Similarly, reduction in

CO_2 emission was calculated at 10.6 Mt. The discounted benefit during the ten years was about $2.4 billion and the discounted cost was $0.8 billion resulting in NPV of $1.6 billion. Corresponding values for 5 years were $1.4 and 0.5 billion with a net present value of $0.9 billion respectively.

The envisaged loss in revenue from fuel taxes to both Provincial and Federal Governments was estimated at $0.70 and $0.40 billion during 10 and 5 year analysis period. Therefore, net savings to society amounts to $0.90 and $0.50 billion respectively.

Governments may not be willing to accept the loss in fuel tax revenue notwithstanding the potential to contribute to meeting the targets developed as part of the Kyoto Protocol. Recent stated strategies for GHGs reduction through technological improvements in the vehicle fleet will likely be promoted since the cost to governments will be far less than the potential loss in fuel tax revenue from reduced speed limits. However, the strategies in the technological area will require a greater time frame than for example the introduction of lower speed limits. A strategy based on an increase in fuel taxes is not expected to have a significant impact except to increase Government's revenue from highway sector, the majority of which is not invested in the transportation sector let alone the highway mode.

5.2 Recommendations

As shown above, benefits from speed reductions are significant and the outcome of the study is encouraging both in terms of economic contribution and environmental improvements. These benefits calculated using a short section of the highway network indicate the significant potential benefits that could be achieved should the reduced speed limit strategy be applied throughout the national highway system. It is recommended that speed reduction on the nation's highways be encouraged in Canada as a viable strategy in attempting to meet the conditions of the Kyoto Protocol.

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Transportation energy demand model: The application of a complete decomposition method

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Abstract

In recent years, the Office of Energy Efficiency (OEE), Natural Resources Canada, has used a direct application of the type of decomposition model first applied to the energy sector by Lee Schipper *et al.* (1992) and Ademe (1994) to attribute the change in secondary energy use in Canada to four factors: activity, structure (the mix of activity), energy intensity and weather. The OEE estimated the impact of energy intensity on changes in energy consumption by isolating the importance of activity, structure and weather. Using the greatest level of disaggregation in the model, an "indicator" of the change in energy efficiency was developed. Unfortunately, within this decomposition model remained the clouding affect of a residual (interaction) term.

In this paper, a complete decomposition model is applied to the passenger light-duty vehicle segment of the OEE's transportation energy use database for the period 1990 to 1998. Using a similar approach to that of J. W. Sun in a recent paper (Sun, 1998), the interaction term is distributed into the core factors of energy use: activity, structure and intensity,[1] making the contribution of the

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* The analysis presented is based upon work done at the Office of Energy Efficiency in its on-going commitment to improve the reporting of trends in energy consumption in Canada.

1 The OEE does not include weather in its calculation of the facets effecting changes in energy use in the transportation sector.

residual term to each factor of the original model apparent. This new approach is aimed at reducing the information lost in the interaction term that, because of its additive nature, grows more significant as the analysis period lengthens.

Introduction

The Office of Energy Efficiency (OEE) of Natural Resources Canada maintains a model of the end-use energy demand in the transportation sector. This bottom-up model, the Transportation Energy Demand Model (TEDM), contains an extensive historical database on vehicle stocks, distances travelled and fuel consumed in Canada. In this paper, data from the TEDM for light-duty, road, passenger vehicles[2] will be used to compare the results of invoking a complete rather than a general decomposition model to explain changes in secondary energy use over the period 1990 to 1998.

General decomposition models decompose changes in energy consumption into changes in the number of passenger-kilometres travelled[3] (the activity effect), changes in the mix of modes of transportation used (the structure effect), and changes in the energy required per passenger-kilometre travelled (the intensity effect). The structure effect combined with the intensity effect represents the change in the aggregate intensity for the sector. General decomposition models share a common problem – the generation of residual terms. Often these terms are regarded as interaction terms among the effects, adding confusion for the readers, or ignored, potentially leaving large estimation errors.

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2 The data for light-duty vehicles (small and large cars, light trucks, and combined motorcycles and mopeds) represent vehicles used for personal purposes only - as distinguished in the TEDM.

3 A passenger-kilometre is the transport of one passenger over a distance of one kilometre.

In a recent paper, J.W. Sun discussed the application of a complete decomposition model to the energy sector (Sun, 1998). Sun noted that a portion of the residual terms could be associated with the three known effects. Sun suggested that the estimates of the activity, structure and intensity effects would thus be improved by distributing equally the assignable portion of the residual terms.

The complete decomposition model used for this paper, and discussed in detail below, differs slightly from the model proposed by Sun. Sun assumed that the residual term generated by changes in both the activity effect and aggregate intensity effect should be divided equally between the activity, structure and intensity effects. The model presented herein, however, notes that when considering data at a disaggregate level a more complex distribution is appropriate.

Factorisation method

Decomposition models use factorisation methods to develop the indices analysed. The indices presented below are based on a Laspeyres index (i.e. using weights based on values in the base year).

The development of the indices is based on the following identity:

$$E_i = A_i \frac{E_i}{A_i}$$

where E is energy use and A is the level of activity. The subscript "i" denotes the "i^{th}" sub-sector. For the "sector" (light-duty passenger vehicles) presented in this paper, the "i" would denote a type of vehicle (i.e. a light truck or a small car). The relationship between aggregate energy use in a sector and those of its sub-sectors is as follows:

$$E = \sum_i E_i = \sum_i A_i \frac{E_i}{A_i}$$

the sum of the activity shares is equal to 1

$$A = \sum_i A_i \qquad \Rightarrow \qquad \sum_i \frac{A_i}{A} = 1$$

$$E = A \sum_i \frac{A_i}{A} \frac{E_i}{A_i}$$

For an energy-consuming sector that is composed of several sub-sectors such as transportation (various vehicle types), movements in aggregate energy can be due to changes in the mix of activity of its sub-sectors or due to changes in the intensity of energy use of its sub-sectors. The basic energy identity is then as follows:

$$E = A \sum_i a_i \Omega_i$$

To denote time, a subscript of "$_0$" is used for base period values (the base year is 1990). The change in energy consumption is represented by the following equation (the identity above in index form):

$$\frac{E}{E_0} = \frac{A \sum_i a_i \Omega_i}{A_0 \sum_i a_{i0} \Omega_{i0}}$$

Movements in the average, sector intensity consist of movements in activity shares and in the intensities of the sub-sectors. The average

intensity indices, which are defined in terms of their sub-sector activity shares and intensities, can be defined as:

$$\frac{\Omega}{\Omega_0} = \frac{\sum_i a_i \Omega_i}{\sum_i a_{i0} \Omega_{i0}}$$

The energy index can now be seen to be the product of the activity and average intensity indices:

$$\frac{E}{E_0} = \frac{A}{A_0} \frac{\Omega}{\Omega_0}$$

The complete decomposition method

As Sun indicated in his paper, the purpose of proposing a complete decomposition model is to improve the reliability and accuracy of the decomposition model. Sun stated that one could safely assume the residual or interaction terms are equally decomposed between the effects that generate them. A two-factor model is used here to express this principle.

Assume that V = xy, therefore the change in V can be expressed as:

$$\begin{aligned} \Delta V &= V - V_0 = xy - x_0 y_0 \\ &= (x - x_0) y_0 + (y - y_0) x_0 + (x - x_0)(y - y_0) \\ &= y_0 \Delta x + x_0 \Delta y + \Delta x \Delta y \end{aligned}$$

In index form, the previous equation may be written as: (the base year values are equal to 1)

$$\Delta V = V - 1$$
$$= \Delta x + \Delta y + \Delta x \Delta y$$

By applying the above example to the energy index,

$$\frac{E}{E_0} = \frac{A}{A_0}\frac{\Omega}{\Omega_0}$$

we obtain:

$$\frac{E}{E_0} - 1 = \left(\frac{A}{A_0} - 1\right) + \left(\frac{\Omega}{\Omega_0} - 1\right) + \left(\frac{A}{A_0} - 1\right)\left(\frac{\Omega}{\Omega_0} - 1\right)$$

The change in the energy index can be expressed as the sum of the changes in the activity and average intensity indices plus an interaction term ε.

Where $\varepsilon = \left(\frac{A}{A_0} - 1\right)\left(\frac{\Omega}{\Omega_0} - 1\right)$

the equation becomes

$$\frac{E}{E_0} - 1 = \left(\frac{A}{A_0} - 1\right) + \left(\frac{\Omega}{\Omega_0} - 1\right) + \varepsilon$$

The average intensity index is defined in terms of its sub-sector activity shares and intensities:

$$\frac{\Omega}{\Omega_0} = \frac{\sum_i a_i \Omega_i}{\sum_i a_{i0} \Omega_{i0}}$$

To isolate the effect of the structure and the "pure" intensity indices on the average intensity index, consider the following simplifications:

$$\frac{\Omega}{\Omega_0} = \frac{\sum_i a_i \Omega_i}{\sum_i a_{i0} \Omega_{i0}} = \frac{\sum_i a_{i0} \Omega_{i0} \frac{a_i}{a_{i0}} \frac{\Omega_i}{\Omega_{i0}}}{\sum_i a_{i0} \Omega_{i0}}$$

$$= \sum_i \left[\left(\frac{a_{i0} \Omega_{i0}}{\sum_i a_{i0} \Omega_{i0}} \right) \frac{a_i}{a_{i0}} \frac{\Omega_i}{\Omega_{i0}} \right] = \sum_i b_i \frac{a_i}{a_{i0}} \frac{\Omega_i}{\Omega_{i0}}$$

where $b_i = \frac{a_{i0} \Omega_{i0}}{\sum_i a_{i0} \Omega_{i0}}$ is the base-period energy share of the "i^{th}" sub-sector. This yields the following representation of the average intensity index:

$$\frac{\Omega}{\Omega_0} - 1 = \sum_i b_i \left(\frac{a_i}{a_{i0}} \frac{\Omega_i}{\Omega_{i0}} - 1 \right)$$

Here, the value in parentheses represents the change in the product of two indices. As was done for the energy index, this term can be presented as:

$$\frac{\Omega}{\Omega_0}-1=\sum_i b_i\left(\frac{a_i}{a_{i0}}-1\right)+\sum_i b_i\left(\frac{\Omega_i}{\Omega_{i0}}-1\right)+\sum_i b_i\left(\frac{a_i}{a_{i0}}-1\right)\left(\frac{\Omega_i}{\Omega_{i0}}-1\right)$$

To simplify, the structure and "pure" intensity indices can be defined as:

$$\frac{S}{S_0}-1=\sum_i b_i\left(\frac{a_i}{a_{i0}}-1\right) \text{ and } \quad \frac{I}{I_0}-1=\sum_i b_i\left(\frac{\Omega_i}{\Omega_{i0}}-1\right)$$

The third term in the average intensity index equation is the interaction term between the structure and "pure" intensity indices. Let's call it δ

$$\delta=\sum_i b_i\left(\frac{a_i}{a_{i0}}-1\right)\left(\frac{\Omega_i}{\Omega_{i0}}-1\right)$$

Then

$$\frac{\Omega}{\Omega_0}-1=\left(\frac{S}{S_0}-1\right)+\left(\frac{I}{I_0}-1\right)+\delta$$

Rrecall the energy index,

$$\frac{E}{E_0}-1=\left(\frac{A}{A_0}-1\right)+\left(\frac{\Omega}{\Omega_0}-1\right)+\varepsilon$$

The factorisation of the energy index beens:

$$\frac{E}{E_0}-1=\left(\frac{A}{A_0}-1\right)+\left(\frac{S}{S_0}-1\right)+\left(\frac{I}{I_0}-1\right)+\delta+\varepsilon$$

where ε is the intensity-activity interaction term and δ is the structure-intensity interaction term.

But ε is

$$\varepsilon=\left(\frac{A}{A_0}-1\right)\left(\frac{\Omega}{\Omega_0}-1\right)$$

thus

$$\varepsilon=\left(\frac{A}{A_0}-1\right)\left[\left(\frac{S}{S_0}-1\right)+\left(\frac{I}{I_0}-1\right)+\delta\right]$$

$$=\left(\frac{A}{A_0}-1\right)\left(\frac{S}{S_0}-1\right)+\left(\frac{A}{A_0}-1\right)\left(\frac{I}{I_0}-1\right)+\left(\frac{A}{A_0}-1\right)\delta$$

Now ε can be represented as the sum of the three following interaction terms:

$$\varepsilon_1 = \left(\frac{A}{A_0} - 1\right)\left(\frac{S}{S_0} - 1\right)$$ interaction between activity and structure

$$\varepsilon_2 = \left(\frac{A}{A_0} - 1\right)\left(\frac{I}{I_0} - 1\right)$$ interaction between activity and intensity

and

$$\varepsilon_3 = \left(\frac{A}{A_0} - 1\right)\delta$$ interaction between activity and δ,

where

$$\delta = \sum_i b_i \left(\frac{a_i}{a_{i0}} - 1\right)\left(\frac{\Omega_i}{\Omega_{i0}} - 1\right)$$ interaction between structure and intensity

Thus, the total decomposition of the energy index is:

$$\frac{E}{E_0} - 1 = \left(\frac{A}{A_0} - 1\right) + \left(\frac{S}{S_0} - 1\right) + \left(\frac{I}{I_0} - 1\right) +$$

$$+ \left(\frac{A}{A_0} - 1\right)\left(\frac{S}{S_0} - 1\right) + \left(\frac{A}{A_0} - 1\right)\left(\frac{I}{I_0} - 1\right) + \left(\frac{A}{A_0} - 1\right)\delta + \delta$$

$$\frac{E}{E_0}-1=\left(\frac{A}{A_0}-1\right)+\left(\frac{S}{S_0}-1\right)+\left(\frac{I}{I_0}-1\right)+\varepsilon_1+\varepsilon_2+\varepsilon_3+\delta$$

Energy Index	=	**Activity Effect**	+	**Structure Effect**	+	**Intensity Effect**	+	**Interaction Terms**

As mentioned earlier, the assumption is made that δ is equal to the product of the structure effect and the intensity effect. In fact, δ is the sum, over all transportation modes, of the product of the change in intensity and the change in the share of total activity for each mode weighted by that mode's share of total energy consumption.

In the complete decompostion model, ε_1 and ε_2 are equally distributed between the structure and activity effects, and intensity and activity effects, respectively, while δ is equally distributed between the structure and intensity effects. ε_3 is the interaction between δ and the activity effect. As δ is created by both structure and intensity effects, and it jointly creates ε_3 with the activity effect, ε_3 should be distributed such that one half of it is distributed to the activity effect while one quarter is distributed to both the structure and activity effects. Thus the "total" effects on energy consumption are expressed as the sum of the activity effect, the structure effect and intensity effect:

$$\text{The total activity effect} = \frac{A\sum_i a_{i0}\Omega_{i0}}{A_0\sum_i a_{i0}\Omega_{i0}}-1$$

$$=\left(\frac{A}{A_0}-1\right)+\frac{1}{2}\varepsilon_1+\frac{1}{2}\varepsilon_2+\frac{1}{2}\varepsilon_3$$

$$\text{The total structure effect} = \frac{\sum_i a_i \Omega_{i0}}{\sum_i a_{i0} \Omega_{i0}} - 1$$

$$= \left(\frac{S}{S_0} - 1 \right) + \frac{1}{2}\varepsilon_1 + \frac{1}{2}\delta + \frac{1}{4}\varepsilon_3$$

$$\text{The total intensity effect} = \frac{\sum_i a_{i0} \Omega_i}{\sum_i a_{i0} \Omega_{i0}} - 1$$

$$= \left(\frac{I}{I_0} - 1 \right) + \frac{1}{2}\varepsilon_2 + \frac{1}{2}\delta + \frac{1}{4}\varepsilon_3$$

Decomposition of the light-duty passenger vehicle energy use for Canada 1990 to 1998

Tables 1 through 4 provide an empirical comparison of the application of the general and complete decomposition models to energy use data for light-duty passenger vehicles in Canada. The results for each model, generated using energy and activity (passenger-kilometres travelled) data, are given as changes in petajoules of energy consumption. The total energy demand for the transportation segment analysed is presented in Table 1.

Table 1. General Decomposition Model Results (petajoules)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Total Energy Demand	907.4	876.0	896.3	917.2	950.7	953.4	953.9	965.9	992.1
Activity Effect	0.0	-8.0	28.6	26.7	50.1	55.3	63.2	71.6	74.9
Structure Effect	0.0	-1.7	1.7	8.2	14.9	19.5	23.9	29.0	35.9
Intensity Effect	0.0	-21.9	-40.3	-25.8	-23.8	-31.5	-43.8	-46.7	-34.6
δ	0.0	0.1	0.2	1.1	2.3	3.3	4.3	5.5	7.8
ε_1	0.0	0.0	0.1	0.2	0.8	1.2	1.7	2.3	3.0
ε_2	0.0	0.2	-1.3	-0.8	-1.3	-1.9	-3.0	-3.7	-2.9
ε_3	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.4	0.6

In the earlier 1990s, the Canadian economy was in recession. The effect of this recession is observed, particularly in 1991, in the negative impact of activity and structure (the mix of light vehicles used) on the consumption of energy. Since 1991, activity and structure[4] has generally increased thus increasing the demand for energy. The upward pressure on energy demand caused by these two effects have been mitigated over the entire period by reductions in the energy intensity of light-duty vehicles – reduced energy intensity can be equivalently referred to as improved energy efficiency.

[4] The increase in the structure effect can be explained by the increased preference of Canadians for minivans and sport utility vehicles over more traditional family cars.

Table 2. Complete Decomposition Model Results (petajoules)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Total Activity Effect	0.0	-7.9	28.0	26.5	50.0	55.0	62.6	71.1	75.3
Total Structure Effect	0.0	-1.7	1.8	8.9	16.6	21.8	27.0	33.0	41.4
Total Intensity Effect	0.0	-21.8	-40.9	-25.6	-23.2	-30.8	-43.1	-45.6	-32.0

Table 3. Difference Between the General and Complete Decomposition Models (petajoules)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Total Activity Effect	0.0	0.1	-0.6	-0.2	-0.2	-0.3	-0.5	-0.5	0.4
Total Structure Effect	0.0	0.0	0.1	0.7	1.6	2.3	3.1	4.0	5.5
Total Intensity Effect	0.0	0.1	-0.5	0.2	0.5	0.7	0.7	1.0	2.6

Table 4. Impact on the General Decomposition Model of the including the interaction terms (percent, absolute value)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Activity Effect		1.3	2.1	0.9	0.4	0.5	0.9	0.7	0.5
Structure Effect		2.2	8.6	8.3	10.8	11.6	12.9	13.8	15.4
Intensity Effect		0.6	1.3	0.7	2.3	2.3	1.7	2.2	7.5

Although the impacts of distributing the residual terms from the general decomposition model into the three descriptive effects are not large, as can be seen in Table 4, the complete decomposition model displays as much as a 15 percent improvement in the estimations of the effects. If a similar analysis was performed on the entire passenger segment of the transportation sector, it is likely that much more significant differences between the two models would be observed.[5]

Conclusion

In this paper, secondary energy use data from the OEE's Transportation Energy Demand Model was used to compare the results of two energy decomposition models. A complete decomposition model, using a factorisation methodology similar to that recently proposed by J.W. Sun, was presented as an alternative to using a general decomposition model to explain changes in energy use over time. The complete decomposition model was shown to improve the estimates of the core factors of energy use – activity, structure and intensity; and thus provide a more complete picture of the trends in energy use over time.

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[5] The Office of Energy Efficiency plans to implement a complete decomposition model similar to the one discussed herein for its upcoming report *Energy Efficiency Trends in Canada, 1990 to 2000*, expected for release in 2002.

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