

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

21st ANNUAL MEETING

PROCEEDINGS

VANCOUVER, B.C.
MAY 1986

PROCEEDINGS

of the 21st Annual Meeting of

THE CANADIAN TRANSPORTATION RESEARCH FORUM

Theme:

"Looking Forward and Looking Back"

Vancouver, B.C.

May 28-30, 1986

Proceedings Printed by

University of Saskatchewan
Printing Services

CANADIAN TRANSPORTATION RESEARCH FORUM

1986 EXECUTIVE

PRESIDENT:
Frank Trotter, The Trade & Transportation Group

EXECUTIVE VICE PRESIDENT:
Rod B. Taylor, Ontario Ministry of Transportation & Communications

TREASURER:
J. J. Smith, Air Transport Association of Canada

SECRETARY:
Craig S. Dickson, Atlantic Provinces Transportation Commission

VICE-PRESIDENT
EXTERNAL AFFAIRS:
E. M. Ludwick, E. M. Ludwick & Associates Inc.

VICE-PRESIDENT
MEETINGS:
T. E. Culham, Swan Wooster Engineering Co. Ltd.

VICE-PRESIDENT
ORGANIZATION & DEVELOPMENT:
B. G. Bisson, University of New Brunswick

VICE-PRESIDENT
PROGRAM & PUBLICATIONS:
Wm. G. Waters II, University of British Columbia

IMMEDIATE PAST-PRESIDENT:
Karen Hecks, Transport Canada, Marine

CHAIRMAN
STUDENT PAPER COMPETITION:
William J. Pascal, Expo 86, Government of Canada

COUNCILLORS:
Ray Bassett, Alberta Economic Development
Mary Brooks, Dalhousie University
Andrew Elliott, PCS Sales
J. A. Greig, Canadian Transport Commission
W. G. Hanks, CN Rail
Donald G. Newman, CN Marine
Fred Nix, Joint Program, University of Toronto/York
T. W. Phillips, Canadian Pacific Limited
W. H. Sheffield, Stelco Inc.
Harold L. Snyder, Memorial University
Richard Wansbutter, Grain Transportation Agency

PRESIDENT'S MESSAGE

Welcome to the 1986 Conference of the Canadian Transportation Research Forum. This is the Twenty-first such gathering of those of us involved in transportation research, policy and planning, and who share a common dedication to promoting wide discussion of current topics in transportation.

This year's conference occurs at a significant time in Canada's transportation history. It is one hundred years since the Canadian Pacific Railway arrived in Vancouver, and it is that city's centennial. There are two current events taking place which are of special relevance to this conference. There is EXPO 86, a world exhibition on transportation and communications, and this is also the time of the first major revision in nearly two decades to Canada's national transportation policy framework. Both of these events will heavily influence this year's meetings, the former providing an endless variety of things to see and do while in Vancouver, the latter providing a variety of topics for debate in the conference sessions.

The papers contained in this volume and the discussion sessions to be covered by this year's program, probably the most extensive in the Forum's history, are a credit to the hard work of Bill Waters. Equally important, Tom Culham has assembled an excellent series of meals and opportunities to meet and reestablish old friendships and to create new ones.

On behalf of the Board of Directors of CTRF, I welcome you to this year's conference, and I thank you for the opportunity to serve as President during the past year.

Frank Trotter
President
Canadian Transportation Research Forum

ACKNOWLEDGEMENTS

Collecting and producing these Proceedings is a daunting task. Several individuals and groups rendered valuable assistance to our "fast track" publication process. I wish to recognize the assistance of CTRF Board members and Chairpersons of paper sessions for their assistance in encouraging authors to complete their papers on time. Special thanks are due Barbara Grassmuck, Barbara Kent and Nancy Schell for their expert secretarial assistance, and to my research assistant, Susan Mar, for her always capable help in organizing these Proceedings. Thanks also to Professor Gordon Sparks, Joan Tilk, and the staff of the University of Saskatchewan Printing Services for their technical assistance in producing this volume.

Finally, there are two groups whose actions are of immense assistance to an Editor, but who rarely receive proper acknowledgement. The first group consists of those authors who, with admirable self-discipline, met the scheduled deadline for submitting their papers. Their promptness makes it possible to cope with the inevitable delays which the rest of us (including yours truly) encounter in completing our papers. The second group, who do receive some recognition in the form of financial compensation for their efforts, is the courier industry. They provide us all with that valuable cushion of a few extra hours or days as deadlines approach; how did we ever manage without them?

W.G. Waters II
CTRF Program Vice President

Table of Contents

Page

GRAIN TRANSPORTATION: CHANGING POLICIES AND THEIR IMPACTS

"Prairie Short Line Railroads: Concept and Practice" 1
Robert L. Banks

"Impacts of Reforms in the Statutory Rates on Trucking" 14
G. Nabi Chaudhary

"Rail Cost- Distance Relationship and the Crow Rate Taper" 27
Trevor Heaver
W. G. Waters II
Thomas B. Schwetz

THE IMPACTS OF DEREGULATION ON TRANSBORDER TRUCKING

"Transborder Trucking Flows and Trends" 40
Garland Chow

"A Survey of the Transborder Trucking Industry 43
Lorraine Clavel

"The Quebec LTL Market" 61
Michael Boucher

"An Overview of International Truck Traffic Patterns in Ontario" 72
Adil Cubukgil

MANAGING TRANSPORTATION FOR THE CANADIAN FORCES

"Transportation Support to National Defence - A Civil - Military Partnership" 84
Lt. Col. James W. Craig

"Automating Transportation Within the Canadian Forces" 91
Major Howard L. Mooney

"On the Operating Aspects of Material Distribution Activity Within the Canadian Forces" 103
Kevin Y. K. Ng
M. N. Lam
J. R. Hudson
Major M. B. Turnbull

Page

MARKETING TRANSPORTATION SERVICES

"The Use of Advertising as a Marketing Variable by Class I Intercity For-Hire Motor Carriers in the U.S.: A Preliminary Analysis" 114
Grant M. Davis
W. R. Darden
J. E. Dillard

"International Physical Distribution Systems and the Demand for Air Freight" 127
Jacques Picard

INTERCITY BUS TRANSPORTATION

"Responses to Deregulation in the U.K. Bus Transport Industry" 134
Mick Carney

"The Impact on the Intercity Bus Industry of Policy Changes in Air & Rail Passenger Transportation" 149
David M. Cape

REFLECTIONS ON THE REGULATORY REFORM PROCESS

"Transportation Policy in a Federal State" 157
Henry Ropertz

TRANSPORTATION DATA BASE PRIORITIES IN A DEREGULATED ENVIRONMENT

"The Canadian Transportation Statistical System in Light of Rapidly Changing Environment - A Statistician's Perspective" 167
B. G. Nemes
R. E. Drover
D. P. Chartrand
S. L. Mozes

"Railway Data Requirements in a Reregulated Environment" 186
J. Kruger

"A Review of Technology, Policy and Legislative Changes Affecting Truck Data Needs & Collection Methodology" 198
Michael Lai
John Rae

Page

CANADIAN AIR TRANSPORTATION: TRENDS AND ISSUES

"Canadian Air Transport Industry: Recent Trends:" 200
Roger Roy

"Demand Analysis of the Scheduled Level I Domestic Air Travel Market" 216
Leesha Lin

"Airline Seat Management" 232
Dennis J. H. Kraft
Tae H. Oum
Michael W. Tretheway

"Economic Deregulation and Airline Safety" 246
William A. Jordan

ST. LAWRENCE AND GREAT LAKES SHIPPING

"The St. Lawrence Seaway Competitiveness" 257
Hazem Ghonima

"Canadian Great Lakes Shipping: Problems and Trends" 272
Peter Yee

GOVERNMENT INTERVENTION AFTER DEREGULATION - WHY GOVERNMENT AND LEGAL CONTROVERSY WON'T GO AWAY

"Government Intervention After Deregulation: Aspects of the U.S. Experience Relevant to Canada" 281
Denise M. O'Brien

"Entry Tests and the Jurisprudence Surrounding Them" 296
Thomas G. Keast

"Final Offer Arbitration: Hard-Hitting Advice to Canadian Transportants" 313
Richard Lande
Donald Weckstein

PROVISION AND UTILISATION OF AIRPORTS

"Allocating Scarce Runway Capacity Via Slot Auctions" 323
J. R. G. Brander
B. A. Cook
J. E. Rowcroft

Page

"Management and Planning of Airport Estate Capacity: A New Microcomputer Based Gate Assignment Simulation Model" 338
Salah Hamzawi

"A Disaggregate Air Fare and Cost Model for Forecasting Aviation Traffic" 351
Richard Westler
John Spacek

MODELS AND METHODOLOGY

"Empirical Bayes Estimates of Demand for Transportation Mode: A Proposed Methodology and Implications for Network Scheduling" 368
J. T. Tomberlin
K. Buyukkurt
M. Buyukkurt

"Transportation Impacts of Acid Rain Mitigation Measures" 377
Michael S. Bronzini
E. G. Altouney

"Transportation Costs: Impact of Deregulation on Market Competitiveness" 385
Neil Meyer
Robert Phelp

COSTS, VALUE OF SERVICE AND RAILWAY RATE NEGOTIATIONS AFTER "FREEDOM TO MOVE"

"Canadian Regulatory Change in the Railway Industry - Solution or Problem?" 386
J. W. Telford

"Impact on Canadian Railways and Shippers of Cost-Based Pricing for Railway Freight" 399
J. A. Nash

"Rail Cost Order R-6313: Paragon or Passe?" 410
Frank E. Collins
J. B. Best

"Revenue Cost Comparisons for Alberta Rail Traffic" 420
R. C. Bassett
G. M. Rosko

Page

BETTER MANAGEMENT OF TRANSPORTATION PLANNING

"Strategic Planning: The New Darling of Management Tools for Public Sector Transport Agencies" 434
Merriene Duncan

"Treatment of Risk and Uncertainty in Transport Investment Planning" 446
David P. Lewis
Ling Suen

"Technological Transfer Policy in Applied Transportation Research" 461
Lionello Negri
Maria Teresa Carmosino

COMPETITION AND PUBLIC POLICY UNDER DEREGULATION

"Anti-Combines Issues After "Freedom to Move" 473
H. S. Chandler

"Entry Barriers and Anticompetitive Behaviour in a Deregulated Canadian Airline Market" 483
D. W. Gillen
Tae H. Oum
Michael W. Tretheway

"Failure in the Privatization of CN and Air Canada" 494
Wilbrod LeClerc

HEAVY VEHICLE USER CHARGES AND HIGHWAY FINANCE

"Structure of Road-User Taxes for Large Commercial Trucks In Canada" 506
Fred Nix

"Rationale for Increasing Truck Gross and Axle Weights" 519
J. J. Wyatt
M. U. Hassan
R. P. Courturier

"Financing Transportation Infrastructure - Issues and Future Directions" 531
B. G. Bisson
A. M. Stevens

Page

MANAGEMENT SCIENCE APPLICATIONS FOR IMPROVING TRANSPORTATION DECISION MAKING

"The Measure of Vessel Utilization: Its Implications for Fleet Requirements" 547
Gordon C. Shaw

"The Canadian Rockies: A Case Study in Rail Modeling" 561
Mara L. McLaren
E. R. Petersen
A. J. Taylor

"Loss-Cost Functions for Evaluating Forecasts of Demand for Transportation Rolling Stock" 562
S. K. Goyal
C. S. Bayne

INTERMODAL TRANSFER AND EFFICIENCY FOR INTERNATIONAL MOVEMENTS

"On-Dock Transfer: Facing the Issues" 572
Daniel Smith

"Understanding the Role of Intermodal Trailer on Flat Car (T.O.F.C.) Service in Canada" 585
Lloyd L. Ash
Charles Schwier
Barry Gardiner

"Economic Analysis of Liner Shipping Intermodal Services and Ratesetting Practices" 596
Michel Archambault

"The Canadian Landbridge" 609
Rejean LeClerc

URBAN TRANSPORTATION ISSUES

"Operations Planning For An Exclusive Bus Lane" 621
Gulgun Pogun
Ahmet Satir

"Development of an Information System on the Taxi Industry" 644
Jean David

Page

"Methods of Allocating Public Transit Operating Subsidies in Canada: Current Practice and Suggested Approach" 645
Attahuri S. Alfa
Jonathan Heads

SHIPPING TRENDS, SHIPPING POLICY AND CANADIAN TRADE

"Structure of Linear Markets & Effect of Conference Rates on Canadian Overseas Trade" 660
Vivian Wei

DEVELOPING ISSUES IN THE CANADIAN TRUCKING INDUSTRY

"Impacts of Changes in Vehicle Mass and Dimension on Trucking Activity in the Atlantic Provinces" 673
D. C. Good
B. G. Bisson

"The Broker in the For-Hire Trucking Industry" 687
F. R. Wilson
Karen Buchanan

TRANSPORTATION RESEARCH - WHAT IS TO BE DONE AND WHO WILL DO IT?

"A National Transportation Research Organization: Alternatives and Factors" 702
Richard W. Lake
Yves Dube

"Transport Research: Reality or Rhetoric" 713
R. M. Soberman

"Shippers' Research Agenda" 725
W. H. Sheffield

"Railway Research and Development and The Realities of the 1980's" 741
R. A. Shea

PRAIRIE SHORT LINE RAILWAYS: CONCEPT AND PRACTICE

by

Robert L. Banks

R.L. Banks & Associates, Inc.

The summer of 1985 brought forth the Ministry of Transport's White Paper, "Freedom to Move," covering virtually the entire spectrum of Canadian commerce. The railway issue accorded the greatest attention is that of Branch-Line Abandonment. The goal of the Government's proposal on this subject is to "facilitate the development of innovative options" with respect to the branch line problem in Canada, so as to foster more efficient means of serving these lines' shippers. The possible transfer of such lines to short-line railways is explicitly contemplated.

"Freedom to Move" provides the first indication that the Federal government takes seriously the possibility that short-line railway companies, consisting of former branches of CN and CP, could represent a desirable enhancement of the nation's transportation system. The rationale is not fully articulated, but the expectation appears to be that the formation of locally-owned and operated railways will introduce a new element in the structure of Canadian transportation, an element that will encourage local entrepreneurs to act in such a manner as to assure the survival of many subdivisions that might otherwise be abandoned, and thus mitigate injurious effects of heavy grain trucks upon provincial highways networks, while concurrently preserving employment opportunities and, most importantly, inducing cost savings to farmers.

That this is an idea whose time may finally have come is apparent from the Report of the Inquiry into Railway Branch Lines by the Western Division of the Canadian Transport Commission. The CTC also recommends examining alternative approaches to maintenance of service to branch line users, including not simply rail alternatives but intermodal solutions as well. It points out that maintaining CN Rail or CP Rail as the operator of a marginal branch line is often the high-cost solution in comparison with other alternatives.

Still a third report followed closely on the heels of the White Paper and the CTC report. This was the Senior Grain Transportation Committee's High Cost Branch Line Study discussion paper. It, too, focussed on the limited number of options available to deal with the branch line problem, and while it did not explicitly endorse short lines as a general cure for this problem it recognized that in some instances local interests would want to pursue this alternative, and in such cases institutional barriers should not prevent them from doing so.

The common philosophical thread in these treatments of the Canadian branch line issue is that it is time to depart from the false dichotomies implied by past and, to some extent, current regulations. Under long-standing regulatory procedures, there were in essence two types of branch line: uneconomic (subsidized) and all other. Policies based on this assumption did little to encourage the parties involved in branch line service to seek out measures to alter the economics of a particular rail operation, and thereby shift a line from one category to the other. The progression was obvious: if a once-economic branch line moved into the subsidized category, the ultimate step would be abandonment.

Another false assumption implicit in past thinking on this subject was that the choice of an operator for a prairie branch line was limited to the two major railways (or to no operator at all, i.e., abandonment). Until very recently, independent operation by local businesspeople was never treated as a serious alternative, and little thought was given to attempting to inject entrepreneurial enthusiasm into the operation of railway branch lines. Here, too, the ultimate failure of these lines has been virtually guaranteed by limiting choices to an unnecessarily narrow range.

Although the Western Grain Transportation Act (WGTA) altered the mechanics of the branch line subsidy program, it left intact the institutions that made many branch lines uneconomic in the first place. The protection afforded several thousands of miles of prairie branch lines through the year 2000 only postpones the day of reckoning that ultimately must come regarding the long-term future of these lines. That day could, in fact, come sooner; recent experience in the U.S. indicates that, no matter how sacrosanct a particular government program may be, it must be able to withstand scrutiny in light of changing economic conditions and social values. The present role of the prairie branch line relative to the rest of the transportation network appears anachronistic. To perpetuate a holding action on

such a large scale over such a long period of time will only magnify the intensity of the problem that ultimately must be addressed.

As suggested by both "Freedom to Move" and the CTC Branch Line report, one means of improving the efficiency and ensuring the future viability of many of these lines is to convert them from appendages of the large railways into self-contained, independent entities--in other words, short line railways. Such a process is already well-advanced in the United States, under conditions that, while different from those of the prairie provinces, may offer useful lessons as to the conceptual framework of a program to encourage formation of Canadian short lines and the ultimate practicality of such railways.

To a large degree, the growth of short lines in the U.S. in recent years has been a result of the financial difficulties experienced by major railroads since 1970. If service was to be preserved on the critical intercity routes of railroads whose survival was at stake, branch lines of negative or marginal profitability had to be eliminated. Such government programs as did exist to support unprofitable branch lines were interim measures designed to lead to profitable, private-sector operation rather than long-term subsidy. More recently, even profitable railroads have seen conversion of branch lines to independent operation in a planned, systematic way as an attractive alternative to gradual retraction and ultimate abandonment.

While there are admittedly many lines that cannot be turned around even through the most draconian cost-cutting measures, there is also a substantial portion of the rail network that falls into a gray area where modest changes in operating patterns and marketing techniques can create an economically viable business. The viability of any rail line, branch or main, depends on a number of factors, including: traffic volumes; revenue levels; maintenance standards and practices; operating strategies; and labour arrangements. When a branch line is operated as part of a far-flung, large-scale rail system, the interrelationship of these factors may produce a negative financial result. The adjustment of one or more factors in the formula can sometimes, however, turn a loser into a winner, and this should be just as true in Canada as it is in the U.S., despite differences in regulatory schemes, rate structures and institutional precedents.

While the two principal contrasts between branch line and short line operation are familiar, they bear repetition in this context if only to emphasize that they could be

applied as well in Canada as in the U.S. First is the local nature of short line management. While large railroads may have managers whose assigned territories include branch lines, these managers are unlikely to put branch line customers at the top of their list of priorities. Operating and maintenance staff (trainmasters, roadmasters and the like) will face far stiffer reprimands if mainline service in their territories goes unattended than they will if the branch line wayfreight fails to make its appointed rounds. Sales and marketing forces are likewise compelled to give first attention to that traffic with high volumes, fat profit margins, or both, and branch line traffic seldom fits that description. A short line manager, by contrast, lives or dies by the operation of that line exclusively; service to the line's customers is not simply his highest priority, it is his only priority.

At the same time, most short lines are small enough that there is little division of responsibility. In many cases, the short line general manager acts both as chief train operator and as chief salesman. Decisions are made quickly, and there is little or none of the cover-your-posterior syndrome characteristic of large organizations. The net result is a level of service and responsiveness to customer needs seldom found in branch line situations.

The second major characteristic of short lines involves use of labour resources. Because most short lines operate in an atmosphere free of the rigid craft lines found in the larger rail systems, they enjoy far greater flexibility in the assignment of personnel to specific tasks. Also, while both Canadian and U.S. carriers have made progress in the area of train manning levels, there are short lines today operating with 2-person crews rather than the minimum of three crew members provided for under the large carriers' recent crew consist agreements. Finally, on the subject of labour, there is the fact that short lines can set their wage levels to correspond to local labour markets, in contrast with the nationally-negotiated wage levels of the large railroads. Payments for unproductive time in the form of arbitraries and constructive allowances constitute another element of labour expense from which short lines are typically free.

These advantages are not without cost, however. A large railroad can afford to invest in more mechanized maintenance equipment and can employ personnel with a greater range and depth of skills than can the short line. Maintaining track, cars and locomotives is generally a more labour-intensive function on a short line than it is on a large carrier. A short line that requires only one locomotive to meet everyday service requirements may also be

forced to have a second, spare unit available in the event the first unit fails. This spare ratio of one hundred percent contrasts with the five or ten percent spare ratio of larger railroads. Some of these handicaps can and have been overcome by common ownership and management of several geographically isolated short lines. This permits greater specialization of skills on the part of both management and labour, as well as greater investment in labour-saving machinery, albeit with the potential loss of some of the management's day-to-day involvement in providing service to shippers.

A recent survey of the branch line-to-short line conversion process in the U.S. found that, from 1971 through early 1984, 122 new short lines had started operations, representing 7,458 railroad route miles, or an average of 61 miles per company, Due, p.5. Thirty percent of these new short lines, with 39 percent of this mileage, were located in just five states (Michigan, Indiana, Illinois, Wisconsin and Iowa), where the process of physical plant rationalization by major railroads has had its most serious consequences. Given the circumstances involved in the births of these new companies (such as the progressive deterioration of service by the former operator, which serves to accelerate the erosion of shipper confidence and traffic levels), the mortality rate has been remarkably low: only 20 of the 122 operators, with 1,082 route miles (or 14.5 percent of the total mileage), had ceased operations as of April 1984, Due, p.5. The most common cause of failure has been simply the lack of adequate traffic, though inexperienced management and physical traumas (such as loss of a bridge) have also played a role in some cases.

There are, of course, obvious differences between the U.S. and Canadian experiences. A substantially smaller percentage of U.S. rail branch lines are dependent on a single commodity (grain) than is the case in western Canada. The market forces and transportation alternatives are somewhat different in the U.S., as well: the network of inland waterways in the U.S. upper midwest has traditionally represented an important competitor to the railroads for grain business, while Canadian growers lack such alternatives. The number of rail carriers in the grain-growing territory of the U.S. was historically greater than the number of rail-ways serving the Canadian prairies.

The historical basis of the differences between the two countries' granger rail networks is easy to discern. Fundamental is the fact that the settlement of western Canada occurred at a later period than did that of the

western U.S. The last spike on Canada's first transcontinental railway, the Canadian Pacific, was driven in November of 1885, more than 16 years after the completion of the first U.S. transcontinental route, the Union Pacific - Central Pacific. By 1900, the states of Iowa, Missouri, Kansas and Nebraska alone had a combined rail route mileage of 30,464, more than half again as much as all of Canada, which had barely 19,000 route miles. And while the total U.S. rail mileage at the turn of the century represented about 76 percent of the peak year (1916) mileage in that country, Canada's rail mileage in 1900 was less than 42 percent of its peak mileage in the mid-1930s. Actually, while the rail network in the U.S. would begin to shrink significantly after the onset of the Great Depression, Canada's network remained relatively stable from 1930 onward and even grew somewhat in the 1950s and 1960s with the construction of several new resource-oriented railways.

As in the U.S., regulation has historically played a major role in keeping a substantial amount of Canadian branch line mileage in service. However, in the past dozen years, while U.S. regulations regarding abandonment were eased, events in Canada were tending toward retention of many thousands of miles of marginal or unprofitable railway. In 1974, the Canadian federal government, through an Order-in-Council, required that 12,413 miles of line in the three prairie provinces be kept in service through the year 2000. Subsidies have been extended in various forms to stem the railways' losses from hauling grain and from operating high-cost, low-revenue branch lines, but the combination of regulation and subsidy has preserved the status quo when the free market (or, at least, a freer market) might have permitted the kinds of change we have seen in the U.S. A major point made by the CTC inquiry is that past branch line subsidies, while nominally paid to the railways, in fact benefited chiefly the growers who used these lines. The fatal flaw in past subsidy programs is that they have provided no incentive for change.

Thus, while different economic circumstances and regulatory policies have created different physical and institutional configurations in the two countries' transportation networks, the forces that have led Canadian transport policy-makers to consider the short-line alternative are nevertheless similar in certain institutional characteristics to those that have led to the growth of this phenomenon in the U.S. The early overbuilding of rail routes took place, in both countries, in an era when the farmer could, because of poor roads and limited capacity of non-rail vehicles (wagons and later trucks),

afford only a short roadway movement to the nearest railhead. In both countries, too, the railways eventually became large, inflexible institutions, with costly labour arrangements solidified in years of prosperity and growth. The technology of rail transportation is substantially identical as well, except for those accomodations made to the harshness of the Canadian environment.

Thus, while the settings may be different, the economics of short line railways are likely to be quite similar as between the U.S. and Canada. In 1975 the Grain Transportation Branch of the Canadian Surface Transportation Administration issued a report entitled, The Short Line Concept: An Answer to the Prairie Branch Line Problem? This volume consisted primarily of case studies of two U.S. short lines, the Nez Perce in Idaho and the Garden City Western in Kansas, whose traffic and physical characteristics resembled those of many Canadian prairie branch lines. The authors discussed the various advantages and disadvantages of converting branch lines into short line operations, and concluded that the Crowsnest Pass grain rates presented the most formidable obstacle to viable short line operations in the prairie provinces. The fact that only within the past two years, after termination of the 1897 grain rates, has the first concrete proposal been advanced to convert a prairie branch line to independent operation, confirms the validity of that conclusion.

The Central Western Railway Corporation has for some time been negotiating with Canadian National to lease and ultimately purchase the Stettler Subdivision, about 100 miles long between Drumheller and Camrose, Alberta, which Canadian National had sought to abandon. In recent years, the line has originated 2500 carloads of grain on the average and terminated about 1 percent of that number. Although at this writing the precise terms of the Stettler agreement have not been disclosed, it is understood that arrangements are being negotiated which provide in essence for a three year demonstration project.

If successful, this initial effort will represent a harbinger of things to come across all three of the prairie provinces. It is therefore pertinent to assess under what conditions prairie short lines are most likely to flourish. First, it needs to be emphasized that there are probably many lines that are simply not susceptible to conversion to short lines. The CTC report made clear that off-line elevators and increased producer trucking would produce lower total transportation costs with respect to many branch lines than would any rail solution. This

being said, there remains a substantial number of lines that could meet the following criteria:

(1) Strong traffic levels. While perhaps obvious, it is surprising how many times in the U.S. hopeful entrepreneurs have tried to rescue pieces of railroad that simply lacked sufficient volumes to justify their continued existence.

(2) Healthy traffic mix. Having a diverse traffic base is just as important to a small railway as to a large one. Branch lines whose traffic is relatively broad-based will have an easier time weathering seasonal fluctuations, market volatility and other unpredictable events than will those whose traffic is virtually all grain.

(3) Connections with both major railways. Being dependent on a single major connecting line has not proved fatal for those U.S. short lines that find themselves in this situation, but those with multiple connections often have an easier time negotiating rates and car supply, and generally getting the best possible deal for their on-line shippers.

(4) Proximity to other lines that can, over time, be converted to short line operation. A single short line will inevitably incur certain overhead and asset ownership costs that are relatively fixed. Improved yields are possible when such costs can be spread over multiple lines. The lines do not necessarily need to connect with each other, but connecting trackage rights should be negotiated in order to allow motive power and other equipment to be shifted between lines as necessary.

Are there prairie branch lines that meet these criteria? It appears that there are, although the lack of publicly-available traffic data prevents a detailed assessment. However, a review of data developed by my firm in the mid-1970s regarding individual branch lines suggests that many of them have traffic bases whose size and diversity compare favorably with those of successful short lines in the U.S. Further, a surprising number of CN branch lines have, if not active interchange points, at least physical crossings with CP, and vice versa. Most such crossings at grade, even if they do not today feature a connecting track, could have one installed at relatively modest cost in order to provide an outlet to a second railway.

Finally, many of them lie in close proximity to one another, and in fact there are points such as Weyburn and Melfort, SK, from which several branch lines radiate, and which could conceivably serve as bases for rather large-scale short line operations.

A relevant model of such a short line in the U.S. is Delaware Otsego Corporation, which has assembled a diverse group of short lines and former branch lines in New York and New Jersey into a powerful competitor, even for its much larger neighbour, Conrail. Several local shippers sit on Delaware Otsego's board of directors, exemplifying a key ingredient in successful short line entrepreneurship: shipper involvement.

In Canada, as has been the case in the U.S., a key ingredient in short line development must be a change of attitude on the part of the management of large rail systems toward the branch line problem. It was common for many years (and still is in some quarters) to look at a branch line as something that should be gradually starved to death and ultimately sold for scrap. A rigid rate structure that could make little or no allowance for the extra costs of branch line service supported this view. The attendant lack of commitment to branch line maintenance resulted in some lines being so undermaintained that they were beyond the point of economically feasible rehabilitation by the time formal abandonment applications were filed.

Changes in the U.S. regulatory framework have helped change this situation. Differential pricing of branch line services is now feasible, though admittedly this has in some cases discouraged use by shippers who benefited from the artificially low rates of years past. More importantly, the Staggers Rail Act of 1980 established a requirement that a railroad seeking to abandon a line sell the line for its "fair market value" (which the Interstate Commerce Commission will set if the parties cannot agree) if a willing buyer comes forward prior to final abandonment authorization.

There has also been a change in the prevailing view as to what types of service a large railroad should offer, a change commonly described as wholesale-versus-retail. The de facto abandonment in the U.S. of the railroads' role as public utilities has allowed a greater concentration on high-volume (i.e., wholesale) business, where the economies of rail service are most pronounced. This means that "retail" services, such as single carloads and boxcar business generally, or what one railroad president calls "scattershot" business, will be likely to get less

attention than bulk commodities moving in unit trains, trailers carried on dedicated intermodal trains between high-volume hub terminals, and the like. Branch lines generally are a poor fit with the emerging business philosophy of the large railroads.

This is not to say that large carriers are unwilling to carry branch line traffic, but rather that they would prefer to leave the origination and termination of it to someone else. Turning over a branch line to an independent operator, especially if this is done in a planned, orderly way, can preserve the traffic that the branch contributes to a railroad's main line routes while stemming the losses associated with high-cost, low-volume branch line switching operations.

Conrail has been in the forefront of U.S. railroads attempting to retain branch line traffic without keeping branch lines themselves in the railroad's network. A paragraph from Conrail's 1983 Annual Report sums up its activities in this area:

> With line abandonments currently filed with the Interstate Commerce Commission under the expedited abandonment procedures of NERSA [the Northeast Rail Service Act of 1981] Conrail will have reduced its route mileage by about 25 percent from 1981, at a loss of less than one percent of the system's carloads. In addition, rail service will be preserved for more than two-thirds of the traffic volume on abandoned lines, either through shortline operators, other railroads or subsidy agreements for continued operation.

Recent statements by Conrail executives indicate that five percent of that company's freight traffic originates or terminates on connecting short lines, generating approximately $150 million in annual revenue for Conrail. The carrier has, in fact, created a position with the title, "Manager-Short Line Marketing" to lead its efforts in developing joint rate and service packages with short lines.

Another example of innovative, progressive thinking by a major railroad in terms of restructuring some of its secondary mileage involves the Illinois Central Gulf Railroad. Over 700 miles of surplus ICG trackage in Mississippi is now operated independently, as the Gulf & Mississippi. ICG has also sold its Iowa Division, from Chicago to Omaha and Sioux City, to a new operator, Chicago, Central & Pacific. Chessie System has embarked as well on a program to dispose of lines that, while not

meeting its own profitability criteria, could be economically viable as separate operations. By taking such action well before a line is proposed for abandonment, both ICG and Chessie are helping to avoid the vicious cycle that pre-abandonment service reductions often trigger: shippers seek alternative means of shipping because of poor service, further service reductions are made (including cessation of significant track maintenance), and ultimately there are so few shippers left that abandonment is the only remaining alternative.

The Conrail, ICG and Chessie cases appear to hold some valuable lessons for the future of Canadian branch lines, notably those in the prairie provinces. The first is that the economics of branch line operations are highly dependent on institutional factors, notably the labour arrangements under which rail service is provided. Because of their low traffic volumes, branch lines are more sensitive to labour expense than is rail service generally, yet few of the large carriers' labour agreements permit smaller crews on branch line trains than on main line trains (sometimes, in fact, the reverse is true). The labour situation on the Canadian railways is so similar to that in the U.S. that this lesson should have equal application in Canada.

The second lesson involves the possibilities for partnership between large and small carriers. Each of the three major railroads I cited above has determined that it can benefit from the retention of traffic generated by its connecting short lines, and that these short lines can be, in effect, valuable customers of the larger railroad. There is no apparent reason why the partnership concept could not be applied by CN Rail and CP Rail to newly-formed short lines operating their former branch lines.

However, it must be pointed out that such a partnership is not one of equals. The short line clearly needs the large railroad as an outlet to the balance of the rail network more than the large carrier needs the short line as a source of revenue. A large carrier must be willing to establish equitable rates with its short line connections, rates that will provide the short line with sufficient revenues to ensure viability.

The joint rate problem does not appear to have been an insurmountable one for U.S. short lines. However, it is problematical whether the highly politicized atmosphere surrounding Canadian grain rates (even after repeal of the Crowsnest Pass rates) would permit such matters to be resolved solely on the basis of corporate good will and enlightened self-interest. In order for the short line concept to work, rates must be set low enough to encourage

the shipper to use the service, yet high enough to provide both the short line and the large railway with an economic incentive to work together. There may be a legitimate role, despite progress toward a stronger free-market transportation environment in both Canada and the U.S., for government regulation to ensure that short line operators are not left totally at the mercy of their connecting lines and, conversely, that efforts to make short lines viable do not burden the main lines with non-compensatory divisions of through rates.

There are, it must be admitted, inhibiting factors at work in Canada that will probably keep short line development in check for at least the next several years. At present a large mileage of Canadian branch lines is protected through the year 2000. There has also been publicly supported branch line rehabilitation. As a result, the shippers are assured of service and the railways are protected from loss. Thus, the incentives to convert to short-line operation are weaker than in the United States. In the United States, the main-line railroads were eager to curtail their branch-line losses. The Canadian railways, by contrast, are insulated from such losses. An overwhelming proportion of prairie branch-line traffic is grain, subject to the Western Grain Transportation Act. The provisions of this Act appear to preclude branch-line or short line surcharges such as have been found necessary and acceptable in some cases in the United States. In addition, in the United States, shippers saw short lines as a way to prevent total loss of service. Canadian shippers are guaranteed continued service. However, conversion to short line operation could still reduce costs, attract new traffic, convert a break-even situation to a profitable one, and improve the shipper's service and his ability to penetrate markets.

Another factor is seasonality. There are some prairie branch lines which have little traffic or no traffic at all for much of the year and then a surge of traffic when grain moves. This has the disadvantage for a short line that it may have an idle locomotive for much of the year. On the other hand, such peaks and valleys of traffic may cause labour complications for a large railway whereas a short line may be able to find local, part-of-the-year employees after the harvest is in.

In brief, conversion to short lines in the United States has been pushed by the pressures of operating losses to the railways and loss of service to the shippers and has been faciliated in some cases by rate surcharges. In Canada this facilitation may not be feasible, and the push of operating losses and loss of service is absent. In its place is the real but not desperate pull of

profitability to supersede merely break-even operations on the railway, and as well as improved service to the shipper.

The overriding message to be drawn from this comparative examination of the branch line/short line situation in the U.S. and Canada is that, as in other realms of human endeavor, large railways should concentrate on what they do best (such as moving heavy tonnage over long distances) and leave things that they don't do well (such as operating light-density branch lines) to others. If the U.S. experience has demonstrated anything, it is that the branch line question is not an either/or matter for large rail carriers (either keep operating it or abandon it). Other alternatives are available that serve the interests of both the railways and the shippers dependent on branch lines. In Canada, especially in the prairies, the opportunity is almost as vast as the landscape.

Reference

John F. Due, The Nationwide Experience with New Small Railroads Formed to Take Over Abandoned Lines 1971-1984, Working Paper Number 7, Bureau of Economic and Business Research, University of Illinois at Urbana-Champaign, 1984.

IMPACTS OF REFORMS IN THE STATUTORY RATES ON TRUCKING

by

G. Nabi Chaudhary
Alberta Agriculture
Edmonton, Alberta

Abstract

The process initiated by the federal government to reform the statutory rates (also known as Crow's Nest Rates) in the '80's has overlooked an important mode of transportation. Trucking which is an integral part of the handling and transportation system was not considered during the policy development process.

This paper describes the development of trucking over the last decade on the Prairies in general and in Alberta in particular. It describes the characteristics of trucking activities, equipment employed, trucking distances for transporting grain and grain products, trucking costs/rates, and the impact of reforms in the statutory rates on trucking. A comparison between rail and truck freight rates on feed grains is also provided for domestic shipments.

The paper provides estimates of government expenditures on road network and maintenance. The paper also discusses trucking as a complement to the railways, potential for unit trains, car turn-around time, grain related transportation efficiencies, and the regulations and institutional constraints.

1.0 Introduction

The railroad system has served as a universal carrier to the Canadian economy for many years. The Prairie farmer still finds that railroad service is essential in moving grain for export to ocean terminals. However with branch line abandonment and consolidation of primary elevators, short and medium hauls to more central locations have been initiated with large capacity trucks in order to maintain and improve transportation service to the grain producer.

Over the last 20 years, the road network in Alberta has increased to 151,470 kilometres while the railway network has decreased by five per cent to 8,689 kilometres. As the number of commercial carriers has increased with highway and road improvement, the dominant position of railways in providing transportation service on short hauls has diminished considerably.

Rail line abandonment and consolidation of primary elevators have increased the demand for truck services. Because of the development of more powerful and efficient motor vehicles, the trucking firms have increased the capacity and payloads of the units used. With the increase in highway and road networks, the role of trucking has become more prominent.

The passage of the Western Grain Transportation Act (WGTA) to reform the statutory rates on grain could have made custom/commercial trucking more attractive in hauling grain from the farm and primary elevators on uneconomic branch lines to mainline shipping points. However, under the act, the Crow Benefit is paid to the railways. This does not give grain producers the opportunity to evaluate alternatives for transporting grain at least cost. In the late '80's, and early '90's, if the statutory rates increase four or five fold, plus the primary elevator and storage charges, trucking grain over longer distances could become a reality.

2.0 Development of Grain Trucking

Trucks have played an important role in the development of the grain industry on the Prairies. Trucks are used in transporting grain from fields to storage on the farm, to primary elevators and other market outlets (feedlots, feedmills, processing plants, etc.). Grain trucking is an integral part of the grain handling and transportation system.

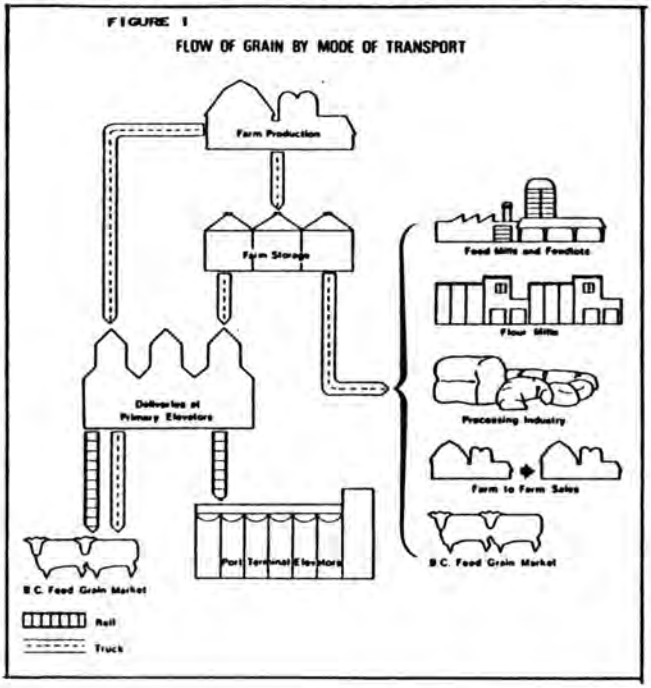
2.1 Intra-Provincial Grain Trucking

Grain producers inevitably truck their products from the farm to primary elevators for furtherance by rail to destination. Figure 1 shows flow of farm production to various market outlets by mode of transport.

Farm truck haul has increased in length with the consolidation of primary elevator system and abandonment of several uneconomic branch lines. During the last decade the number of primary elevators has decreased from 1,357 in 1974-75 to about 900 in 1983-84, a decrease of about 34 per cent (Table 1). Decline in the number of primary

FIGURE 1

FLOW OF GRAIN BY MODE OF TRANSPORT



elevators resulted in a significant reduction in storage capacity, i.e., from 3.41 million tonnes to 2.74 million tonnes during the last ten years. However, more efficient grain handling coupled with an improved grain transportation system resulted in a throughput increase of about 75 per cent, on an average of 7.5 per cent per year. Since 1976-77, throughput ratio at most of the primary elevators has been between 2.5 to 3.5 per crop year which is considerably lower than 5 to 7 turnovers at some points. Lower throughput ratio indicates that the present grain handling and transportation system is not as efficient as it could be.

Significant changes in the primary grain collection system have resulted in longer hauls for grain producers; i.e., from about 11 kilometres in the '60's to over 18 kilometres in the '80's. In some areas of the province (particularly Peace River), producers are hauling grain up to 65 kilometres to primary elevators. Continuous rationalization of the system would lead to further increases in the grain hauling distances.

TABLE 1: LICENSED PRIMARY ELEVATORS AND DELIVERY POINTS IN ALBERTA, 1974-75 TO 1983-84

Crop Year	No. of Elevators	No. of Delivery Points	Capacity (tonnes)	Throughput (tonnes)
1974-75	1,357	449	3,409,410	5,762,404
1975-76	1,330	441	3,371,270	7,271,838
1976-77	1,290	426	3,293,830	7,946,676
1977-78	1,232	406	3,184,850	6,595,400
1978-79	1,210	401	3,167,270	6,309,100
1979-80	1,174	394	3,105,730	8,156,400
1980-81	1,097	374	2,981,270	9,293,100
1981-82	1,040	365	2,901,340	9,887,800
1982-83	979	356	2,778,610	10,079,100
1983-84	899	343	2,740,080	10,114,600

Development of Farm Trucking: There has been a considerable change in the farm truck fleet in Alberta. In 1972-73, the total number of farm trucks in Alberta was 109,676 of which over 80 per cent were under 6,000 kg gross vehicle weight class and about one per cent were in over 14,000 kg group. Number of farm trucks continued to increase by an average of four per cent per year up to 1982-83. In 1983-84, the number of trucks on Alberta farms decreased for the first time by over three per cent to 161,875, from the previous year.

Producers have replaced their obsolete models with heavier trucks as demand for higher payload increased with the increased production of farm products. During the 1980-81 registration year, the number of farm trucks under 6,000 kg gross vehicle weight (GVW) class dropped to 69.4 per cent from about 77 per cent in 1976-77. The number of heavier trucks, i.e. over 14,000 kg GVW increased to 4.5 per cent from just about one per cent in 1976-77. In 1983-84, number of trucks over 14,000 kg GVW was 5.4 per cent of all farm trucks registered in Alberta. Data clearly indicate a trend towards heavier farm trucks as

the demand for increased transportation services on and off-farm continues to grow.

Prior to the 1980's no attempt was made to classify farm trucks by fuel type. In 1981-82, farmers were asked to report fuel type of their vehicles and only 41 per cent complied. However, the following year (1982-83) farmers were required to indicate vehicle fuel type on the registration form. Since the early '80's, farmers have been buying an increasing number of heavier diesel trucks to replace older gasoline trucks because of better fuel efficiency, more power and the longer life of these units. In 1983-84, the number of diesel trucks was 4.3 per cent (6,891) of the 161,875 farm trucks registered in Alberta.

Farm Trucking Costs For Hauling Grain: Farm trucking costs for grain transportation vary considerably from one area of the province to another because of length of haul, net payload, and utilization of truck (annual mileage). A survey in 1985 obtained information directly from 375 farmers on the cost of transporting grain in Alberta for the 1983-84 crop year. Average total costs and the unit costs of transporting grain by farm truck in Alberta are presented in Table 2.

The average costs presented in Table 2 are for a farm truck with the following characteristics:

a) Year of Purchase - 1973, b) Gross Vehicle Weight - 14,319 kg
c) Box Capacity - 7.9 t, d) Annual Distance - 5,545 km

Average shipments of grain per farmer surveyed to various market outlets amounted to 325 tonnes for the 1983-84 crop year.

TABLE 2: AVERAGE TOTAL COSTS OF TRANSPORTING GRAIN PER FARM TRUCK IN ALBERTA (1983-1984)

	Variable Costs	Fixed Costs	Total Grain Trans. Costs	Unit Cost/tonne (15 km)
Dollars	845.16	574.83	1419.99	4.37
Percent	59.52	40.48	100.00	-

Development of Commercial Trucking (Intra-Provincial): Commercial and custom trucks are used in hauling grain from the farm to various market outlets. It is estimated that between 7 to 10 per cent of grain delivered to primary collection points moves by commercial and custom trucks. Intra-provincial commercial truck hauling is mostly from primary elevators to feed mills and processing plants. Commercial trucks have been part of various exercises undertaken by the Canadian Wheat Board and private grain companies to expedite grain shipments to export positions. Trucks have been used to haul grain from primary elevators to inland terminals to determine the feasibility and desirability of unit train/solid train operations to ship grain to domestic or export positions. Since the 1971-72 crop year, commercial trucks have been serving as feeder to the railways in the Prairie region. Rail line abandonment and consolidation of primary elevators had increased the demand for truck services.

Commercial Trucking Rates: Rates presented below in Table 3 have been taken from the Western Tariff Bureau. The published tariffs set out certain conditions and charges which are usually considered as guidelines. These rates have not been increased since May 1982, a reflection of the grain hauling situation and the availability of grain traffic. The main reasons are:

- too many carriers for the same load (severe competition);
- considerable drop in the volume of grain available for trucking because of droughts in 1984 and 1985;
- farmers buying large trucks and increases in custom hauling.

TABLE 3: INTRA-PROVINCIAL COMMERCIAL TRUCK TRANSPORTATION RATES ON GRAIN AND GRAIN PRODUCTS[1]

From: Points in Alberta
To: Calgary, Edmonton and Lethbridge, Alberta

Distance in km	Rates in ¢/t	Distance in km	Rates in ¢/t
0 to 48	572	178 to 193	1197
49 to 64	650	194 to 209	1274
65 to 80	702	210 to 225	1352
81 to 97	780	226 to 241	1404
98 to 113	832	242 to 257	1483
114 to 129	937	258 to 274	1535
130 to 145	989	275 to 290	1639
146 to 161	1067	291 to 306	1691
162 to 177	1119	307 to 322	1769

Note 1: Minimum charge will be the charge for 20.41 tonnes. Full capacity of the unit is 22.68 tonnes.
Note 2: For farm pick-ups add $2.20 per tonne.

Efficiency of Commercial Trucking Versus Farm Trucking: Commercial/-custom trucks have proven to be more efficient compared with farm trucks because of the difference in payload. As indicated above, the average size of a farm truck box is 7.9 tonnes. Although there are large farm trucks with bigger boxes, more than 75 per cent of farm trucks in Alberta are in a weight class of less than 10,000 kg GVW.

A comparison of commercial and farm truck costs show that commercial trucking is less expensive than farm trucking on longer hauls, (i.e., over 48 km). With changes taking place in the grain handling and transportation system, the use of larger trucks will become inevitable if transportation efficiencies have to be achieved. Longer hauls and increases in production of agricultural commodities will require the use of fuel efficient vehicles to reduce the number of trips and lower overall transportation costs.

A farm truck operator's ability to reduce transportation costs is determined by a variety of factors such as the average payload carried, maintenance of the truck, distances to travel, and number of trips to be made. With the increase in hauling distances for the delivery of grain to market outlets, trucks with smaller boxes would become expensive to operate because more time must be spent on the road and maintaining the vehicle. Moreover, it decreases the useful life of the truck, thus increasing the depreciation and interest costs as well.

Costs for hauling grain by farm and commercial truck are:

		FARM TRUCK	COMMERCIAL TRUCK
Box Capacity		7.9 tonnes	21 tonnes
Average	15 km	$4.37/t	$5.72/t*
Distance	20 km	$5.80/t	$5.72/t*
	48 km	$8.64/t	$5.72/t*

* Add $2.20 per tonne for farm pick up

A cost comparison between a farm truck and a commercial truck shows that the former is cheaper for short haul deliveries. As the distance increases, the commercial truck offers cost savings over an average farm truck. If the payload can be increased on a commercial truck by using A or B - trains, higher savings can be realized.

2.2 Extra-Provincial Grain Trucking

Truck transportation has played an important role in the development of the livestock industry in feed deficient areas by hauling grain and grain products from production areas to consumption centres. Trucks have been transporting grains, and feed grains from Alberta to British Columbia, other Prairie provinces, parts of eastern Canada and the south western United States. Alberta is the major supplier of feed grain to British Columbia, providing 66 per cent of the province's feed grain requirements and over 90 per cent of the wheat, oats and barley needs. Figure 2 shows supply of feed grains to British Columbia by areas of origin.

During the seventies, the trucking industry showed a tremendous growth and captured a significant share of the extra-provincial movement of feed grains and grain products. A shortage of railway equipment, high operating costs, and higher domestic freight rates provided truckers with opportunities to haul feed grains and grain products to British Columbia, eastern Canada and the U.S.A. However, in 1978, the railways made determined efforts to get back part of the traffic lost to truckers by offering "truck competitive" rates in the form of contract rates. Figure 3 shows rail and truck rates from Calgary to Vancouver from 1967 to 1985. Figure 4 shows percentage of feed grains and grain products transported under the Feed Freight Assistance (FFA) by rail and truck. The figure shows that movement by truck increased through to the

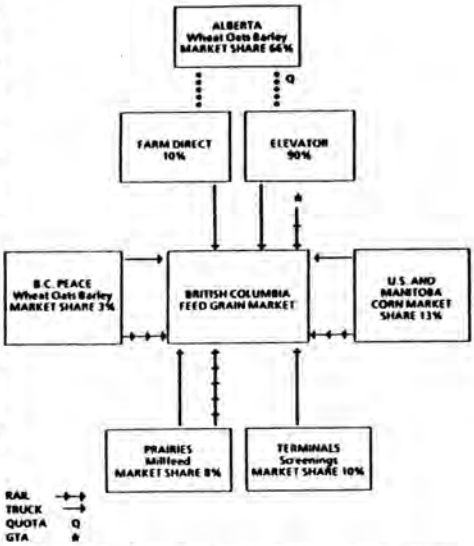


FIGURE 2 SUPPLY OF FEED GRAINS TO B.C. BY AREAS OF ORIGIN

FIGURE 3

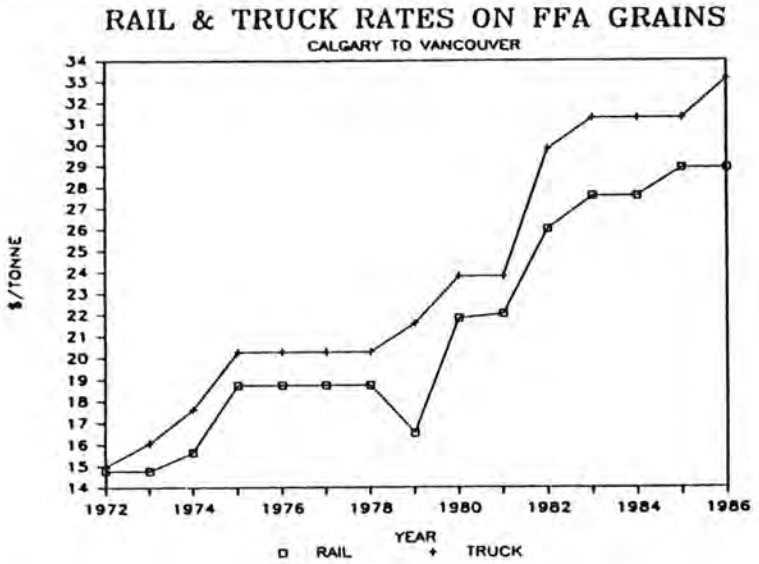
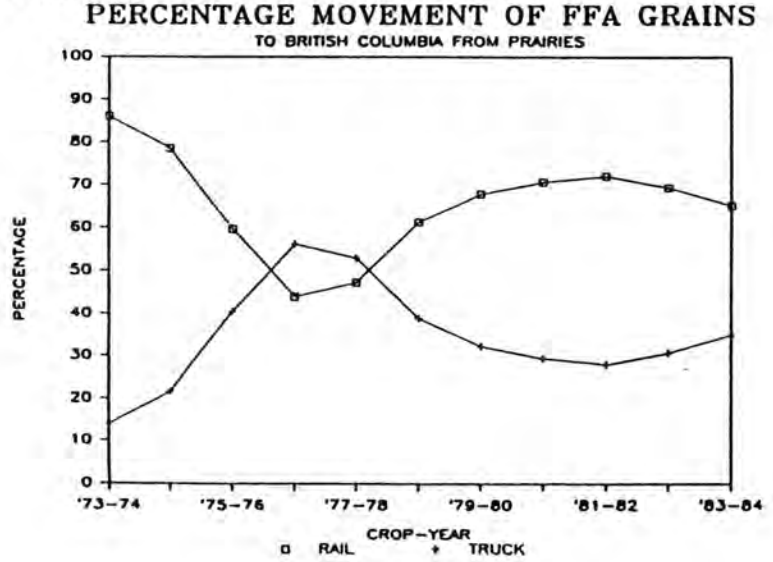


FIGURE 4



1977-78 crop year and then declined when the railways introduced "truck competitive" rates.

3.0 Road Expenditures and Maintenance

The impact of increased grain trucking on local roads is not expected to be severe. Grain producers are quite dispersed therefore individual local roads are not subjected to concentration of trucks. Truck trips begin to concentrate on the collector system which are in most cases either secondary roads or primary highways.

The task of calculating the effect of increased trucking activity on the use of bigger trucks on roads is very complex. The service life of pavements, both asphalt and concrete, are influenced by axle weights and number of axle load repetitions. Canada Grains Council, Alberta Transportation and other highway concerned authorities have stated that "larger trucks can haul a quantity of grain with fewer equivalent load units and less resultant damage to roads than if the same quantity of grain was moved by smaller trucks". Data in Table 4 show that a straight truck would cause 1953 (781 X 2.50) equivalent single axle repetitions to move 7,500 tonnes of grain compared with 940 (203 X 4.63) for a seven-axle B-train. A study in west-central Saskatchewan concluded that the use of commercial trucks would reduce road maintenance cost, since farm trucks tended to be overloaded relative to tire equipment. Therefore, it can be stated that increased grain trucking activity (trucks with proper differential and axle loads) would not lead to any significant increases in road expenditures.

The provincial expenditures for construction of primary highways, approach roads, secondary highways, and grants to counties and municipal districts were estimated at $605.7 million in 1984-85. Grants provided by the provincial government to counties and municipal districts and special areas amounted to over $27 million in 1984-85.

Road maintenance expenditures vary considerably from one type of road to another. For a two-lane primary paved

TABLE 4 ROAD EFFECT OF VARIOUS TRUCK TYPES TO MOVE 7,500 TONNES PER YEAR

TRUCK TYPE	MAXIMUM ALLOWABLE GROSS VEHICLE WEIGHT TONNES	PAYLOAD TONNES	TRUCK LOADS PER YR.	E.S.A.L.[1]
Straight truck; 2 axles	14.1	9.6	781	2.50
Tandem straight truck; 3 axles	21.0	14.4	521	2.12
Tractor and tandem semitrailer; 4 axles	30.1	20.6	364	3.76
Tandem tractor and tandem semitrailer 5 axles	37.0	25.4	295	3.38
Tandem tractor, tandem trailer, full trailer; 7 axles – A-train	53.5	36.1	208	6.65
Tandem tractor, tandem semitrailer, tandem semitrailer; 7 axles – B-train	53.1	36.9	203	4.63

1 EQUIVALENT SINGLE AXLE LOADS

kilometre per year in maintenance. For two-lane secondary highways the costs are about $3,600 per kilometre per year. Gravelled road maintenance costs are estimated to be about $1,250 per kilometre per year. For oiled roads annual maintenance expenditures are around $6,000 per kilometre and about $22,000 per kilometre every three years for re-oiling and grading.

It is anticipated that with an increase in trucking activity (only if producers have choice of mode) maintenance costs for the above roads would not increase significantly.

4.0 Impact of Crow Benefit Payment on Trucking

The two specific decisions under the Western Grain Transportation Act (WGTA) affecting the trucking industry are:

i) the addition of specialty crops, such as lentils, peas, sunflower, canary seed, and alfalfa products, etc., to the list of crops that move by rail at the statutory rates; and
ii) the decision to pay the Crow Benefit to the railways.

Trucking industry representatives strongly feel that the WGTA, enacted on January 1, 1984 did not have a positive impact on their industry. Payment of the Crow Benefit to railways coupled with lower grain production in 1984 and 1985 has squeezed most of the carriers out of grain hauling. During the 1983-84 crop year, over 10 million tonnes of grain were delivered to primary elevators in Alberta by farm and commercial trucks. About one million tonnes were transported by commercial/custom truckers (mostly commercial) resulting in 50,000 truckloads. Truckers feel that this share of traffic could have been doubled if Crow Benefit was paid to producers.

The number of carriers hauling grain and grain products both intra and extra-provincially has dropped considerably. In the mid '70's, the number of extra-provincial authorities for hauling feed grains was more than double the number of 31 reported in the fall of 1985. One carrier estimated that the number of grain trailers in the province has sharply decreased to about 230 from a high of over 400 in 1974-75. Table 5 shows the hopper bottom fleet for hauling grain and grain products.

TABLE 5: HOPPER-BOTTOM FLEET FOR INTRA- AND EXTRA-PROVINCIAL HAULING OF GRAIN AND GRAIN PRODUCTS, 1984-85

	No. of Carriers	Semis	A-Trains	B-Trains	Total
Carriers Contacted	24	107	23	40	170
Carriers Identified by Others	7	12	3	8	23
TOTAL	31	119	26	48	193

4.1 Trucking Industry Concerns

1. "Pay the railways" feature of the WGTA rejects the principle of equal treatment as set out in the preamble of the National Transportation Act of 1967.

2. The federal government through the WGTA has forced commercial truckers to move out of rural communities that they have been serving for the last several years. Economic activities generated by commercial truckers in rural communities have been lost. Most truckers working in rural communities live there, purchase their vehicles and have them maintained and serviced in those communities. It is difficult to quantify such activities because of the diverse nature of these activities. However, apparent effect would be on gasoline/diesel sales, employment opportunities, sales of parts and equipment, truck maintenance and repair service.
3. Truckers feel that by paying Crow Benefit to railways, the opportunities for inter-modal competition in grain handling and reduction in transportation costs have been lost. Furthermore, pay the railway option does not permit grain producers to exercise entrepreneurial choice among alternative transportation and handling facilities.
4. Truckers have argued that unless producers are paid the Crow Benefit, they will be unable to benefit directly from system efficiencies. The opportunity for innovations such as unit train movements and to use truck transport for branch line rationalization and feasible elevator consolidation will be lost.
5. Under the WGTA, producers have not been given the choice to choose a least cost grain transportation mode. Grain producers transportation costs are hidden and they have very little or no apparent economic incentive to reduce these costs. If the full costs are obvious to producers, they would search for the most cost-effective method of marketing grain. Otherwise they are locked into a relatively inefficient system served by railways at statutory rates regardless of cost variations in the system.
6. Participation of commercial carriers in the grain handling and transportation system has been reduced to a minimum due to "pay the railway" option. As a result, a significant number of grain haulers have been forced to merge with other carriers for survival and substantial amounts of equipment has been sold off.
7. At present the existing trucking capacity is greatly under-utilized which has negative impact on the industry. Commercial trucking of grain within the province has decreased considerably compared to the '70's. Extra-provincial movement of grain has also dropped because of the lower rates offered by the railways.
8. Most of the carriers contacted reported that their grain business has dropped from 70-80 per cent to 25 per cent. At one point grain was considered a front-haul and with the implementation of the WGTA and competition from the railways grain has become back-haul.
9. The WGTA has discouraged development of a cost-effective grain handling and transportation system. Most carriers feel that their industry's future is bleak if the method of payment is not changed in favour of producers. At the start of the reform process, truckers were looking forward to participation in the grain handling and transportation system, but the federal policies have further eroded their minimal participation.

5.0 Grain Handling and Transportation System Efficiencies

Participation of commercial carriers in the Canadian Wheat Board trial experiments (Saskatchewan and Alberta) in the early '70's demonstrated that railway equipment can be used more effectively and efficiently. The following factors require serious considerations in order to improve the system:

1. Depletion of box and hopper car fleet, and no more funds for buying new cars would require more optimal use of the available stock for faster turnaround time to haul increased production of grain. It can only be accomplished by using more centralized grain handling facilities across the province and trucks would play an important role in bringing grain to these facilities.
2. Greater utilization of trucks to complement rail would result in much greater efficiency in the entire grain collection and transportation system:
   - faster turnaround time of rail equipment, from about 19-21 days to 10-11 days,[2]
   - savings in expenditures in upgrading branch lines,
   - flexibility of trucks in moving the kind of grain required from country elevators to mainline elevators or terminals to meet peak service demands at export terminals,
   - a more efficient grain collection system moves more grain, thereby lowering the farm inventory and improving the producer's cash-flow position,
   - greater use of trucks would create more jobs in farming communities,
   - truckers provide the essential flexibility in the collection system to move the right kind of grains to railhead in order to meet particular service requirements for export customers.
3. High throughput elevators can offer reduction in elevation tariffs by about $2.00 to $3.00 per tonne depending on a turn-over ratio. Unit-train operations can offer savings of $2.00 to $6.00 per tonne[3].
4. Variable rail rates can also offer savings to producers.
5. Co-operation between grain companies and railways.
6. Off-line elevator facilities/off-track loading.

6.0 Regulations and Institutional Constraints for the Trucking Industry

In western Canada, Alberta could be described as a "non-regulator" with respect to intra-provincial trucking. The province has no regulations with respect to service, conditions of carriage, rates, etc. for intra-provincial hauling of grain by commercial carriers.

For extra-provincial hauling, the regulatory environment in Alberta for commercial trucking is somewhat similar to that of other provinces, i.e., there is entry control. An extra-provincial motor carrier must apply to the Motor Transport Board for authorization. Restrictions (routes, commodities, areas, shippers, etc.) may be placed on this authorization and a nonresident operator may be issued a permit.

The present regulations are no impediment to the growth of the

trucking industry, although complaints have been made about entry and other related procedures. Anticipated changes in regulations in the trucking industry would eliminate some of the concerns and, it is hoped, the industry would face uniform regulations across Canada.

7.0 Summary

Significant changes have taken place in the primary grain collection system owing to rationalization of primary grain elevator system and abandonment of rail branch lines. Grain producers in Alberta who used to haul grain on an average of 11 kilometres are now hauling over 18 kilometres. Some in the Peace River area are hauling up to 65 kilometres. Trucks (commercial/custom) have played an important role in hauling grain from production areas to primary collection points for furtherance by rail to export positions.

Implementation of the Western Grain Transportation Act (WGTA) has affected the participation of truckers in the grain handling and transportation system. Future development of trucking in the agriculture industry will depend to a greater extent on consolidation of the grain companies' elevator system, abandonment of branch lines, railway efficiencies, grain companies' efficiencies, and most significantly on the method of "Crow Benefit" payment.

Under the existing payment option, i.e., "pay the railways", the trucking industry has been squeezed out of the system, and does not visualize any greater participation unless the method of payment is changed. The number of grain carriers over the last few years has decreased considerably as they were forced to merge with other carriers or sell equipment in order to survive.

Several organizations including the trucking industry feel that the method of "Crow Benefit" payment should be changed in favour of producers if efficiencies and cost-effectiveness are to be achieved in the grain handling and transportation system.

FOOTNOTES

(1) Western Tariff Bureau, Tariff No. 75.

(2) "Grain Transportation and Handling in Western Canada", A Technical Report by Booz-Allen & Hamilton and IBI Group, July 1979.

(3) - A Research Paper "The Impact of Unit-Trains on Price Relationships at Country Elevators", published in 'Illinois Agricultural Economics', vol. 16, no. 2, July 1976.
- U.S. multiple-rail rates.

REFERENCES

1. Canadian Grain Commission, "Grain Elevators in Canada", Winnipeg, Manitoba, Annual Reports, 1974-75 to 1983-84 Crop Years,

2. Chaudhary, G. Nabi, "Motor Truck Transportation of Grain to Inland Terminals in Western Canada", Alberta Agriculture, Marketing Division, Production Economics Branch, AGDEX 843, May 1975.

3. Chaudhary, G. Nabi, "Trucking in the Changing Grain Industry (Phase I)", Alberta Agriculture, Production and Resource Economics Branch, AGDEX No. 843-3, June 1985.

4. The Grain Transportation Task Force, "Transportation of Feed Grains to British Columbia", Livestock Feed Board of Canada, January 1984.

RAIL COST-DISTANCE RELATIONSHIPS AND THE CROW RATE TAPER

by

Trevor D. Heaver, W.G. Waters II, and Thomas B. Schwetz
University of British Columbia

"The effect of distance on haulage costs is apparently one of the simpler elements in rate-making, yet the more one examines it, the less simple it does become.

---- J.M. Clark, 1923 ----

1.0 Introduction

The changes to the statutory rail rates on grain (the so called "Crow Rates", from the Crow's Nest Pass Agreement of 1897) by the Western Grain Transportation Act (WGTA) of 1983 was a major event in the evolution of Canadian transportation policy. The WGTA ammended a rate level which had been in existence since the last century. Adjusting statutory rates on grain from a nineteenth century to a modern level poses significant problems.

The leap is great. In 1897, grain for export moved only to the Great Lakes and from a limited number of points on the Prairies. Rail technology was vastly different from that in existence today. A train operating on the Prairies at the turn of the century might have been composed of cars and freight weighing 800 tons. Today, three or more 3,000 H.P. locomotives may pull 14,000 tonnes of grain. It was this contrast in operating and cost conditions that led to our interest in cost and rate distance gradients.

It is to be expected that adjusting the rates from nineteenth century to current conditions would require a considerable increase in the level of rates. Other changes that might be required in the structure of rates are not so obvious. The purpose of this paper is to explore some other changes that might be required, in particular, to raise questions about the change in rates with distance.

The approach taken in this paper is to examine basic hypotheses about the general pattern of change of railway costs and rates over the last century, especially as they relate to distance travelled. Two specific hypotheses are

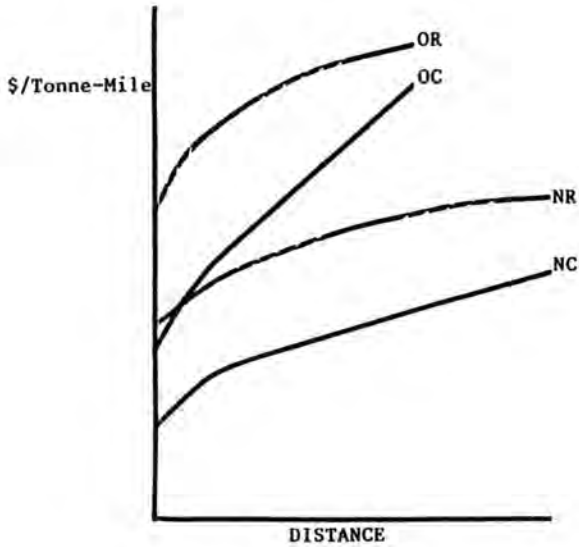
put forward and these lead to a third:

1. real railway linehaul costs per ton mile have decreased on hauls of a given distance;
2. the general slope in railway rates with distance is responsive in the long run to the distance gradient in costs;
3. from 1 and 2, it is hypothesized that simply increasing the level of statutory rates by a uniform percentage to a level covering current costs in total may not be appropriate; this amounts to extrapolating a nineteenth century distance relationship to the late 20th century.

The hypotheses may be illustrated by a simple diagram. Figure 1 illustrates the reduced gradient in costs over time in real dollars; current costs (NC) have a lower slope than old costs (OC). This allows the gradient in rates to be less in real terms today (NR) than it was formerly (OR). (No precise expectations are implied by the position of the rate gradients relative to the cost gradients.)

FIGURE 1

RAIL COST AND RATE GRADIENTS



However, the effect of inflation on the cost and rate

gradients may be noted, also. If inflation takes place, the cost function expressed in current (nominal) dollars shifts up proportionately by the amount of inflation. This affects the gradients expressed in current dollars. Assuming for the moment that rates reflect costs exactly, the more distant shippers would face the same proportionate increase in nominal rates as short distance shippers, but this represents a larger absolute increase in the rate paid by the latter.

It is important, then, that this inflation-induced rate increase for long-haul shippers be based on the appropriate cost (rate) gradient. If our hypotheses are correct, an excessive gradient would result from "inflating" the Crow rates (exemplified by OR) without a downward adjustment in the gradient to reflect the technological changes underlying the reduced real gradients (NR and NC).

The hypotheses are examined in the following sections. The first elaborates on rail cost-distance relationships and how they have changed over the years. The second section focuses on the relevance of costs for rate-distance relationships. The next section examines the rate-distance relationships for the old and new Crow rates, and makes comparisons of how these rate-distance relationships compare with selected other rate and cost comparisons. The paper concludes by presenting the implications of the analysis for the current review of statutory rates and for future research.

2.0 Rail Costs and Distance

This paper does not dwell on the inherent conplexities of railway costing or with the rationale for the different approaches to costing taken at different times. We recognize that the separation of the costs of railway service into distance and non-distance components related is fraught with difficulty. Some costs clearly do vary directly with distance -- fuel costs are an example. But there are more subtle cost influences of distance. For example, longer distances entail longer travel time; ceteris paribus, this necessitates a larger car fleet and larger yard investments. Yet the latter would not normally be directly identified as a distance-related cost item. Another example is that there are tradeoffs between distance and "non-distance" costs. Running longer and heavier trains may economize on linehaul costs per ton, but this requires greater expenditures on yards and related costs. Further, we recognize that there is debate about the validity of the proposition that railway costs are linear with distance beyond short-haul movements.

The reductions in the real cost of line haul service

by the railways since the 1890's is to be expected because of the substantial technological change that has taken place. Three elements are of particular importance. First, the increase of traffic density, as measured by ton miles per route mile. The importance of traffic density for cost levels was recognized as early as 1916 by Lorenz. Second, trains of greater size have been enabled both by the increase of traffic volumes and by technological innovations. Third, technological innovation has greatly increased the potential weight and speed of trains, thereby increasing output per unit of energy and labour needed.

Demonstration of the effects of these changes on costs is not easy. It depends on the information in the costing literature. Detailed examination of past cost estimates and costing studies is beyond the scope of this paper. Studies have used varied methods and different data bases. Appendix A draws on some historical studies of rail costs related to distance. However, it has not been possible to produce precise estimates of the change in real costs of distance over time. The average costs per ton mile of rail transport have clearly fallen through most of the twentieth century, but we are unable to separate the extent to which the falling average costs can be attributed to changes in the average length of haul as distinguished from changes in traffic density and rail technology.

3.0 Rail Rates and Cost-Distance Relationships

It is well known that rate making involves more than cost considerations. Cost measurement itself is ambiguous, not like the precise formula portrayed in Exhibit 1. Agreement on cost formulae for rate making purposes is contentious at best. More important, railway rate making makes extensive use of value of service considerations. This is not only a reflection of the goals of a profit-oriented enterprise; value of service pricing is recognized as an economically efficient pricing mechanism where unallocable costs must be recouped from a number of customers.

Nonetheless, costs are a consideration in rate making and especially, cost changes frequently are cited in making adjustments to an established scale of rates. Therefore, as cost-distance relationships change over time, one would expect this to influence rate distance relationships.

The cost-distance relationship is shown as a constant slope in Figure 1 whereas the rates embody some taper with increasing distance. Although there are some limited cost arguments which can be invoked to explain a rate taper

with distance, it more likely reflects some value-of-service elements. Shippers distant from a market are likely to face competition from intermediate suppliers and are not able to bear freight charges as readily as less distant shippers. Figure 1 is representative of a general relationship among costs and rates, but this could differ depending on particular circumstances.

Is there evidence of a link between changing cost-distance relationships and rate adjustments? A review of historical literature on railway rate making and regulation supports suggests that there was. It is well known that railway rates in the late nineteenth and early twentieth centuries often were quite unrelated to costs. This is because very little was known about costs and costing techniques. But it is clear that as knowlege of rail costs increased, costs became examined in rate cases in both Canada and the United States. As more was learned about costs, and as transportation costs declined over time, cost considerations appear to have been given greater emphasis in regulatory matters.

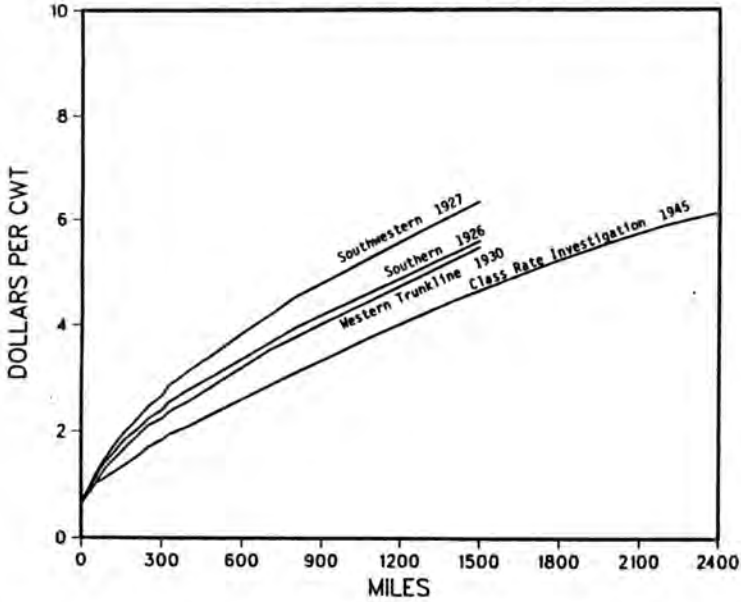
One illustration of the influence of changing cost-distance relationships and rail rate structures is shown in Figure 2. The changes in Class rate structures in the U.S. grew out of sequential investigations by the ICC. When restated in constant dollars Figure 2 shows a tendency for the rate distance gradients to be falling over time reflecting on-going cost investigations by the ICC.

4.0 The Crow Rates and Distance

The WGTA brought about fundamental changes to the statutory grain rates, changes which are still coming about. At the present time, individual grain producers still pay rates well below the true costs of moving grain. Some grain may move at fully compensatory rates (traffic in excess of base tonnage), but these higher freight charges are averaged over all grain producers. There are many points which can still be debated about the level of the Crow rates, the method of payment, and other potential changes to grain handling and transportation in Canada. Here we limit our attention to how the Crow rate changes with distance. The analysis does not deal with the level of the rates which has determined the overall profitability of grain traffic.

The old Crow rate gradient had an unusual shape. The slope increased beyond about 1,200 miles. The increase per mile in the rate for distances between 210 and 1,251 miles was .269 cents. The increase in the rate between 1,251 and 2,200 miles was .464 cents. This is not consistent with our expectation about the slope of either cost or rate gradients. Further, the slope for the distances

FIGURE 2
EARLY ICC DISTANCE SCALES
(1958 constant dollars)



SOURCE:

Class Rate Scales from Various Interstate Commerce Commission Reports:

113 ICC 207 1926
234 ICC 477 1927
164 ICC 249 1930
262 ICC 699 1945

up to 1,200 miles is surprisingly low in relation to our general understanding of railway costs at the turn of the century and in relation to the average cost per mile for 1,900 estimated in Appendix 1. It is interesting that the gradient in the rate beyond 1,200 miles is slightly higher than that estimated cost.

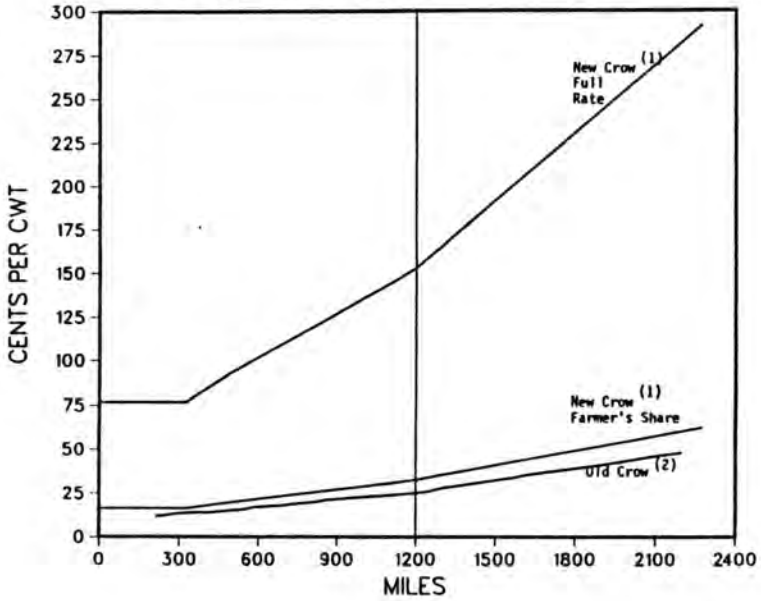
Figure 3 plots the old Crow rate along with the "New Crow" rate which is intended to be a fully compensatory rate. The latter rate is obtained by inflating the "Old Crow" rate schedule by the multiple of total rail costs relative to revenues paid by the shippers. It presumes that it is appropriate to recover the difference between the revenue at the old Crow rates and the current rail costs by increasing the historical rate gradient by a proportionate amount.

A few caveats should be noted about the plot of the Crow rate schedule. The vast majority of grain shipments take place only on a limited portion of the rate schedule. For example, nearly all grain is shipped over 600 miles. Further, very little grain moves in the region above 1,200 miles (the portion of the rate formula with a steeper gradient). There are also special adjustments to rates such as recording the longer CN distance to Vancouver rather than the CP distance, and that grain shipped to a more distant port will pay a rate as though it was shipped to a closer port. But these and other details are not critical to the interest of this paper which is on the general distance relationships. The general point is that inflating the Crow level by a proportionate increase basically keeps this historical cost-distance gradient but changes it to current dollars. Of particular interest to us is the appropriateness of keeping the historical distance gradient and simply inflating it to current conditions. Concern was expressed by the Inquiry on Crow Benefit Payment that such an increase could pose special burdens on the more distant shippers.

Figure 4 plots the Old and New Crow rates in comparison with a few rate and cost curves. Included are an estimate from Ming and Tolliver of the cost of moving U.S. grain to Duluth and to Portland using the U.S. Uniform Rail Cost System, and an estimate of the cost of moving Canadian domestic and export canola from the Report of the Task Force on Rates. The rate gradients for grain, flax and canola, and for fertilizer are obtained from the latter source also.

Contrary to our hypothesis the distance gradient of the escalated Crow Rate is not out of line with other rates and costs which are plotted. This is corroborated by interviews with railway officials who maintain that the distance relationship indicated is at least broadly in

FIGURE 3
COMPARISON OF CROW RATE

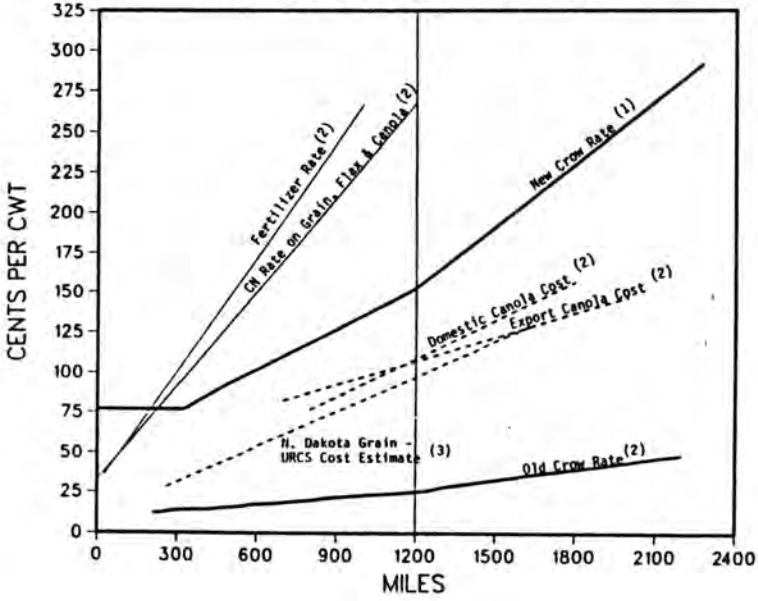


SOURCES:

(1) The Western Producer, May 16, 1985.

(2) TRANSPORT CANADA, REPORT OF THE TASK FORCE ON RATES, Nov. 1982, ENCLOSURE 3.

FIGURE 4
COMPARISON OF RECENT RATE AND COST DISTANCE TAPERS



SOURCES:

(1) The Western Producer, May 16, 1985.

(2) TRANSPORT CANADA, REPORT OF THE TASK FORCE ON RATES, Nov. 1982, ENCLOSURE 3.

(3) Ming and Tolliver, "AN ANALYSIS OF RAIL RATES FOR GRAIN IN NORTH DAKOTA: An Alternative to the Crow's Nest Pass Rates?" in 1984 CTRF Proceedings pp 9-22.

line with their cost experience. But if escalating the distance gradient in the obsolete Crow rate is not out of line with other current rates and costs, what does this imply about the historical cost-distance relationship embodied in the original Crow rate? Given the real decline in rail cost-distance relationships during the twentieth century, this suggests that the rate-distance relationship embodied in the original Crow rates must have been quite out of line with the cost conditions of the time.

We have not had the oportunity to research adequately the development of the rates on grain prior to 1897. However, it is known that railway rates on grain were kept at a low level to encourage the spread of settlement based largely on the export of grain. There was an incentive, therefore, to keep the penalty of distance to a low level. Also, of course, the rate scale used now for west and eastbound movement, was applicable only to relatively few points and to the lower cost eastbound traffic.

Whatever the explanation for the origin of the rate-distance taper embodied in the Crow rate, it appears to have been a distance relationship quite out of line with cost conditions of the time. This leads to a somewhat paradoxical conclusion about the economic distortions engendered by the freezing the rate for most of the twentieth century and inflating them proportionately today.

5.0 Conclusion

There has been extensive discussion and analysis of the inefficiences and distortions in resource allocation caused by the rigidity of the Crow rates in the face of changing technology and market conditions. Most attention has focused on the level of rates whereas this paper addresses the change in the rate with distance.

The constancy of the Crow rate schedule over time despite changes in general price levels gave rise to economic distortions. As nominal costs and prices rose but the Crow rate remained fixed, both the general rate level and the charge for distance did not keep pace with inflation. But it appears that the rate-distance relationship embodied in the Crow rate schedule became less distorted over time, whereas the rate level became increasingly distorted.

The historical distance gradient in the Crow rate seems too flat to have reflected rail cost conditions at the time. But over time, the real costs of distance have fallen, making the distance differential of rates (expressed in 1897 dollars) more reflective of new cost condi-

tions. An across the board adjustment to bring the rates to a compensatory level produces a rate-distance gradient quite similar to other modern rate and cost estimates.

An unusual feature of the Crow rate gradient is the "kink" at about 1,200 miles so that the distance gradient is greater for long than for short hauls. While little traffic moves beyond 1,200 miles now, the pattern is not consistent with cost characteristics. As the rates are revised over time this "kink" will become more significant. It is a matter that should be addressed and dealt with now rather than left to become critical. We do not know whether the rate gradient for hauls beyond 1,200 miles already exceeds the gradient in cost, but it could do so.

Two final caveats should be restated. First, our observations are impressionistic rather than precise. Although we have reviewed the early literature on rail costs and rate making, we cannot offer definitive proof in support of our analysis. The second caveat is a reminder that, while cost-distance relationships do influence rate-distance ones, costs are not the sole consideration in devising a rate formula. While we expect cost considerations to be the dominant influence on amending the Crow rate schedules to facilitate a more efficient grain transportation system, there is a role for value-of-service considerations. It is appropriate to allow some flexibility in devising rates applicable to the shippers most distant from a market to reflect the burden of higher absolute rate levels.

Appendix A

Table A-1 provides an estimate of U.S. line-haul cost per mile in constant (1972) and nominal dollars for various years, 1900-1978. These estimates are constructed by taking the operating expenses per net ton mile for the aggregate of all Class I railroads multiplied by a distance factor. The distance factors are engineering estimates of the extent to which operating expenses were affected by a change in distance (for example, maintenance of way and structures, maintenance of equipment, transportation, etc.). For 1900-1920 use was made of Wellington's 1915 estimates. For 1930-1960, Hay's 1953 estimate was used. Hay's 1982 estimates were applied to 1970 and 1978. Note that over time there has been a decline in these percentage estimates. This is evidence of a relative decline in line-haul costs.

The estimates of real line-haul cost per mile in Table A-1 indicate a pattern of falling costs with the exception of 1978 which reflects the substantial increase in fuel costs. The affects of inflation are noticeable

Table A-1
Estimate of Line-Haul Cost Per Mile
1900-1978

Year	Op. Costs	Distance	Line Haul Cost Per Mile 1972 (Constant)	Line Haul Cost Per Mile (Nominal $)
1900	.0431	.63	.0272	.0043
1910	.0388	.63	.0246	.0047
1920	.0340	.63	.0214	.0091
1930	.0327	.5856	.0192	.0061
1940	.0285	.5856	.0168	.0049
1950	.0226	.5856	.0132	.0071
1960	.0194	.5856	.0114	.0078
1970	.0139	.5045	.007	.0064
1978	.0165	.5045	.0083	.0125

Notes:
1. Operating expenses per net ton mile; derived from "Transportation Statistics in the U.S.", ICC -- Bureau of Accounts. Real dollar figures derived using GNP deflator used in Gordon, "Macroeconomics".

2. Distance Factors represent the percentage of operating expenses which vary with distance. For 1900-1920 use was made of Wellington, 1915; 1930-1960; Hay, 1953; and 1970-1978: Hay, 1982.

3. Product of column 2 times column 3.

when comparing the constant and nominal line-haul costs.

To illustrate, in 1900, the average operating cost per net ton mile for U.S. railways was 0.68 cents on an average haul of 132 miles. Applying the percentage applicable to line-haul operation yields a line-haul cost per mile of .43 cents (nominal dollars). For 1978, the comparable figure is 1.25 cents. When put in constant dollar terms (using a GNP deflator, 1972=100), the line-haul costs per mile for 1900 and 1978 are 2.72 and .83 cents respectively.

References

Clark, J.M. Studies in the Economics of Overhead Costs, Chicago: Univ. of Chicago Press, Fifth Edition, 1933.

Gordon, Robert, Macroeconomics, 2nd Edition, Boston: Little, Brown and Co., 1981.

Hay, William W., Railroad Engineering, New York: John Wiley and Sons Inc., 1953, 1982.

Interstate Commerce Commission, Bureau of Accounts, "Transportation Statistics in the U.S.", Wash. D.C., 1978.

Lorenz, M.O., "Cost and Value of Service in Railroad Rate-Making", 30 Quarterly Journal of Economics, 205 (1916).

Ming, D.R., and D.D. Tolliver, "An Analysis of Rail Rates for Grain in North Dakota: An Alternative to the Crow's Nest Pass Rates?", in Canadian Transportation Research Forum, 19th Annual Meeting Proceedings, May, 1984.

Report of the Task Force on Rates, Ottawa: Transport Canada, 1982.

Willington, A.M., The Economic Theory of the Location of Railways, London: John Wiley and Sons, Inc., 1915.

TRANSBORDER TRUCKING FLOWS AND TRENDS

by

Garland Chow
Arizona State University and
The University of British Columbia

In their report to the Minister of Transportation and Communications on the issue of allowing freer entry into the Ontario-U.S. trucking market, the Ontario Highway Transport Board "...found that the data available was too narrowly based, outdated or incomplete to the point that no specific conclusions could be drawn therefrom." Indeed many of the basic issues that divide various parties on the matter of regulation of transborder entry depend on the magnitude and nature of the freight business to be won or lost in a freer market. The purpose of this paper is to evaluate and utilize available data on transborder trucking flows in order to profile significant dimensions of the transborder trucking industry. Transportation markets are defined by their geographic characteristics as well as the capacity to carry particular commodities. Thus we focus on a particular set of geographic markets, those with end points in Ontario on one hand and the U.S. on the other. Conclusions about the Ontario - U.S. transborder trucking market will not necessarily be applicable to other geographic markets.

Transportation flows can be measure by: 1. the physical quantities transported, 2. the value of the freight transported or, 3. the revenue earned (or the cost incurred) in transporting the freight. The last measure is most important to carriers since it represents the potential benefits of competing in a particular market. However such a measure would be variable with the distance dimension of the transport market and thus can only be meaningful in the context of a specific or narrow set of origin destination pairs. The first two measures would not be significantly variable with respect to distance but would vary with the characteristics of the commodities transported. This study estimates trucking flows measured by weight and value recognizing commodity variation.

Three types of transborder traffic flow data were evaluated and used in this study. Truck vehicle surveys are conducted at border crossing locations to measure the volume and other characteristics of vehicles moving across

provincial borders. Such studies are expensive and thus are done irregularly. Statistics Canada collects data concerning the value of commodities in international trade. This information is comprehensive and collected annually but it is limited to monetary measures of traffic flow. The Niagara Frontier Tariff Bureau (NFTB) conducts the Continuing Traffic Study which is an annual sampling of freight bills of the carriers participating in NFTB tariffs. This source is the only statistically reliable source of information on transborder traffic of regulated carriers and of revenues earned in transborder movements. However the significance of NFTB traffic in the context of the total market has been questioned.

The U.S. Census of Transportation provides an opportunity to transform the Statistics Canada data on dollar flows into tonnage flows. It is reasonable to assume that the value of a specific commodity will not vary significantly between freight markets. The following ratios were computed from the U.S. census for the majority of the export and import commodity classifications as defined by Statistics Canada at the five digit level:

value per ton in Canadian dollars
LTL to total tons
ICC regulated tons to total tons
LTL/ICC tons to total tons

The integration of these data sources on transborder trucking are the basis for the following conclusions:

1. Commodities valued at $69.3 billion (Cdn.) and weighing 22.3 million tons were transported across Ontario - U.S. borders in 1984.

2. In 1982 and 1984 imports to Ontario from the U.S. exceeded exports to the U.S. when measured by value of commodities. However the reverse is true when traffic flow is measured by weight. This is true for LTL tonnage as well as for total tonnage. This is a reversal of the balance of trade observed in earlier studies but is consistent with the most current truck movement studies.

3. Transborder traffic measured by weight increased 51 percent from 1982 to 1984.

4. The Ontario - U.S. transborder trucking market is essentially a short haul market. Over 75 percent of Ontario transborder freight flow measured by weight or value involves states in the East North Central, Middle Atlantic or New England regions of the U.S.

5. LTL traffic accounts for approximately 45 percent of transborder tonnage.

6. Traffic that is under the jurisdiction of the ICC accounts for approximately 62 percent of transborder tonnage.

7. It is estimated that 1983 tonnage carried by carriers participating in NFTB tariffs was:

26.5 percent of total transborder traffic
10.6 percent of LTL transborder traffic
40.3 percent of transborder traffic under ICC jurisdiction
17.3 percent of LTL transborder traffic under ICC jurisdiction

8. It is estimated that the NFTB share of tonnage in 1977 was 34.2 percent. NFTB statistics indicate a decline in traffic for its members. In light of the growth trend indicated above, this suggests the declining importance of NFTB members in the transborder trucking market.

A SURVEY OF THE TRANSBORDER TRUCKING INDUSTRY

by

L. Clavel
Chief, Economic Analysis
Transport Canada

I want to sincerely thank the Transportation Division of Statistics Canada, particularly, Mr. Y. Deslauriers who has collaborated closely to the realization of that survey as well as the Canadian Trucking Association, who has given its full support to the gathering of this supplementary information.

1.0 Introduction

On July 1980, the American government deregulated the trucking industry, after years of studies and even though a lot of controversy existed on the subject. This legislation considerably reduced the legislative constraints associated to the operations of American motor freight carriers.(1) This decision considerably reduced the ease of entry on the American market of the for-hire Canadian domiciled carriers.

During the last years in Canada, the regulatory reform concept has progressed and in certain provinces, some aspects of this reform are already in place. On October 3, 1985, the Ministers reaffirmed their commitment to reducing the burden of regulation on the trucking industry and agreed to work for enforced and uniform safety standards and compatibility with the U.S.(2) The implementation of Phase I of this reform (changes to the Motor Vehicle Transport Act) should take place on January 1st, 1987 while the implementation of phase II (replacing reverse onus test with fitness test only) should start on January 1st, 1988.

There is also the "Freedom to Move - A framework for transportation reform" presented to the public in July 1985 by the Minister of Transport, the Honourable Don Mazankowski which indicates a strong intention to significantly reform the regulations of the transportation industry in Canada.

Furthermore, many discussions are actually taking place concerning the subject of "Free Trade" with the United States. In December 1985, the House of Commons Standing Committee on Transport recommended that Canada consider negotiating "a bilateral trading agreement with the U.S. which would recognize among other things the importance and need to maintain an equitable balance of trade in trucking service".(2)

All of these events did not only increase the demand for data on transborder trucking but made it necessary to have a more detailed knowledge of the characteristics of movements of trucking between our two countries.

2.0 Objectives

This presentation will discuss the results of a transborder trucking survey that looks at the market penetration of around 160 Canadian firms currently operating in the U.S. This survey was undertaken and financed by the Motor Carrier Branch of Transport Canada with the collaboration of the Transportation Division of Statistics Canada who took care of all aspects involving the field survey and the support of the Canadian Trucking Association.

The objectives of the survey were to collect data on the characteristics of international movements by Canadian domiciled for-hire trucking companies during fiscal years 1983 and 1984, in order to determine the share of international trucking services held by Canadian domiciled companies in terms of the current balance of trade over a period of two years and to determine the impact of the United States Heavy Vehicle Use Tax on Canadian domiciled truckers and the implications of deregulation for the Canadian trucking industry.

This survey was a pilot project and results should be interpreted carefully.

3.0 Definitions

For the purpose of this report the following definitions have been applied:

For-hire Trucking Company: A company that for compensation undertakes to transport the goods of others by means of a motor vehicle.

International For-hire Trucking Company: A for-hire trucking company which operates in the United States and Canada.

International Trip: A trip for which the primary origin was in Canada and the final destination was in the United States, or for which a Canadian domiciled carrier had picked up a shipment anywhere in the United States and carried it into Canada.

International Revenue: Revenue generated from international trips.

4.0 Methodology

A special supplementary questionnaire, International Movements by Trucks 1983 and 1984, (see Appendix 1) was attached to the regular 1984 Motor Carriers of Freight and Household Goods Movers Survey questionnaire and sent to those for-hire trucking companies which were known to be involved in international truck transport.

The responses received were verified and edited, missing data were estimated and tabulations were created. The data presented in this report are based on the findings of the regular survey, the Motor Carriers of Freight and Household Goods Movers Survey and the special questionnaire on International Movements by Trucks.

4.1 Data Quality

Comments on data quality will be provided along the report based on information provided by respondents as well as on the analysis of the data.

An important factor to bear in mind when interpreting results is that there was a bias toward surveying large carriers as opposed to small ones. This resulted in survey coverage which is lower in terms of numbers of respondents than in terms of international trucking revenue.

4.2 Survey Coverage

The original intention was to collect data from a number of firms representing approximately 90% of the total international revenue generated by the Canadian-domiciled for-hire trucking industry as measured by the Motor Carriers of Freight and Household Goods Survey (MCF) of the previous year. The 90% coverage was selected for resource and practical considerations.

However, due to the specific nature of the information requested and the difficulty, and in some cases, the impossibility, for some smaller companies to provide the information requested, only companies which earned at least 75% of their operating revenue or which earned at least $1 million from international movements were identified from the 1983 Motor Carriers of Freight Survey. These companies received the special questionnaire. After follow-ups, edit and analysis, information from 119 companies was retained for tabulation. In addition, Motor Carriers of Freight Survey data for 20 companies in 1983 and 42 companies in 1984 were used for tabulations in this report, because these companies had reported that at least 90% of their earnings were from international movements.

5.0 Survey Results

5.1 Overall Situation

The results of the special survey represented approximately 62%

(at the Canada level) of international revenues. However it was possible to estimate for the non-response using Motor Carriers of Freight survey data. In many cases, tables of raw data and tables supplemented with Motor Carriers of Freight data are presented, allowing the reader to make use of the supplementary information. The representation of the companies surveyed is illustrated in Tables 1 and 2.

It can be observed that the carriers of the special survey represented about 20% of the MCF universe in 1983 and 17% in 1984. The representation however is the highest in Ontario for both years. The carriers selected for the special survey in Alberta represented around 95% of the international revenues earned in that province, which indicates that the carriers chosen in that province were the largest international ones. The lower percentages in other provinces reflect the fact that not all international companies were surveyed and that, among those surveyed, not all of them answered the questionnaire.

It can be observed from the Motor Carriers of Freight and Household Goods Movers Survey data presented in Table 3 that the amount of international revenue earned by Canadian for-hire carriers has increased constantly, between 1975 and 1984 at the exception of a small decrease in the recession of 1982. Table 3 shows that the percentage of international revenues of these carriers compared to the total international revenues of the trucking industry has reached 12.8% in 1984 compared to 8.1% in 1975. As a whole, Canadian carriers earned one eighth of their operating revenues from international traffic. The For-hire trucking industry generates in excess of $6 billion annually in revenues and for-hire truckers account for approximately 45% of freight revenue dollars in Canada (for all modes).

Exports to the U.S. have increased between 1982 and 1984 and the trucking mode is moving more than half, in terms of value, of Canada's exports to the U.S.

The increase in the percentage of international revenue earned by Canadian domiciled carriers between 1982 and 1984 (1.6% between 1982 and 1983 and 0.7% between 1983 and 1984) is matched by a parallel increase in the exportations to the U.S. by road (in those years the percentages were 3.3% in 1983 over 1982 and 2.5% in 1984 over 1983). During this period, all the exports to the U.S. by other modes than road have decreased.

The highest amount of international revenue is generated by carriers domiciled in Ontario: as shown in Figure 1, the $514 million earned in 1984 by carriers domiciled in Ontario represent 59.5% of the total $865 million earned by all Canadian domiciled carriers. In this same region, carriers earned almost one fifth (18.6%) of their total operating revenues from international trucking (Figure 2).

5.2 Ownership of carriers involved in international trucking

93% of the carriers studies in 1983 and 94% of the carriers studies in 1984 were Canadian owned. The difference between the two years is not considered to be statistically significant.

Owners of carriers under foreign control are mainly from the United States.

5.3 Revenues prepaid and collected on international trips

Table 4 shows that, in 1983, 55.4% of the total international revenue earned by Canadian domiciled carriers was generated from trips to the United States from Canada, while 44.6% was generated from trips to Canada from the United States. This trend is true for all regions except Manitoba-Saskatchewan and British Columbia-Territories where the directional revenue earned was not only reversed but also constant over the two years under study.

As these data were often estimated by respondents these statistics should be interpreted with caution.

5.4 Amounts of interline payments

Portions of the international revenue reported in this study were used to purchase interline services from other carriers. In Tables 5 and 6 the distinction is made between interline carriers which are parent companies and those which are separate companies. As illustrated by Table 5, there are relatively few occurrences (only in Quebec and Ontario) of carriers interlining with a parent company.

A comparison with Table 6 shows that the carriers of the province of Quebec interline mostly with parent companies while the carriers of Ontario interline for the most past with non-parent companies.

Table 6 presents some puzzling results, in particular the fact that no interline payments were reported by the Atlantic provinces nor British Columbia and the Territories. This interesting phenomenon was further investigated and it was found that carriers domiciled in the Atlantic provinces transport very specialized commodities to and from the United States (such as forest products). This type of transport does not lend itself to interlining. Usually these TL shipments move directly from origin to destination. Carriers domiciled in British Columbia used broker operators almost exclusively for long distance international hauls and probably for that reason were not using services of interline carriers.

Traditionally, much transborder traffic was interlined but with U.S. deregulation when it became easier for Canadian firms to obtain U.S. operating authority, many carriers expanded their single-line operations into the U.S. Consequently, less freight is interlined now than before 1980.

5.5 Equipment, trips and distances

This section presents tabulations related to equipment used for international trips as well as the number of these trips and the total distance travelled on those trips.

The equipment and distance data reported for this special study in Tables 7, 8 and 9 appear to be consistent with similar information for other sectors of the trucking industry. This consistency demonstrates the high quality of the results. However, it is difficult to draw the same conclusion for data regarding trips. The concept of 'trips' is not usually used by the carriers and is not reported for other surveys which could normally be used for comparison purposes. As a result, the numbers of trips presented in Tables 8, 9 and 10 have often been estimated. Any measures related to the trip concept should be interpreted with care.

The data on equipment reported by carriers in Table 7 are consistent from 1983 to 1984. The regional distribution of the average number of power units per carrier appears uneven, particularly in Alberta where the average is higher than in other provinces. This may be explained by the fact that fewer small carriers domiciled in the western regions responded to the survey than in the eastern regions. The national average of 27 power units per carrier for 1983 is somewhat lower than the average of 30 derived for all carriers using Motor Carriers of Freight and Household Good Movers Survey results for the same year.

An important result revealed in Table 7 is the high number of power units which travel more than 8,000 km per year in the United States. These power units may therefore be affected by the Heavy Vehicle Use Tax of that country.

Presently, the imposition of this tax has been delayed until the U.S. Department of Transport finishes a study entitled "Transborder Trucking Study: Motor Carrier Taxes and Fees". This study is supposed to be completed for December 31, 1986.

Data presented in Table 8 show that the total distance travelled for international trips by equipment operated by Canadian domiciled carriers increased 12% between 1983 and 1984.

In 1984, the private carriers travelled in the United States a total distance of 72,175,219 km, which represents about 27% of the total distance travelled in the United States by Canadian for-hire carriers; this percentage was 33% in 1983. It seems then, that the private carriers are losing some ground in favor of the for-hire carriers, in terms of total distance travelled in the States, even if the private trucking industry in total operates three times the number of vehicles as the for-hire industry. But even with that greater number of vehicles, the average for-hire firm is some ten times larger than the average private firm and is involved in longer hauls, using bigger trucks.[2]

In Table 9, international trips are broken into categories of distance travelled in the United States. The respondents reported that in average, over 80% of the trips in the United States were for distances of more than 200 km.

Carriers also reported the percentage of international trips which were truckloads. These data, shown in Table 10, reveal that a majority of the trips undertaken are truckloads. For example, 76% of the carriers surveyed in 1984 reported that their international trips were truckloads between 80% and 100% of the time.

5.6 Tonnage and Expenses

Questions 3f) and 5 of the questionnaire were asking for data on total tonnage of international cargo carried by international carriers and expenses incurred in the U.S. in relation to the operation of Canadian trucks carrying freight within the U.S. such as purchase of fuel, supplies, repairs and maintenance, tolls, fees, etc.

However, only a few respondents provided answers to these questions and their answers could not be completed with MCF data as these questions are not on the regular questionnaire. Consequently, these scarce statistics are not presented in this report.

6.0 Summary of Findings

The major findings of the special study of international activity are listed below. The coverage and quality constraints previously described must be kept in mind when interpreting these results.

- The carriers surveyed represented around 62% (in 1983 and 1984) of the international revenues derived from the MCF survey, while in numbers, they accounted for 20% of the international carriers surveyed in the MCF in 1983 and 17.1% in 1984. (Tables 1 and 2)

- The Motor Carriers of Freight and Household Goods Movers Survey data for 1983 showed that the amount of international revenue earned by Canadian for-hire carriers was $697,526,588, representing 12.1% of total operating revenues. For 1984, international revenue earned was $864,851,001 or 12.8% of total operating revenues. (Table 3)

- The highest amount of international revenue was generated by carriers domiciled in Ontario: as shown in Figure 1, the $514 million earned in 1984 by carriers domiciled in Ontario represent 59.5% of the total $865 million earned by all Canadian domiciled carriers. In this same province, the percentage of the total operating revenue earned from international trucking was 18.6% (Figure 2).

- More international revenue of Canadian domiciled carriers is earned from trips originating in Canada and destined for the United States than from trips originating in the United States and destined for Canada (Table 4).

- Most interline payments by Canadian domiciled carriers for international trips were made to non-parent companies (Tables 5 and 6).

- More than 90% of the power units used for international transport travelled more than 8,000 km annually in the United States (Table 7).

- Total distance travelled and number of trips in the United States increased respectively by 12.1% and 12.9% between 1983 and 1984 (Table 8).

- More than 80% of international trips were for distances of more than 200 km in the United States (Table 9).

- The majority of the international trips represented truckload trips (Table 10).

7.0 Conclusion

This survey constituted a first step in the attempt to measure the balance of trade between Canada and the U.S which may be disrupted by the regulatory changes on both sides of the border. We have decided to continue this survey this year to obtain the 1985 data. A new question will be added to the questionnaire concerning receipt payments made by Canadian carriers to subsidiaries and non-subsidiaries. These data were already included in the revenues collected on international trips but could not be estimated separately. We feel that with the amount of receipt and interline payments, we could have an estimation, for the Canadian carriers side, of who has the favor of the balance in their interline operations.

Let us not forget however that these statistics give us only half of the complete picture of the balance of trade and as long as the Americans will not collect the same statistics as us, it will be very difficult, even almost impossible to know in favor of whom, really, the balance of trade is leaning between Canada and the United States.

The necessary steps to be undertaken in the future will consist essentially in persuading the Americans, through the Consultative Mechanism Group, formed a few years ago, of the merits of collecting statistics similar to ours in order to have a complete picture of the trends emerging in the area of transborder trucking.

Table 1

International Revenue of Canadian Domiciled For-hire Carriers, 1983

Province or Territory of Domicile	Companies Surveyed			International Revenue		
	Number Surveyed	No. in MCF	% of MCF	Surveyed ($)	MCF ($)	% of MCF
Atlantic	11	65	16.9	14,782,998	28,276,328	52.3
Québec	27	145	18.6	45,331,183	74,402,328	60.9
Ontario	67	263	25.5	262,523,200	433,142,537	60.6
Manitoba & Saskatchewan	11	70	15.7	23,006,587	43,248,236	53.2
Alberta	11	71	15.5	50,117,704	53,931,603	93.0
British Columbia & Territories	12	86	14.0	35,075,286	64,524,556	54.4
Canada	139	700	19.9	430,836,958	697,525,588	61.8

Table 2

International Revenue of Canadian Domiciled For-hire Carriers, 1984

Province or Territory of Domicile	Companies Surveyed			International Revenue		
	Number Surveyed	No. in MCF	% of MCF	Surveyed ($)	MCF ($)	% of MCF
Atlantic	16	84	19.0	25,659,188	31,703,171	80.9
Québec	35	232	15.1	57,860,759	102,637,844	56.4
Ontario	78	335	23.3	315,064,338	514,445,585	61.2
Manitoba & Saskatchewan	13	89	14.6	32,116,382	57,268,111	56.1
Alberta	13	85	15.3	67,682,720	70,602,899	95.9
British Columbia & Territories	16	116	13.8	42,724,264	88,193,391	48.4
Canada	161	941	17.1	541,107,651	864,851,001	62.6

Table 3

Total International Revenue, Total Operating Revenue and Percentage of Total Operating Revenue earned from International Trucking by Canadian Domiciled Carriers.

MCF Data - 1975 to 1984

Year	International Revenue ($000)	Operating Revenue ($000)	Percentage %
1975	209,520	2,572,790	8.1
1976	241,137	2,863,822	8.4
1977	296,807	3,270,146	9.1
1978	400,442	4,020,952	10.0
1979	472,512	4,665,657	10.1
1980	489,359	5,223,805	9.4
1981	561,077	5,687,114	9.9
1982	584,299	5,588,523	10.5
1983	697,526	5,752,998	12.1
1984	864,851	6,738,952	12.8

Table 4

Percentage of International Revenue Earned from Trips to the United States and to Canada by Canadian Domiciled Carriers - 1983 and 1984.

Province or Territory of Domicile	Destination: United States		Canada	
	1983 ($)	1984 ($)	1983 ($)	1984 ($)
Atlantic	74.6	77.5	25.4	22.5
Québec	61.5	61.4	38.5	38.6
Ontario	53.9	54.6	46.1	45.4
Manitoba & Saskatchewan	48.6	48.4	51.4	51.6
Alberta	61.7	62.1	38.3	37.9
British Columbia & Territories	46.6	46.4	53.4	53.6
Canada	55.4	56.2	44.6	43.8

Figure 1

Percentage distribution of Total International Revenue according to Province or Territory of Domicile, MCF data - 1983.

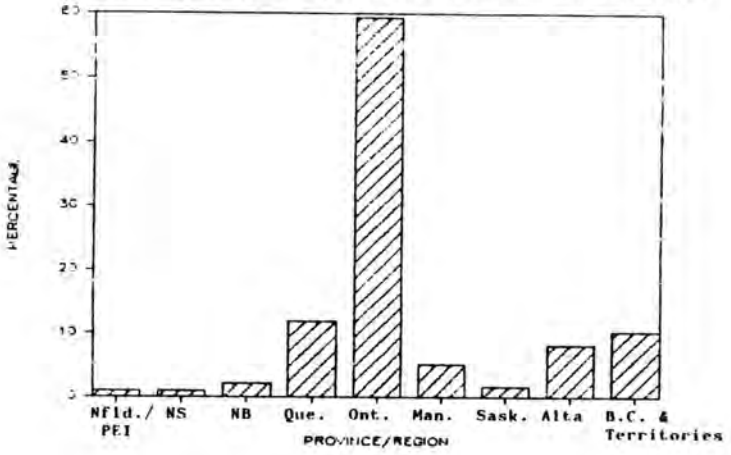


Figure 2

International Revenue earned by Canadian Domiciled Carriers as a Percentage of Operating Revenue, MCF data - 1984.

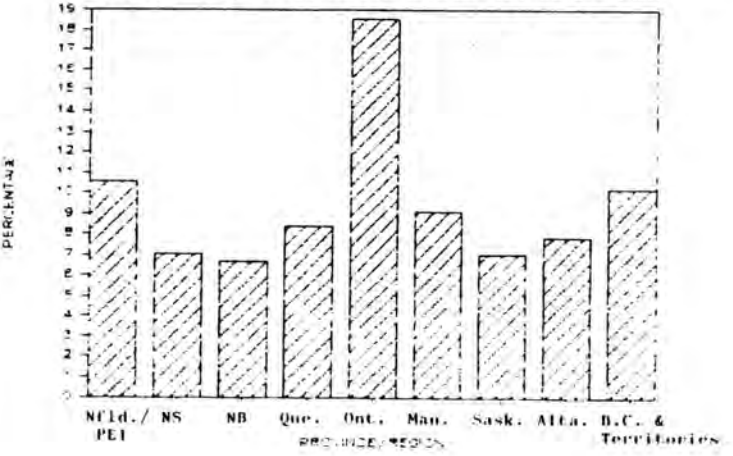


Table 5

Interline Payments by Canadian Domiciled Carriers to Parent Companies for International Trips - 1983 and 1984.

Province or Territory of Domicile	Destination: United States		Destination: Canada	
	1983 ($000)	1984 ($000)	1983 ($000)	1984 ($000)
Atlantic	0	0	0	0
Québec	517	419	1554	1259
Ontario	2242	2849	1963	2982
Manitoba & Saskatchewan	0	0	0	0
Alberta	0	0	20	0
British Columbia & Territories	0	0	0	0
Canada	2759	3268	3537	4241

Table 6

Interline Payments by Canadian Domiciled Carriers to Other than Parent Companies for International Trips - 1983 and 1984.

Province or Territory of Domicile	Destination: United States		Destination: Canada	
	1983 ($000)	1984 ($000)	1983 ($000)	1984 ($000)
Atlantic	0	0	0	0
Québec	30	20	57	41
Ontario	21129	23191	12634	12914
Manitoba & Saskatchewan	1973	2105	1973	2105
Alberta	2506	2173	9235	7510
British Columbia & Territories	0	0	0	0
Canada	25638	27489	23899	22570

Table 7

Power Units Operated by Canadian Domiciled International Carriers for International Trips - 1983 and 1984.

	Province or Territory of Domicile						
	Atlantic	Québec	Ontario	Manitoba & Saskat-chewan	Alberta	British Columbia & Terri-tories	Canada
1983							
Number of units	167	414	1794	355	653	418	3801
Average number of units per carrier	15	15	27	32	59	35	27
% of units which travelled more than 8000 km	100	80	94	94	97	99	93
1984							
Number of units	244	522	2151	422	797	547	4683
Average number of units per carrier	15	15	28	32	61	34	29
% of units which travelled more than 8000 km	100	85	94	94	97	99	94

Table 8

Total Distance Travelled and Number of International Trips by Power Units Operated by Canadian Domiciled Carriers - 1983 and 1984.

Province or Territory of Domicile	No. of Carriers having reported a no. of trips (1983 & 1984)	1983 Total Distance ('000 km)	1983 No. of Trips	1984 Total Distance ('000 km)	1984 No. of Trips
Atlantic	10	14,209	25,656	25,962	29,493
Québec	21	34,091	30,956	48,553	37,423
Ontario	56	89,906	328,039	116,267	371,480
Manitoba & Saskatchewan	10	19,805	16,475	22,046	18,473
Alberta	10	17,826	77,655	18,864	79,431
British Columbia & Territories	12	29,333	61,580	38,988	73,635
Canada	119	241,372	540,361	270,662	609,935

Table 9

Percentage of International Trips by Distance travelled in the United States - 1983 and 1984.

Province or Territory of Domicile	Distance (%)		
1983	Short (0-50 km)	Medium (51-200 km)	Long (more than 200 km)
Atlantic	20	20	60
Québec	5	10	85
Ontario	17	12	71
Manitoba & Sasktachewan	0	0	100
Alberta	10	0	90
British Columbia & Territories	0	8	92
Canada	11	8	81
1984	Short (0-50 km)	Medium (51-200 km)	Long (more than 200 km)
Atlantic	20	20	60
Québec	0	15	85
Ontario	16	13	71
Manitoba & Saskatchewan	0	0	100
Alberta	10	0	90
British Columbia & Territories	0	8	92
Canada	10	8	82

Table 10

Percentage of International Trips by Canadian Domiciled Carriers that represented Truckloads - 1983 and 1984.

Province or Territory of Domicile	Percentage of carriers which had trips which were truckloads		
1983	80-100% of trips	20-80% of trips	0-20% of trips
Atlantic	50	40	10
Québec	81	14	5
Ontario	75	16	9
Manitoba & Saskatchewan	80	0	20
Alberta	100	0	0
British Columbia & Territories	83	0	17
Canada	77	14	9
1984	80-100% of trips	20-80% of trips	0-20% of trips
Atlantic	50	40	10
Québec	76	10	14
Ontario	75	18	7
Manitoba & Saskatchewan	80	0	20
Alberta	90	0	10
British Columbia & Territories	83	0	17
Canada	76	13	11

References

1 - Blanchard, G., Trucking Deregulation in the United States - A Study of the Financial and Economic Impacts of the Motor Carrier Act of 1980, Economic Analysis Division, Motor Carrier Branch, Transport Canada, October 1985.

2 - Under Debate: The Framework for Canadian Trucking, Westac Bulletin, Vol. 12, No. 1, January 1986.

3 - Mazankowski, Don., Freedom to Move - A Framework for Transportation Reform, Public Affairs, Transport Canada, July 1985.

4 - Motor Carriers of Freight and Household Goods Movers Survey, Catalogue No. 53-222, Statistics Canada, 1975-1984.

Appendix I

Transportation Division

MOTOR CARRIER FREIGHT – 1984 SURVEY

INTERNATIONAL MOVEMENTS BY TRUCKS 1983 AND 1984

(Supplementary Questionnaire)

SI VOUS PRÉFÉREZ RECEVOIR CE QUESTIONNAIRE EN FRANÇAIS, VEUILLEZ COCHER ☐

Keep one copy for your file. Return the other copy within one month after the reference period to: Transportation Division, Statistics Canada, Ottawa K1A 0Z9

This supplementary questionnaire is designed to collect data on the characteristics of international movements by Canadian domiciled for-hire trucking companies during fiscal years 1983 and 1984. These data will be used to determine the importance of international trucking services provided by Canadian domiciled carriers and to determine the effect of the United States Heavy Vehicle Use Tax on them.

For the purpose of this survey, an "international trip" occurs when the primary origin is in Canada and the final destination is in the United States OR when a Canadian domiciled carrier picks up a shipment anywhere in the United States and carries it into Canada.

1. **Ownership**

a) Is your company a subsidiary of another company?

i) 1983 ☐ Yes ☐ no ii) 1984 ☐ Yes ☐ no

b) If yes, what was the country of residence of this parent company?

i) 1983 ☐ Canada ☐ U.S.A. ☐ Other (specify) – _____

ii) 1984 ☐ Canada ☐ U.S.A. ☐ Other (specify) – _____

2. **Revenues Prepaid and Collected on International Trips**

a) Record the estimated annual revenues (prepaid and collected) by your company from international trips. Exclude interline payments made by your company on such freight to U.S.A. domiciled carriers.

	$ CDN (omit cents)	
	North-bound	South-bound
i) 1983		
ii) 1984		

b) Record the actual or estimated amount of interline payments* made by your company on international trips to

	$ CDN (omit cents)	
	North-bound	South-bound
i) one of your subsidiaries or parent companies domiciled in the U.S.A.		
i) 1983		
ii) 1984		
ii) U.S.A. domiciled carriers other than one of your subsidiaries or parent companies		
i) 1983		
ii) 1984		

* Interline payments should include traffic destined for international movement carried to a point close to the border on either side.

3 Equipment and Distance

		1983	1984
a) Number of trucks and tractors your company operated in the U.S.A.	No		
b) Total distance travelled by these trucks and tractors in the U.S.A.	No		
i) 1983 ☐km ☐miles ii) 1984 ☐km ☐miles			
c) Number of international trips made by these trucks and tractors	No		
d) Record the estimated percentage of your international trips for which the distance travelled in the U.S.A. was between			
i) 0-50 km (0-30 miles)	%		
ii) 51-200 km (31-125 miles)	%		
iii) more than 200 km (more than 125 miles)	%		
All distances	%	100	100
e) Record the percentage of the trucks and tractors reported in 3(a) that have travelled less than 8000 km (5000 miles) in the U.S.A.	%		

f) Total tonnage of international cargo carried by your trucks and tractors

	North-bound	South-bound
i) 1983 ☐metric tonnes ☐imperial tons		
ii) 1984 ☐metric tonnes ☐imperial tons		

4. International Truckload Trips

	1983	1984
Record the percentage of international trips which represented truckloads %		

5 Expenses incurred in the U.S.A.

	$ CDN (omit cents)	
	1983	1984
Expenses incurred by your company in the U.S.A.		

(Include all expenses incurred in the U.S.A. in relation to the operation of Canadian trucks carrying freight within the U.S.A. such as: purchase of fuel, supplies, repairs and maintenance, tolls, fees, taxes, salaries and wages, insurance, licenses, rents, communications, commissions, equipment rental and other expenses. Exclude interline payments reported in question 2 and expenses of U.S.A. subsidiaries.)

I HEREBY certify that the information given in this report is substantially complete and correct to the best of my knowledge and belief

Person making this report (Print)	Title and signature
Date of this report ☐☐ ☐☐ 198☐ D M Y	Business telephone number ☐☐ ☐☐☐-☐☐☐☐ ☐☐☐ Area code Extension

THE QUÉBEC LTL MARKET

by

Michel Boucher
École nationale d'administration publique
Université du Québec

1.0 Introduction

Two different types of firms are presently operating in the Québec less-than-truckload (LTL) market: the long-haul LTL American carriers and the Québec firms which haul both truckload (TL) and LTL shipments on short distances. This open border policy adopted by the Québec Transport Commission (QTC) does not seem to have produced any significant detrimental impact on the Québec trucking industry and the shipping public. As a matter of fact, the American carriers continue to interline with regional carriers. Moreover, the shipping public perceives their respective entry into the Québec LTL market as increasing the existing level of competition in that they offer a direct single line service at a fair full price. As a result, regional carriers, which are generalists must compete with specialist carriers on some segments of the LTL market where both operate in a complementary manner on some other parts of the market(1). The objective of this paper is to present and analyze the Québec experience and to use it as a benchmark to assess the growing concerns of the Canadian trucking industry towards the large American carriers.

This article is organized as follows: In section 2, I intend to present and analyze the evidence on the entry of Yellow Freight System Inc. (Yellow), of Consolidated Freightways Corporation (CF) and of Roadway Express Ltd (Roadway) into the Québec LTL market; in section 3, I shall analyze and evaluate whether those long-haul LTL carriers have had any significant impact on the Québec trucking industry and on their clients, the shippers; In section 4, I plan to raise two questions which have already been expressed by the Canadian industry and I shall attempt to answer them by analyzing both their theoretical basis and their empirical validity; in section 5, in my concluding remarks, I shall dwell briefly on a fact of the Canadian system of federalism which explains this situation.

2.0 Major American Carriers

The 1980 American deregulation, which reduced the restrictions of trucking activities that affected the daily operations of common carriers, has also fragmented the traditional LTL market. In other words, the American LTL maket is no longer as homogeneous as it once was because competitive forces no longer allow for the standardization of service, independently of the length of haul, imposed by the Interstate Commerce Commission (ICC). This section presents a few general facts about the American specialists in Québec. It is followed by an analysis of their

respective characteristics and their consequences on the Québec LTL market.

2.1 Facts

Yellow, CF and Roadway have been operating in Québec for the past few years. As a matter of fact, Yellow began operating directely in 1972, whereas CF and Roadway came into in operation since 1983 and 1984 respectively. These three firms have bought existing firms or permit authorities from firms which also had some transborder activities. A bit of technical data will help to pin-point their trucking activities in Québec. First of all, the extent of their effective direct service into Québec is really limited. According to their permit, Roadway is allowed only a 5-mile radius from the city of Montréal. When acquiring some shares of Maislin's permit, CF obtained the right to operate an intra-provincial pick-up and delivery service. However, this firm never did avail itself of this possibility. Although Yellow is authorized to serve a given number of provincial cities, the firm does not exercise its right(2). Instead, it prefers to do interlining with local carriers rather than to serve them directly. Secondly, these American specialists interline with a lot of local or regional carriers in Québec to serve points outside the Montréal metropolitan area. In fact, they do business in Québec in the same way as in the United States. They serve the cities for which there exists a financially attractive volume of long-haul LTL. As long as this pick-up and delivery activity does not cover its costs and does not generate profits, they will interline and will take responsability or liability as if they were effectively offering the direct service from the origin to the destination. A reading of their own respective service or customer guides will indicate clearly that the interlining operation is regularly done in the United States with many local and regional carriers. Thirdly, in Québec, although their marketing strategy differs from one firm to another, it is essentially the same as the American one.

In a nut-shell, these major American trucking firms are interested in Québec because of the international long-haul LTL service and they are using the same production technique as in the United States for the long-haul LTL. The best evidence of this fact is that the average length of haul is a little over 1100 miles for Yellow; for Roadway, it is nearly 1200 miles and CF gets the highest distance, namely around 1800 miles. Groups of Québec shippers are being offerred a new single line direct service which did not previously exist. Those shippers are now in a position to reach distant markets more quickly at a full price lower than before. This full price, which includes the monetary price plus a reduction in the transit time and also a high quality of service, such as the tracing system and the entire handling of goods by their own personnel from origin to destination, is inferior to that of their competitors who, as regionally-based independent carriers, have to interline with each other and thus provide slower service.

2.2 The Analysis

The fragmentation of the American LTL market has resulted, among other things, in increased specialization based on a specific production function known as the hub and spoke. The common carriers that adopt it produce an homogeneous product, a long-haul LTL shipment. Technically

speaking[3], these large firms choose a highly specialized production function that enables them to operate on economies of network utilization and network configuration. Network configuration represents the physical structure of the firm's activities and reflects the granting of permit authorities by public commissions and the spatial distribution of its terminals throughout the territory to be served. In contrast, network utilization refers to the actual distribution of traffic over the network and expresses the carrier's efficiency in moving goods throughout its entire network. This specialization implies more than the conventional joint TL and LTL production function to be balanced on both directions.

These large firms adopt this production function because they can offer direct service to clients that are scattered throughout the United States.In other words, their operational stability comes from the direct service to their customers who are spread nationwide. They benefit from economies of scale inherent in every public trucking firm that owns several terminals, and they benefit from network density (utilization and configuration) because of the great distances the shipments must travel. This specialization in the production of a single service enables them to reduce the full price of transport. In addition, the surveys of shippers indicate that they prefer, for a given shipment, as little interlining as possible. This minimizes the chance of loss, delay or damage that could result from additional handling by independent carriers. Consequently, these large carriers generally have a comparative advantage over any other smaller firm providing an interline or an interchange service as the latter is more costly and slower for the delivery of a LTL lot on long distance.

3.0 The Québec Trucking Industry

The Québec firms generally produce a joint product of truckload (TL) and less-than-truckload (LTL) shipments on short-haul, namely under 250 miles. This joint production function was used until the American deregulation of 1980 by most trucking firms, with the exception of those that were specialized in TL production. It is still the technique most commonly used in the United States, even in a competitive system.

3.1 The Generalist Carriers

These non-specialized trucking enterprises do not produce the same product mix because the latter is determined by the regular shippers' needs, inbounds as well as outbounds, and by their cluster in the area of operation which they intend to serve. This multiproduct approach appears because the production of one type of output, say the truckload, is done on a given segment, generally the backhaul in Québec, and the production of the other output, say the LTL, takes place on the other segment of the route, generally the headhaul. The product mix on the same segment is not generally important and it is perceived mainly as an additional service to the shippers. In other words, non-specialization implies the existence of complementarities among certain activities. These non-specialized or generalist Québec trucking firms also give a personal touch to their service in having equipment not in regular use; these firms have grown with their shippers and they expect to remain in business. Therefore, they are in a position to offer additional transportation service to a large shipper as it is required sporadically. They offer direct or single line service in their area

of operation and they interline with other non-specialized firms to satisfy their shippers' irregular needs for which they do not have the proper permit. They enjoy economies of scope or joint production because there are cost savings associated with the simultaneous production of many products. In other words, joint production is more efficient than non-joint production for the markets to be served. The Québec experience is consistent with the findings of American studies that show the existence of economies of scope associated with specific products(4). In the case of Québec, the joint production of TL shipments and consolidated LTL lots is more efficient than if two independent firms were to produce both separately.

These generalist carriers tend to diversify: that is, they reduce the fluctuations in their activities, owing to the relatively limited number of shippers in their area, through joint production and a differentiated production capacity, apt to meet the random needs of their clients more effectively. Thus, diversification of the product mix appears to offer more efficient equipment utilization and traffic allocations. These generalist carriers conform to the general principle that relative abundance and certainty of resources favour specialists whereas relative scarcity and unpredictability favour generalists.

The structure of this market is characterized by the presence of numerous firms, whose size is determined primarily by the clients' needs and their evolution. While there exists one long-haul LTL market, there are many LTL markets shaped by those regional carriers producing various product mixes. These markets overlap according to the permits issued to the carriers by the regulatory commission. The same is true at the national level, where national or inter-regional generalist carriers may be found whose joint production is determined by the needs of Canada's client-shippers. There is no single Canadian market as such, but rather various markets made up of national carriers (CP Express, CN Route, Brazeau-Spéribel, Direct-Motorways, Reimer-Inter City) that produce a TL-LTL combination determined by the location of their clients throughout Canada. In other words, where markets overlap, there is competition. Competition is generally strongly felt when the production functions or firms are similar. The more similar the production functions, the greater the market overlap. In particular, competition among regional or national generalist carriers tends to be more intense than competition by specialist carriers.

3.2 Complementary of Both LTL Markets

The primary objective of regional carriers is quick delivery, and carriers typically provide direct service at the expense of full equipment utilization. However, the objective of the long-haul LTL carriers is to optimize the speed of delivery subject to proper plant utilization. Consequently, these two groups of trucking firms are not necessarily in direct competition because they produce two different services. Their co-existence essentially comes from their complementarity in consumption terms and both parties receive mutual benefits from this procedure. As a matter of fact, they generally cooperate when interlining, because a shipper located in a given city needs some goods which originate from or are destined to areas where single line service is unavailable. In other words, they cooperate by doing different things. On the other hand, service overlapping between the long-haul producers and the regional product mix

carriers may occur at the origin or/and the destination of a LTL shipment. However, none of these specialist carriers will attempt to set up operations in these short-haul segments unless the long-haul LTL volume is high and covers its costs. As a matter of fact, its high trucking costs, its lack of flexibility and adaptability owing to its organizational structure impede a specialist carrier to compete on equal footings with generalist carriers. In other words, it is not as efficient as a generalist carrier on short-haul distance.

3.3 The Shipping Public

Shippers interviewed(5) see the service offered by the long-haul LTL carriers as a new service, namely a direct service of which the full price is less than that of traditional competitors which must interline with others to offer identical service. Their presence in Québec stimulates competition by increasing (according to shippers' point of view) the multiplicity of choices of carrying goods to and from the United States. Secondly, regional shippers correctly perceive that generalist carriers and long-haul specialist carriers produce their respective LTL services in different manners and that their end-to-end juxtaposition permits them to obtain this new service. Thirdly, some exporting shippers refer to the discount system that these specialized firms offer to their regular customers: the requirements to obtain discounts are less demanding than those specified by Québec or Canadian trucking firms operating in the same circumstances. As a matter of fact, their discount system induces some shippers to raise questions regarding the level of international rates as published by the Niagara Frontier Tariff Bureau(6). Fourthly, shippers use them for their inbounds as well as outbounds mainly because of the level of rates and the fast service. The tracing system and the low percentage of claims on loss and damages are considered as secondary. This "just-in-time" service helps them to reduce the level of stocks and consequently, it is becoming a new tool of management for the shipping firm.

In conclusion of this segment, the open border policy that the Québec Transport Commission (QTC) adopted in letting long-haul LTL carriers operate did not produce any significant detrimental impact on the Québec trucking industry and the shipping public.

4.0 The Concerns of the Canadian Industry

This new specialization of firms raises concerns about the future development of the Canadian public trucking industry, especially in Ontario. These concerns are expressed in the two following questions:

a) Will local and regional carriers lose all of their present interlinings should the large American carriers provide direct service?

b) Will large specialized American carriers destroy small non-specialized or generalist Canadian carriers?

4.1 The Loss of Transborder Interlining

Canadian carriers raise three specific points(7) that supposedly favour American generalist carriers and would result in interlining losses for regional carriers. The first deals with customs procedures (forms and other documents), the need for a customs broker and American customs

requirements that oblige carriers to employ the horse-shoe loading technique to facilitate the inspection. The customs procedures raise transaction costs for any carrier, regardless of its nationality, and it is impossible for American carriers to derive any benefit that would not also be accessible to Canadian carriers.

The second point, often mentioned, has to do with American immigration law which prohibits a non-American driver from making a pick-up and delivery in American territory, while there is no comparable Canadian law. American firms could then serve the Canadian territory from the border, whereas the reverse would not be possible. While this argument has some validity with respect to international short-haul trucking, it nevertheless implies that American firms would have to train personnel for this purpose. No American carrier will want to incur additional training costs because of the strong competition from Canadian carriers and their trained personnel. This argument is very much weakned and invalidated for international long-haul transport because of the additional expenses to the firm in the form of additional layover costs. Furthermore, another point that should not be ignored is that drivers are generally interested in returning home at the end of a day's work. In short, American law is not really an effective constraint, since daily industry practices take precedence and are truly more effective.

The third and final point raised involves the regulation of public trucking within American states. It is argued that it is very difficult to obtain an intra-state trucking permit. If a Canadian carrier wishes to balance its backhaul to Canada, it does not need a state permit, the permit authority issued by the ICC being adequate. The fact of crossing a border, any border, implies that the governement of an American state no longer has jurisdiction over the carrier in question since its movement becomes inter-state and subject to ICC authority. In short, this argument holds up when a Canadian carrier, having delivered its TL shipments to a given place, must stop when returning at many points in a given state to make up a truckload.

We attempted to verify the empirical validity of this first question by distributing a questionnaire to many regional carriers. All carriers located in outlying areas stated that these three large carriers did not really compete with one of their basic activities, short-haul LTL service. The maximum length of haul of these regional carriers ranged, from 75 to 500 miles, depending on their proximity to Montréal. None of these carriers mentioned them or referred to them as being among its competitiors. On the contrary, most of the generalist carriers interviewed do interlining with Yellow, CF and Roadway. In other words, there are gains from trade for both groups; they find that it is to their advantage to cooperate. The overlapping of their relative specialty is weak and they are nearly independent from each other. In short, it is reasonable and normal to find reciprocal agreements between these two groups of LTL producers, whatever the circumstances. By analogy, this situation in no way differs from that observed in the American airline industry, where small local and regional firms not only serve certain cities in a given area, but also act as "feeders" for national airlines.

The second element of this empirical verification consists in asking whether shippers see the services offered by these two groups as being substitute or totally separate. Regional shippers see the respective services of these two groups as totally different in terms of production, but complementary in terms of their own consumption, as they now have access to a broader range of services. Shippers in the Montréal area who have direct access to the service of specialists tend to compare the single line service to the interlining service provided by independent Canadian and/or American regional carriers. These two services are considered as imperfect substitutes.

The Québec experience indicates that the large American carriers are continuing to interline with Québec regional carriers. In Québec, they apply the same philosophy which prevails in the United States, in that they serve only cities where there is a profitable volume of long-haul LTL shipments. Where such a market does not exist, they resort to interlining, the production costs of regional carriers being lower than their own. The analysis also shows that the loss of interlining, so feared by Canadian firms, will not be caused by large long-haul American firms, but rather by American regional carriers that also serve certain parts of a province(8). Their production function is more like that of Canada's major carriers such as Direct, Kingsway and Brazeau-Spéribel and consequently they have appreciably the same cost structure. This is where the competition will be, as their respective activities overlap generally within a radius of about 200 miles on either side of the border. In other words, interlining losses caused by the entry of the three large American carriers are minimal.

4.2 Dislocation of the Industry

A second concern raised by the entry of large American carriers has to do with the dislocation of the industry(9). It is feared that these specialist firms will destroy the non-specialized regional carriers. The most commonly heard argument in Ontario goes as follows: any policy of free entry into the Ontario market will systematically squeeze out the carriers of that province and eventually all Canadian trucking firms. The American carriers already enjoy certain advantages and their presence, as a result of industry deregulation, will aggravate the problem. More specifically, these large carriers, in penetrating the Ontario market, will dominate it because of their volume of physical equipment, their know-how and their large clients. They will no longer have to interline at the border with Ontario carriers. The result will be the break-up of Ontario firms, the loss of direct and indirect employment by Ontarians and a decrease in tax revenue for the Ontario Government. In order to avoid bankruptcy, Ontario carriers will be forced to move south to the United States in order to be able to operate in Ontario. All of the mobile capital that follows this move will be an additional loss to be taken into account. In fact, the only strategy will be to imitate the American carriers, who will serve Ontario from their regional hub or break-bulk terminal. In a word, the Province of Ontario will become the end of the spoke of the American trucking networks.

The Theoretical and Empirical Bases. It is appropriate to consider the content of this argument from two angles: its theoretical basis and its empirical validity. First, the economic analysis shows that there are indeed certain economies of scale in the public trucking industry. However, these

economies of scale are limited and remain accessible and available to all firms operating in the sector. Consequently, there is an optimal production capacity for a trucking firm depending on the extent of the market to be served. In specific terms, the operational size of a firm is determined more by the joint TL and LTL production, that is, by economies of scope rather than by the mere presence of fixed physical facilities that underlies the notion of economies of scale. Also, the specialization of long-haul LTL carriers is the explicit and direct outcome of the American deregulation that has rendered the traditional approach obsolete and has allowed a larger diversity of production at all levels. In short, it is not reasonable to suggest that there exists just one market determined by economies of scale. On the contrary, the day-to-day reality suggests that there are many LTL markets that are determined by the overlapping of the joint production functions, as carriers do not all produce the same TL-LTL combination and do not all serve the same areas. To this, of course, is added the long-haul LTL market. Hence, there is no important overlapping or intersection of long-haul and short-haul LTL markets as the respective carriers do not produce the same services, except at the origin and/or the destination of a LTL lot.

Looking at the practical considerations, the experience of Québec does not bear out the soundness of this argument. Firstly, large carriers such as Yellow, CF and Roadway continue to concentrate all of their activities in the long-haul LTL market because of their comparative advantages. Secondly, these specialists systematically resort to regional carriers to serve clients outside of Montréal or Québec. The continued use of interlining and concentration on the production of a single homogeneous product refute the claim that their entry would dislocate the industry and that they would be in a position to serve the whole provincial market because of their large size. More specifically, efficient interlining or interlining generated by market forces continues between large American firms and regional carriers. In contrast, inefficient interlining or interlining induced by regulatory constraints has disappeared. The first reflects the opportunity costs of each of the parties and both stand to gain from interlining; the second was the result of artificial constraints imposed by regulation, such as the ban on operating directly in the area. The opportunity cost of these artificial constraints did not reflect the true relative scarcities of the market in that it also incorporated the rules imposed by regulation. The entry of large carriers, while causing the disappearance of this form of interlining, has also revealed its temporary and artificial nature. One more point is that no Québec firm has deemed it preferable to leave the Province of Québec and set up operations in the United States to be in a better position to serve Québec.

Finally, the argument of industry dislocation may also mean that the superiority of American firms is the result of factors specific to a single use that are not readily available on the market. A look at the elements of the production function of these large carriers reveals that they do not seem to be numerous or significant. Terminals and long-haul rolling stocks (tractors and trailers) can be leased. A firm may hire its employees on contract. The tracing system and computerized management system necessary for this highly specialized production function are also available on the market. Moreover, the exit barriers are weak and almost nonexistent. The only element that may be specific to this industry is the management staff. But here too, there is a competitive market for managers. In other words, as

almost all of the factors used are variables or few costs are sunk, the public trucking industry is really a contestable market in Baumol's terms, which refutes the dislocation theory.

5.0 Concluding Remarks

The Québec LTL market indirectly adjusts to the diffusion of the American deregulation. The price mechanism and the presence of long haul LTL carriers constitute the two precise elements of this slow but real and effective propagation(10). This has come about because the Canadian institutional arrangement has delegated the trucking regulation to the provinces. Québec, or any other Canadian province for that matter, cannot export the burden of any protectionist policy to another party because of its negligeable influence on the world economy. It must assume the social costs of any policy changing its domestic real prices. Moreover, if changes in another country (or province) increase the elasticity of supply, in that case, there exists a clear tendancy for the small country to regulate less. This represents the problem that actually faces some Canadian provinces. Competition among governments or levels of government is as good as competition among firms in an industry because it reduces their respective discretionary power and induces the government to be more responsable towards its citizens.

Notes

(1) Many ideas developped in this paper are from Boucher (1985).

(2) This fact clearly emerges from the cross-examination of Ms Baillargeon, Counsel, in the 1984 application of Yellow.

(3) Chiang and Friedlaender (1984) describe the theoretical basis and estimate a trans-log function to prove it.

(4) Chiang and Friedlaender (1985) present statistical results on the minimum efficient size firm of this industry.

(5) The results of those interviews are from Boucher (1985): pp. 55-58.

(6) Skorochod and Bergevin (1984) arrive to the same results for Ontario.

(7) Some of those points are also found in Chow (1984).

(8) Chow (1984) also shares this conclusion.

(9) A brief sketch of this argument is found in the Toronto Globe and Mail (1983).

(10) This idea is from Boucher (1986).

References

Boucher, M. 1986, "L'inspiration américaine de la déréglementtion en transport routier", Forthcoming in Canadian Public Policy/Analyse de politique.

Boucher, M. 1985, "Le marché des lots brisés au Québec", Working Paper no 8510, École nationale d'administration publique, Centre de recherche sur l'économie publique (October 1985).

Chiang J.S.W. and Friedlaender A.F. 1985, "Truck Technology and Efficient Market Structure, Review of Economics and Statistics, May 67: 250-258.

Chiang, S.J.W. and Friedlaender A.F. 1984, "Output Aggregation, Network Effects and the Measurement of Trucking Technology", Review of Economics and Statistics, May 66: 267-276.

Chow, G. 1984, "An Analysis of the Transborder LTL Trucking Industry", Canadian Transportation Research Forum, May 1984: 158-192.

Globe and Mail, 1983, "Truckers' report warns of dislocation under open-border policy", July 25: B7.

Skorochod, P. and Bergevin R. 1984, "Problems in Transportation/Distribution for the Small/New Exporter", Canadian Transportation Research Forum: 831-853.

Yellow Freight System Inc. vs. Transport Dallaire Ltée et al., Québec Transport Commission, Public Hearing, November 20 1984, tape no 2, side B.

AN OVERVIEW OF INTERNATIONAL TRUCK TRAFFIC PATTERNS IN ONTARIO

by

Adil Cubukgil
University of Toronto - York University
Joint Program in Transportation

1.0 Introduction

The 1980 Motor Carrier Act provided opportunities for Canadian carriers to expand into U.S. markets. American carriers, on the other hand, continued to face a public necessity and convenience test in order to gain access into Ontario. Moreover, they faced strong opposition from Ontario-based carriers who claimed that large American carriers would have detrimental impacts on their operations. The subject has been the source of considerable controversy in the past five years, precipitating a temporary moratorium on Canadian applications in the U.S., the establishment of a consultative mechanism for conflict resolution, provincial hearings to examine the implications of a more open border policy, and attempts by the provincial government to establish some policy guidelines. In the meantime, American carriers continued their struggle to get into Ontario; some succeeded in obtaining new licences while others acquired existing (or bankrupt) carriers.

From Canadian perspective, a major source of concern has been the three largest U.S. carriers' efforts to penetrate Canadian markets. Although there is by no means any consensus about whether the entry of these large carriers would serve Canada's interests or not, the opposition from the trucking industry has been fierce. Canadian carriers have been arguing that they simply do not have the means to compete with the giant U.S. carriers, and that an "open border" policy would only lead to the demise of their industry. The proponents of open competition across the border, on the other hand, have been arguing that Canadian shippers would be the principal beneficiaries of the cheaper and better service that the American carriers could offer.

The debate on these transborder issues continue, but little is known about international traffic characteristics, and even less about the market shares of the carriers domiciled on either side of the border. There are a number of statistical sources on international trucking, but none of these sources provide information on commodity flows or carrier revenues. The purpose of this paper is to draw on the Niagara Frontier Tariff Bureau's (NFTB) Continuing Traffic Study (CTS) in order to provide an overview of traffic patterns over the U.S. - Ontario border.

The CTS provides statistically reliable, both current and historical data on the activities of for-hire trucking companies included in NFTB's carrier frame. The major problem with the CTS is that it does not account for the entire universe of international trucking activity. The NFTB carriers include most of the large LTL carriers handling transborder traffic between Ontario and the U.S., but exclude other specialized in truckload shipments, bridge movements (e.g., Windsor-Detroit), oversized loads and specific trades (e.g., foodstuffs), as well as some LTL carriers. In 1983, international revenues of Ontario domiciled NFTB members represented some 40% of total international revenue reported to Statistics Canada by all Class I carriers domiciled in Ontario.

2.0 Origin and Destination Patterns

The central states account for a significant portion of truck traffic between the U.S. and Ontario. In 1981, 65% of international traffic handled by NFTB carriers was destined to or originated from the central states of Michigan, Ohio, Illinois, Indiana, and western New York (see Table 1). The middle Atlantic states (including eastern New York, New Jersey, Pennsylvania and New England) accounted for a large share (24%) of the rest of the traffic carried by the NFTB carriers that year. The other states (midwest, southwest and south) accounted for a relatively small share of the international traffic volumes.

The central states accounted for a smaller share of revenue than traffic volume. This was due to the closer proximity of these states to Ontario, as well as the relatively larger TL share of the traffic (which generates less revenue) to and from these states. The south and midwest-southwest traffic, on the other hand, accounted for a much larger share of revenue than volume both due to much longer distances involved and a greater share of more revenue-intensive LTL traffic; each of these two routes of states accounted for 12% of the total international revenue generated by the NFTB carriers. The revenue

Table 1
Distribution of Traffic, 1980

Ontario (To/from)	Distribution by Weight			Distribution by Revenue		
	LTL	TL	Total	LTL	TL	Total
Central	51	68	65	46	48	47
Middle Atlantic	30	23	24	31	26	29
Midwest-Southwest	9	4	5	11	15	12
South	9	5	6	13	10	12
Total	100	100	100	100	100	100

share of the middle atlantic states (29%) was also greater than the volume share due to again both the distance effect and the traffic mix.

In Ontario, most of the international traffic was generated in the southwestern region of the province. Although data on traffic volumes are not available by origin and destination, the distribution of revenue shown in Table 2 clearly indicate a significant level of geographical concentration in the traffic patterns. About 87% of the TL and 89% of the LTL traffic to/from Ontario is generated from the area to the south of Highway 7 and west of Highway 12. The rest of the province to the north and east of Toronto account for only 11%-13% of total international traffic. The Toronto Metropolitan region alone accounts for 60% of the LTL and 47% of the TL traffic. It is also worth noting that the Toronto region attracts a larger share of the northbound than that of the southbound traffic it generates. Although detailed statistics are not available, it is also observed that even the traffic outside Toronto, but within southwestern Ontario, is concentrated around the major urban centres such as Windsor, Hamilton, London and Kitchener-Waterloo. Thus, unlike origin-destination patterns in the U.S. which are quite disbursed, large centres close to the border account for a substantial portion of international traffic originating from or destined to Ontario.

The closer proximity of the Canadian sources of traffic to the international border is also revealed by the comparison of shipping distances. As shown in Table 3, on the average, 55% of southbound and 63% of the northbound

Table 2
Distribution of Revenue in Ontario

	Toronto	Other Southwest	North & East	Total
Total	53	35	12	100
LTL	60	29	11	100
TL	47	40	13	100
Northbound	57	32	12	100
LTL	61	28	11	100
TL	52	37	12	100
Southbound	46	41	13	100
LTL	56	33	10	100
TL	38	46	15	100

Table 3
Shipping Distances (Miles), 1980

	Southbound			Northbound		
	Total miles	US mi	% US	Total miles	US mi	% US
All traffic	387	211	55	469	294	63
SL	269	93	35	327	148	45
JL	486	310	64	542	367	68
LTL	535	405	76	615	475	77
TL	375	196	52	431	249	58

distances are travelled in the U.S. For LTL traffic, distances travelled in the U.S. are about three times greater than in Canada. In both TL and LTL traffic, joint-line shipments penentrate deeper into the U.S. than single-line shipments. In comparing shipping distances, it is also worth noting that average length of haul is greater for northbound traffic than for southbound.

3.0 Traffic Mix

The total volume of international traffic handled by the NFTB carriers was 95 million cwt in 1980, but had declined to 80 million cwt in 1983. The LTL share of this traffic was only 16% in 1980, but had increased to 19% by 1983. In 1980, as much as 85% of the LTL traffic was joint-line by two or more carriers, but as a result of a significant growth in single-line traffic over the next three years, the joint line share was down to 77% in 1983. In the case of TL traffic the joint-line share declined from 65% to 56%. In spite of this trend towards single-line movements, however, it is clear that a large share of the international traffic is still handled by NFTB carriers on a joint-line basis.

In 1980, the northbound traffic volume was some 20% greater than southbound, mainly due to much larger northbound LTL traffic. The overall directional imbalance was reversed by 1983, when southbound traffic was actually 10% greater than northbound. Over this period, southbound LTL traffic increased significantly (by 40%) while northbound LTL traffic actually declined (by 18%). In the case of TL movements, traffic declined in both directions, but only by 7% for southbound compared with 28% for northbound. These relative shifts corrected the imbalance in LTL traffic (from 2.9:1 in 1980 to 1.7:1 in 1983), but gave rise to an imbalance in TL traffic in the opposite direction (from 1:1 in 1980 to 1:1.35 in 1983).

As can also be noted from Table 4, there are differences in both traffic mix and handling characteristics by direction. LTL shipments represent a much larger share of the northbound traffic, than southbound (22% versus 10% in 1980 and 25% versus 13% in 1983). Due to a larger LTL share, as well as in part due to longer shipping distances, a greater proportion of the northbound traffic is joint lined (71% compared with 65% southbound in 1980, and 64% compared with 57% southbound in 1983).

4.0 Revenue Characteristics

In 1980 total "through revenue" (i.e., from point of original shipment to final destination) from international traffic was $440 million. The distribution of this revenue is shown in Table 5. For the 95 million cwt. of freight carried that year, average revenue in 1980 was $4.63 per cwt. Given that the average length of haul that year was about 430 miles, this was equivalent to $0.21 per ton-mile. Average revenues for different traffic segments are shown in Table 6.

Table 4

Distribution of Traffic

	Total			Northbound			Southbound		
	mil. cwt.	%		mil. cwt.	%		mil. cwt.	%	
1980									
Total	95	100	(100)	52	100	(100	43	100	(100)
SL	30	32		15	29		15	35	
JL	65	68		37	71		28	65	
LTL	16	100	(16)	12	100	(22)	4	100	(10)
SL	3	15		2	15		1	16	
JL	13	85		10	85		3	84	
TL	79	100	(84)	40	100	(78)	39	100	(90)
SL	27	35		13	32		14	37	
JL	52	65		27	68		25	63	
1983									
Total	80	100	(100)	38	100	(100)	42	100	(100)
SL	32	40		13	36		18	43	
JL	48	60		25	64		24	57	
LTL	15	100	(19)	9	100	(25)	6	100	(13)
SL	3	23		2	25		1	20	
JL	12	77		7	65		5	80	
TL	65	100	(81)	29	100	(75)	36	100	(87)
SL	29	44		12	40		17	48	
JL	36	56		17	60		19	52	

LTL shipments represented 16% of the traffic but generated 45% of the total through revenue. This yields an average revenue of $12.80 per cwt., compared with $3.04 per cwt. for TL traffic. The difference, in part, reflects the longer average haul for LTL shipments. Even after this distance effect is isolated, however, unit revenue from LTL ($0.50 per ton-mi.) is still more than three times that from TL ($0.16 per ton-mi).

Single-line shipments represented 31% of the traffic but only 17% of the through revenue. Unit revenue from SL traffic was $2.57 per cwt. compared with $4.47 from TL. This difference is largely due to shorter hauls for SL shipments. After this distance effect is isolated, the

Table 5

Distribution of International Revenue

	Total			Northbound			Southbound		
	mil. $	%		mil. $	%		mil. $	%	
1980									
Total	440	100	(100)	287	100	(100)	153	100	(100)
SL	76	17		47	16		29	19	
JL	364	83		240	84		124	81	
LTL	200	100	(45)	149	100	(52)	51	100	(33)
SL	27	13		19	13		8	15	
JL	173	87		130	87		43	85	
TL	240	100	(55)	138	100	(48)	102	100	(67)
SL	49	21		28	20		21	21	
JL	191	79		110	80		81	79	
1983									
Total	424	100	(100)	262	100	(100)	162	100	(100)
SL	115	27		68	26		47	29	
JL	209	73		194	74		115	71	
LTL	219	100	(52)	149	100	(57)	70	100	(43)
SL	51	23		35	23		16	23	
JL	168	77		114	77		54	77	
TL	205	100	(48)	113	100	(43)	92	100	(57)
SL	64	31		33	30		31	33	
JL	141	69		88	70		61	67	

remaining unit revenue differential ($0.17 and $0.22 per ton-mile for SL and JL, respectively) can be attributed to the larger LTL share in JL shipments (20%) than in SL shipments (7%). These two factors (i.e., distance and LTL-TL mix) explain the difference between SL and JL unit revenues; interlining per se does not appear to have a notable effect on unit revenues.

Table 6

Unit Revenues, 1980

	Total		Southbound		Northbound	
	$/ cwt.	$/ ton-mi	$/ cwt.	$/ ton-mi	$/ cwt.	$/ ton-mi
TOTAL	4.63	0.21	3.53	0.18	5.55	0.24
single-line	2.57	0.17	1.94	0.14	3.21	0.20
joint line	5.57	0.22	4.37	0.18	6.47	0.24
LTL	12.79	0.50	12.65	0.47	12.84	0.42
TL	3.03	0.16	2.60	0.14	3.44	0.16

In 1980, the higher average revenue for northbound ($5.55 per cwt. compared with $3.53 per cwt. southbound) compounded the traffic imbalance (54%-46% measured in volume), yielding a northbound-southbound split of 65%-35%.

This was partly due to differences in length of haul, but the more significant factor contributing to the imbalance was the difference in traffic mix: the more revenue--intensive LTL shipments accounted for 22% of northbound, but only 9% of southbound traffic.

Between 1980 and 1983, through revenue from international traffic declined by 4% to $424 million. (See Table 5). The following changes from 1980 should be noted.

- LTL revenues showed a net increase of 10%, while TL revenues declined by 15%. As a result, LTL share of the total increased from 45% to 52%.

- This was a substantial shift from JL to SL in both types of traffic (i.e., LTL and TL). In total, SL revenues increased by more than 50%, increasing their share from 17% to 27%.

- Substantial growth in southbound LTL revenue (37%) offset declining TL revenue. In spite of the overall decline, therefore, southbound revenues increased by 6%, increasing the southbound share of the total from 35% to 38%.

These changes in the distribution of international revenue are generally consistent with the changes in volume of traffic discussed earlier There are, however, important differences to note in terms of unit revenues generated in specific traffic segments. As noted already, between 1980 and 1983, volume of traffic declined by 15%, but revenues by only 4%. This resulted in average unit revenue increasing from $4.63 per cwt. in 1980 to $5.27 per cwt. in 1983 (see Table 7). This could have been the combined effect of general rate increases, longer shipping distances due to changing traffic patterns, and changes in traffic mix.

Table 7

Unit Revenues, 1983

	Total		Southbound		Northbound	
	$/ cwt.	1983/ 1981	$/ cwt.	1983/ 1981	$/ cwt.	1983/ 1981
TOTAL	5.27	1.14	3.85	1.09	6.85	1.23
single line	3.58	1.39	2.54	1.31	4.99	1.55
joint line	6.41	1.15	4.89	1.12	7.86	1.21
LTL	14.51	1.13	12.46	0.98	15.55	1.21
TL	3.13	1.03	2.52	0.96	3.91	1.14

In the absence of comparable data on length of haul, it is not possible to determine the exact causes of the increase in average unit revenue from 1980 to 1983. However, it is evident that increasing share of LTL traffic (from 16% to 19% of the total volume) was a major contributing factor, given that LTL unit revenue is four to five times higher than TL. It can also be observed that, on average, unit LTL revenues increased by 13% and TL revenues by 3%. Another notable change over this period was the 39% increase in average revenue from SL shipments. This was probably due to the fact that, with the substantial increase in SL traffic, average length of haul for SL shipments also increased considerably.

The most striking differences in the way unit revenues changed between 1980 and 1983 concern the directional split in the traffic. Average revenue for southbound traffic increased by only 9%. Since unit revenues for both LTL and TL shipments actually declined (2% and 4% respectively), the overall increase was due to the in-

creasing share of LTL traffic, which of course commands a much higher unit revenue. In contrast, northbound unit revenue increased by 23%, reflecting a relative increase in the LTL share of the traffic, but also significant increases in unit revenues from both LTL and TL (21% and 14% respectively).

It was noted above that in examining changes in unit revenues from 1980 to 1983, available data do not permit the isolation of actual changes in rates from the effects of longer shipping distances. In the context of declining southbound and increasing northbound revenues, it is conceivable that average-length haul could have decreased southbound but increased northbound. In any event, however, it is clear that the difference between northbound and southbound revenues has widened between 1980 and 1983 (the former was 57% larger in 1980 and 78% in 1983). As a result, although the directional balance in volume switched in favour of southbound (from 54%-52%), there was not a corresponding improvement in the revenue imbalance. In 1983, southbound traffic accounted for 52% of the total volume, but represented only 38% of the revenue.

5.0 Carrier Characteristics

Carriers that are included in the NFTB's frame can be identified either by ownership or domicile. Some carriers operating out of the U.S. are Canadian owned, while some American-owned carriers are domiciled in Canada. In 1980, Canadian-owned carriers received 47% ($206 million) of the total through revenue from international traffic (see Table 8). A significant share of this revenue ($93 million), however, was received by those domiciled in the U.S. Although U.S.-owned carriers handled more revenue ($233 million), those domiciled in Canada accounted for a smaller share of this total ($63 million). In terms of domicile, therefore, the Canadian share of the total through revenue ($176 million) was considerably less than the U.S. share ($263 million).

Between 1980 and 1983, there were significant changes in the relative revenue shares of Canadian and U.S carriers. By far the most significant change concerned the Canadian-owned carriers domiciled in the U.S., with their revenue declining from $93 million to $9 million (mainly due to the bankruptcy of Maislin). The main beneficiaries from this development appear to have been the U.S.-owned and domiciled carriers, with their revenues increasing from $170 million to $234 million. During this same period, revenues of Canadian-domiciled carriers increased only marginally from $176 million to $180 million. Within this category, there was a shift from U.S.-owned to Canadian-owned ones. This was largely due to the change

Table 8

Distribution of Revenue by Ownership and Domicile, International Revenues by Carriers' Country of Ownership and Domicile

Domicile	Canada		U.S.		Total	
	mill$	%	mill$	%	mill$	%
Ownership						
1980						
Canada	113	(55)	93	(45)	206	(100)
(% of Total)	(64)		(35)		(47)	
U.S.	63	(27)	170	(73)	233	(100)
(% of Total)	(36)		65		(53)	
Total	176	(40)	263	(60)	440	(100)
(% of Total)	(100)		(100)		(100)	
1983						
Ownership						
1983						
Canada	133	(94)	9	(6)	142	(100)
(% of Total)	(74)		(4)		(33)	
U.S.	48	(20)	234	(80)	282	(100)
(% of Total)	26		(96)		(67)	
Total	180	(42)	243	(58)	424	(100)
(% of Total)	(100)		(100)		(100)	

of ownership of one large carrier (purchase of Direct by its Canadian management from the American owners). As a result of all these shifts, by 1983, the Canadian share of the total through revenue was 33% in terms of ownership and 42% in terms of domicile.

For the Canadian-domiciled carriers included in NFTB's frame, international traffic represents a very significant share of their business. Both in 1980 and 1983, international revenues represented 35% of the total revenue they earned (see Table 9). This is very different than the case of U.S.-domiciled carriers, where interna-

tional business plays a much less important role in the context of their overall operations. In order to capture all the interlined revenue from international traffic, the NFTB frame includes a much longer list of carriers domiciled in the U.S., which collectively earned $9.6 billion in 1980 and $9.7 billion in 1983. International revenue was a mere 3% of this total. This share may be higher for some regional carriers engaged in international traffic, but in general, international revenues represent only a small share of U.S.-domiciled carriers. In the case of large national carriers, international traffic represents almost an insignificant share. For Canadian-domiciled carriers included in NFTB's frame (which are much fewer in number but include some of the largest in Canada), on the other hand, international revenues represent a significant part of their business.

Table 9

Comparison of International and Domestic Revenues

	1980			1983		
Revenue Source	Can. Owned	U.S. Owned	Total	Can. Owned	U.S. Owned	Total
Canadian Domestic	261 (67)	61 (49)	322 (63)	325 (71)	13 (21)	338 (65)
Inter-national	113 (29)	63 (51)	176 (35)	132 (29)	48 (79)	180 (35)
U.S. Domestic	13 (4)	- (-)	13 (3)	2 (-)	- (-)	2 (-1)
Total	387 (100)	124 (100)	511 (100)	459 (100)	61 (100)	520 (100)

Note: All revenues in this paper are in current U.S. dollars

TRANSPORTATION SUPPORT TO NATIONAL DEFENCE: A CIVIL-MILITARY PARTNERSHIP

by
Lieutenant-Colonel J.W. Craig, CD
Canadian Forces

1.0 Introduction

> "In a tale of war, the reader's mind is filled with the fighting... nor does he care to look behind to where, along a thousand miles of rail, road and river, the convoys are crawling to the front in uninterrupted succession. Victory is the beautiful, bright-coloured flower. Transport is the stem without which it could never have blossomed."

Sir Winston Churchill, who wrote this truism in his classic, The River War, in 1899, lived to see the development of weapon systems undreamed of at that time. But to a considerable extent the principles of war have not changed; nor has the importance of transportation diminished in the planning of military operations.

At the conclusion of World War II, Douglas Abbott, Minister of National Defence in the King Government, considering the possible advent of atomic war, said that ".. it becomes apparent that there is a need for the armed forces of a country to be immediately available... The keynote in our defence policy ... is preparedness.. We cannot forget the critical risks we have run by our previous lack of preparation..."(2:90). At least one member of the opposition, E.D. Fulton, agreed that it was wishful thinking, to believe"... that we shall again have an opportunity for liesurely preparation ... liesurely mobilization, liesurely assembling of our forces and liesurely direction of our forces to those places where we wish to send them..."(2:101).

Yet it takes more than mere expressions of Government approval to attain the necessary rapid military response to a sudden emergency. Not four years later in the summer of 1950, amid the public clamour for Canada to contribute more to the Korean conflict than three destroyers and an air transport squadron, the Chief of the General Staff, Lieutenant-General Foulkes, admitted that "no ground forces of any significant size were ready"(4:36). The clamour continued, and finally on August 7, Prime Minister St. Laurent announced the recruitment of the Canadian Army Special Force (CASF)..." to be available for use in carrying out Canada's obligations under the United Nations Charter..."(1:4).

No plans existed either for the mobilization and training of such a force or for its transportation. Recruiting proceeded at a hectic pace, however, and by August 26 over 8000 men had been enrolled. Hasty arrangements were made for training to be conducted at three camps across the country; Valcartier Quebec, Petawawa Ontario and Wainwright Alberta. Such arrangements were not without problems! A nation-wide rail strike was called on August 22, and it was not until August 29 that Parliament finally met and ordered the railroad back to work. In the meantime hundreds of recruits were scattered across the country, stranded by the strike, and valuable training time was lost in the process of rounding them up.

The dearth of winter training facilities in Canada resulted in arrangements being made for CASF training in Fort Lewis, Washington. But how to move several thousand men and their equipment from the three camps in Canada to the west coast of the U.S. and ultimately to Korea?

The continental move was conducted by Canadian railroads. On November 11, the first train to Fort Lewis left Valcartier. The journey took five days. In the event, it took 22 trains and 12 days to move the CASF to Fort Lewis. The onward movement was even slower, and it was accomplished by U.S. troopships, not Canadian. The first unit to depart, the 2nd Princess Patricia's Canadian Light Infantry, sailed from Seattle on November 25, disembarking in Pusan, Korea, on December 18, 1950. The first Canadian ground troops thus arrived in Korea over four months after call-up.

The liesurely pace of mobilization had changed little from the two previous wars! There were no forces on standby, or even established, to respond quickly to the UN call. The initial deployment and subsequent sustainment of the CASF relied very heavily on commercial transportation resources, but from the outset of Canadian involvement, use of these resources was based on time-consuming ad-hoc arrangements. The aim of this paper is to outline the Canadian Forces' role as both an operator and user of transportation in peace and war, and to examine initiatives to quickly harness Canada's combined civil and military transportation resources in an emergency.

2.0 The Military Requirement

The situation today is somewhat different. The standing forces of this country are larger now than in 1950 and we have a variety of stand-by commitments to deploy forces in response to emergencies. The UN commitment has been retained; but our family of Defence Plans covers a much wider range of deployment options, including rapid reinforcement of Germany and North Norway in a NATO deterrence role, Canada/US defence arrangements and, of course, defence of Canada or sovereignty operations. The keynote of our defence policy today is indeed "preparedness" as espoused by Douglas Abbott in 1945, and we are striving to eliminate any "liesurely" elements in the assembly and deployment of forces.

During normal peacetime operations the transportation requirements of the Canadian Forces are met mainly by our own integral resources. These requirements are generally routine in nature and, with augmentation from the commercial transportation industry as required, are fulfilled without difficulty. Support provided by civil carriers is excellent and we have developed close working relationships with a cross-section of the industry. A recent example of close civil support for military movements was Exercise RENDEZVOUS 85. Over a two week period, 900 railcars were used to move 3000 vehicles from nine locations across Canada to Wainwright Alberta - and then to move them back.

The point to be made is that the Canadian Forces frequently employs commercial carriers in peacetime, both for routine administrative movements and for force deployment exercises, and that we bid for available civil transportation resources in competition with other users. Fortunately, availability of such resources is normally not a problem.

During periods of emergency the character of the overall national movement requirement - that is to say the sum of the economic as well as the military requirements - changes considerably. From a military point of view there will be very much more to move and, more significantly, more to move simultaneously over a very limited period of time. Our planning effort today is focused on NATO deterrence - to discourage the Warsaw Pact from starting a war, or in the event that hostilities do commence, to deter escalation to nuclear war. Notwithstanding the large number of troops currently in Europe, including over 6000 Canadians, the credibility of such a deterrence policy comes not so much from the presence of these standing forces in Europe, as from the perception by the Warsaw Pact that we have the capability and the resolve to quickly reinforce the standing forces in Europe, to fully sustain them in combat for as long as required, and to expand our forces through mobilization should it become necessary.

Commercially, normal trading patterns will be disrupted, the demand for commodities will be altered, and the distribution and availability of essential goods, services and resources may be regulated. It is certain that the altered nature of the overall national movement requirement will present a significant challenge to the combined Canadian civil and military transportation capability.

3.0 Canadian Strategic Transportation Resources

Canada has very limited strategic transportation resources for the rapid movement of large forces to Europe. In the context of this paper the term strategic refers to a capability for carriage of passengers and cargoes between theatres, i.e. between North America and Europe. Figure 1 reveals that with 75 passenger aircraft of the Boeing 747 to DC-8 type, transatlantic airlift of troops should not be a problem; with the caveat, of course, that civil resources are

made available to the Department of National Defence on a priority basis. On the other hand the combined civil-military cargo airlift capability, in particular the capability to lift large vehicles and equipments, is extremely limited. With only six DC-8s and two Boeing 747-combi aircraft, the commercial general cargo capability is little better than our own five Boeing 707s. The single commercial Hercules C130 aircraft in Canada offers virtually no relief to the vehicle airlift problem.

CANADIAN STRATEGIC TRANSPORTATION RESOURCES

Airlift

Military	26	Hercules C130
	5	Boeing 707*
Civil	75	Passenger
	7	Cargo
	2	Combi**

* fully convertible passenger-cargo configuration
** fixed passenger-cargo configuration

Sealift

Military	Nil	
Civil	1	Roll-on Roll-off
	22	Break-bulk

FIGURE 1

With respect to sealift, a similar dearth of resources exists. The single RO-RO vessel is suitable for large military vehicles but is capable of lifting only a very small portion of the total requirement. The break-bulk vessels are suitable for carriage of military bulk cargoes for sustainment but are not capable of rapid deployment of combat vehicles and equipment. It must be made perfectly clear, however, that this list includes only Canadian-flag vessels; we are well aware of the fact that there are many more highly productive RORO and other suitable vessels that are Canadian-owned but under foreign flag.

Any attempt to quantify a shortfall of strategic lift resources is, of course, scenario-dependent. Suffice it to say that the Canadian Forces has inadequate strategic transportation resources to fully meet our international commitments and must, therefore, look to the Canadian civil sector and even foreign sources to augment our capability.

The movement of a large force to Europe, such as we have committed to the northern flank of NATO, would once again require a combined civil-military effort. Unfortunately we no longer have the luxury of taking months to assemble and move the requisite thousands of personnel and pieces of equipment. To be of any value as a deterrent, our troops must be deployed as early in a period of rising tension, and as quickly, as possible.

Clearly, our capacity for defence, victory and perhaps even survival in another more serious emergency will depend heavily on the state of readiness, not only of our forces but also of our transportation system, to support national defence. The challenge for the Canadian Forces in the 1980s, and indeed for the nation, is to ensure that our commitments are backed by the preparations and resources necessary to fulfill those commitments rapidly and effectively on short notice.

4.0 Current Planning Initiatives

The basis for civil emergency planning in the 1980s is the federal Emergency Planning Order. It charges various ministers with the responsibility, inter alia, for the development and maintenace of plans and arrangements for the provision of "... appropriate and timely support to the Canadian Forces ... in the conduct of military operations within Canada, at sea and abroad.."(3:2). The order also requires the Minister of Transport, for example, to establish a National Emergency Agency for Transportation (NEATRAN) for operation in time of emergency. NEATRAN's primary function will be to control, regulate and direct the operation of civil transportation. It is important to note that this Emergency Planning Order confers only a planning responsibility on Ministers, not the authority to implement the plans. Authority to provide priority transportation support to the military, for example, would have to be obtained from Parliament through appropriate legislation.

The government is committed to the development of new emergency legislation that recognizes the escalating nature of emergencies. It will provide the government with the power to draw on the resources and expertise of the whole nation and not just their own capabilities alone, and it provides that power very early in a crisis. Such powers must obviously be given carefully and must be in accordance with various statutes protecting the rights of individual Canadians, but are absolutely essential as a basis for emergency planning.

But clearly legislation alone will not be enough. Without the "... decision-making and planning mechanisms within the federal government, and structures for coordinating the efforts of government, industry, employees associations and others, in the national defence effort...", we cannot hope to achieve rapid military response to emergencies (5:46). The Director General Transportation in National Defence Headquarters is urgently seeking ways to involve other federal planners and the civil sector as

active and joint participants in transportation support strategies. Several initiatives are currently underway to implement this concept.

Various interdepartmental committees have been established with a view, firstly, to defining the deficiencies in the current transportation system. Notwithstanding the trend to intermodality, the system is now a loose grouping of diverse and specialized modes, competitive with one another and with themselves, with little propensity to accepting extensive integration or coordination. In the national interest in an emergency, the various modes must be joined to function as an integrated system.

To this end we have developed the first of perhaps several Memoranda of Understanding (MOU) between Transport Canada and National Defence, and have begun working together to broaden the involvement of the transportation industry in our planning. This first MOU outlines a general agreement with respect to the operations of the Canadian Forces from Canada Ports Corporation and non-corporate ports. It will be supported with a set of Standing Operating Procedures for each of the ports to be used in an emergency, providing the Canadian Forces and all of the civil agencies involved - the port authority, railroads, stevedores - with detailed procedural guidance for executing the embarkation of military vehicles, equipment and materiel through the port in an emergency. The aim is to streamline the embarkation process to minimize ad-hoc arrangements and thereby speed up the process. Such procedures must be developed for the entire range of possibilities for civil/military interface in an emergency.

As a result of this increased emphasis on the joint civil/ military nature of defence, we are also increasing the use of commercial transportation in exercises, particularly for deployments to Europe. For example, in the summer of 1986 a 4000-man force, together with vehicles, equipment and supplies, will be moved from eastern Canada to North Norway and return. The movement will involve more commercial vehicles, aircraft and vessels than ever before. This trend will continue.

There is also an important role for the Department of National Defence in the process of fostering a better public understanding of security issues. To this end we are in the process of establishing a National Defence Transportation Association in Canada, modelled after a U.S. organization of the same name. One of its principle objectives, in addition to sponsoring public debate on defence transportation issues, is to encourage the development of plans and programs to ensure the readiness of our transportation system to support military responses to emergencies. With the active support of the transportation industry, the academic community, the military and other government departments, we are confident that these vital objectives can and will be met.

5.0 Conclusion

These initiatives to establish the mechanisms for coordinating the national defence transportation effort, require foresight and a continued spirit of cooperation from all concerned in order to succeed. The Canadian Forces has a pivotal dependence on all transportation industries in both peace and war, with much of our capability coming from without, not within. Military ownership is extremely limited and thus the transportation support necessary for the deployment and sustainment of our forces falls quickly upon the nation's railroads, truck lines, shipping lines and air carriers. Indeed, mobilizing the military and commercial transportation resources of this nation must be viewed as a partnership in the common cause of national security.

BIBLIOGRAPHY

1. Canada's Army in Korea: A Short Official Account, Historical Section, General Staff, Army Headquarters, Ottawa. Ottawa: Queen's Printer, 1956.

2. Eayrs, James G. In Defence of Canada: Peacekeeping and Deterrence. Vol III. Toronto: University of Toronto Press, 1972.

3. Emergency Planning Order, P.C. 1981-1305, Canada Gazette, Part II. Ottawa: Queen's Printer for Canada, 1981.

4. Melady, John. Korea: Canada's Forgotten War. Toronto: MacMillan of Canada, 1983.

5. Military Air Transport, Report of the Special Committee of the Senate on National Defence. Ottawa: Minister of Supply and Services Canada, 1986.

DISCLAIMER

This paper represents the views of the author and does not necessarily reflect the official position of the Department of National Defence.

AUTOMATING TRANSPORTATION WITHIN THE CANADIAN FORCES

by

Major Howard L. Mooney, CD
Canadian Forces

1.0 Introduction

In a country as large and geographically diverse as Canada with a harsh, changeable climate and a relatively small and dispersed population, effective transportation is essential for the protection, development, and economic well-being of our nation. No other element of the economy has such a pervasive influence upon our society. Similar to the commercial sector, transportation manifests itself in virtually every activity within the Canadian Forces both in times of peace and during war. In peacetime, transportation expenditures by the Department of National Defence (DND) account for ten percent of our annual budget. In time of war or national emergency transportation forms the vital bridge between support and operations and consequently is an essential ingredient for victory. To quote Sir Winston Churchill's truism from The River War:

> "Victory is the beautiful, bright-coloured flower. Transport is the stem without which it could never have blossomed."

1.1 Situation Assessment

During the last few years, the technological developments centered on the application of automation within the transportation community have been tantamount to an information revolution. New software programs, specifically tailored for the transportation community are being developed almost on a daily basis. Coincident with these developments in the commercial sector, many agencies within DND who routinely interface with our organization have adopted automated systems. Transportation managers who are charged with the responsibility to manage transportation activities and resources on behalf of the Canadian Forces (CF) are placed at a considerable disadvantage for want of comparable systems.

Automated systems have become indispensable for efficient and profitable transportation management in the private sector. In contrast, transportation management within the Canadian Forces has remained almost exclusively a manual operation. Bearing in mind the importance of current and accurate information in order to effectively manage resources; military managers have been forced to

become computer-literate and familiar with the characteristics of automated systems in order to protect the interests of the Crown.

In order to gain greater visibility of our transportation assets, to optimize the use of existing resources, and to provide managers with a performance measurement system; our department has been obliged to assess potential applications for automation. Trends toward deregulation of the transportation industry in Canada and the advent of relatively inexpensive, easy to use "off the shelf" software have prompted us to automate many of our operations in order to efficiently carry out our mission of managing transportation on behalf of the Canadian Forces.

1.2 Outline

This paper basically chronicles two years of work that has been done in developing a Transportation Management Information System (TMIS) for the Canadian Forces. After providing some background information which serves to identify the scope of transportation activity within the CF, management objectives and our goals in introducing automation are described. A brief outline of the system design methodology which was adopted and an explanation of the TMIS which we envision is then provided. After giving a brief narrative descriptions of several projects, some concluding remarks are provided.

2.0 Transportation in the Canadian Forces

2.1 The Scope

It is estimated that transportation expenditures account for approximately one billion dollars annually or about 10% of the defence budget. There are over eight thousand DND personnel directly involved in transportation. This includes a wide range of managers and tradesmen involved in all modes of transportation and every related activity. Unlike our American counterparts, our military managers go to the commercial sector to purchase transportation services only after we have exhausted our own resources. Our involvement therefore is extensive and covers the entire gamut of everything from the movement of household goods to running our own postal system. More specifically, these activities involve:

- an airline providing world-wide personnel and cargo services;
- a sophisticated passenger reservation system that handles over a quarter of a million bookings annually on military aircraft as well as $15 million annually in commercial air reservations;
- a customs clearance service for all personnel and cargo moving into and out of Canada;

- a passport service that is critical to meet military exigencies involving the issue of about 6,000 passports at a cost of $250,000 annually;

- a fleet of over 20,000 commercial pattern vehicles ranging from staff cars, buses, snow removal equipment, tractor trailer units, to airfield support equipment;

- a system to control the movement of household goods which handles 16,000 military moves annually and administers the policy affecting a total of 22,000 federal government moves representing an investment of about $70 million each year in Canada's moving industry;

- a worldwide CF postal system, that is very active in peacetime and crucial in wartime, involving over five million pounds of mail and a value of seven million dollars annually;

- hundreds of military and civilian operators established and trained to drive anything in our inventory and a comprehensive vehicle safety system; and,

- hundreds of traffic technicians trained in the wide variety of transportation services including administrative, strategic, and tactical airlift; and

2.2 The Objective

The Director General Transportation (DGT) for the CF has recognized that automation must be introduced as quickly as possible in order to optimize the use of existing resources, improve service, reduce costs and improve our operational response capability. Enhanced efficiency on the part of Logisticians means that scarce financial resources can be made available elsewhere within the department. In order to remedy the situation, DGT has embarked upon an ambitious, comprehensive plan to automate transportation management within the CF. The integration of component sub-systems for various transportation applications as well as the relationship between DGT and other departmental systems have been addressed resulting in the creation of a Transportation Management Information System. Bearing in mind the lack of empirical data upon which to base management decisions and our direct involvement in the commercial transportation marketplace, most of the systems under development will very rapidly pay for themselves when they are implemented.

2.3 Limiting Factors

Due to the scope and complexity of transportation activity, it has been necessary to divide this omnibus system into smaller, attainable projects which address both word processing and computer requirements at bases and stations, command headquarters, within

geographic regions or topical areas and at National Defence Headquarters (NDHQ). Transportation does not and cannot work in isolation, and therefore our relationships with the supply oganization, Customs and Excise Canada, finance, other departmental projects and the communications authorities within DND have been taken into consideration in planning. Recognizing the fact that automation is not necessary or desirable in every case, preliminary studies were conducted in order to verify each requirement.

Many of our automation requirements can be satisfied with very little modification to existing commercial software which is currently available. The rapid development of cheaper, better, more user-friendly hardware and software makes the in-house development of large omnibus projects impractical and expensive. These factors, combined with the projected life expectancy of any automated system, make many large capital projects obsolete before they can be introduced. Keeping in mind the requirement to obtain systems which are capable of being networked, and the desireability to standardize training and maintenance, a phased approach in developing a TMIS is considered to be the most practical approach.

2.4 Organizational Objectives

The TMIS has been created in order to assist CF transportation authorities in making the most efficient, economical and practical use of the resources at their disposal. Specifically these objectives entail:

- enhancing our capability to respond to operational transportation requirements;
- providing management information to improve the procurement, distribution and use of our commercial vehicle fleet;
- improving efficiency while reducing cost in moving passengers, materiel and furniture and effects;
- minimizing fatalities, personal injuries and costs to DND by introducing a more dynamic and active vehicle safety program;
- providing automation assistance to transportation units at bases and stations;
- introducing word processing, computer and electronic office technology to transportation headquarters wherever it will enhance operations;
- establishing an interface with internal and external computer systems which will achieve DGT management objectives; and
- examining and refining existing and potential functionality with a view to satisfying DGT management objectives.

2.5 ADP Goals

The goals for introducing automation to applicable areas within CF transportation are the following:

- to improve operational response capability;
- to reduce the costs associated with transporting personnel and materiel;
- to improve the efficiency of existing transportation services;
- to facilitate the management of transportation functions;and
- to improve working conditions for transportation staff at all levels and therefore increase their effectiveness.

3.0 System Design Methodology

System Design Methodology/70 (SDM 70), purchased by the DND several years ago from Atlantic Software Inc., is currently in use and provides the framework and necessary guidance to design, develop and implement a computer project from the initial conceptual stage to an after-installation assessment. It has been particularly valuable to military functional experts who are not familiar with computer technology or system design techniques because of the step by step guidance that it provides. It has also served to standardize design and development technique within DND.

The main drawback to strict adherence to SDM 70 methodology has been the amount of documentation required to work through the process. It is designed to be developed in stages and as a result, there is a built-in redundancy of information. The overall effect is that it is a very good but meticulous, deliberate and slow system of design methodology.

In order to concurrently develop a wide range of projects in a relatively short time span, it was necessary for our staff to adopt a refined version of SDM/70 in order to expedite the development of our management information system.

In the first instance, preliminary investigations were conducted for each project in order to ensure that automating that particular transportation function or activity was practical and desireable. Then based on the premise that functional expertise resides with the actual users; personnel from the topical area were appointed as functional analysts for the project. The next stage was composition of a detailed "Statement of Requirement" for each sub-system. This document was written using the principle that the systems analysts who would work on the project in later stages of development would not possess anything other than a very rudimentary knowledge of the functional area. Documentation started with an

extremely detailed description of present operations and procedures. The functional analyst then listed what he perceived as the deficiencies or problems with the existing system. From there, he listed potential solutions to recify the deficiencies which had been identified. The next stage was to select what was considered to be the best solution.

After approval of the Statement of Requirement by senior management, the projects are turned over to systems analysts for design. This work is done either "in-house" or contracted out to civilian consultant firms. In both cases, a set of "Abbreviated Specifications" is composed. The process includes the selection of information elements which will constitute the data base, outlining the relationships of various functions and information elements, then building a logic model for the system. Input and Output screens are designed and finally the entire process is documented. The functional analyst who has actively contributed to this process obtains the concurrence of senior management when he is satisfied that the newly designed system will satisfy the perceived needs which were detailed in the Statement of Requirement.

The project is next handed over to the engineers within the department to compose a set of "Technical Specifications". Only a few pages long, these specifications address the hardware, communications, software, operating system and programming language which will best satisfy the requirement.

Concurrently with the research and development, departmental approval and funding is obtained for each project. Once the technical specifications are completed and funding identified, the project can be sent to the Department of Supply and Services to let the contract on our behalf.

4.0 The Transportation Management Information System

The Transportation Management Information System is the name that we have assigned to the omnibus project which is created in stages as our automated applications are developed and implemented. This conceptual overview of a network of sub-systems integrating to create a TMIS ensures that the standardization of hardware, software, operating systems, programming languages and training is addressed during the developmental phases of each project.

The TMIS establishes the necessary communications and data links between each transportation operating and management level in order to effect overall management of the functions to the degree required. Each component project is designed to permit compatibility of operation and the exchange of information. All transportation projects developed on behalf of the CF are an integral part of the TMIS thereby providing the DGT with a system to effect management of transportation resources throughout the entire structure of the Canadian Forces.

5.0 Projects Currently Under Development

5.1 A NATIONAL MATERIEL DISTRIBUTION SYSTEM (NMDS)

In addition to our own internal freight resources, DND spends approximately 129 million dollars annually purchasing transportation to move materiel. In order to make more efficient use of our existing resources and to minimize expenditures for freight shipments, a system is required to capture information upon which management decisions concerning materiel movement can be based. This system will assist Transportation Agents (TAs) in the field, who currently work in isolation, by coordinating the use of military and commercial freight resources based upon volume and frequency patterns, efficiency and economy. It will allow for far greater consolidation of shipments at both origin and in-transit thereby optimizing the use of all modes of transportation on a regional, national and international basis. In time of war or national emergency, it will form a national materiel traffic network capable of quickly responding to operational requirements.

In order to effectively manage the movement of materiel the entire physical distribution process must be addressed rather than dealing in terms of the supply and transportation functions in isolation. The system must also be proactive and be based upon planned and forecasted movement requirements. The NMDS will replace the current almost exclusively reactive method of responding to freight shipments, with a management planning system. The benefits, particularly the potential monetary savings, become obvious as soon as additional control and coordination are introduced to the distribution function.

The NMDS will provide an information base which will permit the introduction of DRP, MRP or "Just-in-Time" distribution. From the initial procurement through to consumption or disposal of the goods, control can be exercised. In preparation for the NMDS, new freight documentation enabling the capture of transit times, costs, carrier data, volume over given routes, optimum routing, the weight and cube of shipments, and the basis of a performance measurement system was introduced forces-wide during 1985. The NMDS will use this information as a data base to provide managers with information which will assist in the decision making process. Should our tractor-trailer fleet be expanded? Should the routing of existing road freight services be modified? What are the optimum times to pick up or deliver freight at given locations? Are we making optimum use of space available for freight on our buses and other commercial pattern vehicles? Can more or better tariffs be negotiated with commercial carriers between specific city pairs or along high volume routes? In short, the NMDS will enable us to capture the history of our freight movement and use it to our advantage.

The system will provide the local TA with a decision support system as well as a means to automatically generate shipment

documents, the capability to trace shipments and to forecast workloads. It will assist him with mode and carrier selection, pricing, scheduling, and routing. It will facilitate the consolidation of goods at origin and while in-transit and will schedule backhaul shipments for carriers. In addition to improving response time and service, this system promises to yield savings in manhours. The efficiency of existing operations depends largely upon the experience of the individual shipping the freight and in many instances, he does not even communicate with neighbouring bases or stations.

At headquarters, this system will provide an effective communications link to all DND agencies charged with moving materiel and thereby permit efficient management of the system. Costs will be reduced considerably through greater consolidation, better route scheduling and more efficient use of resources. In additon to savings during routine operations, the Materiel Distribution System has the potential to reduce the costs associated with major CF projects and exercises.

5.2 FLEET MANAGEMENT INFORMATION SYSTEM

The department owns a fleet of approximately twenty thousand commercial pattern vehicles. It purchases in the neighbourhood of forty million dollars worth of new vehicles annually and rents or leases another eleven million dollars in vehicles and services. In addition to policy concerning vehicle useage, decisions must be made concerning attrition of old equipment, distribution of replacement vehicles, optimization of the utilization of existing resources and approval of new specifications. In order to effectively accomplish these duties, there is a requirement for more timely, accurate and relevant statistical information. A more effective management system and better visibility of our assets will result in less money being spent on rented equipment to complement the fleet. It will also optimize the use of our fleet and result in the purchase of fewer replacement vehicles. In the event of war, this system will greatly enhance our ability to respond to requirements involving the mobilization and deployment of goods and personnel.

Potential applications for this system include: a master Provisional Procurement List; national procurement surveys; a record of in-lieu holdings; a vehicle contract monitoring process; manipulation of extant manually prepared management reports at NDHQ as an aid for the reassignment of vehicles to exercises; instructions to bases concerning overweight/oversize routing; and maintaining vehicle rental statistics nationally. The creation of this type of data base will enable managers at all levels to make more efficient and economical use of their transportation resources. Through cost avoidance and immediate savings, this system will pay for itself in a very few months.

5.3 COMPUTERIZED CUSTOMS SYSTEM

DND expends millions of dollars annually for the purchase of transportation services to move materiel and a large percentage of this freight has to be customs cleared. An automated system capable of interfacing with Custom and Excise Canada's computerized system will expedite clearances, allow faster access to shipments, and permit customs documentation to be opened and closed instantaneously instead of obtaining temporary and then final clearances. The current manual system of maintaining and researching customs tariffs is labour intensive, slow and prone to human error. This error factor occasionally results in the loss of customs clearance privileges which increases cost substantially. Human error also costs money through poor budgeting, increased paperwork and searching for data after the fact. Automation will speed the processing of customs clearances and consequently result in dollar savings for the Crown through faster response time and the holding of less inventory.

5.4 FURNITURE AND EFFECTS MANAGEMENT SYSTEM

A system is required that will not only perform present functions more efficiently, but also create a database of information concerning government moves which will be available to units and NDHQ. Potential applications for the system include: an automated Government List of Approved Carriers; current rates and tariffs for the movement and storage of furniture and effects, and a carrier penalty reporting system. Changes which result from the de-regulation of the moving industry will have a major impact upon procedures at all levels and will be a necessary component of an automated F&E system. A local management system will also address deficiencies which currently exist and permit efficient and economical management of the F&E system through the availability of accurate, timely and relevant information.

The availability of better statistical data will enable us to compete with industry more effectively during annual tariff negotiations and in the long run, result in lower costs to the department. Currently, annual expenditures for the purchase of services from the moving industry amount to approximately $70 million dollars.

5.5 TRANSPORTATION OFFICE AUTOMATION PROJECT (TNOA)

This project will assist base and station transportation authorities with routine administration such as record keeping, filing, sorting, lists, reports and returns. The labour intensive manual system currently in place results in the lack of timely, useful and accurate information available to a Base Transportation Officer (BTNO) for him to make the most efficient and economical use of his vehicle, manpower and financial resources. This system is designed to provide Base Traffic, Vehicle Safety and the BTNO with word processing and communications capability thereby forming a

local transportation information network. The system establishes a communications link between bases and headquarters thus creating the potential for a regional/national transportation network for mutual cooperation and regional transportation coordination. This system will also standardize all administration and documentation within our transportation system and provide the basis for a national management information system. Trial sites include one base from each of the major functional commands; CFB Kingston, CFB Trenton, CFB London, CFB Lahr and CFB Halifax.

Due to the magnitude of this project, it has been divided into two phases. The first phase consists of a trial of five representative base transport organizations in order to validate the hardware and software that has been chosen and to refine operating and training procedures. The second phase entails adding the remaining thirty-seven bases and stations to the system.

5.6 BASE AUTOMATED TRANSPORTATION OPERATIONS SYSTEM (BATOPS)

A requirement exists to provide automation support to base transportation unit operations. BATOPS, is an integral part of a large capital project which will automate many of the functions performed at bases and stations. Unlike the word processing application described in the TNOA Project, BATOPS will be a database management system that provides the necessary support to unit administration, record keeping, statistics gathering and despatch operations. The system has been designed to simplify and streamline base transport activities. The information, once automation is introduced, will form a dynamic data base upon which transportation supervisors will be able to draw in order to make effective use of resources.

5.7 STRATEGIC MOVEMENTS PLANNING SYSTEM

ADP assistance for contingency planning will significantly reduce the error potential and provide immediate access to the display and amendment of data. In addition, associated hard copy capability will permit the production of phased and master deployment schedules both in draft and final form, with programmed formats from the same data base. The whole process of assembling and moving forces, as well as allocating strategic lift resources for deploying forces will be significantly enhanced.

5.8 VEHICLE SAFETY SYSTEM

DGT is responsible for developing and promulgating all policy concerning vehicle safety, driver qualifications and licencing for the CF. In order to devise and implement an effective national vehicle safety programme and to provide a means of measuring performance, it is necessary to develop a management information system based upon accident statistics and driver information. Potential applications include manipulation of information from accident reports, maintaining records for driver incentive awards,

accident reports, maintaining records for driver incentive awards, driver profiles, accident profiles, maintaining a defensive driving instructors file, sorting a large volume of reference material, and manipulating data in order to answer ministerial and other inquiries. An improved national vehicle safety programme will result in a reduction in vehicle damages, personal injuries and fatalities.

5.9 CF FOREIGN TRAFFIC UNIT PROJECT

The Canadian Forces Foreign Traffic Unit (CFFTU) in Montreal is responsible for arranging all movement of materiel by sea for the CF. Last year this represented approximately 1000 motor vehicle shipments to Canada and 1800 automobile shipments Westbound. 800 sea containers were shipped out of the CFFTU and 1600 were received. In addition, there are recurring special projects such as the shipment of ammunition, goods off contract, and exercises. In order to arrange, control and monitor the import/export,customs clearance and inland shipment of goods, a great deal of documentation must be initiated by the CFFTU. A local area network of word processing equipment and personal computers will greatly assist them in the performance of their duties.

6.0 CONCLUDING MATERIEL

All of the systems discussed, as well as eight other automation projects have been initiated by DGT within the last two years and are presently under development. While some systems remain purely conceptual, others are fully functional, operatinal systems. The number of projects being developed concurrently, and the vast scope of applications inspired the creation of the Transportation Management Information System. The framework of this TMIS ensures that standardization, compatability and communications requirements are addressed early enough to guarantee the development of a true managerial system. Automating transportation within the Canadian Forces is a massive undertaking which will take many years to accomplish, but a remarkably good start has been made.

Bibliography

Birkin, Stanley J. and Donald H. Sanders. Computers and Management In a Changing Society. McGraw-Hill, Inc., 1970.

Boucher, W.I. and E.S. Quade, ed. Systems Analysis and Policy Planning Applications in Defense. American Elsevier Publishing Company, Inc., 1968.

Dickerson, Steven L. and Joseph E. Robertshaw. Planning and Design. Lexington Books, 1975.

FitzGerald, Ardra F., Jerry FitzGerald and Warren D. Stallings, Jr. Fundamentals of Systems Analysis. 2nd Ed., John Wiley & Sons, Inc., 1973.

DISCLAIMER

This paper represents the views of the author and does not necessarily reflect the official position of the Department of National Defence.

ON THE OPERATING ASPECTS OF MATERIEL DISTRIBUTION ACTIVITY WITHIN THE CANADIAN FORCES

by

Kevin Y.K. Ng*+
M.N. Lam+
J.R. Hudson*
Maj M.B. Turnbull*

* Operational Research and Analysis Establishment, Department of National Defence, Ottawa, Ontario

+ Faculty of Administration, University of Ottawa, Ottawa, Ontario.

1.0 Introduction

In support of the National Materiel Distribution System (NMDS) study, the Operational Research and Analysis Establishment within the Department of National Defence was requested to examine the operating aspects of the materiel traffic activity in the Canadian Forces (CF). The intent was to ascertain whether the system met the approved system objectives, namely, "to deliver materiel safely, on time, and at least cost to its destination".

The NMDS study was to consider CF materiel distribution in its full national context. However, due to the lack of a management information system for materiel traffic activities, the task of accomplishing the study on a CF-wide basis would have been too costly in terms of resources, time and money. A random sample of the traffic activity in the Western Region of Canada was chosen as the basis for a special data collection survey and the collected data were analyzed to establish the effectiveness and efficiency of the traffic movement. The performance of the entire materiel traffic system (MTS) was then statistically inferred. Due to the lack of an appropriate data base on historical materiel traffic movements, there was no baseline for comparison purposes and the standard or classical performance measures for this one time snapshot of the MTS in the Western Region did not provide a basis whereby the performance of CF transportation operations could be evaluated. Other evaluation techniques had to be used to establish the levels of effectiveness and efficiency of the MTS.

The organization of the paper is as follows. The principles and policy that apply to materiel traffic activity within the CF is outlined in the next section. This is followed by a discussion of

the data sample. Finally, the evaluation methodology for the effectiveness and efficiency of the materiel distribution within the CF is explained.

1.1 The Materiel Traffic System

The basic principle of materiel traffic management within the CF is to effect delivery of the required materiel in serviceable condition, at the place and on the date designated by the consignee, in a safe and cost effective manner. In addition to the liaison, coordination, planning and programming functions, materiel traffic activity embraces receiving, shipping and customs clearance tasks. It is a policy of the Canadian Forces that materiel should be moved by the most practical and efficient means, including military and non-military transport, consistent with urgency and economy. This implies that where adequate and economical CF facilities and equipment are available, they will be utilized to the fullest extent possible. Thus, small lot shipments should be considered for consolidation along the CF transportation system whenever possible in order to economize on transportation and documentation costs.

Within the Canadian Forces Supply System, supply materiel requested by a consignee is assigned a priority code to reflect the urgency of requirement for the materiel. The codes are defined as OX for Immediate Operational Requirement; 01 and 02 for Urgent Requirements (with the former having a shorter available delivery time from the demand date than the latter); and 03 and 04 for Routine Requirements (where the former is mainly for a specific project and may have a shorter available delivery time than that for Code 04). The essence of the performance evaluation for the materiel traffic system is to determine the degree of satisfaction of assigned due-dates for each materiel priority code. Here, it should be emphasized that there is no obvious advantage in delivering the low priority CF supplies (Codes 02, 03, 04) earlier than the assigned due-dates. Interest will also be directed towards investigating the output per unit cost of delivering supplies from the originating traffic agent (TA) to the consignee.

Presently, the movement of CF materiel is a series of sequential actions which occur over a period of time in different locations. It involves a planned set of Canadian Forces transportation and/or common carrier operations. In brief, the operations are as follows: the traffic agent attempts to consolidate consignments where possible into shipments, marshalls shipments and completes a movement plan; a carrier transports the shipments to the specific destinations and a destination traffic agent receives and inspects incoming shipments for loss or damage. A diagramatic illustration of the sequential actions of the materiel movement through the CF transportation operations can be found in Fig. 1.

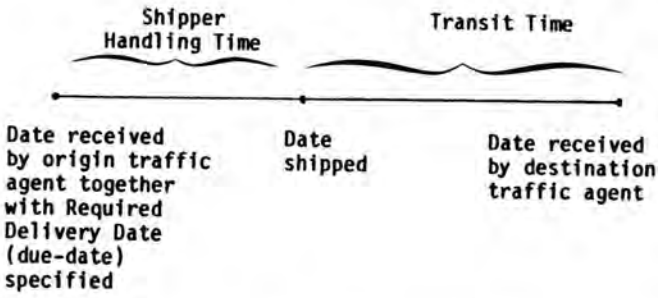


Fig. 1 - Diagram Showing the Various Time Factors Involved in the Transportation Problem

The transportation of CF materiel can be accomplished either by means of CF resources (e.g. Mobile Support Equipment, Air Transport) or commercial means (e.g. Rail, Road, Road Express, Bus, Parcel Post, Commercial Air Freight, Air Express). The Required Delivery Date or due-date is the overriding consideration in selection of the mode of transportation. The mode providing the fastest means of transportation necessary to satisfy the Required Delivery Date should normally be used. Premium transportation, such as Air express, Air freight, etc., should be used only when urgency or characteristics of a particular shipment dictate.

1.2 Materiel Traffic System Sample Data

To collect data, shipping information forms for inbound and outbound shipments were designed and forwarded to various CF bases/stations in the Western Region. The inbound shipment form identified the transportation control number (TCN), the origin and destination base/station, the date received by the consignee, and the weight, volume, mode and materiel priority codes of the shipment. The outbound shipment form collected information on the TCN, the origin and destination base/station, the Required Delivery Date (RDD), the date received from the consignor, the date shipped, the cost, the mode, the materiel priority codes, the weight and volume.

The data sample was collected during time periods, 1 Nov - 15 Dec 1983, and 15 Jan - 29 Feb 1984. A total of 117,083 inbound and outbound shipments (records) were collected. With this sample, 35,669 records were rejected as invalid (e.g. incomplete TCNs) or absence of information on a shipment's final destination. There were a total of 38,345 valid inbound and 43,024 valid outbound records in the sample. The number of shipments where both the

shipper and receiver could be identified through common TCN was 10,298 shipped by CF resources and 1,655 shipped by commercial means. Of the latter, 1141 records or 68.94% contained no indication of cost. This seriously reduced the accuracy of the calculated cost efficiency measure for commercial carriers.

2.0 Measuring MTS Effectiveness and Efficiency

2.1 Effectiveness

Many measures of effectiveness and efficiency might have been selected for the purpose of studying MTS performance [1,2,3]. However, to those operating the CF transportation system, the performance measure of greatest interest is the degree to which a consignee's requirements are met. Since materiels that miss their due dates will directly or indirectly affect the military readiness of the CF, failure to meet the Required Delivery Date (RDD) is taken as the performance measure. The effectiveness of the operating aspects of the CF materiel traffic system is assessed using the following performance measure:

$$\%\ \text{RDD violations} = \frac{\text{Number of shipments not meeting RDD}}{\text{Total number of shipments shipped to meet RDD as specified}} \times 100\%$$

From the collected data, this effectiveness measure has been calculated for each materiel priority code (MPC) and plotted in Fig. 2. Assuming that the data sample is unbiased and random, 95% confidence intervals [4] for the effectiveness of the entire MTS are included in Table I.

Table I

MTS Levels of Effectiveness

MPC	Total number of shipments less pre-shipment violations*	% RDD Violations For The Sample Data	95% Confidence Interval For The % RDD Violations For The Entire MTS
OX	492	33.9%	29.9% - 38.2%
01	866	24.9%	22.1% - 27.9%
02	2071	15.7%	14.2% - 17.3%
03	2641	9.4%	8.3% - 10.6%
04	2402	6.1%	5.2% - 7.1%

* Pre-shipment violations occur when the RDD has already been passed before receipt by originating TA. There were a total of 3481 pre-shipment violations out of 11,953 shipments.

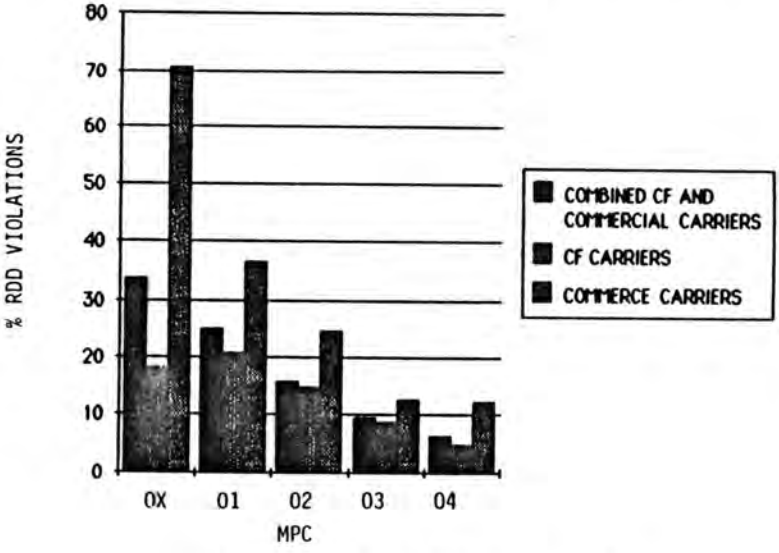


Fig. 2 - Levels of Effectiveness For Sample Materiel Traffic Data

2.2 Efficiency

By definition efficiency defines the relationship between resource input and resulting output. Within the CF we must concern ourselves with two measures: one relating to commercial carriers based upon cost; and the other based upon CF vehicle fleet utilization. The efficiency measure for commercial transport is:

$$\text{COST EFFICIENCY} = \frac{\text{WEIGHT X DISTANCE}}{\text{COST}}$$

(This cost efficiency measure is just the inverse of the cost per output, e.g. cost per ton-mile.) In Fig. 3, the cost efficiency measures calculated from the data for the different modes of transportation are presented. These results correspond to our expectation that cost efficiency for Air Express would be lowest, and Rail would be highest. It is interesting to note that the 'bus' has a remarkably low output to cost ratio, even less so than 'air'. The 95% confidence intervals for the efficiency of the entire MTS are presented in Table II.

Table II

National Materiel Distribution Study

Transportation Efficiency By Commercial Mode

Mode	95% Conf. Interval For Cost Efficiency For Entire MTS
Air Express	0.148 - 0.263
Bus	0.111 - 0.364
Air	0.322 - 0.438
Post	0.486 - 0.626
Road Express	0.259 - 0.993
Road	0.599 - 1.086
Rail	1.604 - 2.243

N.B. The small sample size of the bus shipments required that the Student's t-distribution be used for the evaluation of this confidence interval.

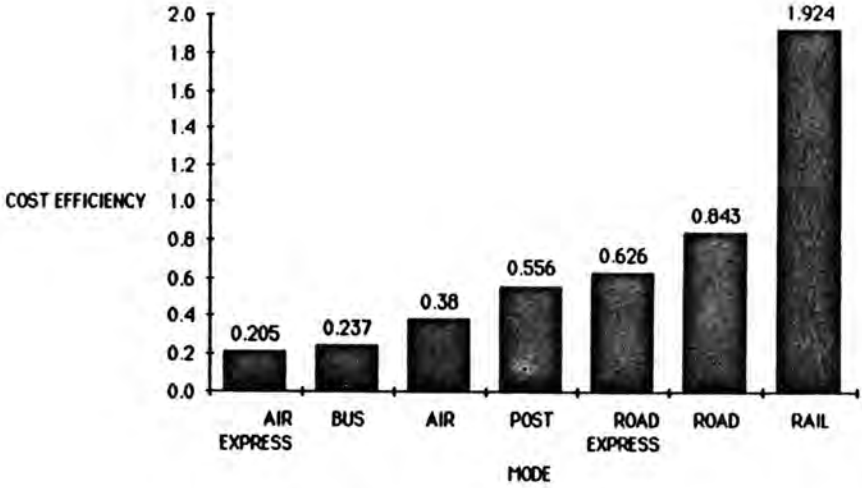


Fig. 3 - Levels of Efficiency For Sample Materiel Traffic Data

The assessment of vehicle efficiency or utilization is difficult because the operation of CF carriers (vehicles or aircraft) is a policy decision, not totally related to cost. There are also varying capacities of different types of vehicles used along different routes. Vehicle utilization assessment is further confounded by the use of both scheduled and unscheduled freight services. This aspect of the study is still under investigation and will not be dealt with in this paper.

2.3. Mean Early Time Evaluation

The % RDD violations in Table I and the cost efficiency measures in Table II, although accurate measures on their own, have no baseline for comparison purposes. Are the resulting values, therefore, good or bad? What is the trend? With the lack of a management information system for CF materiel traffic operations, historical performance cannot be studied and such questions cannot be directly answered. Comparison of the results with those of other such military systems is not possible due to the unique situation of the Canadian Forces in this regard. Given these constraints, a 'mean early time' evaluation scheme is used to quantify MTS performance. This technique in analyzing performance is novel in the literature. It depends mainly on the inherent nature of our problem, namely, there is no obvious advantage in delivering low priority items (Codes 02, 03, 04) earlier than the assigned due-dates. The mean early time scheme illustrates the extent of the potential for more fully utilizing early time to consolidate shipments at the originating traffic agency and also the possibility of transporting materiel on a higher cost-efficient mode of transport.

Table III presents the mean early time for Code 02, 03 and 04 items shipped via commercial means. (Codes 0X, 01 items are omitted in the Table because, by definition, they are urgent requirements and immediate delivery for these supplies is necessary.) Also included in the Table are the calculated 95% confidence intervals for the mean early times of the entire MTS.

Table III

MTS Mean Early Times

Materiel Priority Codes	Total Shipments Less Pre-Shipment Violations	Shipments Delivered To Consignee On Or Prior To Due-Date	Mean Early Time (In Days)	95% Confidence Intervals For Mean Early Times For Entire MTS (In Days)
02	226	170	6.27	5.27 - 7.28
03	388	339	11.65	10.85 - 12.45
04	376	330	15.49	14.68 - 16.30

Fig. 4 illustrates the commercial modes of transportation used for the shipments in Table III delivered on or prior to the assigned due-dates.

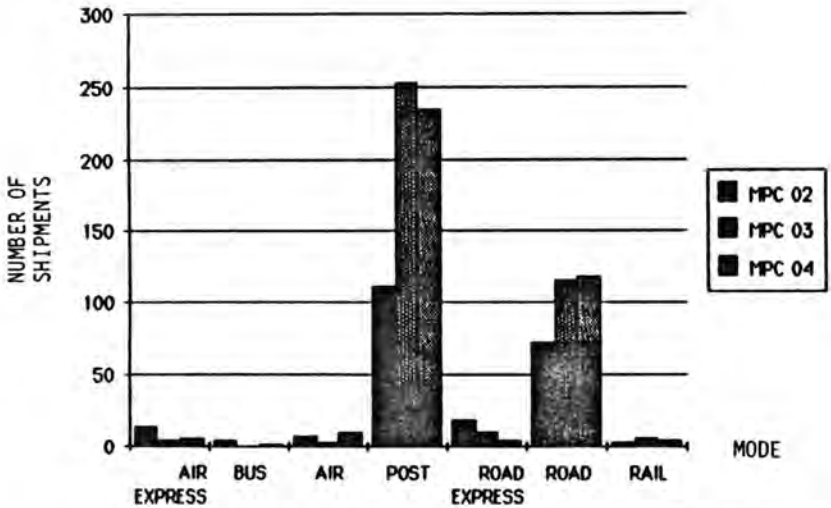


Fig. 4 - MTS Utilization of Commercial Mode Of Transport For Shipments Delivered On Or Prior To Due-Dates

By combining the information from Table II and Fig. 4, the percentages of shipments that use low and high cost efficient modes of transportation are calculated and presented in Table IV.

Table IV

MTS Utilization Of Low And High Cost Efficient Commercial Modes Of Transportation

MPC	Low Cost-Efficiency (Air Express, Air, Bus, Post, Road Express)	
	% of Sample Employing This Means Of Transport	95% Confidence Interval For Entire MTS
02	67.26%	61.14% - 73.37%
03	69.07%	64.47% - 73.67%
04	67.29%	62.55% - 72.03%

MPC	High Cost-Efficiency (Road, Rail)	
	% of Sample Employing This Means Of Transport	95% Confidence Interval For Entire MTS
02	32.74%	26.62% - 38.86%
03	30.93%	26.33% - 35.53%
04	32.71%	27.97% - 37.45%

Approximately 2/3 of the low priority commercial shipments of the MTS are shipped via low cost-efficient means of transport (Table IV). This situation is further worsened by the fact that shipments arrive at destination a lot earlier than the assigned due-dates, as depicted in Table III. Thus there exists some scope for improving the cost- efficiency of commercial shipments without reducing current levels of effectiveness. Areas in which the MTS might be improved are suggested by the above analysis of early shipment arrival times. However, there are within the MTS limited opportunities for improvement that are imposed by geographical and physical factors. For example, for some CF bases/stations, there might not exist the space or facilities whereby the shipments can be held for consolidation.

3.0 Concluding Remarks

This study of the operating aspects of the departmental National Materiel Distribution System (NMDS) required the collection and analysis of large amounts of data. This information on materiel and traffic movement is not available to NMDS managers as there is no automated data collection system currently operating in support of this function. All data have been collected on hand-written forms listing 117,083 materiel movements during a total three months period in the Western Region. Its subsequent transcription to computer tape records has required over a year and a half and a tremendous effort from full and part-time professional and clerical staff to bring it to its present state. However, the information upon which the results of this report is based is both limited in scope (confined to the Western Region) and by now, relatively old. It represents only a one-time reading of NMDS operation, and deficiencies in the data collection, such as the absence of cost data in many of the records submitted, cannot, without an unreasonable amount of further time and expense, be corrected.

The lack of an automated management information system for NMDS managers within the Department of National Defence is much more serious, however, than the difficulties it has imposed upon the conduct of this study. Those responsible for managing the system and achieving the highest levels of operational efficiency and effectiveness lack the essential information necessary for system planning and control. The data gathering and reduction processes used for this study are totally inadequate for management purposes. It is obvious that a nation wide information system network is required to bring together the large number of locations where transportation management decisions must either be made or acted upon. While it is clearly beyond the scope of this study to attempt to specify such a system, it does identify many of the major issues that would have to be addressed and highlights their relative importance and interdependence.

References

1. P.R. Stopher. A.H. Meyburg, Transportation Systems Evaluation, Lexington Books, 1976.

2. M.L. Manheim, Fundamentals of Transportation Systems Analysis, Vol. 1: Basic Concepts, MIT Press, Mass., 1979.

3. G.J. Fielding, T.T. Babitsky, M.E. Brenner, Performance Evaluation for Bus Transit, Transportation Research A, Vol. 19A, No. 1, pp. 73-82, 1985.

4. I. Guttman, S.S. Wilks, J.S. Hunter, Introductory Engineering Statistics, 3rd Ed., John Wiley & Sons Inc., 1982.

The views presented in this paper are solely the opinion of the authors and do not represent the official views of ORAE and the Department of National Defence, Canada. Finally, the authors gratefully acknowledge ORAE's permission to publish this work.

THE USE OF ADVERTISING AS A MARKETING VARIABLE BY CLASS I INTERCITY FOR-HIRE MOTOR CARRIERS IN THE U.S.: A PRELIMINARY ANALYSIS

by

Grant M. Davis, University of Arkansas
William R. Darden, University of Arkansas
John E. Dillard, Jr., University of Tulsa

1.0 Introduction

Prior to congressional passage of the Motor Carrier Act of 1980 (U.S. Congress, 1980), motor carriers primarily marketed their for-hire freight services almost entirely through personal sales efforts (Davis, 1978). In short, marketing programs by motor carriers were essentially personal sales efforts directed to end-use market segmentation; a practice which at best can be euphemistically termed "marketing". Obviously, this somewhat pervasive industry sales effort fails to conform with the conceptual framework of marketing found in the literature. Indeed, marketing was for all practical purposes a neglected area when viewed in the total marketing concept perspective.

Carrier marketing efforts were narrowly constricted for a number of sensible institutional reasons. First, operating routes and rates were for the most part allocated and fixed. Secondly, freight service is essentially a "wholesale" activity as opposed to passenger service which is primarily a "retail" activity (Sampson, 1985). Thirdly, transportation demand is a derived demand functionally dependent upon changes in industrial production and hence is relatively price inelastic when examined on a macro dimension.[1] Fourth, transportation output is homogenous[2]- ton-miles - and hence, difficult to differentiate except on a service basis.[3] Fifth, and lastly, transportation decision-makers regarding freight purchases are difficult if not impossible to identify relative to carrier selection.[4] In short, the common carrier segment of trucking was treated as a classical public utility even through its economic characteristics were somewhat incongruent with other public utility enterprises.[5]

Since 1980, the motor carrier industry has undergone and continues to undergo rather dramatic restructuring; a

process continuing to this day. Liberalized market entry and route restriction modifications have resulted in a plethora of new carriers entering this finite market - over 28,000 (Klein, 1985) - but the majority of these new firms are special commodity truckload carriers or even non-unionized subsidiaries of existing carriers. Rates still have to be published in tariffs and complied with, and price changes can be made in one day except under special circumstances dealing with increases (49 CFR 1307.45). Even though the industry is undergoing dramatic restructuring and earnings are marginal at best (Silberman, 1985), carrier marketing strategies continue focusing on market coverage and terminal placement, with primary emphasis remaining on personal sales service efforts rather than any careful integration of price, promotion, and distribution strategies (Davis, 1978).

Given the climatic impact of regulatory reform and marginal earnings, together with flat traffic projections, one would anticipate that carriers would employ strategies other than price discounting, market coverage, and terminal placement in the freight industries. Advertising as a strategy or marketing tool was not used extensively by the trucking industry prior to 1980. Even though the product appears homogenous, the presence of 14.5 trillion different published prices suggest massive and successful attempts to achieve product uniqueness (Davis, 1975). Informative advertising, moreover, would appear to be appropriate in the case of motor freight service because it not only increases competition, but if successful can inject elasticity in the demand curve, reduce prices, and increase revenues for the successful practitioner (Stanton, 1971).

Because of the structural changes occurring in trucking brought about by liberalized market entry and price freedom, the primary purpose of this paper is to tentatively evaluate the use of advertising by class I motor carriers in the new market environment. Unfortunately the results were not promising, i.e., the extent of widespread product advertising in the wholesale freight markets is questionable. To be more precise, the specific purpose of this paper is to determine if carrier advertising has increased since the passage of the Motor Carrier Act of 1980. Also, a judgmental survey attempted to gain indepth insight into why advertising activities have not increased since 1980.

With all of the regulatory changes which have occurred in the motor carrier industry, it is important to ascertain the effect that deregulation has had upon the firm's marketing efforts. Marketing executives of carriers should be interested in changes in the use of advertising since the Motor Carrier Act of 1980.

Basic variables to be examined in this paper include frequency of freight service advertising, whether or not an advertising agency is employed, perceived importance of the available various advertising media used (Davis, 1978), and, more importantly, whether or not a carrier's advertising practices have changed since regulatory reform. Other important marketing constructs such as personal sales are ignored, for the purpose of this paper, as previously stated, focuses upon carrier use of advertising. No attempt is made, moreover, to classify advertising per se either on a manipulative or informative basis.[6] Lastly, these carrier's primary businesses are in the wholesale freight area; not the retail passenger segment of the domestic transportation industry where the use of advertising is pervasive. The initial survey, moreover, is supplemented by the indepth judgmental survey of four carrier executives responsible for advertising programs.

2.0 The Survey

Inasmuch as the primary purpose of this paper is to measure the use of advertising by firms in the motor carrier industry, the primary research methodology uses a survey of carriers randomly selected from a listing of common carriers listed in Standard and Poors Directory. Dependent and independent variables were used to test certain hypotheses associated with advertising use.

In order to test certain hypotheses, a census was taken of common carriers listed in the Standard and Poors Directory,[7] i.e., sixty-five common carriers are listed in this Directory and, hence were selected to form a census for examination and testing of hypotheses regarding carrier reliance or emphasis upon the use of advertising. Because of deficiencies associated with this census, a judgmental survey was conducted of four major common carriers not contained in the Directory.

One dependent variable of the study was "perceived effectiveness of the firm's advertising efforts," while a second dependent variable is "respondent's perceived change in the use of advertising since the passage of the Motor Carrier Act of 1980." The independent variables measured included both demographic and attitudinal variables. More specifically, the independent variables were: (1) frequency of advertising; (2) use of an advertising agency; and, (3) media preferences. From a pure classification perspective, moreover, advertising was considered to be informative in nature. The judgmental sample augmented these variables.

2.1 Hypotheses

To conserve space, the hypotheses to be tested in this

manuscript are stated in the null form, and each statement of the hypothesis is followed by a pithy explanation of the findings. In all cases the .05 level of significance was employed for all testing of statistical significance.

Hypothesis #1. There is no significant difference between those freight companies which perceive freight service advertising as being effective and those companies which perceive it as being ineffective, with respect to how often freight service advertising is used.

At the .05 level, the t-test indicates there was no significant difference between freight companies perceiving advertising as being effective and those perceiving it as being ineffective, with respect to freqency of advertising. On the average, both groups advertised more on a monthly or quarterly basis, but neither advertised more frequently or less frequently than the other: observations reflected in Table 1.

TABLE 1
FREQUENCY OF ADVERTISING

FREQUENCY OF ADVERTISING PLACEMENT	PERCENT OF PLACEMENT
Weekly	3.8
Monthly	38.5
Quarterly	23.1
Other	30.8

2 Tail T-Test Probability = .335*

*This is the 2 tail t-test probability when comparing those freight companies which perceive freight service advertising as being effective and those which perceive it as being ineffective.

Hypothesis #2. There is no significant difference between those freight companies which perceive freight service advertising as being effective and those which perceive it as being ineffective, relative to using or not using an advertising agency to prepare and place the copy.

Table 2, moreover, reveals in the t-test that there was a significant difference between the two groups at the .05 level. Those freight companies that perceived freight service as being effective used advertising agencies significantly more than those who did not perceive advertising to be effective. This might indicate that advertising agencies do a better job of freight service advertising than "in-house" advertising given the general industry feelings that "wholesale" advertising has little

if any impact on revenues; hence, the usage of outside agencies is more prevalent than in-house advertising. This particular finding is not surprising simply because freight carriers that use advertising are more apt to seek "outside" assistance because of an inability or perceived luxury of maintaining an "inhouse" advertising capability. Arkansas Best Freight, for example, has one executive responsible for public relations and one of his many responsibilities is advertising. This firm, an inordinately large advertiser by motor freight carrier standards, uses outside agencies for all advertising programs.

TABLE 2
USE OF ADVERTISING AGENCIES BY FREIGHT COMPANIES

ADVERTISING AGENCY IS EMPLOYED	TOTAL PERCENT OF OCCURRENCES
Yes	61.5
No	38.5
	100.0

2-Tail T-Test Probability = .001*

*This is a 2 tail t-test probability when comparing those freight companies that perceive freight service advertising as being effective and those that perceive advertising as being ineffective.

Hypothesis #3. No significant differences exist between freight companies who feel freight service advertising is being effective and those that believe it is ineffective, relative to the importance of using newspapers as a media outlet.

The t-test revealed that those freight companies having a favorable perception of the effectiveness of advertising display a significantly stronger preference for newspaper advertising than companies having an unfavorable perception of the effectiveness of freight advertising. In other words, newspapers were significantly more important to the companies perceiving frieght advertising as being effective as an advertising medium; an observation is illustrated in Table 3.

Hypothesis #4. There is no significant difference between freight companies who perceive freight service advertising as being effective and those perceiving it as being ineffective, with respect to the importance of magazines, radio, television and direct mail, as media for advertising messages.

As shown in Table 3, the t-tests on magazines, radio

spots, and networks all revealed no significant difference between freight companies who perceived advertising as being effective and those who perceived it as being ineffective, relative to advertising media. That is, neither group attached any more importance to the use of magazines, the use of radio, the use of television or the use of direct mail for advertising purposes than did the other group, a surprising development given the nature of the industry. Newspaper and magazine preference reveals the industrial goods nature of trucking rather than any strong perception of the effectiveness of any given medium. Many of these media efforts, moreover, are more public relations measures than any serious attempt to gain product uniqueness (Davis, 1978).

TABLE 3
MEDIA PREFERENCE OF FREIGHT ADVERTISING

MEDIA PREFERENCE	TOTAL PERCENT* OF OCCURRENCES	2 TAIL** T-TEST PROBABILITY
Newspaper	50.1	.034
Magazine (General)	47.2	.461
Spot Radio	24.1	.457
Television	19.2	.215
Direct Mail	89.5	.156
Trade Journals	96.2	.009

*All freight service advertisers used multiple media.

**This is the 2 tail t-test probability when comparing those freight companies that perceive freight service advertising as being effective and those that viewed advertising as being ineffective.

Hypothesis #5. No significant difference exists between those freight companies which feel freight service advertising is effective and those which believe it is ineffective, with respect to the importance of the use of trade journals as an advertising medium.

The t-test revealed that freight companies perceiving freight service advertising as being effective attached a significantly stronger preference for the use of trade journals than those companies who perceived freight advertising as being ineffective. Again, as was the case with newspapers, the companies perceiving freight service advertising as being effective attached more importance to the use of trade journals that the other group of companies; an observation revealed in Table 3. Trade journal advertising, moreover, would be expected given the intangible nature of products sold and its market, i.e., ton-miles in wholesale markets.

Hypothesis #6. There is no significant difference between those freight companies which perceive freight service advertising as being effective and those which perceive it as being ineffective, with respect to the effect of deregulation.

Table 4 data reveals that the t-test indicates no significant difference exists between the companies having a favorable impression of advertising effectiveness in the freight service industry and those with an unfavorable impression of advertising effectiveness, with respect to the effect of regulatory reform. Or, a majority of both groups were forced to change their advertising practices since deregulation, but neither group changed significantly more than the other. One partial explanation to this observation may be the concatenated administrative deregulation by the ICC that occurred from 1978 until 1980,[8] a trend that ultimately resulted in the Motor Carrier Act of 1980.

TABLE 4
PERCEIVED CHANGES IN USE OF ADVERTISING
SINCE DEREGULATION OF MOTOR CARRIER INDUSTRY

PERCEIVED CHANGES IN ADVERTISING SINCE DEREGULATION	TOTAL PERCENT OF OCCURRENCES
Definite Change	73.1
No Change	26.9
	100.0

2 Tail T-Test Probability = .609*

*This is the 2 tail t-test probability when comparing those freight companies that perceive freight service advertising as being effective and those that perceive it as being ineffective.

Four additional hypotheses were tested regarding carrier advertising practices since 1980. These hypotheses basically dealt with demographic and attitudinal factors. First, t-tests revealed no significant differences between carriers that had changed their advertising practices since 1980 and those that did not with respect to advertising frequency (P.=.657). Secondly, t-tests revealed no significant difference between the two select groups of carriers relative to the use of advertising agencies; a difference did exist, but not significantly. Thirdly, no significant differences existed between the two groups of carriers regarding the importance of preference to any given advertising media. Or, both groups attached the same amount of importance to newspapers (P.=.925), magazines (P.=.079), radio

(P.=.207), television (P.=.076), trade journals (P.=.229) and direct mail (P.=.097). In short, the media used did not change in importance, thereby supporting earlier observations regarding product homogenity, and the dichotomy between firms committed to advertising and those not using the practice.

Regarding the important issue of advertising effectiveness, the data revealed that carriers believing in the effectiveness of advertising before 1980 slightly increased their level of belief, but not significantly more than carriers not committed to advertising (P.=.425). In other words, carriers committed to the perception that advertising was effective before 1980 continued with this belief, but carriers that did not believe in the effectiveness of advertising continued in their belief.

3.0 The Judgmental Sample

Because of certain limitations associated with any carrier sample selected from Standard and Poor's Directory, the authors interviewed four general freight carriers. These four carriers were selected on a judgmental basis and consisted of one regional LTL general commodity carrier with revenues of $235 million; one seven-state LTL general freight carrier with gross receipts of $65 million; one LTL general freight carrier earning $600 in 1985; and one TL general freight carrier with nationwide authority grossing $192 million in revenues. All four carriers used advertising to some extent before 1980.

Five basic questions associated with advertising were directed to the marketing executives responsible for the carrier's overall marketing efforts. Each question and response will be qualitatively analyzed relative to their use of advertising, a technique that should provide more indepth perspective into advertising use in an industry undergoing major deregulation and restructuring.

Question One. Do you believe advertising in the motor carrier industry is effective? If so, does it increase revenues for your firm?

All of the carrier executives interviewed believed advertising was effective and that it is needed even though the impact on carrier revenues was difficult to quantify. The two major LTL general freight carriers stated that advertising to increase customer awareness is essential, but does not necessarily generate a definitive amount of freight. The smaller LTL general freight carrier replied that advertising of services made personal sales efforts easier and the executive perceived an increase from advertising although the amount could not be

isolated from general traffic trends. The TL general freight firm responded that name recognition was important but questioned its impact on revenues generated. This segment of the carrier market was more "large customer" oriented where price/service factors dominate sales efforts. All four carriers obviously are committed to using advertising as a marketing variable but have reservations regarding measuring the effectiveness of advertising.

Question Two. If you advertise, do you use trade journals, newspapers, television, or radio?

All of the carriers interviewed advertised, and none used radio as a medium. None of the carriers used television or newspapers for copy placement. The respondents stated these three media were two broad and did not focus upon the decision-maker of purchases of services. The extent of journal advertising varied considerably among the four firms. All used Traffic World for advertising displays. The large LTL general freight carriers used the Wall Street Journal, and the truckload carrier advertised in trade journals of industries in which it transported goods. The regional LTL general freight firm relied upon "mail-outs" showing maps, routing guides, and service levels. All agreed, moreover, that the bulk of their advertising effort could almost be categorized as institutional in nature. In short, transportation trade journals represented the principal advertising media for all of the carrier involved.

Questions Three. Do you use an advertising agency for placing ads, or do you have an in-house capability to prepare advertising materials?

The large LTL general freight carriers develops ad concepts in house, but uses an outside agency for trade journal placement. The other two LTL carriers likewise develop material on an in-house basis and places advertising layouts with media. The truckload carrier, on the other hand, prepared some materials in house and other material is prepared by the outside agency. None of the carriers were willing to rely upon an outside agency for ad development and placement to any meaningful degree.

Question Four. Has your advertising budget increased or decreased since 1980?

Replies varied relative to this question. The large LTL carrier and the large LTL regional carrier responded that their actual budget for advertising decreased dramatically since 1980. These are unusual responses given the restructuring of the industry occurring since 1980 and were explained thusly: the number of persons preparing

advertising matter such as point lists and routing guides decreased as a part of overall cost cutting in response to deregulation. By relying almost entirely on a reduced staff, budget outlays such as staff and printing costs were curtailed. Also, more selective placement reduced costs. The small regional LTL carriers, conversely, reported that advertising budgets were approximately three times greater in 1985 than in 1980. This respondent, a growing carrier, felt that market exposure was essential and ergo was willing to sustain an increased advertising expense in order to facilitate sales calls. Somewhat surprisingly, the large TL carrier reported advertising as a percentage of total budget outlays were approximately the same as those incurred before 1980. This response was surprising in that this segment of trucking is the most volatile with some 20,000 new firms since 1980.

Question Five. How often do you advertise? Weekly, monthly, quarterly, or annually?

All of the carriers advertised monthly with major trade journal ads placed on a quarterly basis. The three LTL general freight carriers placed ads on a regular basis, while the TL general commodity carrier advertised on a variable time basis usually associated with either a terminal opening or new service offerings.

By interviewing the four carriers several facets of carrier advertising practices were gleaned which were not evident from the results of the survey selected from Standard and Poor. First, advertising in the LTL general freight market is not functionally related to size. That is, the large firm did not feel more compelled to advertise than the two smaller firms. Secondly, advertising outlays since 1980 have decreased among three of the respondents, an unanticipated expectation. Third, advertising agencies are used merely as a channel for ad placement by the four carrier involved. Fourth, only one of the respondents appeared truly dedicated to an ongoing program of advertising, even though all of the respondents proffered a belief in the effectiveness of advertising in increasing revenues. Fifth, and lastly, all three of the LTL general freight carriers advertised in industry trade journals. Only the TL general freight carrier placed advertising in an "end-use" publication.

4.0 Summary and Recommendations

Advertising by motor carriers before 1980 was not used extensively except by a minority of carriers in the industry. Industry members relied almost entirely upon personal sales efforts in lieu of advertising simply because of the nature of the product produced and marketed: a perceived homogenous ton-mile. Most

advertising was and remains institutional because of the "wholesale" nature of the business, i.e, industrial goods market. The primary purposes of this research effort was to measure the impact of the Motor Carrier Act of 1980 on carrier advertising efforts; a landmark act that liberalized market entry, route structure, and price. Not surprisingly, given the restructured industry, advertising effectiveness has not appreciated in terms of acceptance by carriers. In this regard, the industry's basic perceptions of advertising have not changed since 1980.

When comparing freight companies respondents who see freight service advertising as being effective to those companies believing freight service advertising is ineffective, relatively few differences were discovered. Carriers viewing advertising as effective were more apt to make greater use of advertising agencies to develop and place their advertising, and this same group displayed stronger propensities for newspapers and trade journals, but neither group indicated stronger preferences for the use of magazines, radio, networks, or direct mail.

Also, neither group had a stronger preference for how many times freight service advertising was used (both advertised more on a monthly or quarterly basis). Lastly, both groups of carriers had changed their advertising practices since deregulation, but neither group had changed significantly more than the other. When those freight service companies which had changed their advertising practices since deregulation were compared to those freight service companies which had made no changes with respect to selected demographic and attitudinal factors no significant differences were found between the two groups.

Based on the findings of these surveys, deregulation or regulatory reform has not substantially affected carrier advertising. Because transportation demand is a derived demand and relatively inelastic from a macro perspective, advertising programs would not necessarily increase demand for carrier services. On the other hand, in micro terms advertising can increase demand for service. The judgmental survey reveals a preference for advertising that is probably illusionary, i.e., all believed in the need for advertising, yet budget outlays were reduced, not increased, for three of the carriers.

Advertising effectiveness is difficult to quantify, but the continuing restructuring of trucking with emphasis upon price/quality options suggests that advertising practices and programs used by other service firms in the industrial goods markets should be examined by marketing executives of U.S. trucking concerns developing and implementing market strategy. Failure to recognize and effectively use advertising as a marketing variable is

myopic even in the industrial goods markets. Future research may well reveal more extensive use of advertising by class I intercity motor carriers as the industry restructuring continues.

5.0 Footnotes

[1]A majority of empirical studies reveal that transportation demand is relatively price inelastic when examined on an industry basis. See George W. Wilson, Transportation Economics Analysis of Intercity Freight Transportation (Bloomington, IN: Indiana University Press, 1980), chapter 1.

[2]For an indepth analysis of the putative homogeneity of the "ton-mile", consult George W. Wilson, Essays on Some Unsettled Questions in the Economics of Transportation (Bloomington, IN: Foundation for Economics and Business Studies, 1962), chapter 2.

[3]Third degree price discrimination is one of many methods employed that differentiate ton-mile for individual consignments; see Grant M. Davis and Linda J. Combs, "Some Observations Regarding Value of Service Pricing," Transportation Journal, Vol. 14, No. 3 (Spring, 1975), pp. 49-55.

[4]Why shippers selected a given carrier is difficult to quantify. In many instances, difficulty is encountered when attempting to truly determine the individual in a given organization who actually makes this decision. For an attempt to quantify shipper preference, see Daryl Wyckoff, Timothy Tardiff, and Bram Johnson, "Shippers' Preferences for Trucking Services: An Application of the Ordered Logit Model," Proceedings - 23rd Annual Meeting Transportation Research Forum, Vol. XXIII, No. 1 (Oxford, IN: The Richard B. Cross, Co., Inc., 1982), pp. 195-201.

[5]See Alfred Kahn, Economics of Transportation, Vol. 11 (New York: John Wiley and Sons, 1970), pp. 178-186. But also consult Martin G. Glaser, Public Utilities and Capitalism (New York: Macmillan Co., 1957), pp. 8-13, for an opposing viewpoint.

[6]All carrier advertising efforts were assumed to be of the informative type.

[7]Although other listings of carriers are available for sampling purposes, Trincs, ad infinum, Standard and Poor's grouping providing a census of different types of motor carrier rather than just common, contract, exempt, and private; a classification schema that is not as important as before 1980. This work was originally conducted in conjunction with Professor Steven Green of Southeastern

Louisiana University.

[8]Between 1975 and 1980, the motor carrier industry was partially deregulated through a series of Ex Parte decisions rendered by the U.S. Interstate Commerce Commission. The Motor Carrier Act of 1980 was enacted to define permissible and undesirable limits to which the market liberalization could go. For evaluation of these Ex Parte activities, see Grant M. Davis, Motor Carrier Economics, Regulation, and Operation (Washington, DC: The University Press of America, 1981), chapter 6.

6.0 References

Davis, Grant M., Farris, Martin T., and Holder, Jack J., Jr., Management of Transportation Carriers (New York: Praeger Publishers, Inc., 1978), p. 160.

Davis, Grant M., and Combs, Linda J., "Some Observations Regarding Value of Service Pricing," Transportation Journal, Vol. 14, No. 3 (Spring, 1975), pp. 49-55.

Klein, Marilyn W., Five Years After the Motor Carrier Act of 1980: Motor Carrier Failures and Successes, Office of Regulatory Programs, U.S. Department of Transportation, (Washington, DC: September, 1985), pp. 4-6.

Sampson, Roy J., Farris, Martin T., and David L. Shrock, Domestic Transportation: Practice, Theory, and Policy, 5th ed.: Houghton-Mifflin Co., 1985), p. 109.

Silberman, Irvin, statement before the House Subcommittee on Surface Transportation of the Committee on Public Works, U.S. Congress (November 6, 1985).

Stanton, William J., Fundamentals of Marketing, 3rd ed. (New York: McGraw-Hill Book Co., 1971), p. 535.

U.S. Congress, Public Law 96-296 (July, 1980).

49 CFR 1307.45.

INTERNATIONAL PHYSICAL DISTRIBUTION SYSTEMS AND THE DEMAND FOR AIR FREIGHT

Jacques Picard, Ph.D.
Associate Professor, Administrative Sciences Dept.
Université du Québec à Montréal

1.0 Introduction

During the 1950's when the volume of air traffic began to increase significantly, experts projected that by the 1970's, air freight would constitute a large portion of airline revenue. Some went so far as to suggest that more than 50% of total airline revenue would originate in air cargo. These predictions were based on the assumption that by reducing packaging, freight insurance, and storage costs, air freight would offer many industries, an attractive alternative to conventional especially those dealing with transoceanic markets, modes of transportation. These projections have turned out to be incorrect. With few exceptions, air freight continues to be used by most companies only for emergencies or special circumstances. The object of this article is to account for the effect of organizational distribution structure on the under-utilization of air transportation by multinational corporations.

2.0 Distribution systems for multinational corporations

A company marketing its finished products abroad is faced with several options. Three important alternatives are: it can market its products through on agent, a distributor or a sales subsidiary. There are also a number of possibilities when it comes to the physical distribution of the products. Products can be expedited the warehouses of overseas subsidiaries or distributors and stored there until they are ordered by customers (classical system). They can be sent directly from the production center to the customer warehouse without the intervention of subsidiaries or distributor (direct system). The direct system is often used in cases where a company is marketing its products abroad through n an agent who does not take title of the merchandise. The products might also be shipped to the warehouse of a subsidiary or distributor only after they have been ordered by the customer, and remain there for a short period of time before delivery (transit system).

The main advantadge of the direct and transit systems is that storage costs are reduced. The merchandise is shipped only after it has been ordered by the foreign client and the company is not required to keep an inventory in that market. Storage costs at home may increase but not in excess of the savings achieved in the overseas markets. The direct system includes another advantadge in that handling and shipping expenses are entirely eliminated at the level of subsidiary or distributor. Furthermore, there is no need for transportation between the subsidiary or distributor warehouse and the local customer.

These savings may be offset however by cost increases. The need for a higher frequency of shipments reduces the opportunity for volume discounts, and increases the cost of paperwork, shipping and handling at home. Transit and direct systems also generally require more costly transportation to achieve levels of service similar to provided by a classical system. Furthermore, when the production center and export markets are not linked by an efficient highway or railroad, air cargo services must be used.

The use of one of these systems (i.e. classical, transit or direct) over the others, should ostensibly be dictated by economic market factors. The shorter systems (i.e. direct and transit) make more sense for companies selling high cubic value products (relative to their weight), perishable products, low turnover products, or products with a short life cycle. Also, companies dealing with a limited number of important customers would find a shorter system more beneficial. Other considerations include the level of customer service required by the competition, the cost of inland transportation (in the export market) and host government regulations (customs, export licences, etc.).

Some companies would do better to use different types of systems for different types of products (e.g. a direct system for high cubic value - low turnover products, a classical system for low value - high turnover products). In cases where parts are only rarely requested in a particular market, they can be stored at home and shipped as they are needed by plane.

Most companies are well aware of the benefits of air freight for emergency shipments. Airline companies have little chance of increasing sales dramatically on the basis of this type of service. The real potential for growth exists in the use of air freight for regular and planned transport, and more specifically, in the increased use of direct and transit systems by multinational corporations the demand for air freight service will increase only if more companies consider for their products and spare parts. In the next section, we examine the obstacles to the introduction of such distribution which would lend themselves to greater use of air transportation.

3.0 Constraints on the potential growth of air freight

Under normal circumstances, economic considerations would drive a good number of companies to abandon the classical system of distribution in favor of a shorter system for many if not all, of their products. However, several factors prevent them from doing so.

3.1 Routing considerations

Some destinations make it possible for companies to supply their overseas customers quickly and efficiently by shipping merchandise directly by air. Customers do not suffer because of the absence of an inventory in a geographic location close by. Unfortunately, this is not true for

all routes. There may be no direct air connection between the production center and the final destination, making transit necessary. Often cargo is slow in leaving transit cities with a high volume of passengers. The consequence is that a trip that would take a traveller approximately 30 hours to complete (i.e. Stockholm-Sydney), might take several days for cargo. Custom authorities could further delay the delivery, making it necessary to stock spare parts and other products which might be required instantly, with foreign subsidiaries and distributors.

Routing clearly represents an area for potential improvement. Only by assuring reliable service can airlines hope to get companies to abandon inventory build-ups in favor of direct shipments. This means eliminating systematic bottlenecks on certain routes, if possible, and by passing airports that present chronic problems. Also, there is a need for better coordination among and between airlines and freight forwarders.

3.2 Other elements of the physical distribution system

More often than not, decisions pertaining to various aspects of the physical distribution system of a firm are not coordinated and as a result, the system is not optimized. For instance, in deciding on plant location multinationals often do not give due consideration to the proximity of airports served by frequent flights and Aircrafts with sufficient freight capacity. Packaging and conditioning decisions will also affect the possibility of using air transport. It seems that air transport companies could do a better job of creating awareness of the importance of these logistic decisions among potential and current customers.

3.3 Managerial evaluation systems

An important factor to consider for sales subsidiaries (but not for independant distributors) is the basis of evaluation for company management. If a company appraises its subsidiary's management mainly on the basis of its sales revenue, managers will emphasize customer service. To this end they will maximize the stocking of products and spare parts in company warehouses. However, if a company is interested in maximizing its profits rather than its revenue, an increase in inventory at the subsidiary level does not necessarily make economic sense. The problem is that in many cases subsidiaries are not required to carry the full cost of their inventories. Many companies that adhere in theory to the principle of a profit center for their subsidiaries (i.e. the subsidiary is appraised by the home office on the basis of its net profit. All costs and revenues associated with its operation are accounted for.) fail in practice to implement it and do not hold their subsidiaries accountable for all costs associated with their operations. This practice is due in some cases to a lack of sound managerial policy. Generally however, it is a consequence of the difficulty that multinational corporations have in implementing the profit center concept.

The rationale behind the profit center management concept is that if each subsidiary is judged on the basis of its profits, it will attempt to maximize those profits and contribute in turn to the maximization of the company's total profits. Theoretically, a profit center management concept would encourage subsidiaries to find the most efficient distribution system possible for the level of service most likely to maximize profits. If the subsidiary's management persists with a classical system of distribution, it should be only because economic considerations point to such a system. In most cases however, subsidiaries should find it more profitable to move, at least partially, towards a more direct system and towards greater use of air cargo.

But there are a number of reasons why it is not always feasible for a company to implement the profit center concept.

Short terms profits are not always the objective

Subsidiaries are often set up not to generate immediate profits but to develop markets which will prove profitable in the long run. It is in the interest of the company then, to appraise the subsidiary not on its short-term profits but on the sales revenue it generates.

Ability to control cost

There is a basic rule in personnel management according to which no one can be held accountable for actions over which they do not have complete authority and therefore control. In many cases decisions and actions taken at the home office result in unreliable supplies to subsidiaries and force these subsidiaries to keep inventories using a classical system of distribution. This in turn decreases their profits relative to a shorter distribution system and makes it difficult for the home office to use net profit as a basis for assessing the performance of the subsidiary. Indeed if a subsidiary cannot assure prompt delivery of products and spare parts for its customers, it will not accept a cut in inventory.

This raises the question of why it is that home offices cannot be more prompt in supplying their subsidiaries and subsidiary customers? There are several reasons which are not so dissimilar from problems often found in the domestic market.

a. Global excess demand. When the global demand exceeds the production capacity of the company it becomes impossible to supply every potential customer. Typically, those locations furthest away from the manufacturing center and those without a direct link to its personnel are at a disadvantage. In order to prevent discrimination between domestic and exports markets some companies comply strictly with the iron rule that favours "forecasted before unforecasted". That is every subsidiary must make provisional plans; orders that exceed their projections get a lower priority. However this practice encourages subsidiaries to overforecast as a way of

assuring that none of their customers will be deprived. Aware of this strategy, the home office management of many companies will discount these provisional plans leaving the subsidiary where it started. Also, in cases of excess demand some home offices prefer to assess the situation on a case per case bassis and to make their decisions on the basis of what seems best for the company as a whole.

b. Bottlenecks in the shipping process. Unnecessary delays also occur between the time an order is received and the time at which the product is sent. In the case of spare parts for instance, if a subsidiary cannot be certain that an order will be shipped immediately by plane, it is not likely to relinquish its stocking privileges.

Lack of confidence in subsidiaries' expertise in physical distribution

Lack of confidence is another factor that might prompt the home office management to limit the subsidiary's prerogative to select on its own distribution system. Moreover, many headquarter executives suspect that the sales orientation and background of their overseas colleagues does not allow them to appreciate the overall cost impact of their decisions. By limiting the subsidiaries' autonomy, the home office management undermines the profit center approach.

Global interest of the firm

There are some decisions multinational corporations make that may be beneficial for the company as a whole but detrimental for certain of its subsidiaries. We have shown in the case of excess demand, how such decisions might be made. They tend to occur also in cases where the subsidiary is responsible for supplying another subsidiary in the vicinity or when a regional warehousing center is established in order to serve several countries.

The difficulty in fully implementing the profit center concept for subsidiaries overseas, puts the burden of optimizing the global physical distribution activities of a company on the headquarter staff. But this often creates distortion. First, the home office personnel responsible for physical distribution see the minimization of global physical distribution cost as their main objective. By focusing on the global level they tend to neglect the service requirements of overseas markets. Furthermore, some companies evaluate the physical distribution staff at home on the basis of the cost of delivery to the subsidiary and not on the inland distribution, storage, handling and shipping costs within the foreign market. This practice encourages both the home staff and the subsidiary management to use a classical system of distribution even if it is not economically justified. The headquarter staff will utilize the cheapest means of transportation to the subsidiary warehouse (generally a boat for transoceanic shipments) delay shipments, and maximize the volume of merchandise shipped (allowing for volume discounts and

decreases handling, shipping and order processing expenses) all for the purposes of reducing its accountable costs. The subsidiary management, appraised mainly on its sales, will benefit from maximum inventory because it allows for better customer service. The whole process leads to global under-optimization. Some companies attempt to remedy the situation by holding their headquarter staff responsible for all physical distribution costs including subsidiary costs. However, this can potentially lead to a conflict of objectives between the headquarter staff and subsidiary management: the headquarter personnel might decide on physical distribution policies including subsidiary inventory control, which do not fulfil the service requirements of the market for maximum long-term profitability, simply because they improve cost figures and measured performance.

Some companies also engage in the practice of appraising physical distribution staff on the basis of costs incured up until the goods arrive at the subsidiary warehouse, and appraising subsidiaries on their revenues minus the costs incured within its market (including storage and inland transportation). Although this system is fair to both sides it still has the potential to lead to under-optimization: the home office is still likely to reject the direct system and to a large extent the transit system because of the increases they represent in transportation costs.

To reiterate then, the central problem is that the profit center organization system is often difficult to implement for a multinational corporation with sales subsidiaries abroad. The responsibility for physical distribution costs falls on the shoulders of the home staff and leads to inefficiency and under-optimization. What options do multinational corporations in these circumstances have?

4.0 A possible solution

The main dilemma presented by the uneasy profit center is that the personnel responsible for revenue is not responsible or does not have full authority over those distribution costs that affect revenue, and the staff responsible for distribution costs is not appraised on those revenues affected by its decisions. There is an obvious need for coordination between sales subsidiaries and headquarter staff. It is imperative to have headquarter staff responsible for international physical distribution and subsidiary management reporting to one and the same entity. In many companies this function could be served by the vice-president of the international division or a coordination staff reporting to him. In either case, the general rule should be that headquarter staff give priority to reducing total physical distribution costs except in cases where their decisions conflict with the sales objectives of subsidiaries. In these cases the entity ultimately responsible for profits and in direct contact with all sides concerned should make the final decision. It is at the level of this entity that air transportation companies should make their representations and recommandations concerning the advantages of shorter distribution systems in increasing the global profitability of overseas operations.

5.0 Conclusion

This article has attempted to indicate why the organizational structure for physical distribution and international marketing activities might create situations where air freight is not used while strict economies would dictate it. Since airlines have much to gain from an increase in air freight volume it would be to their advantage to understand what are those organizational obstacles and then develop selling approaches targeted at a management level qualified for initiating and implementing changes in the organizational structure and evaluation system.

RESPONSES TO DEREGULATION IN THE U.K. BUS TRANSPORT INDUSTRY

by

Mick Carney
Concordia University

1.0 Introduction

Despite important differences in industry structure, regulatory provisions and market needs, the U.K. experience of deregulation is of some significance here in Canada. Airline and rail deregulation presently under government review is likely to have some impact upon the bus sector. Provincial governments are rethinking their approaches to financial support and regulatory frameworks for buses, for instance, the Ontario transportation minister recently appointed a bus regulatory review committee with a mandate to produce a new set of regulation policy proposals for the industry--the first such overhaul since the early 1950s.

Unlike telecommunications and airlines where, internationally, there is accumulating evidence about the effects of the policy, little is known about the way deregulation will work in bus transport. There are arguments and economic models to support a variety of conclusions about the desirability of increased competition but there has been little opportunity to test these in practise.

The main hypothesis of pro-market advocates is that deregulation will lead to greater price competition, more consumer choice, a search for internal economies and efficiency, and an improved allocation of resources in the industry as a whole. However, the mechanism through which this is achieved is rarely specified. At best, it is assumed by policy makers that entrepreneurs, who perceive they may offer a service at a lower price and still make a profit, will enter into rivalrous competition with those offering a service at less than full efficiency.

Evidence from the U.K. suggests this version of the competitive process to be oversimplified. While price competition based upon superior efficiency represents one potential strategy, other types of responses are available. Innovation, which is strategy based upon

doing things differently rather than doing things more efficiently, is observed in certain circumstances. Another strategy we call consolidation is widely practised and involves the articulation of political and institutional support for particular ideas (Butler & Carney, 1986). This perspective, along with the debate about bureaucrats and entrepreneurs, is developed in Section 2.

The structure of the U.K. bus industry, the regulatory framework, and the provisions for deregulation are briefly outlined in Section 3. In Section 4 the strategies undertaken by operators are described in detail. A preliminary assessment of these responses and other related developments is made in Section 5.

2.0 Entrepreneurs versus Bureaucrats: The Case for Deregulation

It is suggested here that how one views the results of deregulation depends upon how one expects the market to operate in practise. In its most basic form the case for deregulation reduces to postulated differences between entrepreneurs and bureaucrats--the former are agents of competition in a free market, the latter are, essentially, managers operating within an organized or bureaucratic environment. The superiority of entrepreneurs is based upon beliefs about the inadequate motives of bureaucrats. The argument runs along the following lines: Managers in a regulated industry have no incentive to respond to the demands of customers because they know that they cannot go bankrupt or lose their jobs. As a result they will tend to be inefficient, they will permit costs to rise and pass them on to consumers who have no alternative but to pay because there is no choice of using another firm's services. Deregulation permits those who believe a better job can be done to enter the industry and set up in rivalarous competition with the bureaucrat. Providing the government is willing to let the latter go out of business, there is an incentive to improve the way things are done which will ultimately benefit the consumer. In this view, the impact of deregulation is to be assessed around the parameters of efficiency, price and consumer choice.

The role played by cross-subsidization is critical in this industry. The argument for cross-subsidization is based upon the averaging of costs which permits a particular operator to subsidize socially desirable, but unprofitable routes from profitable ones. Deregulation will allow entrepreneurs to enter the profitable routes and reduce the surplus available for subsidization purposes.

The argument against cross-subsidization suggests

suggests the principle is merely a convenient way for an operator to hide inefficiencies (Hibbs, 1971). Evidence is adduced from statistics which show large public bureaucracies to be overstaffed in relation to private firms, for example, see Table 1.

TABLE 1
RATIO OF EMPLOYEES TO VEHICLES: 1979, 1984

	1979			1984		
	Direct	Indirect	Total	Direct	Indirect	Total
L.T.E.	3.2	2.4	5.6	3.4	2.2	5.6
P.T.E.	2.3	1.9	4.2	2.2	1.8	4
Municipals	2	1.3	3.3	1.9	1.3	3.2
NBC	2	1.5	3.5	1.8	1.4	3.2
SBG	1.8	1.3	3.1	1.6	1.4	3
Private	.7	.5	1.2	.6	.6	1.2

'Direct' includes drivers and conductors.
'Indirect' means all other staff.
'Total' is total staff employed per vehicle operated.

L.T.E.=London Transport
P.T.E.=Passenger Transport Executives
NBC=National Bus Company
SBG=Scottish Bus Group

Source: H.M.S.O. Transport Statistics: 1980, 1985.

Table 1 suggests that public bureaucracies are inefficient because they have large overheads, in this case due to the high ratio of non-productive administrators. Pro-market advocates argue, on this basis, that the actual true cost of running an unprofitable route is overstated in a bureaucracy because averaging costs raises the costs of all routes. The important question is: Does it follow that deregulation will lead to an abandoning of 'unprofitable' routes due to the bureaucracies' inability to cross-subsidize? At this point, the argument usually turns to an analysis of long and short term, fixed and variable costs, and the debate becomes mired in wrangling over definitions about what constitutes a cost.

Pro-market advocates suggest that none of this matters. If a firm cannot make an adequate return upon a route, it should get out; however, it does not follow that the route will be abandoned. With free entry and exit, another operator (possibly small and with lower overheads) may find it profitable to operate such a route. Moreover, if economic demand did not justify service but other, social considerations required it, then government might devise some other mechanism to support the socially desirable activities. Friedman (1982) for example,

argues for individual cash transfers or vouchers to in-need groups. In the U.K. bus industry, the preferred solution is the direct subsidization of particular routes through a process of competitive negative bidding--the firm requiring the least subsidy to operate a given route is awarded the franchise.

The question which is not effectively answered by pro-market theorists is why so many excess bureaucrats should be employed by public bureaucracies and why private firms do not employ non-productive labour. A number of explanations have been offered (eg. Niskanen, 1971; Tullock, 1979), but all remain in need of verification. One potential explanation is developed here.

2.1 Markets, Information and Coordination

In a regulated state, bureaucrats deal in information and coordination. For example, they are required to monitor market trends, locate demand for services, allocate resources to satisfy this demand, or more generally, coordinate supply and demand. The process is what Chandler (1977) calls the 'visible hand' of management. In a free market the coordination of supply and demand is done costlessly through the operation of the 'invisible hand'--no one is paid to match supply with demand but the task is, however, performed (Hayek, 1945). For example, in a bureaucracy, if there is a feeling that a particular route needs service, a task force or team is sent out to determine the exact requirement by using a variety of tools and techniques which have been developed through professional training. In a free market, the same task might be performed by an entrepreneur who will put on a bus for a time to test the demand (Carney, 1984). Incidentally, a number of best-selling authors (eg. Peters & Waterman, 1982) have advocated this "try it-test it" entrepreneurial approach as an alternative to planning in organizations of all types and sizes.

To summarize, deregulation implies a cost-advantage will accrue to entrepreneurial firms which do not carry the burden of sophisticated planning and coordination staffs. To compete, public bureaucracies must shed staff performing non-productive coordination activities since these tasks are now provided at no cost by the market mechanism. That is, of course, unless bureaucrats do in fact perform a valuable and socially productive task.

2.2 Price and Non-Price Competition

A consequence of the classical view of perfect competition is that we expect to see deregulation bring about price competition as the means of bringing supply into line with demand. However, such a mode of competition

defies all the instincts of the simple entrepreneur as sustained price competition does not lead to long-term profits. While price wars may intermittently break out, they are typically accidental and steps are soon taken to end hostilities. Private business knows that long-term viability is better assured when it does not compete head-on with those offering similar services. Elsewhere we have suggested that two other strategies are available as a means of avoiding price competition (Butler & Carney, 1986). These are the innovative and consolidative strategies. Innovation simply means doing something different from competitors, such as applying a new management technique or offering a different type of service, or taking an existing idea and applying it in another context.

The consolidative strategy means an organization will seek to defend a particular market from predators. In the private sector, firms enter into collusive agreements to limit competition; in the public sector, firms attempt to coopt the support of government to achieve the same end.

These strategies are designed to protect against damaging price competition and the aggregate effect is to produce a dynamic process characterized by diversity of behaviour and outcomes. This strategical process permits organizations to proclaim their uniqueness, an outcome which is the opposite of that predicted by the classical view of competition. This view posits competition as a mechanism which ensures efficiency. To test this implicit hypothesis, one has to compare like with like, that is, firms must be comparable and homogenous. This test can only be performed under the assumptions of perfect competition and in the hypothetical state of market equilibrium. However, this discussion of strategy suggests firms will seek to avoid the homogenizing forces of the market and strive to differentiate themselves, so avoiding strict efficiency tests of performance.

3.0 Market Structure and Regulation

The U.K. bus transport industry has, like most bus transport sectors throughout the world, contracted in both relative and absolute terms as a mode of transport. In 1954, the peak year for U.K. bus travel, 40% of all transport mileage was made on buses; in 1984, the figure is less than 8% and continues to fall. Despite this trend, the Department of Transport believes bus transport will continue to play an important role in the future since it it anticipated that 25% of the population, and 40% of households, will not have access to private transportation in the year 2000.

The bus industry may be divided into four broad sectors: stage, express, tours, and contract/private hire. Table 2 shows the size of each of these sectors in terms of vehicle kilometres and the proportion accounted for by the principle operators for the years 1979 and 1984. The industry is operated by a mixture of private firms, crown corporations, and local and municipal government departments. The London Transport Executive (LTE) is a department of the Greater London Council and is also responsible for the operation of the London Underground. LTE is similar in structure to Passenger Transport Executives (PTE) which are operated by county councils in densely populated areas of the country. The principle underlying their structure is area coordination, and differs from municipal operators who are controlled at the city or town council levels. The National Bus Company (NBC) and Scottish Bus Group (SBG) are structured on a regional basis and together operate approximately 50 subsidiaries in rural areas and in towns with no municipal operation. The NBC/SBG also operate an extensive intercity network.

The private sector consists of a large number of independent companies which range in size from more than 1800 one-vehicle businesses up to a handful owning 200-400 vehicles. The various types of operators are closely associated, linked together in a variety of ways. The present public sector is largely an outcome of the reorganization of the industry mandated by the 1968 Transport Act. Under this act PTEs were instructed to allow NBC operators to share some traffic routes which allow NBC to cross-subsidize unprofitable rural routes. Prior to deregulation, the relationship between PTEs, NBC and municipal operators had generally been cooperative.

A number of private operators are effectively appendages of the NBC. Some subscribe to national agreements on wages and conditions of service or through area arrangements on routing. Companies in the public sector often print the timetables of their smaller neighbours in their booklets (Hibbs, 1971). There are also a number of joint services in the express coach sector: a typical arrangement is for the NBC to use the capacity of private operators in busy periods such as weekend peaks or during the holiday season.

Most towns in the U.K. with a population of 20,000 or more have an internal transport system based upon stage services. It is the decline in this sector which accounts for the decline in bus transport in general; between 1974 and 1984, the provision of these services fell by approximately 10%. However, stage services still account for the largest proportion of the total market

TABLE 2
MARKET SHARE/KILOMETRES BY
OPERATOR AND SERVICE TYPE: 1979, 1984

OPERATOR	SERVICE					
	Stage	Express	Tours	Con-tract	Operator Total Kilom	Operator % Total Share
1979						
LTE	11.9	-	-	-	265	8
PTE	24	-	-	1.4	505	15
Municipal	10.6	-	-	1.0	242	7
NBC/SBG	48.7	59	20	8.8	1253	38
Private	6.3	41	80	89	1073	32
	100	100	100	100		100
Service Total Km	2204	141	98	896	3338	
Service Share	66	4.2	3	26.8	100	
1984						
LTE	12.6	-	-	-	268	8
PTE	22.3	1	-	1	486	14.5
Municipal	10.4	1	1	1	235	7
NBC/SBG	46.7	77	10	7	1182	35.6
Private	7.8	21	89	91	1142	34.3
	100	100	100	100		100
Service Total Km	2125	142	128	918	3314	
Service Share	64	4.3	3.8	27.8	100	

Source: H.M.S.O. Transport Statistics: 1980, 1985.
Kilometres in millions

(64% in 1984) and provision is dominated by the public sector.

The Express sector is a long distance (defined as 'over 30 miles' in the 1980 Act), limited stop, intercity service. While this segment represents only a fraction of total bus travel (approximately 4%), it is significant from the point of view of this paper as it is this segment which has been most liberalized as a result of deregulation. Immediately apparent from Table 2 is the growth in the market share of the NBC/SBG, up from 59% to 77% between the years of 1979 and 1984, in a relatively stagnant market.

The Tours sector represents the smallest part of the market (3%) but is unique in bus transport in that it is growing rapidly. Tours are essentially express services without 'one-way fares', but Tours is clearly identifiable as the 'leisure' sector. Table 2 underestimates the growth in this sector since it represents figures for domestic travel only and omits international tours which are currently enjoying a boom period.

The Contract and Private Hire sector is the school and work bus sector. It also has a large 'leisure use' component to it. The private hire market is a product of a legal definition and the U.K. licensing system, and in many ways, Private Hire is similar to Tours. An individual, club or organization may hire a bus on a tours basis (i.e., no single fare allowed) but only members of the club, etc. may travel. The service may not be advertised except in places where club, pub, association members are likely to frequent. The sector is clearly dominated by the private sector who account for 90% of its mileage. The sector is of particular importance to the smaller private operator (i.e., having 15 or less vehicles) who account for 60% of the sector.

In general, the U.K. bus transport industry, though declining, is still a significant business, with revenues of £ 2.1 billion 1984. Though dominated as a whole by public organizations, there is a significant private sector involvement which, in 1984, accounted for almost 25% of industry-wide revenues.

The 1980 Transport Act. Prior to the 1980 Transport Act, economic regulation of the industry had remained essentially unchanged since the 1930s. The industry continues to be regulated by traffic commissioners who award licenses for particular routes to operators according to pre-determined criteria. The main provision of the 1980 Transport Act was to abolish the licensing requirement for express services. A similar provision was made for the Tours sector, but this has attracted less attention due to the apparent liberality on the part of the traffic commissioners when awarding Tour licenses in the past. The control of prices and fares was also liberalized.

4.0 Responses to Deregulation

4.1 The Data

The data upon which this paper is based are part of a comparative study of regulation and corporate strategy (Carney, 1984). The relevant data was collected by a mailed questionniare to 150 private operators in 2 U.K. regions in June 1981, approximately 9 months follow-

ing the implementation of the 1980 Act. The response rate was 22% (33 of 150); a further 30 firms were subsequently reached by telephone. The source of data was supplemented with several personal interviews and by extensive archival material. Data on public sector organizations included in this paper is exclusively archival.

4.2 An Entrepreneurial Revolution?

Given the objectives of the 1980 Act, one test of the implicit classical theory is to examine the extent and nature of responses from the private sector. The overwhelming response of the private sector to the opportunities created through deregulation was to do nothing at all. A third (11 of 33) of those operators answering the questionnaire had not done and were not planning to do anything at all as a result of the 1980 Act. Of a further 30 operators reached by telephone, 20 were not planning to do anything. Another 5 had recently gone out of business.

An explanation for this apparent inertia is to be found in the make-up of the private sector. The 'average' private sector organization is an extremely weak creature compared to the public sector bus firm (see Table 3). While the private sector in the aggregate accounts for 25% of the industry's revenues and 40% of the vehicle stock, any one firm is very small. 60% of private sector capacity is in the hands of firms with less than 14 vehicles. In 1979 there were nearly 4000 independent firms operating only 7000 buses between them. While there are very few public operators with less than 100 vehicles, there are only 20 private firms with more than 50 buses.

The private sector is dominated by the small family-owned firm operating a few buses in a well-established niche such as works and school bus sectors. Often a particular service had been operated by the same family for two or more generations. Several operators indicated they were quite happy with such a business and possessed neither the resources nor the inclination to venture into more competitive arenas. If the Government was anticipating an entrepreneurial revolution, it is not at all clear that it could be led by present private sector operators.

The next class of responses are those that one might reasonably expect as a result of deregulation. That is, greater price competition and simple market extension (Butler & Carney, 1986). Simple market extension means that an operator will extend services already offered, for example, an operator with 20% of his business in Tours will attempt to offer more Tours services. 17 of the 22 more proactive firms fall into this category.

TABLE 3
OPERATOR SIZE (VEHICLES OPERATED) 1979

PUBLIC SECTOR			PRIVATE SECTOR		
	# of Operators	Mean # Vehicles Operated	# of Vehicles	# of Operators	Mean # Vehicles Operated
LTE	1	6157	under 5	3678	1.9
PTE	7	1524	5 - 14	1486	8
Municipals	51	114	15 - 24	241	18.5
NBC*	37	481	25 - 49	111	33
SBG*	7	546	50+	20	88
Total Operators	103		Total Operators	5536	
Total Vehicles	44328		Total Vehicles	29154	

*NBC and SBG numbers are subsidiaries.

Thirteen of these 17 represented a response that might be called 'sector creeping', that is, a firm will attempt to add services in areas that account for the smallest proportion of existing business. For instance, a firm whose major line of business is contracting, but operates a few tours, will attempt to build up the tours side; firms whose major business was tours will attempt to build up express work and so on. The process is one of relatively minor or gradual extensions of the firm's domain into sectors where the firm has at least some experience.

The second important class of responses were those that involved fares and prices. 14 of the 21 pro-active firms had made some type of price/fare adjustment as a result of the 1980 Act. The interesting point about these price adjustments is that they give little evidence of 'price competition' in the sense of attempting to undercut another operator on a comparable service (a few operators did say this was their intention). The majority, however, were attempting to create more discriminating fare structures by offering volume discounts, off-peak, off-season special rates which better reflected the nature of the operators' loading patterns. Fare controls effected through the traffic commissioners had worked to standardize fare structures in a way that did not match the particular economies of individual firms--the liberalization of pricing permitted operators to bring fares and costs back into line.

In both these response types, the general thrust or intent is that of increased efficiency. New routes

were manned by underutilized buses and represented a marginal commitment of resources since withdrawal and reallocation is a rather simple task. A number of operators indicated that they had tried new services but had soon withdrawn when demand proved inadequate. Others said they would withdraw from new routes if business had not improved within a short period of time. Only 5 firms in the sample had entered markets where they had no experience. However, there are a number of other ventures not covered by the sample data which should be mentioned.

In the Express segment, the most significant development was the formation of British Coachways (BC), a consortium of 8 large private operators who put together a fleet of almost 700 vehicles to compete head-on with NBC's express network. The reasoning behind the venture was described by the operations manager of the lead unit: "The benefits are mainly logistical; the need to have pick-up points in various parts of the country along with breakdown, repair services and substitute buses and to avoid having empty coaches travelling all over the place. Only a large organization can manage this and compete effectively with NBC's massive service."

BC attempted to compete with NBC on the basis of a three-pronged strategy: lower price, higher in journey service (videos, etc.), and a large promotional effort. In the first year of operation, the venture encountered a variety of problems.

NBC reacted swiftly by matching BC's prices on a route-for-route basis. NBC also excluded BC and other private operators from their facilities--in the past, private firms had relied heavily upon NBC's infrastructure of bus stations. In general though, the impact of BC's promotional campaign was to increase traffic on NBC's buses!

Three of the participants withdrew from the venture within the first year of operation. The venture collapsed completely within two years--some operators attempted to service particular high-volume routes as independents, but these efforts too very quickly failed and most went back toward the collaborative relation with NBC. Table 2 shows that NBC's market share of the Express sector increased from 59% to 77% over a 5-year period.

5.0 Discussion and Evaluation

It was suggested in Section 2 that how one views the results of deregulation depends upon the theory one holds about the way markets and competition operate in practise. Adherents to what we have called the classi-

cal view must be a little disappointed with the effects of the 1980 Transport Act. The evidence presented in the preceding section indicates a high degree of intertia on the part of many private sector operators. Many have a comfortable niche in private and contract-hire markets, and for the most part are unconnected to the wider network of coach and bus transport. Others had established a niche within public sector-dominated markets (Stage and Express) where they were heavily dependent upon one or other public operator. In a declining, lean environment it would appear that these operators were reluctant to step out into the rough waters of market competition and risk losing essential sources of existing support.

This should not be too surprising. The industry had been tightly regulated for 50 years and during that time a certain equilibrium had been reached. Prior to deregulation, the major task facing all operators had been the continuous adjustment to a steadily declining market for bus travel. The public and private sectors had reached a mutual accommodation--private sector operators were prepared to rely upon their larger and stronger public partners for support. Public operator strategy was directed at articulating support from government in the form of ensuring direct subsidies and securing access to funds from local authority rates and central government revenues. The network of interdependence between public and private operators was not well recognized by those anticipating an 'outbreak' of free competition.

Another interpretation of events is that we are perhaps witnessing a very gradual movement toward a user-supported, market-based system of bus transport. However, this involves giving more weight to the more proactive private operators. The typical response of proactive entrepreneurial operators was a small commitment of resources to a new market segment. These limited commitments (buses and drivers; some advertising expenditures) were generally underutilized anyway due to excess capacity in a declining industry compounded by a severe economic recession--and to that extent did not represent an expensive investment. A classical market theorist might be encouraged by this, suggesting that the market mechanism actually works in this way: operators gradually, incrementally, or experimentally discovering opportunities. This gradual extension permits the operator to evaluate the move before making a further commitment. Over time we might expect these experiments to fully discover the exact need for bus travel. The classical market theorist might suggest this is the manifestation of the 'information-processing' function of the market.

If the private sector is gaining ground, then the

process is painfully slow. In 1979 private sector revenues accounted for 21% of total industry revenues; in 1984, these had increased to 23%. However, Table 2 suggests little progress had been made. In the largest sector (Stage), private operators' share has increased from 6.3 to 7.8, but this does not represent real growth; the private sector has merely held their own in a declining market. Private operators lost ground in the Express sector. Only in the leisure areas (Tours and Contract) has the private sector position improved, but this sector has traditionally been dominated by private operators.

In contrast with the view that a free market system is emerging, we may give more weight to the observation of many inert private operators and to the public sector operators who in many cases have effectively pre-empted competition and private sector initiatives. The consolidatory stances of NBC and, to a lesser extent, municipal and PTEs have successfully defended a number of domains from private sector competition. From this perspective, successful consolidatory strategies directed at government have caused the industry to rapidly move back to its pre-deregulation equilibrium. A second aspect of the consolidatory strategy involves NBC co-opting private operators. A number of express service operators reverted back to an interdependent relationship with NBC by pooling resources and offering joint services. We might anticipate that in the future NBC will remain the dominant partner in such relationships and that the position is little different from the pre-deregulation days where NBC used private operators to cope with seasonal and cyclical peaks in demand.

Those anticipating improved public sector efficiency have been disappointed too. The measure of efficiency cited in Table 1 does show some improvements in staff to vehicle ratios, but those changes are part of longer-term trends that had begun long before deregulation (eg. 1-person operated buses; consolidation of public operators into larger units). One long-term study of efficiency in bus operations (Acton, 1983) suggests that by the adoption of the most modern working practises, the best the average public operator can expect to achieve is a 10% increase in efficiency. Government had originally believed increases of 30% were possible.

An alternative way of assessing the impact of deregulation is to look at developments in terms of the dynamic process outlined in Section 2. From this perspective we can hypothesize that the real impact of deregulation has been to increase the rate of managerial and technological innovation in the industry as a whole. Furthermore, it is suggested that this has been done

in a way that government and regulators did not, and arguably could not, have anticipated. In this final section one type of innovation, Managerial, is discussed.

5.1 Management Innovations

Since deregulation, NBC and the public sector appear to have embraced the 'marketing concept'. Prior to this, public management had a strong operational focus: keeping the buses running being the critical task, marketing was widely believed to be expensive and unnecessary. One might argue that NBC were too concerned with efficiency.

At the prospect of deregulation, NBC initiated major market research, product planning and a reorganization which delegated operational responsibilities to subsidiary companies (Winfield, 1984). Senior management began to speak of the 'needs' and the 'leisure' markets. A major investment in the leisure sector (international holidays) proved successful. NBC discovered that they were essentially a marketing organization which linked the work of a number of subsidiaries.

The experience of British Coachways forced NBC to realize the value of their own marketing infrastructure (High Street booking agents, bus stations, etc.). The British Coachways promotional campaign increased the public's interest in bus travel but it directed customers into NBC-owned channels and facilities.

The important discovery here is the critical role played by customer habit or inertia--customers had become used to going to an NBC bus station, and it apparently takes more than a marginally lower price or improved service to lure people away from established travelling habits. This factor suggests there are major limitations to private sector entrepreneurial "try it-test it" forays into the market place. These fail because travelling patterns change very slowly and the methods used to detect demand (eg. putting on a bus for a short trial period) are inadequate to the task. Research by Goodwin (1985) suggests these habits take years to form and may be life-long in effect. In another study, Fairhead (1981) shows that the prospect of significant cost savings did not induce commuters to abandon rail travel in favour of commuter buses.

In conclusion, we might suggest that the larger public sector organizations are at a distinct advantage over the private sector as they possess the necessary planning and administrative expertise to identify, co-ordinate and service demand. All this should not be very surprising to managers in large private sector orga-

nizations who recognize the importance of marketing and long-term product planning and, generally, allocate the required resources to these functions.

References

Acton, P., "Buses are Still Value for Money", Surveyor, (Jan. 27, 1983), pp. 13-15.

Butler, R.J., and Carney, M.G., "Strategy and Strategic Choice: The Case of Telecommunications", Strategic Management Journal, 7:2 (Apr./May 1986).

Carney, M.G., "Organizational Strategy and Industry Regulation: Responses to Deregulation in the United Kingdom Telecommunications and Bus Transport Industry", Unpublished Ph.D. Thesis, University of Bradford Postgraduate School of Studies in Management (1984).

Chandler, A.D., The Visible Hand, Cambridge, Mass.: Harvard University Press (1977).

Fairhead, R.D., "Recent Developments in Commuter Coaching", Working Paper, Public Transport Division, Transport and Road Research Laboratory, Berkshire (1981).

Friedman, M., Capitalism and Freedom, Chicago: University of Chicago Press (1982).

Hayek, F., "The Use of Knowledge in Society", American Economic Review, 35 (1945), pp. 519-530.

Hibbs, J., Transport for Passengers, London Institute for Economic Affairs (1971).

Goodwin, P., "South Yorkshire County Study", Lecture given at Concordia University Centre for Transport Studies, Montreal (1985).

Niskanen, W.A., Bureaucracy and Representative Government, Chicago: Aldine-Atherton (1971).

Peters, T., and Waterman, R.H., In Search of Excellence, New York: Harper and Row (1982).

Tullock, G., Bureaucracy and the Growth of Government, Institute of Economic Affairs (1979).

Winfield, R., "Time for Bus Entrepreneurs to Show", Transport (July/Aug. 1984), pp. 29-30.

THE IMPACT ON THE INTERCITY BUS INDUSTRY OF POLICY CHANGES IN AIR AND RAIL PASSENGER TRANSPORTATION

by

D. M. Cape

1.0 Introduction

Passenger modal substitution capability is becoming an increasingly important issue as deregulation continues, the initial impact analyses of which concentrated on intramodal carrier substitution. This paper addresses the intermodal substitution and modal reaction issues with particular reference to the intercity bus industry.

2.0 Canadian Policy Background

At time of writing, March 1986, the Government of Canada is in the throes of implementing their "FREEDOM TO MOVE" document, which has had wide circulation since the summer of 1985. The sub-title "a framework for transportation reform" connotes the contents which are proposals for economic regulatory reform in the transportation sector. The proposals in "FREEDOM TO MOVE" will likely have been embodied in a new National Transportation Act by the time of presentation of this paper. On surface passenger transportation issues, "Freedom" is deafeningly silent. The concept of deregulation discussed precludes any weakening of safety constraints, but concentrates instead on entry, exit, and pricing. One other piece of legislation is in the mill, Bill C-97 The National Rail Passenger Transportation Act.

As the major thrust of current policy in all modes is toward market reliance to determine the industry direction, it seems useful to assess how regulatory easing in other modes might be expected to reflect on the intercity bus industry. Unfortunately, hard data is sparse.

One may presume that passenger rail travel is preferable to intercity bus travel where both are equally available. This presumption is re-inforced by the fact that the bus industry typically undercuts rail prices, and by the ability of passengers to readily stretch their legs and perhaps obtain refreshments at their convenience en route. Quality differentials in intercity surface passenger trans-

port were discussed in Cape, 1984 [1]. On the same basis, on aggregate, air travel is presumed to be preferable also to intercity bus.

3.0 Canadian Modal Perspective

3.1 Railway Policy Changes-Canada

Perhaps the first major competitive jolt inflicted by the railways on the intercity bus industry in Canada was the introduction of demand based pricing by Canadian National Railways in the late 1960's when they introduced their Red, White and Blue fare plans as a form of price discrimination/differentiation and market segmentation.

Such pricing strategy was designed to flatten peaks and troughs in rail passenger demand. In off-peak periods the new low rail fares would generate additional demand, persons who would not otherwise travel would now do so. Additionally this action would divert some traffic from the competing modes as the price differentials among rail, air, automobile and bus would have moved in favour of rail in the off-peak period. It is significant that the peak periods for all intercity modes are contemporaneous. This action leads to a deepening of the off-peak trough in the non-rail modes. Similarly in the high peak period, the swing in traffic would be away from rail and toward inter-city buses and the other modes, again aggravating the peaking problem in the intercity bus industry. At this time, the bus industry was in a developmental, even if not growth, phase. The construction phase of major inter-city highways was almost complete, and the technological change within the bus industry in the form of air suspension, more efficient air conditioning, reclining seats and on board toilets was continuing to make the bus a more appealing alternative than previously. These concurrent changes would tend to mask the impact on the bus industry of changes in the other modes.

Reschenthaler, in 1981 [2] estimated the overcapacity supplied by the intercity bus industry to satisfy peaking and to ward off potential entrants to be of the order of 25% of total equipment. No doubt the rail pricing policy changes have been responsible for some of that additional capital investment in rolling stock by the bus industry.

A second incursion into the revenue base of the inter-city bus industry was taken on a much smaller scale by VIA Rail Canada in 1981 in Southwestern Ontario when, for a few weeks, VIA [3] offered its "Way-to-Go" fare structure with 40% reductions in off peak periods, ostensibly to combat the severity of unemployment and decline in travel in that region. The intercity bus industry, determined not to lose market share, reduced its fares on competitive services to

return to a point one dollar under those offered by VIA Rail, a fare structure that has "stood the test of time". Mathematically, this change has to be a fare reduction in excess of 40% given the smaller base price. The bus industry voiced its protest against predatory pricing by a crown corporation, certainly informally if not formally. "Way-to-Go" fares went away.

A third incursion arose in the early 1980's with the increasing reliability of VIA's modern LRC rolling stock, providing what some would assess as improved travel quality. That the intercity bus industry did not completely disregard this development is reflected in the adoption by Voyageur Colonial Coach Lines of a demonstration project involving articulated intercity equipment. As will be discussed later in the paper, the adoption of higher quality equipment by the intercity bus industry in the United Kingdom in 1980 was an effort to match quality improvements being offered there by British Rail in the form of widespread introduction of High Speed trains.

With close substitutability between the bus and rail mode, and in Canada basically one intercity bus carrier competes head-to-head with the one rail carrier, VIA, the economic description of the intercity surface public passenger industry has to be that of an oligopoly - small number of suppliers, each heavily interdependent. The standard economic outcomes in such an environment are either that of sticky prices upward or of the presence of a price leader. The examples above suggest that, in Canada, rail has been the price leader, at least up to now.

There are, however, other opinions of the substitutability between bus and rail. Gormick [4] notes that "buses and passenger trains serve different markets. 'The competing bus line even admits it had no success in attracting local passengers left without service when the [Toronto-Havelock] train was chopped in 1982'". Notably Trentway-Wagar Bus Lines offered to provide the same service as VIA on this route for the same amount as the VIA subsidy $5.8 million and charge no rider fees, or alternately charge rider fees and return part of the subsidy. As an operating carrier on this line, this action alone would seem to suggest that Gormick's claim is only partly correct. Voyageur's testimony [5] eives a very real threat to the survival of the bus industry if the rail is to continue and step up its penetration of the intercity market, leaving the local collector services to the bus.

The new National Rail Passenger Transportation Act does have implications for increased cost recovery by VIA Rail Canada Inc. At this stage 100% of specific costs in [Windsor-Quebec] Corridor service; 60% in Transcontinental service; and 40% in Regional service. The first and third

are likely to result in rail price rises to the advantage of bus.

3.2 Air Policy Impacts-Canada

To date, Canada's intercity bus industry probably has not felt much impact of air policy changes. The development of third level air services in the early 1970's as a result of efforts by the Government of Ontario in the development and extension of its norOntair network probably had minimal effect. This network was designed to serve low volume routes, primarily serving communities such as Timmins, Earlton, and Sault Ste. Marie. Of itself this network would not divert a large volume of the intercity bus industry's ridership, but this short haul air technology was bound to have incursions on the higher volume routes.

Other demonstration projects followed on such higher volume routes such as Ottawa - Montreal. Now "City Express" is providing a well-regarded Short Take Off and Landing service among Montreal, Ottawa, Peterborough, and Toronto and recently upgraded to full Dash-7 service. General Aerospace currently provide STOL service from Toronto's downtown Island Airport to Buffalo, a link that up to now has been the preserve of Gray Coach. Such efforts being priced between air and rail are bound to draw, as well, from the bus not only for business travel but for the VFR (visiting friends and relatives) category also.

A more significant incursion into the VFR category for longer hauls has arisen since the acceptance in 1978 by the Canadian Transport Commission of Charter Class Canada fares which allowed air carriers to offer fares within Canada at prices comparable with those being offered on "charter" services to destinations outside Canada. Again, this pricing policy would have attracted ridership from other (cheaper) modes as well as having generated new traffic. As little data is available publicly on a link basis for the bus, one can only draw inferences.

4.0 U.K.Perspective

4.1 Rail Policy Impacts-U.K.

In the U.K., it might be said that the intercity motor coach industry (as the bus industry is known there) became frozen in time from, essentially, the mid-1930's to 1980 with perhaps the only improvement being the building of the motorway network (the U.K. equivalent of North American freeways) in the 1950's and 1960's. During this same period the railway passenger industry was modernising slowly, first by dieselisation resulting in faster and cleaner travel, and later by the development and introduction of 100 mph electrically hauled services on the West Coast Main

Line. This sequence ultimately resulting in widely available 125 mph High Speed Train services. In sum, these developments had one main effect, that being to widen the quality differential with the bus industry.

In the U.K. rail could not be as easily construed as being a price leader. Although nationalised since 1947, British Rail's operating subsidy is considerably less than VIA's, of the order of 3% (12 million pounds on 450 million pounds) [6]. VIA's 1984 Financial Report indicates that passengers paid $177m of $596m expenses, or 29.7% implying a subsidy of 70.3% [7]. Ostensibly the services covered by VIA in these figures are non-commuter in nature, although many rides are serving remote stations.

British Rail's financial structure segregates commuter, provincial, and freight services from intercity but will require by 1989 that 5% return on assets be obtained, a far cry from a 70% subsidy in Canada. That British Rail (at least in 1980) felt absolutely no threat to it from the intercity bus industry is evidenced by the fact that, on Nov 30, 1980 a scant 55 days after the deregulating of the coach industry, proceeded to raise its ordinary fares by a whopping 19 per cent, and season tickets by 17%. So much for the argument that deregulation would lead to price shaving by the competition. Later, though, the rapid technological progress that the bus industry adopted as a result of its deregulation in 1980 accompanied by innovative pricing and service characteristics resulted in retaliatory, defensive tactics by British Rail in the form of market segmentation and SaverCards.

4.2 Air Policy Changes-U.K.

The major intermodal competition for air travel within the U.K. comes from the railway, essentially on services in excess of 200 miles. The acceptance of proposals by more carriers to serve more markets has resulted in an expansion of chiefly business travel over the longer links. Possible expansion of short hop services using STOL technology may, in the future, be a force for the intercity coach industry to reckon with. At present it is inconsequential for the coach industry.

5.0 U.S. Perspective

5.1 Rail Policy Impacts-U.S.

Little analysis has been made public on the intermodal responses to deregulation in the U.S. Babcock and German [8] in a paper presented at the 1984 TRF concludes a sizeable interaction presently and in the future among AMTRAK, low-cost air services, and intercity buses.

Although AMTRAK's reputation has improved steadily over its 15 year life, The Reagan administration is still making noises about future full cost recovery. Such efforts would seem to presage increased trade for the bus industry as well as the (deregulated) low cost air carriers. The public interest group, NARP, is quoted by Transport 2000 as estimating that only a cut in excess of 10% in AMTRAK's budget could result in closure of the entire system.[9]

5.2 Air Policy Impacts-U.S.

The announcement of the U.S. air industry deregulation came initially at the time of the TRF meetings in New York in October 1978. Over the last seven years the shake-outs have resulted in a greater variety of more appropriate services. Many of which will have impacted adversely on the bus industry. A link specific analysis would seem to be needed to assess whether there is a quantifiable relationship. It has been said that

> ...the intercity bus industry in the United States is threatened with near extinction by airline competition due to deregulation. There are now 49 AMTRAK served communities with no bus service (94 have no air service) and a number of other communities have only very poor bus service. Trailways, for example, has cut numerous runs between Los Ang[e]les and San Francisco. Greyhound is responding to the crisis by franchising its weaker routes to other operators. In the latest round of AMTRAK-bashing, bus companies have joined the attack. However market surveys show very litle overlap between rail and bus markets [in the U.S.-ed.].[10]

6.0 Conclusion

There seems to be little doubt that in Canada that the intercity bus industry is

(a) relatively unsubsidised, and
(b) competitive with rail where rail chooses and is able to operate.
(c) serving some 3400 communities compared with 900 for rail and 300 for air (obviously bus must be the sole supplier to over 2000 communities -ergo no competition)

What seems to be less well realised is that in the intercity market, new STOL air services can be expected to draw more business from the bus. It is well recognised that for heavy traffic city pair links between 50 and 350 miles, bus and rail do compete and changes in one will affect the other in a predictable way.

The perspective offered by perusal of the U.K. and

U.S.environments is useful for future policy planning in Canada.

The philosophy of the new Rail Passenger Transportation Act says, quite succinctly, that the goal is a safe, modern, efficient, reliable network at the lowest cost to the Government of Canada without unduly affecting the ability of any passenger carrier to provide transportation services under normal competitive conditions. Policy makers are going to have to deal with the fact that, in all probability, the free world's transportation systems are presently in. what the economists call, Pareto optimal conditions in that no player can benefit from change without at least one other player being unable to be compensated for the loss sustained by such change. The choices are difficult, and the social implications pervasive.

ENDNOTES

1. Cape, D.M. 1984, Intermodal Surface Passenger-Competition-and Co-ordination in Southern Ontario-1983,Annual Proceedings of the Canadian Transportation Research Forum, pp.302-306.

2. Reschenthaler, G.B. 1981,Performance Under Regulation: The Canadian Intercity Bus Industry,Consumer& Corporate Affairs Canada, Research monograph #10.

3. VIA Rail Canada Inc.advertisement in Globe & Mail Toronto, Feb.21, 1983.

4. Gormick, G.Transport 2000 Ontario,Winter 1985/6

5. Voyageur Colonial Ltd.,1981,Submission to the House of Commons Standing Committee on Transportation,Montreal.

6. "This Is InterCity",1986,Modern Railways,Vol.43,-No.448.p.26

7. VIA Rail Canada Inc., Annual Report 1984, p.26

8. M.W. Babcock and H.W. German, 1984, "A Model for the Demand for Intercity Bus Travel", Annual Proceedings-of the Transportation Research Forum,Vol.25,-no.1.pp.187-193

9. "AMTRAK Wounded But Alive", Transport 2000 Ontario Spring/Summer 1985 Newsletter, p.10

10. "Bus and Truck Industry News", op.cit.,p.3

BIBLIOGRAPHY

Abbott, J. (ed) "InterCity faces the future-a review of British Rail's InterCity business", ModernRailways, Vol.43,No.448 January 1986

American Association of State Highway and Transportation Officials, Deregulation of the Transportation Industry:Task Force Report, Denver, 1983

Babcock, M.W. and German, H.W. "A model of the Demand for Intercity Bus Travel", Annual Proceedings of the-Transportation Research Forum, Vol.25, no.1.pp.187-193

"Bus Industry Opposes VIA Restoration Plan", Transport-Action, Ottawa, Transport 2000, Mar-Apr 1985

Cape, D.M. 1984, Intermodal Surface Passenger Competition-and Co-ordination in Southern Ontario 1983, 19th Annual Proceedings of the Canadian Transportation Research Forum, pp.302-306.

"City Express expands STOL Service", Transport Action, Ottawa, Transport 2000, Jan-Feb 1985.

Reschenthaler, G.B. 1981, Performance Under Regulation: The-Canadian Intercity bus Industry, Consumer & Corporate Affairs Canada, Research monograph #10.

Transport 2000 Ontario Spring/Summer 1985 Newsletter, Transport 2000Ontario, Toronto, 1985

Transport 2000 Ontario-Winter 1985/86 Newsletter, Transport 2000 Ontario, Toronto, 1986

Talley, W.K. and R.P. Kilvington, "Deregulation of Inter-city Bus Service", Annual Proceedings of the Trans-portation Research Forum, Vol.26 No.1 pp.327-332

Transport Canada, 1981 Intercity Bus Competition Study:Issues and Conclusions, Motor Carrier Branch.

U.S. Department of Transport, 1981 Deregulation and Inter-city Bus Operations in Florida since 1980

VIA Rail Canada, Annual Report 1984, Montreal

Voyageur Enterprises Ltd. 1981 Submission to the House of Commons Standing Committee on Transportation., Montreal

Canada, House of Commons, 1986 Bill C-97 National Rail Transportation Act

TRANSPORTATION POLICY IN A FEDERAL STATE

by

HENRY ROPERTZ

UNIVERSITY OF BRITISH COLUMBIA

1.0 Introduction

It is common to begin an article on transportation in Canada by invoking an hyberpole to describe how significant transportation is to both the economic and social well-being of this country. Given this importance the departure of practise from the policy embodied in the National Transportation Act, 1967 is a conundrum. The NTA, section 3 contains an explicit statement which recognizes the importance of transportation. That statement calls for "an economic, efficient and adequate transportation system". This is the basic philosophy or theory of transportation policy as it exists today. Yet the policy or paradigm that is practised on a day-to-day basis deviates significantly from this theory.

The paper will document those areas where the implementation of transportation has strayed from the stated policy and will analyze how the emerging role of the provinces within the federal state has been a major factor of this deviation. As well, the paper will highlight those areas where the federal government discussion paper entitled, Freedom to Move - A framework for Transportation Policy - fails to address this issue and finally the paper will extract a recommendation made 25 years ago by the MacPherson Commission on Transportation which could provide a potential solution toward creating transportation policy in a federal state.

2.0 Federalism as a National Policy Constraint in Canada

Canada is one of the more de-centralized federal states in the world. As such, Canadian Provinces have constitutional and economic authority equal to that usually associated with sovereign states. According to that authoritative economic historian, Harold Innis, "provincial control over lands and resources was a survival of feudalism and a source of weakness for Canada."[1] Any one who participated in or witnessed the discussion on transportation at the Western Economic Opportunities Conference in 1973 in Calgary can identify with or recognize how difficult it is for the federal government to adhere to national transportation policies. In fact, the constraints created by the provinces in both the creation and practice of national transportation policy has never received the full recognition of any of the major reviews undertaken on transportation in this country. Federalism as a classical theory is significantly different today than it was back at the time of Confederation or at the time the CPR "Transcontinental" Railway was completed, "provincial governments, (today) possess impressive means of complicating, frustrating, and interfering with policy making at the federal level, areas which they are far less hesitant to use than the federal government is to employ its virtually abandoned power of disallowance".[2]

The evolution of national transportation policy has never been fully integrated with this transformation of federalism. It is no accident of history that even as late as 1959 the MacPherson Commission was requested to report "upon the problems relating to railway transportation in Canada". Railways are a federal responsibility and hence were the subject of continuous complaints from the provincial governments. However, to its credit, and to the credit of its Research Director, Fred Anderson, the MacPherson Commission did identify the massive and largely undirected expenditure on roads which was underway at that time. It is estimated that between 1950 and 1985 approximately $65 B was spent on the road system. In Fred Anderson's own words;

> "Twenty-five years (since 1958) has seen over most of the agricultural regions of Canada the creation of all-weather roads running from every farm gate to any designated destination in North America. This is a truly phenomenal event, an investment of gargantuan size far exceeding any transport undertaking which ever preceded it. It dwarfs the drama of railway building by its sheer size and extent, even if it does not match the railway in romance and nostalgia. The whole process occurred in the public sector, effected by monies raised from taxes and made totally available to anyone who can put a vehicle on it."[3]

A comparison of budgets between the Federal Department of Transport and the provincial departments of transportation/highways/communications show further evidence of the significant role of provincial governments in the Canadian Transportation System.

Departmental Budgets (1984 - 1985)

($ Millions)

Federal	2,200	Sask.	243	P.E.I.	40
Ontario	1,581	N.S.	238	Yukon	23
Quebec	1,381	Man.	229	N.W.T.	22
Alberta	862	N.B.	199		
B.C.	761	NFLD	179		

Source: Transport Canada Government Expenditures on Transportation by Province, 1981/82 - 1984/85

In 1984 - 1985, the total Provincial Government expenditures on transportation was almost $5.7 B which is approximately three times the budget of the Federal Department of Transport. However, if the total federal expenditures on transportation which includes user charges and expenditures of the St. Lawrence Seaway, National Harbours Board, and other federal departments is included, the total federal expenditure would be approximately $4.8 B. Moreover, the trends in inter-city freight and passenger movements are increasing over those modes which move over the provincially operated road system. Between 1965 and 1983 freight moved by For-Hire Truck had increased almost 300 per cent. In terms of domestic inter-city passenger movements almost 94 per cent of all trips are taken by auto or bus over the road system. These statistics become even more significant when one recognizes that the provinces in terms of their own identity and economic development plans actually compete with each other within the Canadian Transport System. This rivalry was demonstrated across Canada when provincial governments began purchasing regional air carriers e.g. Alberta purchased Pacific Western Airlines ostensibly to improve services in northern Alberta, but may have made the purchase to prevent the government of British Columbia from making a similar purchase for presumably the same reason i.e., improved service into the interior and northern regions of British Columbia. Subsequently, PWA absorbed Transair, which had its base in Manitoba. Both the governments of Quebec, which purchased Quebecair, and Ontario were interested in Nordair. This placed the federal government in the uncomfortable position of regulating airlines owned by provincial governments.

Inter-provincial rivalry can also take place within a region. Prior to the resolution of the Crow Rate and as part of the many ad-hoc programs that were established in those days, both the governments of Alberta and Saskatchewan purchased 1,000 hopper cars at a cost of approximately $78 M per province and initially intended that their cars should be dedicated to moving only grain grown in their own respective province. Fortunately, this was not possible because the railways operate an inter-provincial system and the job of keeping Saskatchewan and Alberta cars separate would have been costly and inefficient.

The most recent example came during the resolution of the Crow Rate. The federal government attempted to establish a comprehensive transportation package to modernize the grain handling and transportation system on the

Prairies and to make it possible for CN Rail and CP Rail to begin the massive upgrading of capacity through to the West Coast. Despite the obvious need for change and the considerable benefits to the Prairie Region, both the governments of Manitoba and Saskatchewan resisted the change. Alberta disagreed with both Saskatchewan and Manitoba. British Columbia, which stood to benefit from most of the rail upgrading supported change as did Ontario where many of the purchases for rail upgrading would be made. Interestingly, Quebec, although not really affected by the change, was convinced by its agricultural lobby that the province would be affected and aligned itself with Saskatchewan. As a result of these provincial disagreements, national policy is again constrained as many of the key features of Crow Rate reform are still not resolved, such as method of payment (should the railways or producers receive the annual federal subsidy of $659 M) and variable rates.

Who can deny that the major historical transportation problem has been the dispute over rail freight rates and regional development. As Howard Darling outlined in his classic textbook on The Politics of Freight Rates, "the course of transport policy in Canada can be defined as a struggle of ideologies versus realities and at the forefront of this ideology struggle were the regional development plans of the provinces."[4] In theory, the provinces believed and in some instances still do believe that cheap transportation, i.e. cheap rail transportation was or is essential as a means of promoting economic development. In reality or in practice, it was and it is competition from truckers that destroyed the railway rate structure over which the provinces have devoted so much debate and effort.

3.0 Departures from National Transportation Policy Theory

The second area to be discussed is that even within the area of federal jurisdiction there is a departure from the transport policy in place and the manner in which it is practised on a day-to-day basis.

The Freedom to Move document states that the "last substantive review of Canada's transportation legislation was back in 1959-1961 (The MacPherson Commission)".[5] This is not correct.

At the Western Economic Opportunities Conference the Minister of Transport, Mr. Marchand, and the Prime Minister, Mr. Trudeau, agreed to certain basic principles and policies involving transport, i.e., greater attention to ways of reducing rail cost such as elimination of alleged freight rate discrimination. Frustrated in his attempt to deal with these issues and to be responsive to complaints of the Prairie Premiers, Mr. Marchand rose in the House of Commons on March 07 and stated: "Transportation is in a mess".[6] In the Speech from the Throne on September 30 that year, the government announced its intention to carry out a comprehensive review of transportation policy by a Departmental Task Force. The Task Force was formed under the since tragically deceased Jim Davey. Among the chief aims of the Task Force were the inclusions of regional objectives in transportation policy and dealing with freight rate concerns. The work of the Task Force resulted in the tabling in Parliament in June 1975, three comprehensive documents[7] outlining a new transportation policy framework. There are many lessons to be learned from the work of this Task Force. The

Task Force took over a year to prepare its documentation. It involved a wide range of consultations and discussions with carriers, shippers and labor groups as well as a number of studies, reviews and analyses.

Back in 1974-75, consultation with the provinces was a high priority. It involved an unprecedented scale of federal-provincial discussions. Indeed, the new framework for transport policy was to a large extent a 'national' policy because it did include many of the requirements of the provincial governments, particularly from Western Canada.

The NTA goals of an "economic, efficient and adequate transportation system" were de-emphasized in favour of a system providing for the support of national objectives and "accessibility and equity of treatment for users", a phrase which was considered more specific than "adequate". It was proposed that the term "efficient" be retained but, at least relatively reduced in prominence. Legislation (Bill C-33 and Bill C-20)[8] were introduced into the House of Commons in 1977 and 1978 but were never passed. The proposed legislation did recognize an increased role for "government" in using "transport" as an instrument of National policy. The mistake made in this conjunction was once again "government" meant "federal" and "transport" meant "rail". No attempt was made to incorporate road and where applicable provincial rail and marine jurisdiction as part of this instrument. No provision was made to coordinate federal transportation policy with provincial transportation policy and practise. Unfortunately it is unlikely that the provinces would have agreed to such a proposal.

Yet, such an agreement is necessary if the NTA goals of an "economic, efficient and adequate transportation system" are to be achieved. This inconsistency is not rectified by the "de-regulation" thrust contained in the Freedom to Move proposal because the area of provincial responsibility was not fully addressed. To give effect to the de-regulation approach will require not only the cooperation of provincial governments but also the coordination of federal-provincial programs and policies in transportation. The inter-city passenger and prairie grain handling system are two areas where there is a need for "cooperative federalism". At present the federal subsidy is approximately $532 M annually for rail travel and $659 M annually for grain movement.

It is difficult to determine how these subsidies relate to the overall objectives in the Freedom to Move proposal which calls for "greater efficiency and the lowering of total unit costs for all transportation services". For example, in the Ottawa - Montreal corridor, the most efficient passenger mode is inter-city bus. Without heavily subsidized rail service, bus frequency between Ottawa and Montreal could increase to one bus departing every 30 minutes for 18 hours a day for most of the year. This is accessability. This is efficiency.

No mention is made in the Freedom to Move document concerning grain transportation. Grain handling companies are among the top customers of both CN Rail and CP Rail, yet grain traffic will remain regulated. This is of particular importance to both major railways since at present in Western Canada about 20 per cent of their workload is devoted to grain shipments, yet the

railways are prevented by legislation from moving that grain in a more efficient manner, e.g. unit trains. But this is only part of the problem because grain movement is also the most high cost and inefficient movement on the railway system.

3.1 Grain Transportation Inefficiencies

1. Consolidation of grain on mainline and secondary lines has resulted in 1/5 of the delivery points (250) handling 1/2 of all the grain. Perhaps even more revealing are the facts that 30% of the growers sell over 80% of total production. They own 60% of the farm machines. They use about 70% of the fertilizers and on average these farms employ about $ 1 million in assets.

2. According to railway costing expert, Carl Snavely, variable costs incurred by Canadian Railways for grain may be between 40 and 60 per cent higher than those incurred by U.S. railroads.

3. Despite the above two points, the Prairie grain collection system is still comprised of about 85% of the rail mileage which existed in the 1930's, a system which was established when horse haulage was still important.

These inefficencies cause problems not only for the railways but also for the grain shippers. Under the Western Grain Transportation Act the grain shipper pays an increasing share of system-wide costs. The result is that unless changes such as variable rates are allowed, the grain shipper will be locked into a high-cost, inefficient grain collection system. Moreover, from a marketing (Canadian Wheat Board) production (Canadian Grain Commission) and Transportation (Western Grain Transportation Agency) grain remains the most regulated product in Canada.

Under Transportation Policy objectives in the Freedom to Move document a reference is made that "the heart of NTA Statement of objectives, which calls for an economic, efficient and adequate transportation system will not be discarded." The problem however, is that the heart of the NTA was never implemented. Approximately 50% of the Federal Department of Transport (including the CTC) expenditures of about $2.2 B per annum is accounted for by subsidy or deficit payments of Crown Corporations. These expenditures will not be eliminated by the proposals contained in the Freedom to Move document.

This paper has attempted to demonstrate how difficult it is to establish a consistent and equitable national transportation policy without the full cooperation of the provinces. This was a problem for the MacPherson Commission, the Davey Task Force and for the drafters of Freedom to Move. What are the possibilities for Canadian Transportation Policy given the constraints imposed upon it by the federal structure with it regional stresses and differences?

4.0 Transportation Advisory Council

To address the issue of regional requirements, provincial government priorities and disputes between shippers and carriers, the Davey Task Force recommended a greater Ministerial role as does the Freedom to Move proposal.

The problem inherent in such an approach is that it would make Federal Ministers of Transport acutely vulnerable to pressure from not only Provincial Transport Ministers and special interest groups but also from his/her cabinet colleagues. It is unfair to expect tranportation companies to make capital investments or to expect users of transportation services to make choices resulting from over-lapping or redundant federal-provincial jurisdictions.

Any transport policy must be consistent and the rules must apply fairly. The rules cannot be changed at the discretion of a politician (federal or provincial). As Fred Anderson said in his remarks to a recent forum hosted by the Center for Transportation Studies at the University of British Columbia to discuss the Freedom to Move document "Ministerial intrusion, cabinet referral and the promise of arbitrary support payments carry with them the threat of arbitrary action, influence peddling, prejudice and budget irresponsibility."[9]

The drafters of Freedom to Move had almost an impossible task in attempting to establish a national transportation policy for Canada given the shared responsibility of transportation jurisdiction between one federal and ten provincial governments. Moreover, the level of service and the degree of competition varies considerably in different regions of the country. Nor is it possible to discuss transportation in terms of individual modes. The public transport system is dynamic. Its key features include increased inter-modal competition and expanding inter-modal interdependence in such areas as piggybacking, container movement and access roads to airports and harbors. To address such problems the MacDonald Report on Economic Union and Development Prospects released in 1985 called for greater dialogue and consultation between and among all parties concerned with specific federal - provincial issues. Interestingly, the need for more dialogue and consultation was the reason the MacPherson Commission 25 years ago recommended the establishment of an open advisory forum.

This long forgotten recommendation to establish a Transportation Advisory Council came about because the Commission was "sufficiently convinced of the unique situation in Canada to think that this nation with its peculiar federal structure could and should attempt to solve its transport problems in the context of dialogue and consultation."

The brevity of the article does not allow space to elaborate on the Transportation Advisory Council in depth. Those interested are directed to pages 82-84 of Volume II of the MacPherson Commission Report.[10] The Advisory Council was to be comprised of individuals "vitally interested in the achievement of efficency in transportation". Individuals were to be appointed on a part-time and short time basis to ensure new ideas and vitality. Although the Commission foresaw the advantages of the Advisory Council or Forum in making recommendations on all modes of transport, it did recommend the Council to be federal in nature and to have a statutory base in legislation. In view of the

present federal structure it is advised that this council if established, also receive a basis in provincial legislation.

Comprehensive dialogue and consultation was also one of the policy approaches undertaken by former Transport Minister, Mr. Pepin to address the Crow Rate issue in 1982. One of Mr. Pepin's strategies was to remove the center of the Crow debate from the conflict of the Federal-Provincial arena to a forum headed by University of Manitoba Professor, Dr. Clay Gilson to allow those most affected by changes to the Crow Rate to negotiate a comprehensive settlement within a fiscal framework provided by the federal government. This approach did lead to establishment of the Western Grain Transportation Act, 1983. However, as previously indicated, major structural problems remain in the grain handling and transportation system. What is required is a similar approach to deal with the outstanding issues of method-of-payment (should the railways or producers recieve the $659 M annual subsidy payment) and variable rates. There is a need for a permanent Transportation Advisory Council with a small support Secratariat so that issues such as variable grain rates or rail passenger services could be discussed and perhaps even resolved outside the contentious federal-provincial theater, although there will be times when both levels of government will need to participate directly in discussions with interested organizations and individuals.

We need to move not just along de-regulation lines but along a path toward a comprehensive (multi-model) transportation policy which requires conscious federal-provincial coordination and cooperation. Federal-provincial agreement cannot be reached if each level of government considers its responsibility as sacrosanct or untouchable.

A prototype for a National Transportation Advisory Council may already be in place in the form of the Western Transportation Advisory Council (WESTAC). WESTAC formed in 1973, is an organization of senior business, labor and governmental leaders which seek to enhance the economic development of Western Canada through cooperative approaches to transportation related issues.

There have been a number of changes since 1967 which have affected transportation policy. These changes were the National Transport Act, the creation of a single regulatory agency, the Canadian Transport Commission, the constant organizational changes in the structure of the federal department of Transport and the emergence of competent provincial departments of transport.

These changes did not create a process which: enabled transportation policy to be debated as part of the changing national scene; established a national data bank of transport statistics which could be used to assess transport investments and policy changes; and, resulted in bringing the ever increasing role of provincial responsibility into the decision-making process of Canadian Transportation Policy.

It is suggested therefore, that a Transportation Advisory Council be established to create a process whereby transportation policy and specific transport related issues can not only be discussed, but could also be resolved within the context of the total transport system. "Railways" are no longer the euphemism for transport in Canada.

The advantages of a Transport Advisory Council would be as follows:

1. It could provide a vehicle for organizations other than government to influence transport policy.

2. It could initiate research free from political constraint.

3. It could act as a sounding board in research findings.

4. Regional stresses and differences could be discussed in a non-political environment.

5. Disputes and differences could be resolved through negotiation and cooperation between or among affected/interested parties. The adversarial context of CTC Hearings could be avoided.

6. Depending on how successful the Advisory Council was in achieving the above points, this could result in the Council becoming a key and influential advisor to both government(s) and industry.

5.0 Conclusion

This paper has attempted to demonstrate that since the National Transportation Act was established in 1967 there have been major departures from the basic philosophy of the Act. The paper identified the emerging role of the provinces as one of the main reasons for this departure. Reference was made to the significant role of the provinces in terms of total expenditures on transportation to illustrate a need for federal-provincial co-operation in transportation policy development. The paper provided two examples, inter-city passenger and grain transportation where over-lapping jurisdiction and expenditures have resulted in high cost inefficient systems. The Freedom to Move proposal was discussed to show the difficulties faced by the federal government to establish a national transportation policy when it does not have jurisdiction over all modes and when its own level of expenditures on transportation are less than that of the provinces.

Finally, a Transportation Advisory Council was recommended as a means to establish a process whereby a Canadian Transportation Policy could be developed affecting all modes of transport.

REFERENCES

1. Stevenson, Garth, "Federation and Intergovernmental Relations" in Canadian Politics in the 1980's edited by Michael S. Whittington and Glen Williams, Methuen, Toronto, 1981, pp. 275-291

2. Ibid, pg. 276

3. Anderson, Fred, "Regulation and the Characteristics of the Supply of Transport and Agriculture in Canada", Suplemenatary Essay in Economic Council of Canada Technical Report E/16, 1981

4. Darling, Howard, The Politics of Freight Rates, McClelland and Stewart Toronto, 1980

5. Canada, Transport Canada, Freedom To Move, A Framework for Transportation Reform, Department of Supply and Services, Ottawa, 1985

6. Canada, House of Commons, Debates, March 07, 1974

7. Canada, Transport Canada, Transportation Policy, A Framework for Transportation in Canada, Summary Report Information Canada, Ottawa, June, 1975

8. Canada, House of Commons, Second Session, Thirtieth Parliament 25 Elizabeth II, 1976-1977, Bill C-33

9. Anderson, Fred, "A Perspective on Freedom to Move" in A Synopis of Views and Issues Raised at the Transportation Policy Forum on Freedom to Move, edited by Trevor D. Heaver, Centre for Transportation Studies, Vancouver, 1985

10. Canada, Royal Commisssion on Transportation, Vol. II, Queen's Printer, Ottawa, 1961

The Canadian Transportation Statistical System in light of the rapidly changing environment - A Statistician's Perspective

B.G. NEMES — Assistant Director
R.E. DROVER — Director
D.P. CHARTRAND — Chief Aviation Statistics
S.L. MOZES — Chief Surface/Marine Statistics

Transportation Division, Statistics Canada

1.0 Abstract

In general, it is the characteristics of an industry which play a major role in the organization, collection, analysis and production of statistics which describe the industry. Transport industries have entered into a phase during which major changes will occur as the structure of the industries shifts away from a regulatory to a more competitive environment; as the newly developed technologies are implemented and as new transportation and trade policies are formulated.

The Transportation Division of Statistics Canada is responsible for the management of a significant portion of the Transportation Statistical System in Canada. Its data bases include information on the economic performance of the transportation industries and on the movement of commodities and passengers by mode.

This paper presents and analyses scenarios which will have an impact on that part of the Transportation Statistical System which is managed by Statistics Canada. More specifically, this paper:

(i) presents scenarios and describes the nature of the changes and the direction which may influence the future statistical system. Included in this section are descriptions of changes to the mix of the data, shifts in demand towards more international data and more comprehensive, comparable and integrated traffic data;

(ii) analyses the scenarios to provide suggestions on how the structural, technological and policy changes can be measured statistically. Principal among the measurement tools are common defini-

tions across all modes and greater utilization of machine readable data;

(iii) outlines some practical solutions to the major statistical issues.

2.0 Introduction

The Transportation Statistical System in Canada has evolved to its present state as the result of the demands placed upon it from its users. These users are interested in the System of National Accounts and regulatory types of statistics. The statistical system is maintained centrally, is organized along modal lines, is composed of a set of variables which are comprehensive and which are integrated among modes. It has achieved this state will considerable assistance from the Canadian Transport Commission and Transport Canada.

The purpose of this paper is to describe the statistical system as it exists today and to describe the forces of change, both regulatory and economic, which it faces in the immediate future. An analysis of these issues is presented with a view to describing the statistical system which will result after the forces of change are spent. The paper concludes with suggestions regarding the statistical system in the longer term.

3.0 The Present Transportation Statistical System

The present statistical system as developed and implemented by the Transportation Division of Statistics Canada was influenced by many factors; the most important of which are the existence of dual frameworks and associated legislative instruments.

3.1 Dual Frameworks

In order to maximize the utility of statistics, it is essential to develop, collect, process and compile statistics within an integrated framework using standard units, concepts, classifications and definitions. Statistics developed using such a framework can be related to the economy and to the various modes of transport.

The present statistical system is based upon dual frameworks, namely a fully integrated and conceptually well defined System of National Accounts and a less well defined regulatory framework.

The conceptual framework of the System of National Accounts (SNA) has its origin in economic theory. The central concepts of production, income, consumption, and capital formation are all fundamental concepts of

economics. The translation of these concepts into a system of economic statistics which describe and explain the functioning of the economy is the principal objective of the SNA.

The concepts for the regulatory framework are not as well defined as the SNA; however, it is generally accepted that the major demand under a framework for transportation statistics involves the measurement of people and commodities on an Origin-and-Destination basis. In addition, capacity utilization statistics, performance data and detailed costing and pricing data are required.

Within each mode of transport, the measurement of these variables is performed under a framework which is characterized by a unique set of definitions, concepts, classifications and statistical units. The uniqueness of this framework is further determined by the output characteristics of the transport industries: the directional nature of the service, the non-storability of the productive capacity and the dichotomy between the production unit and the consumption unit.

The existence of these two frameworks and their relative influence on each mode of transport determines not only the amount and type of information to be obtained from what unit, but also the degree to which individual data can be released and to whom.

In the statistical system, the reporting unit differs according to the relative importance of the use of the framework. The reporting unit in the air and rail modes is the regulated entity defined by the respective regulatory authority, while in the trucking, bus and marine modes, the reporting unit is defined by the statistical structure of the SNA. This results in the inability of direct comparison of reporting structures, and their economic characteristics, between modes. Even within the regulatory system, direct comparison becomes impossible because the regulations change between provinces (and territories) and from year to year.

The amount of detail collected from a respondent depends on the framework under which the data are collected. As a general rule, data collected under a regulatory framework tend to be micro in nature while SNA data are, in comparison, macro in nature.

Information collected for the purposes of the SNA are economic statistics. They are used as inputs to national aggregates such as the Gross National Product (GNP) and the Gross Domestic Product (GDP). The information collected are estimates of the value of gross output and the associated inputs such as capital, labour and purchased

goods and services. On the other hand, data collected for regulatory purposes include traffic data, service utilization statistics, detailed costing information, infrastructure utilization information and pricing. The emphasis is on micro detail and reliability.

The methods of data collection vary to meet the needs of the framework being served. The SNA can be satisfied by using any one or a combination of collection methodologies ranging from complete enumeration to sampling and the use of administrative data. In addition, because of the uses to which the data are put, estimation and imputation for missing or invalid information are acceptable. Under the regulatory framework, the data are required to be very precise; a precision which in most cases precludes the use of sampling and the use of imputation techniques. Data at the level of unit of observation must be capable of receiving an accounting certificate.

The regulator defines what is to be reported, when it is to be reported and in what format it is to be reported. Uniform accounting systems are often required. Under the SNA, uniformity is not easily achieved because the industries which are being measured are invariably heterogeneous. Complete data for the ultimate reporting unit in many instances do not exist. This permits estimation of values to describe the industry by the respondent or by the statistician. The result is that there is a consistency from industry to industry (mode to mode) but not from firm to firm.

In summary, the SNA measures the contribution of each industry to the national total. This requires standard principles, definitions, concepts and a framework which describes the whole economy. In contrast, the regulatory framework concerns itself with the individual transportation issues first, all other issues are secondary. It can also assign different measures of importance to individual modes depending on policy considerations.

The statistical system can operate under the dual frameworks without being inconsistent or contradictory. However, to do so requires that the statistician devote more effort to reconciliation, analysis and interpretation of the data.

3.2 Legal Instruments

Further complications are added to the transportation statistical system because the data are collected under a diverse set of legal instruments. The use of these instruments and their relative strengths and weaknesses influences not only the response rates but also the quality of the data reported.

The Statistics Act

Prior to the passage of the first Statistics Act in 1918, data on transportation were collected under the authority of various acts, the most notable of which was the Railway Act. Policies governing the release of the data were the responsibility of the respective regulatory authority. In 1918, authority over the publication of transportation statistics was transferred to the newly formed Dominion Bureau of Statistics, which was renamed Statistics Canada in 1971.

As set down in the Statistics Act, data are to be made available to users within a reasonable period of time provided each release conforms to the guaranties of confidentiality. Within budgetary restrictions, Statistics Canada strives to meet the statistical needs of all levels of government and the private sector. In exercising this mandate, officials are always mindful that they are a service-oriented source of public information with the responsibility of protecting the interests of the suppliers of information. However, in recognition of the unique and often monopolistic nature of large portions of the transportation industries, the Statistics Act gives to the Chief Statistician of Canada discretionary powers which permit the release of individual carrier data. Strict guidelines have been established regarding the use of such data.

The Statistics Act does not provide a uniform set of accounts for financial data which are specified by regulators. To ensure that the regulatory requirements are met, other acts are required.

The Aeronautics Act and the regulations associated with this Act are used to collect all air carrier information. In the regulations, the Aviation Statistics Centre of the Transportation Division of Statistics Canada is specifically named as the agent of the Air Transport Committee of the Canadian Transport Commission.

The Railway Act and the regulations associated with this Act are used to collect all information about federally regulated railways. Federally regulated railways are those which cross provincial or national boundaries. The Act requires all carriers to file certain information with the Railway Transport Committee of the Canadian Transport Commission and file a copy of this information with Statistics Canada.

The Customs Act is used to collect information on vessel and commodity movements to and from Canadian ports in international seaborne shipping.

Various administrative records such as air traffic control records, air carrier licensing records and provincial motor vehicle licensing records are also used to collect information. The above examples show that the use of administrative data is most prevalent in the air mode because Transport Canada plays an important role as the provider and the operator of an infrastructure.

The existence of these legal instruments, their relative application and the extent of the authority which underlies them, determines the nature, the amount, the accuracy and the response rate of the data collected.

4.0 Current Transportation Issues

The Transportation Statistical System has already been described as one which has evolved in response to external forces. The statistical system has remained relatively static over the past few years. It is no longer static. A set of issues has been presented which will have a serious impact on the future of the statistical system. In the paragraphs which follow, these issues are discussed under the following headings: government policies and regulations; economic forces in the market place; and technology. The discussion is centered on aspects of the issues which will have a major impact on the Transportation Statistical System.

4.1 Government Policies and Regulations

The issue which will have the most significant impact on the Transportation Statistical System is the degree of regulatory reform which is to be reflected in the proposed National Transportation Act. It is anticipated that it will be based on the 1985 White Paper, "Freedom to Move". At the time this conference paper was written, the details of the legislation were not known. However, there have been strong indications that major revisions to the National Transportation Act of 1967 are proposed.

Reduction of Entry and Exit Controls

There is a proposal that in aviation, entry to any class of domestic air services will be governed by the criteria of "fit, willing and able". This is expected to mean the carrier will need to satisfy safety regulations and submit proof of adequate insurance coverage. This relaxation to conditions of entry will result in an increase in the number of air carriers entering the market. Some increases have already been noted, particularly in the area of medium-sized carriers wishing to provide service to and from major centers.

The impact of such a change will be increases in the amount of traffic, and reductions to the stability of the number of carriers providing similar services. Only if these medium sized carriers participate in a survey of their services will the data base be able to reflect a complete picture of passenger markets. It is expected that adjustments to the statistical system will be required to account for structural changes.

In trucking, it is expected that the experience in the United States will be paralleled in this country. In the US, the number of carriers offering their services has almost doubled. Private carriers have sought to optimize their operations by looking for backhaul traffic which was previously the sole preserve of the for-hire carrier. In addition, a large number of industries have entered the market place to provide better services to their clients. These changes to the structure imply that the distinction between private and for-hire carriers may blur. This in turn will require adjustments to the industrial classifications in order that the revised structure will be correctly represented in the SNA.

Confidential Contracts

One proposed change will provide the Canadian railways with the right to enter into confidential contracts with shippers on both sides of the border. This will provide the Canadian railways with the same freedom as has been given to their US counterparts by the Staggers Act of 1980. If the experiences in the US are repeated in this country, there will be a shift in the market share from one mode to another, particularly for commodities which are currently transported by both trucking and rail. The impact on the statistical system is that there may be a loss in the geographic and commodity detail which is now obtained from the trucking industry, a loss which may not be matched with a corresponding increase in the detailed information available from the railway companies.

In the case of marine carriers, confidential contracts would be possible between shippers and members of shipping conferences. The contracts could be extended to become multi-modal by setting rates with the inland carriers. Competition between members of the same shipping conference would be fostered and might result in shifts from one mode of transportation to another or in an increase in cargo diversions from Canadian to U.S. ports and vise-versa. These structural changes would have to be examined and adjustments to the statistical system would result.

Collection of Regulatory Statistics

Explicit reference to a reduction in the amount of data required for economic regulation of the aviation industry is made in "Freedom To Move". The proposal is to reduce the filing of financial data items to those which would be justified by "safety, maintenance and planning" considerations. The result would be an obvious reduction in detailed information from that currently available.

Traffic data will continue to be required. Adjustments may have to be made to account for the problems of entry and exit that have been mentioned above. However it is not anticipated that these changes will require changes to the framework or to the statistical system.

As the process of regulatory reform continues in the direction towards less regulation, the importance of the uses of the SNA related data will increase. The SNA has a requirement for financial and operating data. This need will be satisfied in the future. It is not known at this time if the monitoring function's need for financial data can be satisfied from this data set.

4.2 Economic Forces in the Market Place

Economic forces are expected to play a role in the formulation of revisions to the Transportation Statistical System. The ones which are described below are those which may be isolated from the mix of economic forces and which may have characteristics that are measurable.

Mergers

Adjustment to the proposed reregulated environment is likely to involve a strategy of consolidations and mergers. Some of this activity has already been observed in aviation and trucking. In aviation, there is the example of Canadian Pacific Airlines' purchase of Eastern Provincial Airways and acquisition of a controlling interest in Nordair. These mergers will have an impact on the number of carriers who provide the services and the concentration of that service. Industry concentration and structure will change and will require adjustments to the statistical system to permit tracking of the changes.

Multi Modal Ownership

The Transportation Statistics System is currently independent of the question of form of ownership. However, there is an anomaly resulting from companies which currently define themselves to be multi-modal and which later decide that one mode is really an extension of another, at least from the viewpoint of statistical reporting. The

statistical system is able to account for this anomaly, but only if the company does not change its philosophy. If the company either decides to view itself as operating in two or more separate modes or decides to divest itself of a set of companies which make up one of these modes, then the statistical system will be unable to react. Carriers who compete with such companies have voiced frustration with the situation. The result may be a restructuring of companies along strict modal lines, a change which will have a great impact on the structure of the data base.

Intermodal Competition

It is expected that with reregulation, there will be shifts in the choices that are made to ship goods. Competition will arise between modes. Rail and trucking companies will intensify their competition for commodities which can be carried by either of these modes. It is expected that modal choice will focus on the rates. As the shifts in modal choice occur, there will be parallel shifts (or distortions) to the statistical series because the two sets of information are collected using slightly different methodologies.

Modal Interdependence

Modal interdependence is a term which describes the activity of integrating diverse transportation networks. The integration of the network has the principle objective of providing a faster more efficient service to the client. Some evidence of this activity occurs in the emerging industry of the courier where the pickup and delivery capability of trucks is joined to the speed of the aircraft.

In the US, railroads and foreign shipping lines have started to modify their terminal facilities to adapt to the double stack container. In some cases, it is the steamship lines, not the railroads which have the responsibility for setting the rates and filling the containers. Similar grouping of modes can be seen with the transportation of passengers. VIA Rail uses buses in some markets to optimize its transportation network.

These operational solutions to problems of optimization of the movements of passengers and cargo are not wholly accounted for by present survey methodologies. New ways will have to be found to reflect the interdependencies and to account for the movement of passengers and goods by individual mode.

Foreign Carrier Competition

The reregulation of trucking has lead to the expectation of fierce competition from large American carriers. In the case of the railroads whose principal activity comes from their efficiency in the movement of bulk commodities, concern is being expressed that the US carriers will be able to augment their transborder service by offering an East-West service using rail lines located entirely south of the border. Neither of the two frameworks currently has the capability to account for such activity; both will require adjustments.

Similar conceptual problems exist with the current practice of diverting Canadian cargo through US ports and US cargo through Canadian ports. The present transportation statistical system does not provide mechanisms to account for such activity. Estimates of this sort of activity are available only through US trade statistics. If in the future there is an increase in this activity made possible by reregulation, then fundamental changes to the concepts which underlie the system will be required.

Safety

It has been suggested that reregulation will result in carriers becoming more efficient, in both the operating and the financial sense, in order to remain competitive. Such activity might result in the carrier neglecting its obligations to respect safety requirements. To ensure that the safety regulations will continue to be respected, there will be a requirement to monitor the financial status of the carriers to seek signals that the carrier is entering a period where sacrifices may have to be made to ensure solvency.

In the past, the Transportation Statistical System has provided valuable information for the monitoring of safety in aviation. The challenge will be to maintain such an information base and to extend it to cover the other modes.

4.3 Technology

One final area worthy of note concerns reaction relative to technology. In aviation, shifts have already begun. Carriers have turned towards reconfiguration of their fleets. They have opted for aircraft fleets which are consistent and which are tailored to the markets served.

In trucking, it has been observed that the average age of vehicles has been increasing: an indication that new equipment was not being purchased. As these older

vehicles are replaced by the newer models which are capable of achieving better fuel consumption, an impact on the rate structure and the services offered to clients is to be expected.

Railways too are looking to upgrade their equipment and their lines. Double-tracking is becoming a reality in many parts of the country. Double stack container trains are also being tested. Both of these changes are expected to impact on the freight rates.

None of these technological innovations will have a measurable impact on the SNA. However, there will be an impact on the detailed data collected, as the carriers expand their markets or change the type of service provided.

Computer technology will also have a large impact on the transportation industries. The technology will be used to improve their efficiency and productivity thereby permitting the carriers to become more competitive. More data will be captured in machine readable formats and will provide a large potential source of data for the Transportation Statistical System.

5.0 Statistical Issues

Survey statisticians have centered their professional activity around three fundamental concerns; timeliness, quality and response burden. Their quest to ensure that data are timely and of high quality has touched on the users and the suppliers of data alike. The result was that both users and suppliers of data took these issues as their own.

The question of response burden is relatively new. Governments have always assumed that they had a right to information which would permit analysis of their policies and the scope to monitor the impact of policy initiatives. Recently, the business community has demonstrated a reluctance to provide information because of its cost of production and their concern that individual data remain confidential.

The statistical agency, in response to the issue of response burden, has reacted by taking a combination of steps which range from the reduction of the frequency of response which is required, to the substitution of the data collected by data available through some administrative process. Reduction to the frequency of enquiry requires that the statistician examine the purposes to which the data are to be put. Consultations with the user community are initiated and solutions to the problems which will result from reducing the frequency of a survey

are sought. In some cases, the solution can be found by selecting a representative sample from the same list of entities which had previously been used to obtain the full set of information. Alternatives to the sample, or to be used with the sample, include the reduction of information which is collected from any one entity.

Substitution of the data requires that a source of information be found which is as comprehensive as was the original survey. Under the purview of government, there is one source of information on business which satisfies this condition of comprehensiveness: income tax data. Tax data provides the statistician with a set of information which covers the same universe as does the survey. The problem is that the purpose underlying the collection of tax data differs from that of the collection of survey data. This difference manifests itself principally in the amount of detail and the scope of content. Tax data is one component of the total amount of information required to describe the economics of individual industries and the industrial composite. In addition, statisticians need the dimensions of industry, geography and activity, which are not present on tax forms. These requirements must be satisfied if the statistician is to fully execute the mandate: to provide industrially and geographically classified information to describe the country's economy.

Timeliness of the data is an issue which relates to the usefulness and currency of the information released. Regulators require that every piece of information be available before they are willing to release the information or use it as the basis for some policy. In this regard, their need for data which can be certified causes delays in the acquisition, the processing and the ultimate release of the data. In a regulated environment, the statistician must continually weigh the need to have quality data against the need to make the data available as early as possible. To date, solutions have been sought in the areas of speeding up the responses from the carrier and the development of computer systems which will accept carrier data in machine-readable formats and process the data faster than was previously possible.

The pursuit of quality underlies most of the activity of the statistician. Processes are designed and implemented to scrutinize the data to ensure that it is consistent internally, consistent with the information received from similar carriers and consistent with what was previously reported. Much time is spent in reviewing the results of these tests. Follow-up telephone calls are made to the respondent to determine if the data are accurate and if there has not been some inadvertent oversight. All of these activities are undertaken to ensure that the statistician's product, the data, is of high quality.

Also faced are issues associated with the methodologies of measurement. The issue is that the statistician must choose between alternative statistics which are designed to portray all or part of the change being measured. Choices lie between counts of entries and exits to and from the market in such a way that the final value represents movements due to the change and not to the usual market forces. Other measures such as industry profitability and financial ratios must also be scrutinized to ensure that they too reflect the change and not the market forces. To complicate the problem there is the question of how frequently the measurement should be taken, and over what period of time the event should be measured. The final question relates to the choice of a signal which permits the conclusion that some stability has returned. In short, the statistician must choose the tools, and specify the method to isolate the event, the frequency of observation and the signal of returned stability.

Measurement must also be made of changes in statistical policy which result in the substitution of direct survey data by that derived from administrative records. The choice here is somewhat less complicated because there is no need to isolate the effect. A methodology has been devised to permit subsampling of tax filers to formulate a relationship between the two data sources, direct survey and tax data. Use of the relationship permits the alignment of the two sets of data.

Under the regulatory framework, the current practice is to request data from holders of permits or licences to operate. This practice results in data which measures transportation activity, but not the transportation industry. The difference between the two is that the former may be found from operating entities of other industries. The SNA framework requires that business be classified as industries on the basis of rules which specify that it is the majority activity that receives the classification. While this policy tends to overlook industries such as transportation which might be nested in other industries, it does permit the whole of the industrial composite to be classified.

At Statistics Canada, a major project is underway which will result in every business being represented in a single data base. When completed, this data base will permit a consistency of classification and of data which has to date not been possible. Current computer technology will provide such a vehicle and will also provide a facility to track the units and their associated data characteristics over time.

More and more businesses are able and willing to provide the data government requires in a machine readable form. This will change the collection procedures and will affect the quality, the timeliness and the quantity of data. Statisticians will have to devote their energies to the processing of vast amounts of data in a multitude of formats. The challenge will be to provide the user community with data which continues to improve in quality and timeliness and which is taken from a much larger data base.

Conditions of economic restraint have significant impact on the Transportation Statistical System. In fact, restraint will require that as solutions are found to the issues discussed in this paper, some efficient use of resources will result.

6.0 The Future of the Transportation Statistical System

The future of the Transportation Statistical System will be shaped by the issues which have been outlined above. It is felt that the future direction will follow the general direction dictated by the dual demands made on the system and that there will be a narrowing of the differences between the two.

Liberalization of industry regulations will have a far-reaching impact on the statistical system. In particular, those modes which are currently operating under a regulatory framework will be subject to the greatest change; a relaxation of their current burden. Economic regulation needs detailed data on such items as costing and pricing in order to plan, monitor and analyze the traffic and the utilization of the infrastructure. It is expected that there will be a reduction in economic regulation. This will result in a reduction of the current set of micro level statistics. There is also an expectation of changes in the mix of data required. This will be seen as a shift from micro to macro statistics and from an economic regulation use to uses related to monitoring, planning and analysis. The statistical system will change towards a system which displays a greater balance and which will support generalized analyses rather than detailed economic studies.

Changes to the regulatory environment will also have an impact on the way in which business is done. It is expected that the statisticians will be asked to measure the impact of changes to the regulatory system. The industry structure is expected to change; some of the changes will be abrupt and others will take some time to work themselves into the system. Disruptions to the data base will be inevitable. Users, however, expect that the statistical system will be capable of recording the changes

so that they may be analyzed. Statisticians are not able to comment because they do not yet know what the requirements to monitor change might be.

Some of the time series may be lost, especially those which are dependent on the regulatory process. These losses will be compensated for by the initiation of new surveys, probably on a monthly basis, to reduce timely data to measure changes.

If there are relaxations of the current Canada - US trade restrictions, the impact will be towards a shift in the movements of commodities and passengers using North-South services. Measurement of such a shift will present a new set of problems and a new dimension to the statistical system. These problems will range from the creation of surveys to capture this information to the creation of a legal framework which will permit acquisition of the data.

Conditions of economic restraint will have the effect of consolidating the statistical system. Rather than expansion of the current system to provide measurements of the changes as they occur, there will be a demand for the creation of a statistical system which will be generalized sufficiently to permit, at a relatively small marginal cost, responses to demands for more detailed regional studies or special micro studies. Within Statistics Canada, the new centralized register of businesses will be standardized in terms of definitions, concepts and framework. Studies using this system as a starting point will be able to move towards an integrated macro level transportation statistics program which will relate not only to other industries in the industrial composite but also to those of other countries.

Estimates will be required for industries (e.g. taxicabs) which are not currently part of the statistical system. New demands will have to be weighed against the erosion of available resources which follows from conditions of restraint.

The conditions of economic change and budgetary restraint and the resultant impact on response rates will force decision makers to establish new conditions of internal balances, changes to priorities and reallocation of resources. Greater effort towards standardization and integration between and among surveys will result. Evolution towards a Transportation Statistical System which is macro oriented and which is characterized by standard concepts and definitions will be the result.

Expectations are that there will be an increased usage of administrative data. In addition to the potential which exists from the use of income tax data, there is in

transportation a wealth of data in machine readable form which has not yet been used. One example is the information which currently lies dormant in the provincial motor vehicle registration tapes. This data set has the potential to be used as a universe for surveys designed to determine the characteristics of the road transport mode, both freight and passenger. Such information when used in conjunction with the income tax data will provide new insights into the movements of commodities and people.

It is expected that as the evolution of the two frameworks continues, there will be an increased awareness of the potential uses of the data and a resulting narrowing of the gap between the "transport data" and the "economics data". Dependencies will emerge and will increase the extent that the two sets of data become interdependent.

There is no doubt that the statistician will face a greater challenge. The statistician will be required to devote an increasing proportion of time to the acquisition, analysis and management of data which does not today exist. Statisticians and users of the data will have to develop new skills in the selection of samples, the development of imputation techniques to account for missing or invalid data and the analysis of such data. The work will become more interesting, more complex and will provide a greater scope to the professional who is able to exercise creativity by bridging disciplines. The Transportation Statistical System will provide centralized knowledge, expertise and definitions which will result in a comprehensive body of information. As the use of such information increases, so will a demand for a body of senior officials in government and the private sector to assume the role of an advisory committee.

7.0 Closing

The next few years will see shifts in the data base. For the user who has become familiar with the intricacies of the current data base, there will be some difficulty experienced in linking back to past data and in the formulation of relationships between data elements. Nevertheless, it is expected that the new data base will be well founded.

The data base will be leaner because it is expected than the current conditions of fiscal restraint will continue. The expectation is that the Transportation Statistical System will contain a concise core of data on all modes supported by a consistent set of definitions and concepts. In addition, because the core data base will not be able to respond to all of the demands which are anticipated, it will have the capability to be used to support

special enquiries for transportation data. This facility will permit satisfaction of demands for data in a fashion which will permit linkage of separate enquiries to each other and to the core data base.

Over the next several months it is expected that the forces of change affecting the data base will begin to solidify. During this phase, officers of the Transportation Division of Statistics Canada (the authors of this paper) will focus their attention on the demands of the users. A period of consultation with all of the users is underway. Please think over the concepts and the structure which has been outlined above. Match it to your needs and communicate the results to us as soon as possible.

ENDNOTE: The opinions expressed in this paper are those of the authors and do not necessarily reflect those of Statistics Canada.

Bibliography

Archambault, M., "Canadian and Overseas Trade Diversion," Canadian Transport Commission Research (October, 1985).

Baldwin, G., and Di Sanza, E., "An Integrated System Approach to Statistical Reporting - Canadian Air Transport Sector," Paper presented to the Fourth World Conference on Transport (May 11 - 15, 1986).

Caron, J.P., "Regulatory Changes in the Trucking Industry," Commercial and Industrial Analysis, National Bank (September, 1985).

Eldon, D., "Review of Transportation Statistics," Report to the Royal Commission on Transportation (1961) pp. 409-54 (1961).

Jordan, W.A., and Roman, A.J., "Submission to the House of Commons Standing Committee on Transport," Public Interest Research Centre (1985).

Forgie, I.J., "Statistical Information on Transportation available from Federal and Provincial Governments," Statistics Canada (1980).

Lebrun, S., "La déreglementation force l'industrie de transport à changer," Le Devoir (June 14, 1985), p....

Mazankowski, Hon. D.F., "Freedom to Move - a Framework for Transportation Reform," Transport Canada White Paper, TP6678 (July 1985), p. 30.

Mozes, S.L., "Report on the Peruvian Sectorial Statistical System (Transportation and Communications), Study and Implementation Project," (1977).

Mozes, S.L., "The Canadian National Transportation Statistical System," Paper presented to the Fourth World Conference on Transport Research, (May 11-15, 1986).

Nix, F., "Relevance of Products Project, Transportation & Communications Division - Trucking Statistics," Audit Project Report to Statistics Canada, (February 9, 1983).

Pollock, J., "Leasing and De-reg: What's Ahead?" Bus & Truck Transport (March, 1985), pp. 20-21.

Rae, J.C., and Askin, T., "Development of a Statistical Process to meet Identified Provincial Data Requirements," (1982).

Ritchie, R.J., "Outlook of Canadian Railway Transportation: Notes for Remarks," Presentation to the British Railway Study Association, (February 5, 1986).

Studnicki-Gizbert, K.W., "Methodology of Transport Statistics," York University Transport Centre (1970).

References

"A Framework for Transport Statistics: an Introductory Paper for Discussion," Australian Bureau of Statistics (1978).

Canadian Transportation & Distribution Management, (October, 1985) pp. 10-37.

"Committee Recommends More Safeguards," Canadian Transportation & Distribution Management (February, 1986) pp. 33-35.

"An Evaluation Assessment of the Transportation, Storage and Warehousing Programs," A Report to the Program Evaluation Division, Statistics Canada Touche Ross & Partners (November, 1985).

Final Report, Highway Statistics Symposium (1979).

Memorandum of Understanding Respecting a Federal-Provincial-Territorial Agreement on the Economic and Administrative Regulation of Truck Transport, Federal-Provincial Conference of Ministers Responsible for Transportation and Highway Safety (February 27, 1985).

National Income and Expenditure Accounts, Volume 3, Statistics Canada (1975).

"Program Profile, Transportation, Storage and Warehousing," A Report to Statistics Canada Touche Ross & Partners (September, 1985).

Submission to Parliamentary Transport Committee concerning "Freedom to Move" by Canadian Trucking Association.

"Transportation Deregulation in Canada," National Bank of Canada Economic Review, (3rd Quarter, 1985) pp. 1-6.

"Freedom to Move - Change, Choice, Challenge," Standing Committee on Transport, Sixth Report, (December, 1985).

RAILWAY DATA REQUIREMENTS IN A REREGULATED ENVIRONMENT

by

Joseph Kruger
Research Branch
Canadian Transport Commission

1.0 Introduction

In mid 1985 the Canadian Government announced its intention to reform transport policy and legislation. The document "Freedom to Move" proposed a new philosophy and broad framework for reform in Canadian transportation embracing the concepts of

- less economic regulation in general
- greater reliance or market competition, innovation and enterprise and
- a more responsive regulatory process

The benefits of this proposed reform are expected to result in lower prices, a wider choice of user services, and a more efficient transport system, ultimately promoting economic growth.

The effects of these changes, once implemented, are difficult to assess at this time. For one thing, the legislation has not been tabled, and it is expected that as a result of consultations with interested parties some modifications will be made. However, if comparisons with U.S. deregulation under the Staggers Rail Act are valid, there will be some beneficial effects but there may also be some dislocations. Recognizing that there may be problems of adjustment to a new reregulated environment, the Minister of Transport in Freedom to Move proposed that the effects of legislative reforms be reviewed within 4 years of implementation. The Standing Committee on Transport reviewing Freedom to Move indicated a preference for a 2 year review and monitoring by the New Regulatory Agency. It is now our understanding that review and monitoring will be continous, although at this time it is not clear that there is agreement

on the meaning of "monitoring and review." How this review will be carried out to evaluate the impact of legislative changes is also unclear.

This paper provides a background on research which has recently been undertaken within the Canadian Transport Commission (CTC) towards the development of a Railway Freight Monitor (RFM). It indicates the process which is now underway in CTC Research to develop the RFM, briefly traces the changes brought about by deregulation in the United States and proposed changes in Canada, looking at some similarities and differences. Finally, some reasons why a Railway Freight Monitor might be of value in a changing regulatory environment, are highlighted.

2.0 Monitoring-What is it?

It is useful at this point to define what monitoring means in the context of this paper. Of course any endeavour which involves measurement or analysis of changes over time can be termed a monitoring activity; everything qualifies. According to Webster the verb "monitor" means;

"... to watch or observe for a special purpose."

Within this paper railway monitoring activity refers to the regular objective measurement and analysis of change in certain key rail transportation areas so as to reduce uncertainty. This can be considered analagous to a check-up carried out on a regular basis, which ensures that the patient is healthy and no negative trends are apparent. The older the system gets the more regular check-ups you may require because the more sensitive you are to major changes. Also, as major changes occur the future becomes more uncertain. In the current Canadian context the measurement of change would refer to a comparison of rail transportation before and as it settles to a new equilibrium after the new regulatory regime is introduced. (Note that the mere prospect of regulatory change can precipitate changes in the market.) In the U.S. it would refer to changes and effects occurring with and after the Staggers Rail Act.

An example of what we mean by a monitoring activity is the Air Transport Monitor (ATM) currently being developped and published in prototype form by the Research Branch. The purpose of this endeavour is the collection and distribution of information on the

air transport market in Canada which allows identification and assessment of changes in the industry from the perspectives of and by governments, consumers and competing firms. In its current form, the ATM is a 5 part document: covers Applications and Decisions, Services, Pricing, Operating Performance, Issues of Current on Longer term Interest. It is distributed quarterly to a relatively large readership, and is in its second year of publication.

2.1 The Railway Freight Monitor

In anticipation of the information required to facilitate both a review and continuous monitoring of the post rail reregulation period in Canada, a Railway Freight Monitor (RFM) is presently being designed by the Canadian Transport Commission's Research and Traffic and Tariffs Branches. The goals of the RFM are (1) to develop a database of information concerning the impact of regulatory change on shippers, carriers, labour, and government. (2) to provide market information that would facilitate competitive decisions by carriers, shippers and potential shippers, and (3) to provide timely analysis of current issues.

We think that an RFM, properly designed and available on a regular basis, could be used by all interested parties in the Transport Sector to track market changes, and thus promote a more efficient and equitable transportation system in Canada.

Development of the RFM is planned in two phases. Phase I, which is presently well underway, is considering in some detail USA deregulation, what monitoring has been done, and how monitoring has been helpful in assessing the impact of deregulation on institutions, shippers and carriers. Following this review, Phase II will establish the framework and data requirements for a Canadian RFM system.

Questions that must be answered include:

(1) What is to be measured: that is, what are the key items which will signal the effects of market changes on various parties?

(2) How should the measurement of this impact be affected; that is, what methodology could be employed?

(3) How and to whom will this information be communicated?

(4) What data are currently available, and what data will be required in future -- giving due consideration to information costs?

In the aftermath of regulatory change, there will be a significant increase in uncertainty in the transportation marketplace as organizations adjust to the new environment. One consequence of reregulation may be a reduction in publicly available data. For example, only summary information would be available for confidential contracts. It is intended that, information provided by an RFM would mitigate the negative effects of that uncertainty.

3.0 The United States Example

It is useful to consider the experience in the United States six years after deregulation. As it was so aptly stated by Andrew Elliott Manager, Potash Corporation of Saskatchewan, the "... Staggers Act had a demonstration effect on Canadian rail regulation which is likely to lead to at least a portion of Canadian rail regulation paralleling the existing U.S. regime."

3.1 U.S. Deregulation

The cycle of U.S. railroad regulation has come full circle in the last 100 years. It began in the late 1880's with the goal of preventing the abuse of railroad monopoly power directed against shippers and communities. Stabilized rail rates and services were considered essential to economic well being, and were heightened in importance by the fact that in many cases there were no practical alternative means of transportation. As railroad monopoly power eroded with the advent of trucks, buses, barges, aircraft and pipelines, new legislation simultaneously promoted preservation of the U.S. railroad system and alternatives to railroad transport. Railroads as monopolies were in decline. The Railroad Revitalization and Reform Act (4R Act) of 1976, began a major shift in emphasis away from government regulation of transportation industries towards dependence on the forces of competition in an open market. The new philosophy espoused that decisions on financial returns and treatment of workers, suppliers and users be left to a competitive market.

Regulation by competition became the order of the day, and new laws were passed reflecting this mood. Airlines were deregulated in 1978, motor and household goods carriers in 1980, and intercity buses in 1982.

For railroads, the watershed was the Staggers Rail Act of 1980, which went far beyond the 4R Act in reducing rail regulation. Some key aspects of this legislation are:

(1) confidential contract rates as well as rebates are now permitted;

(2) joint rates and through routes can be cancelled almost unilaterally by railroads;

(3) rates and services can be tailored to market requirements and adjusted much more easily than before;

(4) a market dominance threshold exists below which the ICC has no jurisdiction.

3.2 Monitoring the Effects of Staggers

The Interstate Commerce Commission (ICC) is charged with implementation and administration of the relevant U.S. transport legislation and publishes information through its annual reports, proceedings and decisions. There has been much debate about the way in which the ICC has interpreted and implemented its mandate. In addition to the ICC, the House and Senate both have Transportation Committees who conduct "oversight hearings" almost annually. Additional proceedings are usually held in response to public pressure for legislative change or amendments to existing laws. Other branches of government, namely the Department of Transport, and the General Accounting Office, also undertake studies on request or on their own initiative, and the Bureau of Labour Statistics publishes indices of freight rates.

From an industry perspective the Association of American Railroads (AAR) does monitoring activities on behalf of its members and acts as a spokesman for the industry at most proceedings. Numerous special interest groups also exist, such as C.U.R.E., (Consumer United for Rail Equity) R.A.M., (Railroads Against Monopoly), CFA (Consumers Federation of America), all of which evaluate the Staggers Act and publish information that affects their members.

Clearly there are numerous and diverse groups affected by rail deregulation in the U.S. who have an interest in monitoring the effects of Staggers. However, it appears that whatever monitoring is done is on an exception basis; that is, information is brought into the public domain as part of a proceeding

or special study or investigation, usually in response to a problem situation. Information produced in this way is sporadic and can reflect the special interest of the parties involved. This may not always be an objective source of data or present the total picture. As far as we are able to determine there is no conscious effort to establish a central monitoring activity or data base, other than the ICC, concerned with the effects of deregulation on the various groups. The exception to this is the Contract Advisory Service established by law in the ICC. It provides information and advice on confidential contracts.

One thing is certain, under deregulation in the U.S. less information is publicly available. Confidential contracts are becoming increasingly popular; the use of this method of establishing rate and service packages has increased from 768 contracts in 1981 to more than 34,000 in 1986. Only brief summaries of these contracts are in the public domain, and without a set format they are difficult to interpret.

The problem of availability of data is being compounded further by proposed budget cuts initiated by the Reagan Administration. For example, it was recently proposed by that Administration that the ICC budget be reduced to zero as of the end of 1986. This along with other budget reducing measures (Gramm-Rudman) preclude maintainance of an adequate transportation data base for government, shipper, and carrier.

A brief review of the literature concerned with various oversight hearings in the Senate and the House, and Ex Parte proceedings, leads to the following general conclusions with respect to the effects of Staggers. There appears to be a general concensus concerning the beneficial effects of less regulation and more competition on the major U.S. railroads. Financially, the industry has greatly improved since the mid 1970's, and this is directly attributable to the removal of regulatory restrictions. It also appears that this improved profitability has arisen from both growth in revenues and reduction in costs.

While generally, the effects of deregulation are viewed positively, some shippers are not pleased. Most notably, those shippers considered captive, such as coal shippers for example, feel that they have not received the protection from railway monopolistic

practices that they were expecting. Recently numerous representations have been made to Congress to amend this condition with new legislation (e.g. H.R. 4096 proposed by C.U.R.E.).

The Staggers legislation has certainly enabled the railroad industry in the United States to consolidate and improve its financial situation dramatically. However, the current interpretation and monitoring of the effects of the legislation have not significantly reduced the uncertainty regarding the balance between the relative market power of railroads, shippers, and consumers. For example the ICC uses the revenue adequacy criterion as one of the bases for its intervention in railroad shipper disputes. This has been a point of controversy. It has been argued that the way in which the ICC determines revenue adequacy is not realistic. It is unlike criteria used by any other U.S. regulatory bodies or financial analysts and is perceived to bias the regulatory process in favor of the railroads. A shipper who wishes to dispute a rate increase is essentially wasting his time unless the railroad concerned is considered "revenue adequate". As one witness (for C.U.R.E.) at a recent oversight hearing of the House Subcommittee on Commerce, Transportation and Tourism on the sunset of the ICC indicated:

> Our member groups regularly participate in proceedings at the Federal and state levels, as have I on numerous occasions. We win some cases and we lose some, but above all, we have a sense that the process is reasonable -- that the rules are impartial and the deliberative bodies are engaged in a good faith effort to balance the needs of consumers and the providers of monopoly services. That simply is not the case with the ICC's implementation of the captive shipper provisions of the Staggers Act.

On the question of revenue adequacy it was stated:

> Specifically, the Commission has established standards for evaluating the adequacy of a railroad's revenues which are at odds with financial reality and which no railroad now satisfies, or will in the foreseeable future satisfy. The resulting apparent inadequacy of the railroad's revenues is in turn relied upon to justify the reasonableness of the railroad's rates for captive shippers.

This reflects generally the attitude of those who feel that the implementation of the Staggers Rail Act by the ICC has not produced beneficial results for them. Of paramount importance is the uncertainty with respect to fair and equitable treatment of all parties by the regulatory body. As stated by the National Association of Regulatory Utility Commissioners in March 1984:

> (The ICC defines) revenue adequacy, on which several pricing freedoms for railroads under the Staggers Act are based, unrealistically, so that no Class I railroads, no matter how profitable, are considered to have adequate revenues, and highly profitable railroads will be allowed billions of dollars in extra rate increases.

The ICC has responded to these criticisms by making adjustments to its regulatory rules: the onus of proof in market dominance disputes is now on the railroad rather than the shipper; more information regarding confidential contracts is being released in certain cases; changes to cost criteria used in determining revenue adequacy and reasonable rates are also being considered, etc.

4.0 Canada and the U.S. - A Comparison

As in the United States Canadian railway regulation is now going to rely more on market driven factors than before. Historically, the evolution of the Canadian regulatory regime has been similar to that for the U.S. The railways initially held a virtual transport monopoly in many parts of the country. The involvement of government was precipitated by the fact that railways decisions affected the economic fabric of industries and sometimes entire regions. With the advent of extensive highway construction and the Great Lakes and St.Lawrence Seaway, trucking and water competition eroded the monopoly power of the railways. Airlines, intercity buses, and alternatives such as pipelines also reduced the railways' market. Although competition was increasing, Government was still setting freight rates and requiring the maintenance of certain services in the public interest (Statutory Grain, Passenger Services and Branch Lines). Initially the railways were not compensated directly but required cross-subsidization to extract appropriate revenues.

The National Transportation Act of 1967 began deregulation in Canada. Within the confines of

Sections 276 and 278 of the Railway Act the railways could establish rates and services based on market conditions in direct competition with other modes. Compensation mechanisms for publicly imposed duties were also put in place. Although the focus of this legislation was to enable the railways to remain competitive through pricing freedom in a changing market environment it was not considered beneficial to promote intramodal price competition at that time.

The U.S. and Canadian transportation environments are closely related but important political, geographic and population differences exist. The reform of transportation regulation in Canada is largely in response to the events which have occurred in the United States but, U.S. deregulation and Canadian proposals for railway regulatory reform are quite different. For example, U.S. legislation was primarily focussed upon improving and revitalizing the general financial condition of the railroad industry. In contrast, Freedom to Move is more shipper oriented; its impact upon the Canadian railways is less clear. Competition between private and Crown railways is uniquely Canadian. Another important difference is that, whereas route cancellations for competitive purposes are now permitted in the U.S., Canada is moving in the other direction, towards mandated joint-line rates.

These reforms among others, will alter the present regulatory regime, but they will also differ significantly from the changes which have occurred in the U.S., and their impact is less certain. There is no doubt that as experience is gained with the new rules in Canada, adjustments will be required (as they have been in the U.S.). Monitoring and comprehensive reliable data will be essential in this regard.

5.0 Progress on the RFM

As noted earlier development of the RFM is planned in two phases. Phase I is well advanced and the interim report, dealing with U.S. deregulation and the monitoring experience there, has been completed. The second phase is now underway and some key elements will have to be addressed before the foundation for monitoring activity can be laid. The goals of the national transportation policy must be translated into a form from which appropriate measures of impact can be defined. Impact measurement principles and the range of relevant interest group perspectives should be planned.

Data availability and cost must be studied in detail. It is not realistic to presume that currently available rate and cost data will always be accessible; a reduction in data filing is an element of Government policy. For any data deemed desirable or necessary the cost to the provider of the data must be carefully assessed and contrasted with the value of the data concerned. One must presume that data collection not thoroughly justified will not be permitted; current data cannot be presumed.

Data confidentiality guidelines may have to be reformulated; the presumptions that shippers and consumers should have access to rate and fare data will no longer hold. The question of public and shipper access to the monitoring reports must also be addressed. At present the prototype ATM is published quarterly, and similar publication is contemplated for the RFM -- but, this is before the new policy becomes law. It may be necessary to treat monitor reports as confidential for the Governments policy making purposes. It may be possible to continue public disclosure, or some compromise between the two may be reached.

Some of these questions cannot be answered definitively at this time, but they can be analyzed. Those for which an answer is not readily apparent may benefit from the public discussion that is expected to surround publication of a prototype Railway Freight Monitor. It is also expected that such publication will lead to a measure of government, industry and public interest in the monitoring exercise.

References

Thompson, S.J. Summary of the Staggers Rail Act of 1980, Congressional Research Service, The Library of Congress, Report No. 85-9E, January 1985.

Thompson S.J., Railroad Economic Regulation, Congressional Research Service, The Library of Congress, Brief No. 1B85017, January 1986.

United States General Accounting Office, Report on Shipper Rail Rates - Interstate Commerce Commission's Handling of Complaints, Report No. GAO/RCED-86-54-FS, January 1986.

United States General Accounting Office, Report of Information on Regulatory Reform Under The Staggers Rail Act of 1980, Report No. GAO/RCED-83-174, August 17, 1983.

Statement of Heather J. Gradison, Chairman Interstate Commerce Commission before the Subcommittee on Commerce, Transportation and Tourism of The House Committee on Energy and Commerce on The Staggers Rail Act of 1980, Washington D.C. February 6, 1986.

Testimony submitted by Edward F. Mitchell, President, Potomac Electric Power Company, Chairman, Consumer United for Rail Equity, before the Subcommittee on Commerce, Transportation, and Tourism, Committee on Energy and Commerce, United States House of Representatives, Washington D.C., February 6, 1986.

Freedom To Move - A Framework for Transportation Reform, Cat. No. T2269/1985, July 1985.

Interstate Commerce Commission - Annual Reports various.

Freedom To Move, Change Choice, Challenge, Sixth Report Standing Committee on Transport, December 18, 1985.

Inquiry Into Effects in Canada of U.S. Rail Deregulation Canadian Transport Commission Report to the Minister of Transport under Section 48, National Transportation Act., June 1985.

Air Transport Monitor, Report No. ISSN 0826-8711 Canadian Transport Commission, Research Branch, January 1986.

Dr. Mark Cooper, Staggers Rail Act Research Paper for Consumer Federation of America, April/July 1985.

ICC Ex Parte Proceedings - various.

Richard Thivièrge, Rail Freight Monitoring (First Draft), Freight Studies Directorate, Research Branch Canadian Transport Commission, March 1986.

A REVIEW OF RECENT TECHNOLOGY, POLICY AND LEGISLATIVE CHANGES AFFECTING TRUCK DATA NEEDS AND COLLECTION METHODOLOGY

M. LAI
MANITOBA HIGHWAYS & TRANSPORTATION
WINNIPEG, MANITOBA

J.C. REA
MANITOBA INDUSTRY, TRADE & TECHNOLOGY
WINNIPEG, MANITOBA

ABSTRACT

Data respecting truck operating characteristics and commodity movements occurring on the highway system is an important requirement of highway engineers, planners, transport policy analysts, researchers and industry. Such data is essential for addressing various matters such as: (i) developing a better understanding of the pavement deterioration process as a function of axle spacing and loading; (ii) developing more efficient pavement and bridge designs; (ii) developing an optimum vehicle weight and dimension policy for the province; (iv) developing a more equitable road-pricing system; (v) developing a hazardous goods movement monitoring system; (vi) developing better vehicle size, weight, speed and operating authority enforcement; (vii) truck fleet maintenance/management, and; (viii) vehicle design.

Methods currently utilized for data collection respecting trucks and commodities on our highway infrastructure are very costly to both the trucking industry and the government agency. In addition, significant amounts of resources have been (i.e. several billion dollars) and are committed to the highway infrastructure annually. A primary concern respecting protection of this enormous investment is the availability of appropriate and adequate truck-related information necessary to address the issues of growing concern.

Recent technological developments (e.g. automatic vehicle identification, weigh-in-motion devices and on-board information systems) in the U.S. and Canada have enhanced traffic monitoring and data collection activities respecting truck transportation over the last several years. Specifically, developments in policy and legislation (e.g. weight-distance taxation, vehicle weights and dimension regulations, operating authorities and dangerous goods) have provided the thrust for developing and testing these technologies.

This paper addresses the subject of technology, policy and legislative changes respecting truck data requirements and collection techniques. The paper also comments on the implications of these developments for government and industry.

CANADIAN AIR TRANSPORT INDUSTRY: RECENT TRENDS

by

Roger Roy[1]
Canadian Transport Commission

1. INTRODUCTION

On May 10, 1984, a new Domestic Air Policy was unveiled. Some associated this new policy to deregulation, others saw in it a regulatory reform allowing a staged liberalization of regulation. The gradual elimination of pricing controls and the allowed free and open competition proposed in the policy, created public expectations. New trends emerging from the relaxation of airline economic regulation are distinguishable and this paper identifies them in relation to the expectations created by the new policy. The most telling expectations have to do with the anticipation of an increase in the level of competition. Increased competition promises to impact on costs (and, by the same token, on fares), on services and on efficiency. It is important to examine the recent trends in relation to foreseeing changes. To do so, a standard economic approach consisting of analyzing the industry's structure, conduct and performance, is used to review the domestic air passenger transport industry.

2. STRUCTURE AND PERFORMANCE

By allowing free and open competition between the so-called National, Regional and Local carriers, and by permitting new or existing carriers to apply to the Canadian Transport Commission (CTC) to serve any domestic route with any equipment it wants, the new policy promised a more competitive market structure. But the word "market", in the context of air services, can mean, at one extreme, the entire industry or, at the other, an individual city-pair. The first point to emphasize is that the actual number of airlines in the industry is not the best indicator of market structure competitiveness.

Level I airlines[2] dominate the industry in terms of number of passengers carried and of revenue passenger kilometres[3] (RPK) (Table 1). Level I carriers' market share (percentage of the industry's output) has decreased slightly from 1981 to 1984. In 1981, Level I airlines

were responsible for 93.8% of the total number of passengers carried (27,188,609) compared to 91.7% in 1984 (from a total of 27,700,754). It is important to note that in 1984 the passenger traffic level was back to its pre-recession level. Level I airline passenger traffic was still inferior in 1984 to its 1981 level while both Level II and Level III airlines were observing, over the same years, a net increase in their actual number of passengers carried. Traffic gains of smaller carriers appear to have resulted from losses by the Level I carriers. However, because of the recession, the evidence is far from being conclusive. When looking at the RPK's figures for unit toll operations, the market share gain achieved by smaller airlines are negligible.

Two sources of explanations for the recent traffic trend can be found and have to be presented in the context of the new competitive pressures prevailing in the industry. One has to do with the moving structure of the industry while the other stands on the activities occurring at market level, the latter being addressed in the next section.

Changes in the structure which preceded and followed the new policy, have created opportunities for some moves which, under the new freedom, result in competitive situations. For instance, between March 1979 and November 1980, Jim Pattison assembled Air West, West Coast Air Services, Gulf Air, Pacific Coastal Airways, Island Airways, Trans-Provincial Airways, six flying enterprises into a single commuter airline, Air BC. In July of 1983, an interline agreement between Air BC and Canadian Pacific Air Lines (CPAL), allowed the commuter carrier to inaugurate in October 1983 a Victoria-Vancouver airport feeder schedule linked to CPAL's domestic and international route patterns, a market where a competitive situation now prevails.

· Changes of control and amalgamations

Between January 1, 1984 and September 30, 1985, the Air Transport Committee issued twenty-one decisions concerning changes of control and amalgamations of airlines.[4] Concerning changes of control of air carriers, Eastern Provincial Airways Limited (EPA), Quebecair, Pacific Western Airlines Ltd. (PWA) and Nordair were Level I carriers who had their control modified. For Level II carriers, only Time Air and Norcanair experienced a change of control although a somewhat similar development has since involved Air Ontario. The acquisition of EPA by CPAL could have been perceived as an indication that the airline industry was heading towards a period of consolidation in which stronger carriers would try to absorb weaker lines. In fact, EPA's acquisition has meant, for the travelling

public, a coast to coast competitive service. CPAL's move to acquire Nordair should also give the carrier a stronger presence in Quebec and Ontario, complementing already existing routes in both Western Canada and throughout Atlantic Canada. (A large block of Nordair's shares have been bought by CPAL. It is noted that Quebecair also has a substantial investment interest in Nordair and has expressed a desire to acquire the company.) Prior to the publicly announced intention of CPAL with respect to Nordair, a change in Nordair's control from Air Canada to Innocan Ltd. was allowed by the ATC on November 28, 1984. Earlier that year, PWA had acquired minority interest in Time Air while in November of 1984 PWA's change of control from the Government of the Province of Alberta to the general public was approved.

· Commercial agreements

An efficient competitive tool in a deregulated environment which impacts indirectly on the structure of the industry has to do with commercial agreements between airlines. Alliances of large airlines with small commuter carriers complement the network with traffic flows from smaller communities. In some cases, the alliance model follows an equity investment in the partner carrier. If PWA's interest in Time Air is an example of such an arrangement, it is not the only one. PWA and Air Canada have each acquired a 24.5% share of Air Ontario, despite criticisms of such intention on the part of Air Canada. As a result of this move, Air Canada dropped some short haul markets in Ontario. In other cases, a pure commercial arrangement is behind two carriers' collaboration. A commercial agreement allows, among other things, passengers to transfer with ease from one carrier's operation to another for connecting flights. Such an agreement exists between CPAL, Air BC as well as Pem-Air. As a result, CPAL and Air BC are competing with PWA and its local service partner, Time Air in British Columbia. The trends of local carriers linking up with larger carriers is not new to Canada. As a matter of fact, Air Ontario has been operating under a commercial agreement with Air Canada for the past ten years, Air Ontario reservations being handled by Air Canada and the local carrier being a member of the national airline's frequent flyer program. The agreement also allows the offering of combined fares.

If commercial agreements are not new to the airline industry, the new challenge facing airlines force them to look more and more at such agreements as a way to maintain or expand their position in the marketplace. This tendency can be illustrated by recent cases. A new carrier in Quebec called Nordair Metro, jointly

formed by Nordair and Toronto Airways (Torontair) is to provide a feeder service to CPAL in Quebec and to compete with Quebec Aviation; in this case, many of the cities to which it intends to fly are already served by the other local carrier. Nordair Metro's creation is interesting because it illustrates the new emphasis prevailing in the industry toward cooperation between scheduled jet and turboprop services. In Atlantic Canada, as a result of the demise of Air Maritime, a subsidiary of the now defunct EPA, Air Atlantic, backed by CPAL, and Air Nova, a potential Air Canada protege, are to succeed to Air Maritime. Air Atlantic has an agreement with CPAL to act as the large carrier's commuter airline in Atlantic Canada, using its reservation system and its passenger checking facilities. The 10 year agreement with CPAL allows Air Atlantic to operate Air Maritime's routes once the airline is set to fly. Air Atlantic flights will connect with CPAL jet flights in major Maritime locations as part of a hub and spoke schedule. Air Nova is trying to strike a similar deal with Air Canada to have a streamlined feeder system to larger destinations. These two new commuter airlines will fly Dash 8 turboprop aircraft.

Early in 1986, Nordair announced that it has reached a commercial agreement with CPAL. Since then, the two airlines honour each other's tickets and share some fares. Joint fares are a less expensive method of purchasing tickets than if each airline sells them separately. Because of EPA's acquisition by CPAL, Nordair is able to offer many connecting flights from the east coast to Sudbury. Nordair is also part of CPAL's travel bonus plan.

Although the evidence presently available is not as extensive as could be desired, a preliminary appraisal of the economic implications of agreements between air carriers indicate that they have so far allowed 1) replacement of the big carriers' cumbersome and infrequent jet service in short haul low density markets by turboprop feeder service, providing an improved service for the customer with the resulting increased frequency; 2) benefits for local carriers resulting from the access to a major carrier's interline marketing, advertising and reservation facilities; 3) and, finally, with the assistance in passenger handling from major carriers, an offset to financial handicap of short haul operators.

The fact that Level I airlines account for more than 90 per cent of the industry's output is misleading, because it overstates the monopoly power prevailing in the industry. The number of firms which dominate the industry has decreased but the rivalry between

the carriers has intensified. A number of important markets are served by competing airlines. Through mergers and commercial agreements, large carriers are confronted with an environment where they each have to develop their market strategies both in terms of their corporate objectives and in terms of their competitors' reactions.

3. CONDUCT AND PERFORMANCE

3.1 Labour relations, costs

Even before the liberalization in Canada of the controls over fares and route structures, airline were compelled to find ways to reduce their costs to prevent an erosion of their profitability. Because of a downturn in air traffic resulting from the early 1980's recession, because of the post deregulation changes in the U.S. air transport industry and because labour constitutes an important cost component in the operations of air services, Canadian airlines, in response to threatening pressures emanating from a liberalized regulation, have managed to obtain concessions reducing labour costs. Concessions were obtained through collective bargaining negotiations sometimes in the face of a strike. Only some of the recent agreements are presented to illustrate concession bargaining in the Canadian airline industry. They have to be viewed in the context of deregulation and the cost-cutting exercise of the last few years.

- In 1984, Air Canada's pilots accepted to extend their **work sharing agreement** for another year and to fly a maximum of 71 1/4 hours per month instead of the usual 75 hours to save the jobs of 134 colleagues who, otherwise, would have been laid off.

- In a one year contract effective September 1, 1984, CPAL's pilots took a 7% **cut in salary** and a 3% cut in medical, dental and vacation benefits. For the airline president, the agreement was a "landmark" in Canada's new regulatory environment. Such cuts followed losses totalling around $78 million over the previous three years.

- PWA, after two months of strike[5] from its flight attendants, ticket clerks and machinists, was still sticking to its demands of concessions in the new contracts, concessions at least comparable to the ones obtained by Air Canada (after a long strike) and by Canadian Pacific Air Lines. PWA wanted **more flexibility in work practices**, the **ability to hire more part-time employees** and **the right to reduce starting wages.**[6] The flexibility in work practices of interest to the carrier had to do with the introduction of "cross-utilization" also refered to as "job-sharing".

Since the two national airlines had won most of these concessions in 1985, PWA's survival required it to bring labour contracts in line with those of its two major competitors. The PWA example is one among others illustrating the position taken by airlines in the negotiation of new labour contracts. Basically airlines are looking at lean salaries and flexibility of their work force to keep their expenses at lower levels.

Other strategies used by airlines to reduce their labour costs are **voluntary early retirement programs** and **fleet standardization.** For instance, about 350 managers at Canadian Pacific Air Lines (a quarter of the airline's total management team) have been offered a few months ago an early-retirement incentive package. CPAL had offered during 1985 a similar retirement incentive program to its non-management, non-unionized employees as well as to unionized employees. To reduce costs, including labour costs, fleet standardization can also be used, as evidenced by a recent CPAL decision. CPAL is selling its four Boeing 747-200 to buy four McDonnell Douglas DC-10-30's which will eventually bring the number of DC-10-30's in their fleet to 12. Such a wide body standardization of CPAL fleet is aimed at increasing aircraft utilization, improving flight training efficiencies, reducing inventories and lowering expenses for engineering, maintenance, ramp and inventory handling and training. CPAL could save 10% per year on pilot wages and bonuses, since the DC-10 is lighter than the Boeing 747 and, with one less engine, pays less.

Mergers identified in the previous section, like the EPA-CPAL one, are not free of labour issues, one of the important ones being the employees' seniority list to be used under the regrouped operations of the carriers involved. Such labour issues are important enough to be discussed during the negotiations preceding a merger decision and to prevent an agreement from being reached by the two parties.

As competition increases, airlines will continue to pressure the unions for concessions, labour being one of the few areas where airlines can achieve significant savings. But some measures can be taken to trim other expenses as well. For instance, to cut on fuel spendings, taxiing out to the runways on one engine instead of two and installing lighter-weight seats offer some potential.

3.2 Fares

One of the objectives of the May 10, 1984 Domestic Air Policy was to offer more price/service options which means to be more responsive to consumer preferences. Since the policy allowed airlines to compete freely in price and service quality, one would

expect that airlines have since offered more price/service variations. With fares less regulated, airlines are experimenting with so many plans that passengers travelling on the same flight can often pay widely different prices. Airlines now offer a wider variety of options, including lower fares at less desirable flight times, separate seating at higher prices for business travellers and discounts for advance reservations.

It is too early to assess the effects of the May 10 Policy on price because airlines are still experimenting. It is however important to look for changes in the conduct of the industry in terms of its behaviour in setting prices. This section describes new options that have appeared since the liberalization of the industry, which are indicative of new trends. The approach selected here is an illustrated description of new fare/service combinations symbolic of potential trends.

- Most lower fares come with what the industry calls "fences". Fences are restrictions. Restrictions have to do with advance booking requirements, changes in travel plans. The lower the fare, the more restrictions attached to it. Some really cheap fares are even non-refundable if one has to cancel the flight. With competition, 'ticket rules' including restrictions on advance booking times are likely to start to erode. **Example:** On the Toronto-Montréal route, the country's busiest air route, lower fares continued to appear. In January of this year, Quebecair slashed its one way fare from $123 to $59, no restrictions. This implied that passengers had the possibility to reserve their ticket for same-day travel and to choose their length of stay. If the fare's introduction corresponded to the time of the year when air travel usually declines, it was also aimed at competitors. In comparison, Air Canada charges $123 for a regular one-way economy ticket, while passengers who book a month in advance and travel after next Wednesday can obtain a $98 round trip excursion fare, but bookings cannot be altered once made. City Express charges $89 for a weekday daytime flight from Toronto Island to Montréal, inclusive of free transportation between airports and city centres.

- Discount fares are traditionally aimed at vacationers willing to accommodate travel plans for cheaper rates, while economy and first class fares are directed more towards business travellers. As discount fares are becoming more common in an increasingly deregulated market, discount air travel is viable and accessible to more companies. A new trend has appeared which has to do with the introduction of price differences reflecting cost differences, thus

making price differences non-discriminatory. **Example:** Such a price/service option is the result of the newly introduced luxury services for business travellers. Air Canada's Executive Class fare is aimed at business traffic. A special section aboard aircraft has been set aside in designated cabins, mainly for business travellers, in the hope of giving them the comfort they feel they deserve, commensurate with the money their companies or they are paying in premium fares. Services offered on an a-la-carte basis include baggage handling, check-in, haute cuisine, linen trays, china, glassware, hot towels a better choice of wines and liquors, electronic headsets and travel bonuses. Business class fares are, needless to say, higher. If such a marketing strategy is highly competitive on long distance international flights, its introduction on domestic flights assumes that the mark of restraint on the corporate travel sector is over, that the battle to assure corporate survival has been won, that a new wave, based on an old prerecession corporate behaviour will draw business clients back to premium class travel comfort.

· In a more competitive environment, market strategies are oriented toward the improvement of market share. Price/service options have to differentiate somehow the product from competitors. **Example 1:** Air Canada's Executive Class, introduced in January 1986, came more than a year after Canadian Pacific Air Lines 'Attaché' Class. If the two main competitors cater the same business travellers, differences between the two services can be observed. Attaché is offered on Boeing 737's. The Executive network is served by Air Canada's wide-body Boeing 767 fleet. In the case of CPAL service, only first class or Attaché passengers are on the aircraft, the entire plane being dedicated to business travellers, a total of 62 or 74 seats (depending on the type of Boeing 737) on board a plane that would normally have 122 or 140 seats. The new configuration on Air Canada's Boeing 767's, which also carries First Class and Hospitality (the new name for Economy) passengers, has 48 seats dedicated to the Executive Class. Differences in the cushion space, the pitch and in the reclining capability of the seats can also be observed as well as other differences between the two competing services. **Example 2:** Air Canada, competing with Canadian Pacific Air Lines, is the first to offer air-to-ground telephone service on a Canadian airline.

· The increased competitiveness under which airlines have to operate forces competing airlines to match their competitor's strategy. **Example:** In January 1986, Canadian Pacific Air Lines announced a 'clearance sale' offering tickets for February at savings of up

to 82 per cent. Air Canada matched a few days later CPAL winter clearance seat sale.

- An innovative marketing strategy brought "brand loyalty" back to the airlines. **Example:** The strategy, called frequent flyer program, is geared to clients on expense accounts and is a highly competitive marketing strategy. With such programs, carriers offer free or discounted tickets, hotel rooms and car rentals as well as all-expense-paid holidays to passengers who accumulate various levels of travel kilometres. The programs were originally introduced in the United States and, prior to May 10, 1984, similar incentives were not readily available. When regulation was eased regarding the offering of travel incentives, Air Canada and CPAL introduced frequent flyer programs. Air Canada's 'Aeroplan' features reduced rate of free transportation with credits based on the distances flown. By the end of July 1984, PWA, British Airways, Lufthansa, Hilton International Canada and Budget Rent-A-Car had joined the Air Canada program. CPAL introduced its 'Travel Bonus Program' awarding points for flying CPAL, staying at CP or Delta Hotels or renting cars from Budget or Tilden. At Air Canada, the newest bonuses for frequent travellers are high technology products, travellers being now able to cash in kilometres for a dictaphone or typewriter, a cellular phone or a portable computer. The recent government decision to require people who take a free trip from an airline to declare it on their income tax might jeopardize these programs, if a way to monitor them was to be found.

- With fares generally unregulated, airlines now offer a wider variety of options. Passengers in heavily travelled long-distance markets gained the most, as increased competition brought greater choice in fares. **Example:** To illustrate this general observation, the February 1986 Toronto-Vancouver fare offerings can be used. CPAL offered 22 different price tags on seats travelling between Toronto and Vancouver, the low end being $199 and the high end $1210. Between the same two cities, Air Canada had 28 different prices. The lowest CPAL price came with the airline's cuts on all its Canadian fares by up to 82% for flights between February 1 and March 6 of this year. Without the special February rate, the lowest price was $268 return and required one to book 30 days before travelling and to pay within 14 days and to leave on a Tuesday or Wednesday before June 16. The same $268 deal was offered by Air Canada. Both carriers were offering youth standby at $432 return (but last moment bumping is possible). For the top CPAL price ($1210), a second ticket for a child between the ages of 2 and 11 was $806 return, and, on the family plan, the spouse's fare was $1008.

On Air Canada's Executive Class, the price was $910 return and $755 for the spouse on the family plan; the hospitality class was $864 return, a ticket for an accompanying child under the age of 12, $576 and $717 return for a family plan ticket. Senior Citizens (over 65) qualified for a special $648 return fare. On a roundtrip excursion fare, senior citizens payed $432 during the high-travel seasons, $346 at other times, with requirements of 14 days advance booking, staying at least one Sunday, returning 180 days and paying $50 to cancel any portion of the ticket or make any booking changes.

3.3 Services

Markets where more than one airline was providing through-plane service[8] in the first quarter of 1985 and 1986 were identified. A total of 77 southern[9] Canada O/D markets had, either in one of the two years or in both years, more than one airline offering through-plane services. This indicator of the state of competition can be associated to a hub classification of the communities from which air services originated and/or terminated. Communities can be classified as large, medium or small hubs on the basis of the percentage of total passenger enplanements at that location. If at least 20% of unit toll passengers carried by Canadian and U.S. carriers in Canadian domestic and transborder services board a plane at a particular community, it is classified as a large hub; from 2 to 20%, a medium hub; from 0.45 to 2% a small hub. Communities with shares below 0.45% are called non-hubs. (A list of Canadian communities in each hub category is provided in footnote 10.)

Only nine O/D markets where a competitive situation prevailed had neither one of its two cities classified as a hub. This indicates that if competition and traffic density are closely related, traffic density is not the sole justification of competition. Of the 77 competitive markets, 28 had both an origin and a destination classified as a hub, thirteen of which involved a medium hub to another medium or large hub. This reinforces the earlier observation that competition is not solely seen in the densest markets. However, it is interesting to note that Toronto and Vancouver are the two communities benefitting the most from competitive air services to other communities, Toronto having competitive air services with thirteen other communities as opposed to sixteen for Vancouver.

In many respects, the most revealing observation that transpires is that 27 of the 77 O/D competitive markets saw the competitiveness of air services increased between the first quarter of 1985 and the first quarter

of 1986. This improvement in the prevailing level of competition came mostly, if not solely, from services introduced by smaller airlines such as norOntair, Burrard Air Ltd., Time Air Ltd., Skylink Airlines, Northwest Territorial Airways, Austin Airways Ltd., CP Air Commuter, Tropical Helicopter Airways Inc., Quebec Aviation Ltd., Air Ontario, Voyageur Airways Ltd., and Air BC Ltd. All in all, more markets were served in 1986 by competing airlines. The exclusion of connecting services in the assessment of the level of competition understates the level of competition and of passenger choice in some markets. For example, in February 1986, Air Canada was the only airline with direct flights between Calgary and Ottawa but, between the same two points, Air Canada's connecting services were competing with CPAL's.[11]

At the same time, it is noted that changes in the route structure of CPAL, Air Canada and PWA, dropping from their services, markets like Québec-Montréal, Montréal-Vancouver, Winnipeg-Calgary, Winnipeg-Toronto, Edmonton (Mun.)-Calgary, St. John's-Deer Lake, resulted in a deterioration of the competitiveness prevailing in those markets.

The May 10, 1984 policy, by removing licence restrictions, allowed licence consolidations which resulted in adjustment of service patterns from which major new non-stop routes were created. Licence consolidations gave to the carriers the freedom to fly from any point to any other point on their system. For regional carriers, hardly any new points were added to their network. But it is interesting to note that the removal of licence restrictions allowed, for example, Nordair to carry local traffic between Montréal and Québec, and that Nordair's licence consolidation allowed them to service Québec-Ottawa, a route already operated by Quebecair and Quebec Aviation. As well, Nordair's consolidated licences allowed the carrier to inaugurate an Ottawa-Sudbury-Thunder Bay-Winnipeg routing with Boeing 737 equipment on July 14, 1985, the same day that Air Canada dropped the route from its service and that Air Ontario started a parallel route with Convair 580's. This example is also indicative of a new trend which has resulted from the May 10 Policy: local service carriers are competing with their turboprop equipment with pure jets within some markets.

Local carriers were quick to take advantage of the new Canadian air policy and to make a move to create competitive situations. They even showed a willingness to enter competition on low density markets. For instance, Austin Airways was awarded the Toronto-Elliot Lake (Ontario) route, a route which put Austin in competition with Torontair. Toronto

to North Bay and Sudbury in Ontario, served by Air Canada from Pearson International, and by Voyageur Airways from Toronto Island, interested Air Ontario and Nordair who both applied to serve these points. But the evidence available so far indicates that the industry is still adapting to the new regulatory environment. Airlines are experimenting with service. For example, in the fall of 1984, Air Canada entered the Edmonton (municipal airport) - Calgary market with a daily frequency of two flights while PWA was offering 17 daily flights on the same route, flown also by Time Air with Dash 7 equipment. After a year of poor load factors, Air Canada dropped the route.

Local service carriers took advantage of the increased freedom to enter markets. For instance, out of a total annual traffic of 600 thousand passengers between Vancouver and Victoria in 1984, only 33.8 thousand were carried by Level I carriers. Vancouver-Victoria air travellers are given a choice of carriers and they face a great variety of services, equipment and fares.

3.4 Efficiency

Critics have argued that the air transport industry has used a high proportion of advancing efficiency related to aircraft design to overpay staff and indulge in inefficient practices. Bearing in mind such criticisms, and the fact that labour represents a very important cost element in operating an airline, it is important to track recent trends in the efficiencies with which air services have been provided in Canada. For this purpose, simple output per employee or output per labour dollar ratios are used. Such efficiency measures have the advantage of being easy to calculate. They are absolute measures which offer the possibility of tracking whether efficiency trends are along the lines of those expected under a more competitive environment.

The most recent year for which complete information is available is 1984. But, as previously indicated, pressures on Canadian airlines to improve the efficiency of their operations came first from deregulated U.S. carriers and then from the recession and the competitive forces which resulted from the May 10, 1984 Policy. As indicated in Table 2, airlines between 1981 and 1984 did manage to lower their labour per-passenger costs. The new Policy and the resulting increased competition have forced airlines to seek further cost reductions. Recent strategies such as route changes, withdrawal from markets where profitable competition is not possible, concession bargaining, etc., suggest that the trend observed between 1981 and 1984 was maintained if not intensified.

4. CONCLUSION

The May 10, 1984 New Domestic Air Policy has unleashed the powerful forces of competition into a field that had been rather tightly controlled. Continuing emphasis on competition has been and will continue to be beneficial to consumers. They have benefitted through innovative fares and new or expanded services. Travel bonus-type programs, business travellers-type products and vacation tour products are indicative of a more and more intense market segmentation.

Increased competition has resulted in more direct services and more product offerings. All high and medium density routes west of Toronto are flown by Air Canada; CPAL flies most of these routes and PWA and Nordair are actively present on many. However, the expansion of air services into markets occurred mostly on short haul routes. Domestic mature routes are the type of routes where a choice of carriers and a great variety of services, equipment and fares are offered to consumers.

New alliances, affiliations, mergers, buy-outs and even shared investments have appeared between large and small carriers since partial deregulation was implemented. Some low density and very short haul markets are no longer served by the large carriers. But, when an airline drops direct services to a route, it arranges either for a replacement carrier or for a different pattern of service on the route. Additional frequencies on individual routes by new competitors have resulted, in some instances, in fewer passengers on each aircraft and in smaller aircraft being used. In an increasingly competitive market, concessions such as lower starting wages, longer hours and increases in part-time positions have been asked from unions by the airlines in order to improve their efficiency. The extensive transport policy changes announced in July 1985 in a policy position paper entitled **Freedom to Move** is one more step toward a wider range of air services and the lowest possible costs.

TABLE 1: DISTRIBUTION OF PASSENGERS AND REVENUE PASSENGER-KILOMETRES BY CARRIERS' LEVEL

Level of Carriers	1984	1983	1982	1981
	Passengers (,000)			
Level I	24,745	21,155	22,098	24,870
Level II	1,377	1,091	1,023	1,216
Level III	1,456	1,444	1,248	1,075
Level IV	123	99	78	27
TOTAL	27,701	23,789	24,447	27,188
	Passenger-kilometres (million) Unit Toll Services			
Level I	34,105	31,288	32,095	35,350
Level II	320	255	252	240
Level III	201	154	170	148
Level IV	16	12	10	29
TOTAL	34,642	31,709	32,527	35,767

Source: Statistics Canada, Catalogue No. 51-002

TABLE 2: INDICATORS OF AIRLINES' EFFICIENCY

Carriers' Level	1984	1983	1982	1981
	Passengers flown per employee			
Level I	681	579	555	610
Air Canada	591	497	496	536
CPAL	500	464	420	437
EPA	1,105	972	1,081	1,182
Nordair	865	764	602	902
PWA	1,095	1,085	1,018	1,136
Quebecair	845	779	833	898
Wardair	1,204	956	816	668
Level II	967	869	794	833
Level III	321	333	270	203
	Hours flown per employee			
Level I	16.7	16.0	15.5	16.2
Level II	79.6	88.4	85.6	100.7
Level III	145.9	153.2	164.4	168.6
	Labour cost per passenger flown			
Level I	$52	$58	$55	$45
Level II	$25	$29	$31	$26
Level III	$75	$74	$92	$115
	Labour cost per hour flown			
Level I	$2,118	$2,103	$1,975	$1,704
Level II	$309	$290	$290	$213
Level III	$165	$162	$151	$139

Source: Statistics Canada, Catalogue No. 51-002.

FOOTNOTES

1. Roger Roy is the A/Director of Economic and Social Research, Research Branch, Canadian Transport Commission. The paper is built upon the Air Transport Monitor, a quarterly report produced by the Research Branch of the CTC. The author's debts are too numerous to mention but Eric Mainville and Marie Bellavance have to be cited for special thanks.

2. Level I airlines: Air Canada, Canadian Pacific Air Lines, Pacific Western Airlines, Nordair, Quebecair, Eastern Provincial Airways, Wardair.

3. Passengers and revenue passenger kilometres reported here are not limited to domestic operations.

4. See Canadian Transport Commission, Research Branch, Air Transport Monitor, Vol. 2, No. 1.

5. PWA's employees strike started on November 25, 1985.

6. The reduction of starting wages is known as the two-tier system. It allows newly hired employees to be paid lower salaries.

7. Job sharing = flexibility = more work from fewer employees = cost savings.

8. Through-Plane Service: air transport service provided between two points such that passengers can make the trip on the same aircraft, without disembarking during stops en route.

9. The dividing line separating the southern domestic and northern domestic sectors is defined in the Air Carrier Regulations.

10. Large hub: Toronto; Medium hubs: Vancouver, Montréal, Calgary, Winnipeg, Edmonton, Ottawa, Halifax; Small hubs: Regina, Saskatoon, St. John's, Victoria, Québec, Kelowna, Thunder Bay, Prince George, Moncton, Windsor, London. For more details on the hub concept, see Air Transport Monitor, Vol. 2, No. 1, Part E.

11. According to the services listed in the Official Airline Guide, for the Calgary-Ottawa market, there was in the first week of February, 1986, 14 direct Air Canada flights as opposed to 33 connecting Air Canada flights, 28 connecting CPAL flights, 16 possible connections between Nordair and Air Canada services, 13 between Air Canada and PWA and one between Nordair and CPAL.

The Demand Analysis of the Scheduled Level I Domestic Air Travel Market

CANADIAN TRANSPORT COMMISSION
RESEARCH BRANCH
Leesha Lin

I. Introduction:

The move towards market segmentation of passenger air services in Canada started in January 1978, with the introduction of deep discounted fares in the scheduled domestic long-haul markets. Since then, this market practice has been increasingly used by Canadian scheduled carriers to capture additional segments of the travel market, placing them in direct competition with charter carriers for a share of the "pleasure-trip" market. In essence, the market scope of scheduled carriers has been enlarged to serve not only "must-go" travellers but also "pleasure-trip" passengers. To do so, the scheduled carriers have segmented the market to meet the travel requirements of the two types of passengers.

The Research Branch of the Canadian Transport Commission has undertaken studies to examine the performance of market segmentation strategies widely used by the Scheduled Level I carriers in their domestic operations. As a general rule, the objective of market segmentation activity is to maximize profits by providing services or goods to all segments of a lucrative market. The key to successfully attaining such an objective is to select appropriate characteristics by which segments of the market can be divided. In doing so, diversion between segments of the market is minimized. In segmenting the domestic scheduled air travel market, restrictions (called "fences" in the industry) are chosen to isolate the full fare segment from the discounted fare segment. This implies that cross elasticities between two products as well as partial elasticities are tools with which carriers can properly segment their market. These price elasticities have been estimated and analysed in this study.

II. Demand Analysis

2.1 The Demand Model

A survey of the literature on demand modelling for air services suggested that the following variables are of importance in explaining demand variations: prices (own and competing air fare products), passengers' level of income, population at origin and destination, distance between two city pairs, competitive pressure, geographic characteristics represented by market segregation features, and waiting time (which is linked to the quality of service). Based on these explanatory variables, the following model for estimating air passenger demand can be formulated:

$$Pax_{ijk} = f(POP_{ij}, Y_{ij}, D_{ij}, W_{ij}, M_{ij}, N_{ij}, Ufare_{ijk}, Ufare_{ijl})$$

where: $i = 1, 2, \ldots N$ origin points;
$j = 1, 2, \ldots N$ destination points;
$k = 1, 2, \ldots K$ classes of fares (i.e. full fare, discounted fare and average fare);

Pax_{ijk} = passengers who travelled between origin i and destination j on fare type k;
POP_{ij} = population at both origin i and destination j;
Y_{ij} = income at both origin i and destination j;
D_{ij} = great circle distance between origin i and destination j;
W_{ij} = waiting time required to travel between origin i and destination j;
M_{ij} = market segregation characteristics between origin i and destination j (i.e. intra-northern region traffic, intra-southern region traffic, and inter region traffic);
N_{ij} = competitive pressure as measured by the number of carriers operating between origin i and destination j;
$Ufare_{ijk}$ = fare per kilometre for the Kth class of fare product between origin i and destination j;

Having adopted such a specification for the structure of the Model, the next step was then to estimate the model with the appropriate data for each variable.

2.2 Choice of Variables in the Demand Equation

a) The Phenomena to be Explained

Since the objective of this study is to evaluate and measure the effect of discounted fares not only on

air travel demand for discounted fare products, but also on demand in the segment of the market using economy fare products, information on actual traffic must differentiate the two types of air travellers. Such information is available from the Fare Basis survey instituted by the Aviation Statistics Centre of Statistics Canada. The survey is a sample of flight coupons collected by participating carriers.[1]. In the Fare Basis survey, passenger volumes are estimated for 1983 and 1984 by city-pair market, by carrier, for the following fare groups:

1) Premium Fare (e.g. First Class Fare);
2) Full Fare (e.g. Economy Class Fare);
3) Discounted Fare (e.g. Charter Class, Seat Sale, Advance Purchase Excursion, Group, Senior Citizen, Youth, Family Plan);
4) 'Other' (e.g. Military or Industry and Agent Discount Fares).

Air travellers using either "premium" or "other" fare groups are not part of the analysis herein, as these two groups represent less than 10% of the total traffic.

There are approximately 500 city pairs included in the survey, 304 of which were retained for the analysis on the basis of the reliability of the estimates generated by the survey in the study period (i.e., 1983 and 1984). The selected city pairs include flight segments served by one scheduled unit toll carrier, as well as segments served by two carriers or more. Non-scheduled services, which generate less than 10% of the total revenues of Eastern Provincial Airways, CP Air and Air Canada, and a somewhat higher proportion of the revenues of Pacific Western Airline and Nordair, have been excluded from the study.

b) Explanatory Variables

1) The Income Variable

For a city served by an airport, the personal disposable income of the residents in that city's census division was selected as a measure of its traffic generating potential. The traffic generating potential of two cities was estimated by summing, and then averaging, the two census divisions of a city pair.[2]

The 1983 income figures were also used to approximate the 1984 figure; the 1984 figures not being available for all markets in the analysis. It should be noted that per capita income was also tested as a measure of potential traffic generation, however the average income of the two areas representing each

city pair was felt to be a better measure according to criteria discussed later in Section 2.3.

2) The Fare Variables

As a wide variety of discounted fare products were offered in each city-pair market, it was difficult to systematically organize and aggregate the information such that a representative discounted fare variable could be developed. In view of this difficulty, the average price levels of the various air services were measured by using average yields observed in each city-pair. As the fares charged in each market were correlated with the distance separating the two cities served, average yield per kilometre was used to isolate the price effect on market demand.[3] The average yield per kilometre for a type of service on a given market was calculated by dividing the total annual revenues generated by the service by its total number of passengers kilometres. Average yields per kilometre for full fare products and for discounted fare products were calculated as well as an average yield per kilometre for all services. The ratio of the average yield of discounted fare services to that of full fare services was also tested to estimate the cross elasticity between the two services.

3) The Population Variable

For each city-pair, an average of the two cities' population is the unit measurement selected to approximate the need to travel between any two cities. The introduction of such a variable reflects the basic assumption that the need to travel is related to population size. The source of population data by area was the 1981 census. From the 1981 census population data, estimates for 1983 and 1984 were made by computing the average annual increase in population between 1976 and 1981 and projecting the same annual growth rate to 1983 and 1984 respectively. The annual growth rate information was obtained from the "Financial Post Canadian Markets 1985".

4) The Distance Variables

Since passenger surface transportation services are more likely to be competitive with air services within short-haul markets than in long-haul markets, distance of trip can serve as a proxy for inter-modal competition. The Great Circle Distance (GCD) separating any pair of cities is used to measure the length of haul. Due to the fact that fares reflect the distance separating two cities, price effects derived from a cross-section analysis are bound to also account for fare differences between city-pairs resulting from trip length differences. Thus, in

order to separate price effects from distance effects, city pairs were grouped into 8 distance classes. The distance classes are:

Class 1: trips of less than 200 kilometres;
Class 2: trips of between 200 and 399 kilometres;
Class 3: trips of between 400 and 599 kilometres;
Class 4: trips of between 600 and 899 kilometres;
Class 5: trips of between 900 and 1199 kilometres;
Class 6: trips of between 1200 and 2399 kilometres;
Class 7: trips of between 2400 and 3599 kilometres;
Class 8: trips of 3600 kilometres or more.

Note: A trip is defined as a direct flight from the city of origin to the city of destination.

5) The Market Segregation Variable

In light of regulatory differences between southern and northern air services[4] which have resulted from the May 10, 1984 policy, a market segregation variable is introduced to account for such differences. Three market segregation classes are considered:

Class 1: trips within the southern region;
Class 2: trips between the southern and northern region;
Class 3: trips within the northern region.

6) Competitive Pressure

As the study includes flight segments served by only one carrier as well as segments served by at least two carriers, competitive pressure is expected to be an important factor determining market conduct and passenger behaviour in the domestic air travel market. Therefore, competitiveness of the environment is expected to impact on the demand for air services. In order to measure the effect of competitive pressure on market demand, the number of carriers offering direct services in each city-pair is used.

7) Waiting Time

In the literature on air passenger demand, both travel time and waiting time are considered measures of the quality of airline services. Travel time includes both flight time and access time. Waiting time can be expressed in terms of:

i) frequency delay, which is the difference between one's desired, and actual departure time; and

ii) stochastic delay, which is time lost when no seats are available at the nearest departure time.

Therefore, waiting time can be seen as a reflection of flight frequencies and load factors.

Due to data availability constraints, "quality of service" in this analysis is approximated by an actual count of direct flights offered in each market in each year.[5]

2.3 Empirical Results

Except for the variables dealing with the number of carriers operating between a city pair, the distance classes, and the market segregation classes, all other variables are transformed by taking the natural logarithms. As a result, the estimated coefficients of the transformed variables directly represent estimates of the elasticity of demand with respect to these variables.

As part of the scope of the Study is to estimate the cross elasticities between fare classes, the demand function for a product should include its competing fare as well as its own fare. However, a problem of multicollinearity is encountered when both fares are present in the demand function; in this study, a relatively high correlation of -0.9 was observed for these two variables. Intially, it was felt that a variable measuring the ratio of discounted fares to economy fares could provide a solution. Unfortunately, this variable had to be discarded because the sign of the estimated coefficient for the economy fare products was inappropriate. As a result, the demand function for each product includes only its own fare.

A number of alternative specifications for the model, using various combinations of the explanatory variables described earlier, were considered and tested. The following set of criteria was established to determine which specification was to be retained: appropriate coefficient signs, significant T and F statistics, model stability, and the absence of multicollinearity and heteroscedasticity. According to these criteria, the frequency of flights and market segregation classes were both eliminated from the specification for the demand model. The remaining variables were sufficiently reliable, and were therefore retained in the model. The statistical results are presented in Table I.

III The Elasticity Analysis:

Price elasticities are essential to airline executives in determining appropriate levels of output and prices. Price elasticity measures changes in demand for a particular product which result from price movements of the said product. The elasticity concepts of particular interest in this study are:

a) total price elasticity;
b) service type specific price elasticity; and
c) cross elasticity of price.

a) Total Price Elasticity

Notwithstanding the theoretical interest shown in analysing price elasticities by service type, empirical evidence on such a subject is fairly limited. To date, most studies have been based on the total volume of passengers and average yield for all fare types, or for economy fares only. Table II provides a summary of the various total price elasticities which have been found for all fare types. Total price elasticity measures the responsiveness of total air passenger demand to changes in average yield. The elasticity parameters found by Tally and Edcroade are not representative of all air travel market, as the study focused mainly on short-haul monopolistic markets (e.g. the average stage length of markets under study being approximately 195 miles). In addition, a sample size of 19 and 22 city pairs is too small to arrive at a representative view of the overall air travel market. The elasticity estimates of A. DeVany and the ones of R.A. Ippolito would not fully represent domestic air travel behaviour in Canada, firstly because these studies were based on U.S. domestic air travel markets, and secondly, because they were carried out before the introduction of discounted fare products. Elasticity estimates derived by DeVany and Ippolito can only be used to provide a range for a Canadian estimate of price elasticity for air travel. Therefore, according to previous studies the total price elasticity is expected to vary between -0.5 and -1.2. As shown in Table II, the total price elasticity estimated in this study does fall within the specified range. Results place the total price elasticity for Level I domestic air travel markets in Canada at approximately -0.9. This means that a 1% reduction in average fare results in a 0.9% increase in demand for domestic air travel.

b) Service Type Specific Price Elasticity

Due to the unavailability of accurate disaggregated data on passenger demand by service type by city pair, own price elasticities by service type have rarely been estimated either in the U.S. or in Canada.

Nevertheless, airline executives have exercised their judgement to come up with some "ballpark" estimates to be used in their planning process. Table III provides a comparison of the CTC's estimated service type specific price elasticities with those provided by airline executives. It should be noted that the figures published in "Lloyd's Aviation Economist" reflect not only domestic but also international air travel. Our estimated service type specific price elasticities for discounted fare products are consistent with the figures used by Air Canada and "Lloyd's Aviation Economist". However, our estimated service type specific price elasticities for the economy fare products are somewhat greater than the corresponding ones derived from the other two studies. The CTC service type specific price elasticities indicate that while a 1% increase in economy fares results in a 1.07% reduction in the demand for economy fare products, a similar 1% increase in discounted fares results in a 1.56% reduction in the demand for discounted fare products. For comparison purposes, a "ballpark" service type specific price elasticity for discounted fare products was also estimated through interpretations of various survey results conducted specifically for the following seat sales:

- Skybus/Skydeal/One-Way One-Day Survey of Aug. 1982;
- Air Canada Seat Sale of April 29 to May 1, 1982; and
- B767 Survey of June 1983.

These estimates are listed in Table III. As the survey results were based on responses from passengers who travelled on discounted fare products available for special seat sales only, the estimated service type specific price elasticity for discounted fare products is expected to be greater than the one estimated with actual data.

c) Cross Elasticities

Since the introduction of discounted fare products in 1978, traffic diversion from the economy fare class to the discounted fare class has been a source of concern. Ideally, cross elasticities measuring the extent of traffic diversion should be estimated from a demand function. In practice, there are problems associated with this type of estimation. The most common barrier encountered by researchers is a multicollinearity problem in the demand estimation. The problem arose as a result of a high correlation between the price representing products examined and the price representing competing products. For this reason, fares representing competing products were excluded from our analysis, thereby assuming the

absence of cross-elasticities. By assuming the cross elasticity of discounted fare products is equal to that of economy fare products, two cross elasticity parameters can be derived. The derivation is described in Appendix I. With the adopted approach, it was possible to arrive at an estimated measure of cross-elasticity of approximately 0.85 for the 1983 domestic air travel market. This figure indicates that a 1% increase in the economy fare will result in a 0.85% increase in the demand for discounted fare products. Under the above assumptions, the corollary is that a 1% increase in discount fares will also result in a 0.85% increase in the demand for economy fare products.

IV. Summary and Conclusions

Based on our analysis, the level of domestic air travel demand in 1983 and 1984 is largely affected by the average populations (or income) of markets, the number of carriers serving them, air fares for own and competing products, and distance classes. Because of statistical problems which hindered the task of measuring cross-elasticities, fares for competing products were excluded from the estimation process. Instead, cross-elasticities were calculated by assuming that the cross elasticity of discounted fare products is the same as that of economy fare products.

As expected, the price elasticity estimates of demand for economy fare products are lower than the corresponding ones for discounted fare products. Furthermore, our service type specific price elasticity estimates for discounted fare products are consistent with results reported in "Lloyd Aviation Economist" and with Air Canada approximate figures. Price elasticities of demand for economy fare product obtained in this study are somewhat higher than the corresponding ones derived from the other two sources. Price elasticities for the demand of all air services clearly show that the high price elasticity of demand for economy fare products is indicative of a relatively high rate of traffic diversion. The diversion rate measures the portion of discounted fare passengers, who were previously willing to travel at the economy fares, diverted to the discounted fare products. Cross price elasticities are proxys for such a diversion rate, i.e. the higher the value of the cross-elasticity, the greater the value of the diversion rate. In our analysis, a cross-elasticity of 0.85 was observed. This suggest that as the discounted fares decreased in relatively terms by 1%, 0.85% of the economy fare passengers responded by travelling on discounted fares. This would imply that

any improved access to discounted fares in any market would translate for these markets in relatively high elasticity of demand for economy fare products at that point in time.

Table III: Service Type Specific Price Elasticities by Product

Study	Economy fare Products	Discounted fare Products
Air Canada[1]	-0.5	-1.5
Lloyd's Aviation Economist[2]	-0.7 to -0.9	-1.3 to -1.7
CTC estimates using Fare Basis Survey[3]	-1.04 (1983) -1.1 (1984) -1.07 (1983 & 84)	-1.43 (1983) -1.64 (1984) -1.56 (1983 & 84)
CTC "ballpark" estimate using Special Seat Sale Surveys[4]	N.A.	-2.1

Source of data:
1) "Forecasting for Transportation - Lessons for the Future", CTC, May 1985.
2) "Lloyd's Aviation Economist", June 1985.
3) Table I for 1983 and 1984.
4) "Skybus Survey", Research Branch of Canadian Transport Commission, January 1983, "B767 Survey" and "Air Canada Seat Sale Survey" conducted by CTC, Research.

Table I: Demand Estimation:*** 1983 and 1984

No. of Pax		Pop. or Income*	Own* Fare	No. of carriers	Dist. Class	F Stat.	R^2
economy products*	1)	0.4**	-1.07	1.301	-.494	138.8	.48
		(11.)	(-3.)	(14)	(-7.7)		
	2)	.41	-.999	1.307	-.485	139.4	.48
		(12.)	(-3.)	(14.1)	(-7.5)		
discount products*	1)	.528	-1.5	1.394	-.417	214.0	.58
		(14.)	(-5.7)	(14.3)	(-7.1)		
	2)	.512	-1.532	1.41	-.413	210.3	.58
		(14.)	(-5.5)	(14.4)	(-7.0)		
all products*	1)	.447	-.898	1.386	-.393	173.6	.53
		(13.)	(-3.2)	(15.1)	(-6.5)		
	2)	.44	-.863	1.395	-.39	173.8	.53
		(13.)	(-3.1)	(15.2)	(-6.4)		

* Variable is in logarithmic form.
** Brackets contain t statistics.
*** Coefficients of the constant term are not given, due to a lack of space

1) The income variable was excluded from this equation.

2) The population variable was excluded from this equation.

Table II: Total Price Elasticity for Domestic Air Travel Markets

Study	Total Price Elasticities	Description of the Markets Studied
W.R. Talley & W.R. Edcroade	-4.5(1979)*** -2.8(1980)	19 city pairs in 1979 and 22 city pairs in 1980** (US).
A. De Vany	-0.76(28 miles) -1.02(400 miles) -1.14(1500 miles)	the top 600 US domestic air travel markets in 1968 excluding the domestic portion of an international flight leg.
R.A. Ippolito	-0.53(440 miles) -1. (830 miles)	105 monopolistic flight segments in 1976. (US).
CTC-Research*	-0.9 (equation I) -0.86 (equation II)	304 flight segments per year (including the domestic portion of an international flight).

* Source of data: Table I
** Only monopolistic flight segments are included.
***Brackets contain either year of data or length of flight stage for each total price elasticity.

I would like to thank Catherine Higgens and Pierre Vincent for their assistance, and Roger Roy for his guidance and comments. Please note that the views expressed are those of the author and do not necessarily reflect those of the CTC.

[1] It should be noted that the Fare Basis Survey covers scheduled services operated within Canada by Level I carriers. It also includes the domestic portion of international flights. The Level I carriers who participated in the survey are Air Canada, CP Air, Eastern Provincial Airways, Nordair, and Pacific Western Airline.

[2] Two sources were used to extract personal disposable income information. For census divisions where the population was in excess of 10,000, the associated demographic information for 1983 was obtained from the "Financial Post Canadian Markets 1984", which was compiled and published by MacLean Hunter Limited. In all other areas, the total income by census division was provided by the Statistical Services Division of Revenue Canada - Taxation.

[3] The problem of a serious correlation between fare and distance was mentioned in R.A. Ippolito, "Estimating Airline Demand with Quality of Service Variables", Journal of Transport Economics & Policy, Vol. 15, Jan. 1981, pp. 7-15, and Wayne K. Tally and William R. Eckroade, "Airline Passenger Demand in Monopoly Flight Segments of a single airline under Deregulation," Transportation Journal, winter 1984, pp. 73-79.

[4] The dividing line is defined by:

a) the 50th parallel from the Atlantic Ocean to the Ontario-Manitoba boundary;
b) the diagonal joining the 50th parallel at the Ontario-Manitoba boundary to the 53rd parallel at the Manitoba-Saskatchewan boundary; and
c) the 55th parallel from Manitoba-Saskatchewan boundary to the British Columbia - Alaska boundary.

[5] Direct flights between selected city pairs listed in the November (1983 and 1984) editions of the Official Airline Guide were used.

Appendix I

METHODOLOGY USED TO CALCULATE CROSS-ELASTICITY IN THE CASE OF A TWO-PRODUCT MARKET

The cross-price effect of economy fare products on the discount fare market segment is assumed to be the same as the cross-price effect of discount fare products on the economy fare market segment. In addition, it is assumed that both demand functions are monotonically decreasing, and that the demand elasticities are non-zero. The aggregated market structure can be described as follows:

$$Q = q_1 + q_2; \qquad \ldots\ldots (1)$$

$$q_1 = f(p_1, p_2);$$

$$q_2 = f(p_1, p_2);$$

$$P = a\,p_1 + b\,p_2;$$

$$a = \frac{q_1}{Q},\ b = \frac{q_2}{Q};$$

$$0 < a < 1 \text{ and } 0 < b < 1$$

Where:

- Q is total passenger demand;
- q_1 is passenger demand for the economy fare product, is a function of both the economy fares and the discount fares available in market;
- q_2 is passenger demand for the discount fare product, is a function of both the economy fares and the discount fares;
- P denotes average yield for a specific city pair;
- P_1 denotes the average yield of the economy fare products;
- P_2 denotes the average yield of the discount fare products;
- a is the market share of the economy fare products;
- b is the market share of the discount fare products.

The total differential of equation (1) can be written as:

$$\frac{dQ}{dP} = \frac{\partial Q}{\partial q_1} \cdot \frac{\partial q_1}{\partial p_1} \cdot \frac{\partial p_1}{\partial P} \cdot \frac{\partial P}{\partial P} + \frac{\partial Q}{\partial q_2} \cdot \frac{\partial q_2}{\partial p_2} \cdot \frac{\partial p_2}{\partial P} \cdot \frac{\partial P}{\partial P}$$

$$+\frac{\partial Q}{\partial q_1}\cdot\frac{\partial q_1}{\partial p_2}\cdot\frac{\partial p_2}{\partial P}\cdot\frac{\partial P}{\partial P}+\frac{\partial Q}{\partial q_2}\cdot\frac{\partial q_2}{\partial p_1}\cdot\frac{\partial p_1}{\partial P}\cdot\frac{\partial P}{\partial P} \qquad \text{.....(2)}$$

Since $\frac{\partial p_1}{\partial P}=\frac{1}{a}$, $\frac{\partial p_2}{\partial p}=\frac{1}{b}$, $\frac{\partial Q}{\partial q_1}=1$ and $\frac{\partial Q}{\partial q_2}=1$

Then equation (2) can be rewritten as:

$$\frac{\partial Q}{\partial P}=\frac{1}{a}\cdot\frac{\partial q_1}{\partial P_1}+\frac{1}{b}\cdot\frac{\partial q_2}{\partial p_2}+\frac{1}{b}\cdot\frac{\partial q_1}{\partial p_2}+\frac{1}{a}\cdot\frac{\partial q_2}{\partial p_1}$$

Multiplying both sides of the above equation by $\frac{P}{Q}$, we can arrive at the total demand elasticity:

$$\frac{dQ}{dP}\cdot\frac{P}{Q}=\frac{1}{a}\cdot\frac{\partial q_1}{\partial p_1}\cdot\frac{P}{Q}+\frac{1}{b}\cdot\frac{\partial q_2}{\partial p_2}\cdot\frac{P}{Q}+\frac{1}{b}\cdot\frac{\partial q_1}{\partial p_2}\cdot\frac{P}{Q}+\frac{1}{a}\cdot\frac{\partial q_2}{\partial p_1}\cdot\frac{P}{Q}$$

$$=\frac{1}{a}\cdot\frac{\partial q_1}{\partial p_1}\cdot\frac{p_1}{q_1}\cdot\frac{q_1}{p_1}\cdot\frac{P}{Q}+\frac{1}{b}\cdot\frac{\partial q_2}{\partial p_2}\cdot\frac{p_2}{q_2}\cdot\frac{q_2}{p_2}\cdot\frac{P}{Q}$$

$$+\frac{1}{b}\cdot\frac{\partial q_1}{\partial p_2}\cdot\frac{p_2}{q_1}\cdot\frac{q_1}{p_2}\cdot\frac{P}{Q}+\frac{1}{a}\cdot\frac{\partial q_2}{\partial p_1}\cdot\frac{p_1}{q_2}\cdot\frac{q_2}{p_1}\cdot\frac{P}{Q} \qquad \text{.....(3)}$$

where:

$\frac{\partial q_1}{\partial p_1}\cdot\frac{p_1}{q_1}$ is the demand elasticity of economy fare products with respect to changes in economy fares and is hereafter represented by ϵ_{11};

$\frac{\partial q_2}{\partial p_2}\cdot\frac{p_2}{q_2}$ is the demand elasticity of discount fare products with respect to changes in discount fares and is hereafter represented by ϵ_{22};

$\frac{\partial q_1}{\partial p_2}\cdot\frac{p_2}{q_1}$ is the cross elasticity which measures the changes in demand for economy fare products with

respect to changes in discount fares and is hereon represented by ϵ_{12};

$\frac{\partial q_2}{\partial p_1} \cdot \frac{p_1}{q_2}$ is the cross elasticity which measures changes in demand for discount fare products with respect to changes in the fare level of economy fare products and is hereafter represented by ϵ_{21};

Equation (3) can be rewritten by substituting the notations for elasticities, and the relationship between demand elasticities and cross elasticities can be expressed as being:

$$\epsilon = \frac{1}{a} \cdot \epsilon_{11} \cdot \frac{q_1}{Q} \cdot \frac{P}{p_1} + \frac{1}{b} \cdot \epsilon_{22} \cdot \frac{q_2}{Q} \cdot \frac{P}{p_2} + \frac{1}{b} \cdot \epsilon_{12} \cdot \frac{q_1}{Q} \cdot \frac{P}{p_2}$$

$$+ \frac{1}{a} \cdot \epsilon_{21} \cdot \frac{q_2}{Q} \cdot \frac{P}{p_1}$$

$$= \epsilon_{11} \cdot \frac{P}{p_1} + \epsilon_{22} \cdot \frac{P}{p_2} + \frac{a}{b} \cdot \epsilon_{12} \cdot \frac{P}{p_2} + \frac{b}{a} \cdot \epsilon_{21} \cdot \frac{P}{p_1}$$

Airline Seat Management

by

Dennis J.H. Kraft, Tae H. Oum and Michael W. Tretheway

A. Introduction

When airline deregulation was proposed in the United States, proponents predicted that it would result in uniformly lower fares, albeit with peak/off peak and distance related differences. The low fares and single class service of the non-federally regulated intrastate carriers (Southwest, Air California and PSA) were cited as examples of what lay in store for all travellers. When deregulation began, carriers responded with capacity controlled and restricted fares, such as American Airlines' Supersaver. These were dismissed by some observers as being a temporary phenomena--eventually the restrictions and capacity controls would disappear. After all, the coach fares of the late 1940's, originally introduced on a capacity controlled and restricted basis, quickly became a uniform fare.

It is now almost ten years since the first capacity controlled restricted airfares appeared. Far from being transformed into a uniform low fare for all travellers, these discount fares seem to be here to stay. In fact, the number of restricted fares continues to increase. A single airline will now offer tickets ranging in price from full fare to an 80% discount with varying degrees of restrictions (e.g. 3 day versus 90 day advanced purchase). The tenacity of the fare class proliferation phenomena is due to the advent of the modern Airline Seat Management system. Alternatively known as Yield Management, Inventory Management or Discount Fare Management, these system allow the airline to achieve a higher level of profits than with a much simpler fare structure. The fact that almost every major North American airline has adopted some system for managing seats indicates their importance for post deregulation profitability.

The purpose of this paper is to introduce the reader to the concept of modern airline seat management. The economic underpinnings of the concept, the mechanics of the system and a number of special issues are described. A survey of some of the systems available is presented and finally topics for further research in the field are discussed.

B. A Short History

The idea of offering seats on the same flight at different fares dates from before World War II. In the late 1940's in response to competition from charter carriers, U.S. trunk carriers established coach fares. Originally on special all-coach flights, the airlines eventually adopted a mixed cabin with first class and more densely packed coach seats on the same flight. With the advent of jet service in the late 1950's, economy fares were introduced. Although originally lower than coach fares, eventually, the distinction between the two disappeared. While all of these concepts were innovative, they all generally involved an allocation of seats between the classes that was fixed for all flights for extended periods of time.

By the early 1970's, Boeing Commercial Airplane Co. had developed a concept for increasing airline revenues. This was to be done by tailoring the allocation of seats between an unrestricted and a restricted fare class for each flight. The intent is to sell full fare seats whenever possible. However, by using computer analysis of historical sales, it is possible to predict when a seat on any flight of any day would likely be flown empty. These seats could be sold at a substantial discount to individuals who otherwise would not have flown. A key aspect of the Boeing concept was attaching restrictions to the discount fares to prevent those who would have flown anyway to divert to the lower fares and thus lower flight revenue.

British Airways had wanted to adopt the Boeing concept for some time as a response to growing competition, especially in North Atlantic markets, from charter and non-IATA carriers. Government regulators resisted B.A.'s requests until the day when Laker Airways started to fly scheduled London-New York flights. In 1977 the concept spread to domestic U.S. markets, first with Texas International's "Peanuts Fares' and then with American Airlines' "Supersaver." Within months these capacity controlled and restricted fares spread to all major airlines and to most major markets. At present, even some of the smallest commuter carriers offer such fares.

C. Economic Underpinnings

The concept of airline seat management rests on four characteristics of airline markets: Perishability of the product, the ability to effect price discrimination, joint production of seats in various fare classes and predictability of demand. Airline services are perishable. Once a flight departs, unsold seats cannot be inventoried and sold at a later date. If an airline could reliably predict how many seats on a flight are likely to be flown empty, and if it could find potential customers who would not fly either on that flight or on other flights at the going airfare, but who is willing to fly for a fare below it (but above the marginal cost of the fuel and food services associated with the filling otherwise empty seat), then airline profits could be increased. The

otherwise empty seats would be sold at a discount to these potential customers, while existing customers would pay the full fare.

An important assumption is that the potential passengers for the empty seats would not have otherwise flown. For a seat management system to be effective, the airline must be able to segregate its customers into two market segments. The first segment consists of those who would have flown at the high air fare. The second are those who would only fly at the lower air fare. For the system to work, it is necessary that the customer willing to pay the high air fare not get access to the low fare. This is the economic concept of price discrimination utilizing the different price elasticities among consumer groups.

In most industries, price discrimination is difficult to effect. The airlines, however, have discovered that placing restrictions on air fares, such as the requirement of staying over a Saturday night, gives them an ability to price discriminate. There is, of course, a nonzero cross-price elasticity between the two products. Some of the high fare or unrestricted passengers will divert to the low fare category, but this cross elasticity (airlines refer to it as diversion) is not perfect. Many of the existing high air fare customers are not willing to satisfy such restrictions, i.e., the "high air fare" customer is willing to pay significantly more than the "discount air fare" customer in order to avoid the restriction.

With modern computer systems maintaining and analyzing large historical databases, the cross-price elasticity and amount of diversion is predictable. This predictability allows the airline to determine the mix of products that will maximize its profits. Determination of whether or not to offer two or more fares (products) in the market, and if so, which set of restrictions to employ, what level the fares should be set to and how many seats to allocate is the task of an airline seat management system. Both seat allocation and fare for each class may be reviewed and changed at any time before the flight departure.

D. Seat Management Fundamentals

For seat management to work, it is essential that the airline be able to predict, with a reasonable degree of accuracy, demand for each and every one of its flights. The advent of the modern computer reservations system has made this possible. By analyzing the results of perhaps millions of flights, reasonable short-run predictions are possible. Further, these systems also allow the determination of the variance of demand for a flight. This allows the airline to predict and regularly update its predictions not only how many seats on average it will sell by the flight's departure, but also how many seats it needs to have available if it wishes to accommodate all full fare passengers, say 95% of the time. This information can be utilized to reallocate seats between fareclasses in order to maximize a given flight's expected revenues. A typical seat management system follows these steps:

1. Determine the Capacity of the Flight. The first step is determining how many seats will actually be available for sale on a specific flight. This is often exogenous. Flight 147, for example, is always flown with a 100 passenger Boeing 737. In some cases, airlines with fleets with varying number of seats per aircraft will attempt to optimize the assignment of aircraft to flights in an attempt to maximize its profits. This optimization of the flight schedule is a very complex process and deserves a specialized paper by itself. For simplicity, let us proceed assuming that a 100 passenger aircraft has been allocated to flight 147.

2. Forecast the Demand By Full Fare Passengers. The next step is to rely on the airline's historical data base of Flight 147 and related flights to forecast a) the number of full fare passengers expected to fly, and b) the variance around that expectation. Figure 1 demonstrates this. Based on experience with this and related flights, Flight 147 has an expected demand of 60 full fare passengers. There is a probability associated with the actual realization of 60 as well as with the realization of any other number of seats. It has generally been observed that passenger demands are normally distributed. The capacity of the airplane is indicated in Figure 1 with a solid vertical line at 100 seats. Note that there is a small probability that demand could be greater than the 100 seat capacity of the aircraft.

3. Determine a Spill Rate. The next step is to determine how many seats should be allocated on this flight for full fare passengers. This is done by choosing a probability level for seating all full fare passengers. For example, the airline might choose to allocate seats to full fare passengers such that 95% of the time all full fare passengers will be accommodated. This is easily determined using the variance of demand for the flight. Figure 2 shows that if we allocate 90 seats on Flight 147 to full fare passengers, then 95% of the time all full fare passengers will be accommodated. If only these 90 seats are available to the full fare passenger, then 5% of the time some customers will be turned away. This 5% is referred to as the "spill" rate. We note that not all of the "spill" is actually lost to the airline. Some of these potential customers will be captured on other flights of the same airline. A good yield management system accounts for this.

4. Assign Seats to Discount Fare Classes Figure 2 indicates that ten seats are now available on Flight 147 for a discount fare class.

5. Determine Discount Fare Level and Restrictions The airline must now choose the level of the discount fare, and associated restrictions. Restrictions are essential if the airline is to prevent the full fare passengers from availing themselves of the discount fare.

Figure 1

Full Fare Demand for Flight 147

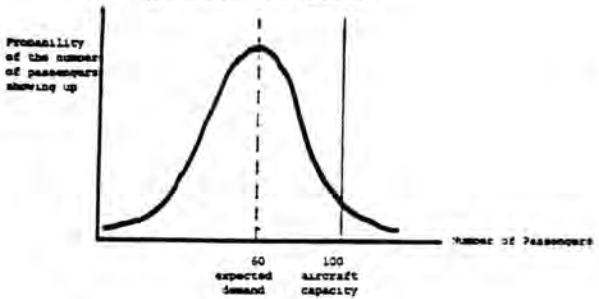


Figure 3

Diversion From Full Fare Class to Discount Fare Class

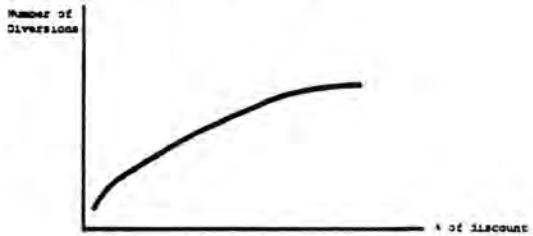


Figure 2

Full Fare Seat Allocation

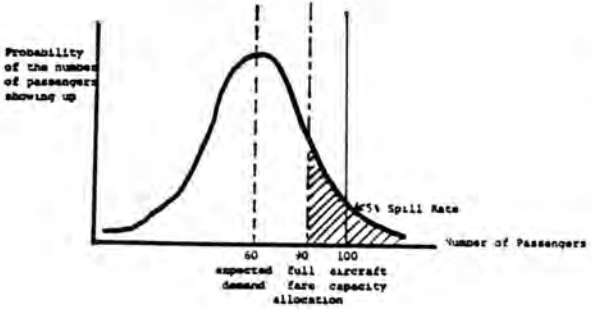


Figure 4

Diversions Versus Restrictions



A discount has two effects. The first effect is "stimulation". That is, the discount fare attracts those who would not have flown. The second effect is "diversion". Some of those who would have flown at the full fare, will divert to the discount fare. Luckily, with modern yield management systems, the amount of this diversion can be predicted. It has been found that the amount of diversion is positively related to the size of the fare reduction. See Figure 3. Airlines have found in recent years that with large fare reductions, they get substantial stimulation and diversion of traffic. With smaller fare reductions, the amount of diversion is considerably reduced.

The airlines have also observed that the number of diversions is inversely related to the severity of the restrictions on the discount fares. See Figure 4. For example, there will be fewer diversions to a 60% discount fare when the restrictions include 90 day advanced booking, 60 day advanced purchase, 14 day minimum stay, 31 day maximum stay, and no cancellation privileges, than to a 60% discount fare where the only restriction is 3 day advanced purchase and staying over a Saturday night. Table 1 gives a list of some typical restrictions used by airlines.

In determining the amount of the discount and the surrounding restrictions, the air carrier may simulate various alternative combinations of discounts and restrictions and choose the one that maximizes the profit for the flight, given the number of seats available at the discount fare. These simulations account for the differing stimulation and diversion rates for various discount seat programs. In general, airlines make available larger numbers of seats with small rather than large discounts and with relatively severe restrictions.

Because of the diversion of some full fare passengers to any discount fare class, the number of seats that need to be allocated to full fare passengers to achieve a given (5%) spill rate will be less than if the flight only catered to full fare passengers. Thus, in the final analysis, the number of seats allocated to full fare passengers on Flight 147 might be 85 rather than the 90 indicated in Figure 2.

E. Other Seat Management Issues

We now bring up three other issues associated with seat management programs.

Dynamic Adjustment of Seat Allocations. The above discussion was for a one time static allocation of seats between full fare and discount classes. This is typically done 3 to 6 months before the actual date of the flight. In practice, most airlines revise their expectations of the demand for the flight as they gather information on actual sales for the flight. This is typically done using a "booking curve". Figure 5 is an example of this. As the day of the flight approaches more and more of the full fare seats should be booked. In the example the expectation is that on the day of the

Table 1

List of Restrictions Typically used by Air Carriers

Advanced booking: book seat at least N_1 days in advance of flight

Advanced purchase: pay for ticket at least N_2 days in advanced

Minimum stay: time between originating flight and return flight must be at least N_3 days

Maximum Stay:

Return (or round trip) ticket: ticket must be round trip to qualify for discount. This excludes one way, triangular or complex itineraries.

Saturday night stayover: there must be a Saturday night between the originating and return flights

Refund penalty or No Refund: if booking cancelled before flight, traveller forfeits all or part of airfare

Rebooking fee or no rebooking privilege: if traveller wishes to change to another flight for originating and/or return flights

Limited or no stopover privileges: on a flight from New York to Rome via London, traveller cannot spend time in London

Limited or reduced service: associated with fare type.

Limited to specific time of day: e.g. Nighthawk service

Class of service restrictions: if flight full, no upgrade privilege to a higher class which might have empty seats

No interline privilege: tickets cannot be endorsed to another carrier.

Standby seating:

Figure 5

Expected Flight Booking Curve

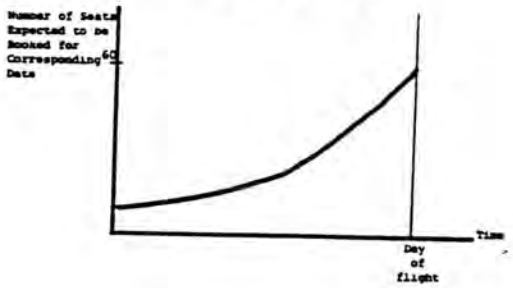


Figure 6

Actual Versus Expected Bookings

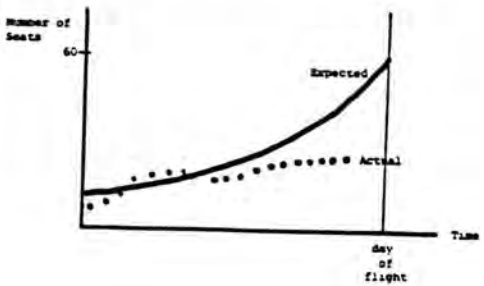


Figure 7

Threshold Range

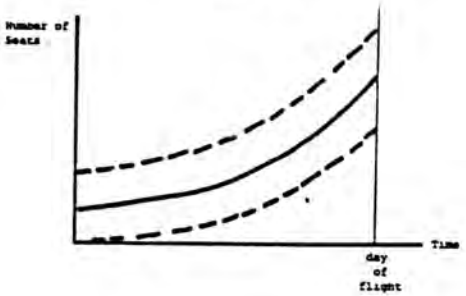
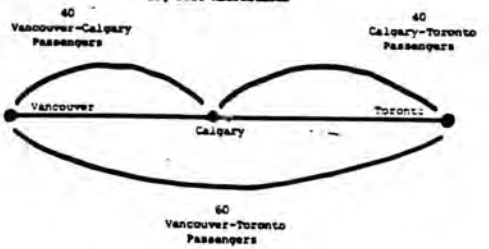


Figure 9

One Stop Flight

Leg Seat Allocations



flight, 60 full fare seats should have been booked. The shape of the curve is drawn intentionally to reflect the fact that most full fare passengers book close to the day of the flight.

The airline compares actual bookings against this expected booking curve. Figure 6 is an example. Here we see that actual bookings are falling below expectations as the day of the flight approaches. In this case, the airline may choose to increase the number of seats it has available in the discount fare categories or decrease the discount fare. If bookings run ahead of expectations, then the carrier might choose to reduce the number of discount seats available on this flight or increase the discount fare. By tracking actual versus expected bookings, the airline obtains better predictions of the number of seats that will be flown empty as the flight date approaches.

Since airlines may have to track thousands of flights on any given day, it is not feasible to compare actual versus expected bookings for all flights. Instead the computer will be instructed to make the comparison itself. Flights which seriously deviate from expected bookings are flagged by the computer and brought to the attention of management for a decision. This is generally done by a daily "exception report" indicating all flights that have exceeded or fallen short of a "threshold" level. Figure 7 illustrates this. Here upper and lower bounds are given for the threshold range. When actual bookings fall outside of the threshold range, then the flight is added to the exception report list. Flights whose bookings fall below the threshold range may be cancelled, the number of discount seats increased or the discount fare can be decreased. If a flight rises above the threshold range, the number of discount seats can be reduced, larger equipment might be substituted, an extra section might be flown or the discount fare may be increased.

Airlines in the United States have greater flexibility than those in Canada. In Canada mandatory government restrictions still apply to some discount air fares. Typically these require 14 day or greater advanced bookings. Often a carrier will not know how its full fare bookings are progressing until only a few days prior to the flight. (Full fare travellers tend to book late.) In the U.S., many carriers have discount fare classes with only three day advanced booking requirements (plus minimum stay or Saturday stayover restrictions), although the level of discount might be modest, such as 30%. This gives the U.S. carrier greater flexibility in adjusting its inventory of seats in the last few days before a flight.

More Than One Discount Class Can Be Offered. We have described the case of a flight with a full fare class and a single discount fare class. In fact, air carriers will apply the same seat management concept to the discount fare class and offer additional discount fare classes. Figure 8 illustrates this. The top part of the figure is a duplication of Figure 2. Here a 5% full fare

seats for discount classes. Discount fare class 1 is offered with some restrictions and a modest discount. Just as for the full fare class, there is a probability distribution of actually selling the 10 discount seats. This is plotted in the lower part of Figure 8. A spill rate can be specified for this class, 10% in the case of Figure 8, indicating that 7 seats are to be allocated to discount fare class 1. This leaves 3 seats available for a second discount fare class, usually with a deeper discount, but more stringent restrictions. The multiple fare class system is effective in allowing the airline to fine tune its price discrimination so as to maximize revenues.

Route Assignment. The discussion thus far concerned itself with a non-stop flight. Consider the one stop flight depicted in Figure 9. Here the plane flies from Vancouver to Toronto making a stop in Calgary. There are 100 seats available on the Vancouver/Calgary "leg" and 100 seats on the Calgary/Toronto leg. The question now becomes how many seats on the Vancouver/Calgary leg should be allocated to Vancouver to Calgary passengers and how many should be allocated to Vancouver to Toronto passengers. The profit-maximizing solution will be a function of the demand on the Calgary to Toronto leg as well. This problem is very difficult to solve. In general, short passenger trips reap higher fares per mile. This is offset by the fact that it may not be possible to fill all of the short haul seats on both flight legs. There can be severe traffic imbalances. A flight from Vancouver to Kamloops to Prince George might stimulate significant amounts of Vancouver to Kamloops traffic during the ski season with little stimulation of Kamloops to Prince George traffic.

Again, a modern seat management system with a sophisticated optimization program can determine the optimum "blocking" of seats between the various route legs. It accounts for different demand elasticities (and cross elasticities) on different flight legs.

F. Seat Management Systems Available and Selection Criteria

There are four general types of providers of seat management systems: airlines, aircraft manufacturers, computer manufacturers and specialized consultants. Airlines such as American and United have invested hundreds of millions of dollars in developing systems for their own use. In some cases, such airlines may sell seat management services to other, generally non-competing, airlines. Airlines jealously protect the seat management systems and decisions, often housing them in very secure restricted areas. It is well known that an oligopolist with knowledge of how its competitor makes pricing decisions can achieve a higher level of profits. A system that improves revenues by a mere 1% can increase the profits of a typical $1 billion air carrier by $10 million per year.

Boeing developed and offers seat management services to airlines. Presumably, this is because it finds the services to be a profitable product line and because anything that increases airline profits increases the demand for aircraft. Computer

vendors such as Univac and CDC have long provided services such as reservation systems to airlines. It is only natural that they also provide seat management systems to their clients. In recent years, a number of specialized consulting firms have emerged to plan for and/or provide system. Interesting among these is the recent appearance of consultants providing systems for the smaller commuter airlines.

When deciding whether or not to introduce a seat management system, determining the timing of introduction and choosing a vendor, an air carrier should recognize that a system cannot be introduced in isolation. Airline marketing executives recognize that the seat management system is a key tool in assessing and implementing competitive actions. Information such as, leg load factors, discount seat mix allocations and flight profitability is critical on a daily basis. However, the executive must put the system in perspective. One must consider the following factors in selecting a seat management system.

Computer Strategy. The system must be compatible with the computer system development strategy within the air carrier. Large systems require facility management expertise, maintenance and program support.

Reservation System. The air carrier must consider the impact of utilizing the reservation system as a key source for competitive information. Carriers "hosted" on a rival's reservation system will have to consider reservation bias.

Management Information System. The air carrier is forced to evaluate the adequacy of financial reporting systems. Examples include flight profitability reports, operating costs over legs, and the need to link to cost systems.

Revenue Reporting System. The air carrier will focus on revenue generated over each flight leg. Accurate and timely clarification and reporting of revenue and non-revenue traffic is critical in calibrating predictor models.

Table 2 outlines a number of key factors that air carriers utilize in screening vendors of seat management systems.

G. Closing Remarks

Airline seat management systems have allowed carriers to increase their profits, provide a predictable level of service and to improve their utilization of otherwise empty seats. The ability to separately alter seat allocations on every flight distinguishes the concept from earlier discounting such as coach and economy seats. Because of this, we believe capacity controlled discount seats are not a temporary phenomena, but are a permanent fixture of the industry.

Table 2

SELECTION CRITERIA FOR A SEAT MANAGEMENT SYSTEM

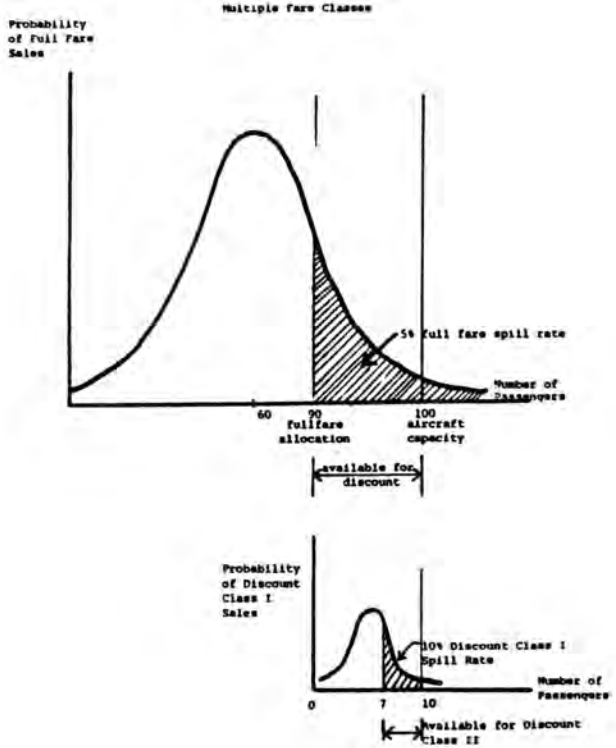
1. Dynamic Analysis	Systems must be flexible in order to react to changing booking patterns, load factors and no-shows based on current market conditions.
2. Threshold Reports	Predefined reports that profile selected business and leisure markets.
3. Exception Reports	Focus on flights on an exception basis.
4. System Update	Daily update of system with Reservation data.
5. Sensitivity Analysis	The ability to change flight mix on a simulated basis.
6. Display Multiple Fare Classes	System should have ability to handle many discount fareclasses
7. Interactive	Staff must have on-line access to system.
8. Graphics	System should have graphical display capability.
9. Systems Support	Most use 4th generation languages. Key is to ensure compatible systems in airline.
10. Payback	Expect payback within one year.

The purpose of seat management is to maximize airline profits. The systems that have evolved have been quite effective in achieving that goal. Nevertheless, upon close inspection we find that the systems are intuitive and somewhat ad hoc. The nature of the problem is optimization (profit maximization) of a process with stochastic elements (sales can never be predicted with certainty). This lends itself well to the area of management science known as stochastic dynamic programming.

The current procedure for establishing the lower and upperbounds of computerized exception reporting system appears to be also somewhat ad hoc. This reporting problem lends itself well to a scientific probability study of periodic or continuous review of seat inventories (or reservations). Our current research involves putting the seat management problem into such a framework with an intent to improve decision rules so as to improve carrier profits. Repeating an earlier point, a system refinement that improves carrier revenues by a mere 1% still translates into a $10 million profit improvement per year for a typical $1 billion carrier.

Figure 8

Multiple fare Classes



Footnotes

1 Kraft is Senior Director Yield Management and Marketing Information, Pacific Western Airlines. Oum and Tretheway are Associate Professor and Assistant Professor, respectively, Faculty of Commerce and Business Administration, University of British Columbia.

2 For a discussion of the introduction of coach fares, see Caves, Christensen, Tretheway and Windle (1985), "The Effect of New Entry on Productivity Growth in the U.S. Airline Industry", Logistics and Transportation Review, Vol. 21, No. 4, December.

3 The notable exception to this is People Express which continues to offer all seats at a uniform unrestricted fare, except for peak/off-peak discounts. As this carrier's growth matures, we expect it to adopt a seat management system.

4 See R.E.G. Davies (1972), Airlines of the United States Since 1914, Smithsonian, Washington, D.C.

5 See A. Sampson, (1984), Empires of the Sky, p. 110, Hodder and Stoughton, London.

6 See Howard L. Banks, The Rise and Fall of Freddie Laker Faber, London, 1982.

7 See E.E. Bailey, D.R. Graham and, D.P. Kaplan, Deregulating the Airlines, MIT Press, Cambridge, 1985, p. 43.

8 See, for example, M.A. Brenner, "The Significance of Airline Passenger Load Factors," in G.W. James (ed.), Airline Economics, Lexington Books, Lexington, Massachusetts, 1982.

9 Naturally, the demand for full fare seats would depend on the spectrum of seat offerings (fares and restrictions) on this and other substitutable flights of the carrier and its competitors.

10 Flight 147 is a 1 PM flight. Some of the spill will be recaptured by flight 145 (10:45 AM) and 149 (3:15 PM).

11 Economists would say that there is a negative own-price elasticity of demand for the discounted product.

12 Economists would say that there is a positive cross elasticity of demand between the two products: unrestricted full fare seats versus restricted discount seats. See, for example, Oum, Gillen and Noble (1984), "Demand for Fareclasses and Pricing in Airline Markets, "(Working Paper No. 1004, Faculty of Commerce, U.B.C.) for estimates of our own and cross-price elasticities on various major U.S. routes.

13 As this is being written, a proposal to give carriers more freedom is being considered by the government.

ECONOMIC DEREGULATION AND AIRLINE SAFETY

by

William A. Jordan
Faculty of Administrative Studies
York University

1.0 Introduction

Both the Minister of Transport and the House of Commons Standing Committee on Transport have made it clear that reforming economic regulation of Canadian airlines should not have an adverse effect on safety.

> "I would like to indicate unequivocably that the Government will neither propose nor permit any economic regulatory reform that might be detrimental to safety standards." (Minister of Transport, 1985, preface p. 2.).

***

> "So, even though safety is outside the Committee's Order of Reference, we feel compelled to state that whatever form the new national transportation policy finally takes, it must not in any way compromise safety." (House of Commons Standing Committee on Transport, 1985, p. 41.).

Given this common policy objective, it is desirable to investigate whether or not airline safety may be adversely affected by deregulation. The purpose of this paper is to provide evidence on this matter using passenger fatality data for both Canada and the United States.

2.0 Concerns About Safety

The Standing Committee noted on p. 41 of its report that some witnesses "were convinced that safety would be sacrificed to competition and profits" if deregulation were adopted in Canada. The reasoning appears to be that the removal of economic regulation would result in lower safety because increased competition would either result in losses or would motivate individuals to place greater emphasis on profits which, in turn, would cause airlines to cut corners on maintenance and operating practices.

The above reasoning overlooks several factors. First, it ignores the fact that one way to compete is on the basis of relative safety. Second, it takes no notice of the fact that changes in economic regulation will not change the operating/safety regulation performed by Transport Canada, or else it assumes that direct safety regulation is less effective without support from economic regulation. Third, it assumes the profit motive is reduced under regulation. Fourth, it ignores the fact that economic regulation has not guaranteed profits for all airlines, nor has deregulation in the United States resulted in losses among all U.S. airlines (Jordan, 1982, pp. 21-24, and 1985, pp. 13-16). Finally, even though Air Canada, CP Air, Eastern Provincial, Nordair and Quebecair all experienced losses before taxes in various years between 1979 and 1984, no concern has been expressed about the safety of these airlines.[1] This is surprising if, indeed, people believe that losses result in decreased safety. In the same vein, Pacific Western should be promoted as the safest airline in Canada since it is the only Level I carrier that has been profitable in each year since 1978 (or does this successful search for profits indicate that Pacific Western has cut corners and is the least safe of the Level I carriers?).

3.0 Methodology

Since the transition to deregulation in the United States began in late 1978 and early 1979,[2] and since the economic regulation of Canadian airlines continues (albeit with some liberalization since May 10, 1984),[3] it is possible to obtain some evidence on the effects of economic deregulation on airline safety by investigating the relative safety performances of scheduled Canadian and U.S. airlines. Comparing the records of scheduled passenger carriers in these two countries prior to 1979 will indicate their relative safety under both economic and direct safety regulation. Then, comparing their records after 1979, during which time the U.S. airlines were transitioning to economic deregulation, will indicate whether or not reducing economic regulation has had an adverse effect on safety (given the continuation of direct safety regulation in U.S.).

Safety can be measured in many different ways. For example, the U.S. National Transportation Safety Board regularly calculates and reports accident rates per million aircraft miles, per 100,000 aircraft hours flown, and per 100,000 departures. These measures are particularly useful when comparing diverse operations, such as commercial service with large transport aircraft relative to such service with small commuter aircraft, or relative to general aviation operations with very small aircraft. Other measures will be used in this paper -- specifically,

passenger fatalities per billion revenue passenger-miles (RPM) and passenger fatalities per million enplaned passengers, in both cases for scheduled operations by airlines operating jet aircraft. There are three reasons for adopting these measures. First, they are of prime concern to consumers. Second, since passenger fatalities are verifiable events that are always recorded, these measures are unambiguous and are little affected by differences in reporting policies and procedures. Finally, airlines operating jet aircraft are a fairly homogeneous group so that aircraft-based rates need not be used to provide commonality.

Scheduled passenger operations by carriers operating only propeller aircraft are excluded from this analysis. This is done both because of the differences in operations between jet airlines and commuter carriers and because U.S. commuter carriers were exempted from economic regulation back in 1952.[4] Thus, the major focus of economic regulation in the U.S. was on scheduled passenger service which, since the late 1960s, was largely conducted with jet aircraft.

4.0 Evidence

Table 1 presents the annual passenger fatalities and fatality rates in Canada and the U.S. for the two relevant periods. The first period covers 1969-78, the last ten years of economic regulation in the U.S., while the second period covers 1979-84, the first seven years of the transition to economic deregulation.

If the introduction of deregulation serves to decrease safety, one would expect the U.S. fatality rates to be higher in the 1979-84 period than in the 1969-78 period when economic regulation was in effect. However, Table 1 shows this was not the case. To the contrary, passenger fatality rates for the U.S. airlines decreased from an average of 0.86 fatalities per billion RPM in 1969-78 to 0.37 per billion RPM in 1979-85, and from 0.67 to 0.32 fatalities per million passengers. Thus, U.S. fatality rates during the recent period of transition to economic deregulation were less than half of what they were in the ten-years prior to the implementation of deregulation.

Comparisons between Canada and the U.S. provide added perspective to the subject. The Canadian carriers' average fatality rates were somewhat higher than those of the U.S. during the 1969-78 period, but they decreased more in the second period so that they were somewhat lower than the U.S. rates. In terms of RPM, the Canadian carriers' safety improved under continued economic regulation from 1.07 fatalities per billion RPM in 1969-78

Table 1

Passenger Fatality Rates in Scheduled Operations
Canadian and U.S. Airlines Operating Jet Aircraft, 1969-85

Year	Number of Passenger Fatalities		Fatalities per Billion RPM		Fatalities per Million Passengers	
	Canada	U.S.	Canada	U.S.	Canada	U.S.
A. Prior to the U.S. Airline Deregulation Act						
1969	0	130	0	1.02	0	0.74
1970	100	2	10.45	0.01	9.80	0.01
1971	0	174	0	1.29	0	0.97
1972	0	160	0	1.03	0	0.81
1973	0	197	0	1.20	0	0.94
1974	0	416	0	2.51	0	1.93
1975	0	113	0	0.68	0	0.53
1976	0	36	0	0.20	0	0.15
1977	0	60	0	0.30	0	0.24
1978	41	141	2.25	0.61	2.22	0.49
Sub-Total	141	1,429	1.07	0.86	1.04	0.67
B. Subsequent to the U.S. Airline Deregulation Act						
1979	14	318	0.66	1.21	0.65	1.01
1980	0	0	0	0	0	0
1981	0	1	0	.004	0	.004
1982	0	210	0	0.81	0	0.72
1983	23	8	1.18	0.03	1.27	0.03
1984	0	0	0	0	0	0
1985	0	174	0	.52*	0	0.46*
Sub-Total	37	711	0.25	0.37	0.25	0.32
17-year Total	178	2,140	0.63*	0.59*	0.63*	0.49*

*Partially estimated using preliminary traffic data for 1985.

Sources: Calculated using traffic data in Appendix A and fatality data from:
Canadian Aviation Safety Board, "AIDS Complete Record Print Summary," computer printout (March 28, 1985); and letter from Ms. Laura Pitts (March 7, 1986).
U.S. National Transportation Safety Board, Annual Review of Aircraft Accident Data (1975-78)
___, "Safety Information Press Release," (January, 1970-86).

to 0.25 in 1979-85, while the U.S. rate improved from 0.86 to 0.37 fatalities per billion RPM. In terms of passengers, the Canadian fatality rate fell from 1.04 to 0.25 fatalities per million passengers, while the U.S. rate fell from 0.67 to 0.32 fatalities per million passengers. Clearly, safety improved substantially in both countries in the second period regardless of whether economic regulation was present or was being phased out.

Since the decline in passenger fatality rates after 1978 was greater in Canada than in the U.S. it might be argued that safety would have improved even more in the U.S. had full economic regulation been retained. There are two reasons to question this argument. First, it happens that over one-third of the total U.S. passenger fatalities in the 1979-85 period were caused by one accident -- the crash on May 29, 1979, of an American Airlines DC-10 on takeoff from Chicago. This crash killed 258 passengers out of the total 711 fatalities for the entire seven years. Eliminating these fatalities from the 1979-85 data would reduce the U.S. fatality rates to 0.23 per billion RPM and 0.20 per million passengers -- slightly lower than the Canadian experience. The National Transportation Safety Board determined that this accident was caused by an engine separation resulting from "improper maintenance procedures which led to the failure of the pylon structure" (NTSB, 1980, p. 11). These procedures had been adopted prior to 1979 (during the period of economic regulation) and, therefore, it seems inappropriate to say that their adoption could have been influenced by deregulation.

Annual data in Table 1 provide the second reason to question the possibility that U.S. safety performance would have improved even more had economic regulation been retained. It can be seen that there were no passenger fatalities among these U.S. airlines in 1980 and in 1984. It happens that these were the first years in U.S. aviation history in which airlines operating large aircraft in scheduled service did not have a single passenger fatality. It is doubtful that this very desirable performance would have been achieved had the removal of economic regulation actually served to worsen safety performance.

5.0 The 1985 Record

Much has been made in the popular press about the fact that more airline fatalities occurred worldwide in 1985 than in any previous year. About 2,000 people died in airline accidents in 1985, and some individuals have used this fact to argue further that economic deregulation is causing decreased safety.[5]

Again, there are some problems with the argument. First, there has been a failure to recognize that while economic deregulation has been implemented in the U.S., most of the fatalities occurred on airlines that operated under unchanged economic regulation in their respective countries. The February 19 crash of an Iberia B-727 (148 passenger and crew fatalities), the June 23 crash of the Air India B-747 (329 passenger and crew fatalities), the August 12 crash of the Japan Air Lines B-747 (520 passenger and crew fatalities), and the British Airtours B-737 engine fire on August 22 (55 passenger fatalities) together accounted for 1,052 fatalities, but none of these carriers operated under deregulation in their own countries.[6]

Second, it can be seen in Table 1 that the 174 passenger fatalities in U.S. scheduled jet service in 1985 are not an unusually high total. Furthermore, the majority of them (126) were the result of the Delta Airlines crash at Dallas in which wind shear appears to have been the causal factor.[7] Surely this crash cannot be attributed to economic deregulation.

Not included in Table 1 are two crashes of U.S. airlines in charter operations. The crash of a Galaxy Airlines L-188A at Reno killed 64 passengers, and the Arrow Airways DC-8 crash at Gander killed 248 more, making a total of 312 passenger fatalities.[8] The Galaxy crash has been attributed to the pilots' failure to control the aircraft after an unexpected vibration developed because a ground handler failed to properly close an air-start access door.[9] The cause of the Arrow crash has yet to be determined. If people wish to argue that these accidents were influenced by economic deregulation, it seems fair to point out that they were the first passenger fatalities in U.S. charter operations since 1977, when 573 passengers and crew were killed in the Pan American/KLM ground collision at Tenerife in the Canary Islands.[10]

6.0 Conclusion

The above evidence and analyses support the conclusion that the removal of economic regulation in the U.S. has had no adverse effect on safety among scheduled airlines operating jet aircraft. To the contrary, the improved safety performance in both Canada and the U.S. since 1979 indicates that airline safety is the result of many factors other than economic regulation, and implies that high levels of safety will continue under the overall influence and control of direct safety regulation by the Federal Aviation Administration and Transport Canada.

A final point should be noted. One major result of economic deregulation has been appreciably lower fares in the U.S. which has encouraged rapid growth in airline travel (see Appendix A). This has doubtless resulted in more people traveling by plane rather than by automobile. Given the markedly superior safety record of air travel over automobile travel, it seems correct to conclude that a number of lives were saved in the U.S. simply because of the greater use of air travel due to economic deregulation. Indeed, given this transfer of travel from auto to airlines, there would have been fewer fatalities from travel on all modes even <u>if</u> the safety record of the U.S. airlines had deteriorated somewhat due to economic deregulation. Since this appears not to have happened, the overall effect of economic deregulation on total traveler fatalities is likely to have been positive, rather than merely neutral.

Footnotes

[1]Quebecair incurred losses during all six of these years. (Statistics Canada, 1979-84, Tables 3 or 6.)

[2]The Airline Deregulation Act of 1978, Public Law No. 95-504, 92 Stat. 1705, was adopted on October 24, 1978. Its key provisions began to come into force on January 1, 1979.

[3]The liberalization of economic regulation of Canadian airlines followed the publication of the New Canadian Air Policy (Minister of Transport, 1984). The result of this new policy has been to make Canadian regulation similar to that practiced by the U.S. Civil Aeronautics Board (CAB) during 1977-78 while the debate regarding the adoption of deregulation was underway in the U.S.

[4]Effective February 20, 1952, a blanket exemption from the CAB authorized any carrier operating aircraft having a maximum gross take-off weight of 12,500 pounds or less to provide scheduled service between communities not served by certificated carriers and from those communities to points served by certificated carriers. The aircraft size limitation was increased to 30 passengers/7,500 pound payload on July 18, 1972. Civil Aeronautics Board, Handbook of Airline Statistics, 1973 ed. (1974), pp. 515 and 530.

[5]Brampton Times (January 3, 1986), p. 1.

[6]Aviation Week and Space Technology (February 25, 1985), p. 36; (July 1, 1985), p. 32; (August 19, 1985), p. 30; and (August 26, 1985), p. 28.

[7]National Transportation Safety Board, Press Release SB 86-3 (January 13, 1986), Table 7.

[8]Ibid., Table 8.

[9]Aviation Week and Space Technology (February 3, 1986), p. 39.

[10]National Transportation Safety Board, Press Release SB 78-1, Table 1.

References

House of Commons Standing Committee on Transport, 1985, Freedom to Move -- Change, Choice, Challenge, Sixth Report to the House. Ottawa, Queen's Printer for Canada, December 18, 1985.

Jordan, W. A., 1982, Performance of Regulated Canadian Airlines in Domestic and Transborder Operations. Ottawa: Consumer and Corporate Affairs Canada, Research Monograph No. 12, 1982.

Jordan, W. A., 1985, "The Economic Implications of Transportation Deregulation: The Case of the Airline Industry," in Public Interest Research Centre, Submission to the House of Commons Standing Committee on Transport regarding Freedom to Move (November 7, 1985), pp. 2-43.

Minister of Transport, 1984, New Canadian Air Policy. Ottawa: Transport Canada, May 10, 1984.

Minister of Transport, 1985, Freedom to Move -- a Framework for Transportation Reform. Ottawa: Transport Canada, July 1985.

Statistics Canada, 1979-84, Air Carrier Operations in Canada (October-December 1979 through 1984), Catalog 51-002.

U.S. National Transportation Safety Board, 1980, Annual Report to Congress, 1979. Washington, D.C.: NTSB, 1980.

Appendix A

Scheduled Revenue Passenger-Miles and Passengers
Canadian and U.S. Airlines Operating Jet Aircraft, 1969-85

Year	Scheduled Revenue Passenger-Miles (000,000)		Passengers (000)	
	Canada	U.S.	Canada	U.S.
A. Prior to the U.S. Airline Deregulation Act				
1969	8,074	127,045	8,885	176,378
1970	9,568	133,547	10,202	175,212
1971	9,504	135,070	10,750	179,643
1972	11,407	154,656	12,068	198,027
1973	12,492	164,421	11,465	209,576
1974	14,181	165,579	12,796	215,380
1975	15,534	165,591	16,742	213,191
1976	16,128	182,042	16,851	232,344
1977	16,959	196,904	17,539	251,335
1978	18,191	231,121	18,481	287,789
Sub-Total	132,038	1,655,976	135,779	2,138,875
B. Subsequent to the U.S. Airline Deregulation Act				
1979	21,309	261,958	21,377	313,754
1980	22,462	254,551	22,608	292,759
1981	21,966	248,134	22,004	280,994
1982	19,934	258,964	19,625	290,541
1983	19,441	280,995	18,105	317,746
1984	21,195	305,686[b]	21,579	346,577[b]
1985	22,276[a]	335,900[b]	22,680[a]	380,000[b]
Sub-Total	148,583	1,946,188	147,978	2,222,371
17-year Total	280,621	3,602,164	283,757	4,361,246

[a]Estimated by increasing 1984 data by the 5.1 percent increase in unit toll plus charter RPM reported for the first 11 months of 1985.

[b]Preliminary data for Total Form 41 carriers.

Appendix A (continued)

Sources: Air California, Air Florida, PSA and Southwest Airlines, Annual Reports (1969-78), various pages.
I.P. Sharp, computer printouts of Schedules P1 and T1, CAB Form 41, for 1984.
Statistics Canada, Civil Aviation (1969), Cat. 51-202, Table 5.
___, Transcontinental and Regional Air Carrier Operations (December 1970-71), Cat. 51-001, Table 2.
___, Air Carrier Operations in Canada (October-December 1972-84), Cat. 51-002, Table 4.
___, Aviation Statistics Centre, "Service Bulletin" (January 1986), Cat. 51-004, Table 1.
U.S. Civil Aeronautics Board, Air Carrier Traffic Statistics (December 1969-84).
U.S. Department of Transportation, Office of Aviation Information Management, telephone conversation with Mr. Paul Gavel (March 5, 1986).

THE ST. LAWRENCE SEAWAY COMPETITIVENESS

by

Hazem Ghonima
The St. Lawrence Seaway Authority

ABSTRACT

The Seaway traffic has declined significantly since 1979. Grain, iron ore and coal movements, the major cargoes using the waterway, have all shrunken bringing the total cargo traffic in 1985 to a level not seen since 1963. As a result, the viability of the system has come under scrutiny.

This paper will attempt to answer some fundamental questions about the economic viability of the Seaway. Major factors which contributed to the decline in traffic along the Seaway will be identified and analyzed, and the Seaway cargo traffic performance vis-à-vis alternative routes and modes will be assessed. Particular emphasis will be given to the grain and iron ore traffic.

BACKGROUND

The Seaway is part of a highly complex commercial framework with tremendous economic importance to both Canada and the U.S.A. It is mainly used for international as well as domestic shipments of bulk commodities. The Seaway proper is an essential part of the Great Lakes - St. Lawrence transportation system. It extends from Montreal to Lake Erie and includes two sections; the Montreal-Lake Ontario section (MLO), consisting of five Canadian and two U.S. locks, and the Canadian Welland Canal with its eight locks. The waterway is administered by the Canadian St. Lawrence Seaway Authority (SLSA) and its U.S. counterpart, the Saint Lawrence Seaway Development Corporation (SLSDC).

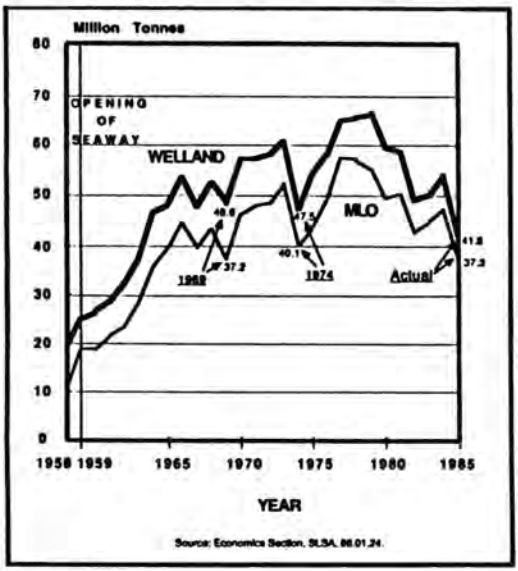
The opening in 1959 of the North American hinterland to world shipping, as a result of the Seaway, has been of great economic benefit to Canada and the U.S., particularly to the provinces and states forming the Great Lakes-Seaway region. The Great Lakes-Seaway region is larger than all of Western Europe and contains nearly one third of the combined populations of Canada and the U.S., as

well as a great part of their industrial infrastructure. Goods of all kinds are shipped over long distances at reasonable cost by ships which, after pipelines, remain the lowest energy-consuming carriers. The value of these goods, which move through the Seaway, is estimated to range between 8 to 10 billion dollars.

The movement of grain is, together with iron ore and coal, the most significant on the Seaway since they constitute about 75% of the Seaway traffic. Moreover, downbound movement of grains provides a back-haul for the upbound movement of iron ore. In essence, these three commodities are basic to Seaway economics. The remaining traffic is distributed over a wide range of commodities such as iron and steel products, petroleum products, coke, stone, salt, etc.

In 1959, the Seaway traffic was 18.7 million tonnes and 25 million tonnes on the MLO and Welland Canal respectively. With periodic fluctuations, Seaway tonnage trended steadily upwards with a peak of 57.5 million tonnes recorded during the 1977 season on the MLO section and 66.2 million tonnes on the Welland in 1979 (see Figure 1).

FIGURE 1: CARGO TRAFFIC THROUGH THE SEAWAY - MLO & WELLAND



Since these record levels, Seaway traffic declined substantially, mainly due to the deep and prolonged economic recession. By 1982, shipments on the MLO section had

fallen to 42.8 million tonnes and 49 million tonnes on the Welland. Nevertheless, the economic recovery which started in mid-1983 contributed to a slight rebound of Seaway traffic.

Unfortunately, this short recovery was followed by a drastic decrease in the 1985 traffic. The overall cargo traffic on the MLO section was 37.3 million tonnes, 21.4% below the 1984 level. On the Welland Canal the traffic dropped to 41.8 million tonnes, 22.3% lower than the previous year.

GRAIN TRAFFIC

Grain moving via the Seaway consists primarily of Canadian and U.S. export shipments that originate at the Great Lakes terminals and are destined for Europe, the U.S.S.R., North Africa/Middle East and Latin America. Most of this grain traffic is carried by Canadian lakers to lower St. Lawrence ports for trans-shipments to ocean vessels, while a smaller part, consisting particularly of feed grain, is dropped off for domestic use at Toronto, Montreal and other river ports. Beside the laker movements, there is also a considerable amount of grain, mainly U.S., which is shipped directly overseas in ocean vessels. When the Seaway opened in 1959 the grain traffic was only 7.5 million tonnes. It gradually increased to the record level of about 28.1 million tonnes in 1980. Last season, this traffic dropped substantially to only 17 million tonnes.

The size of the Seaway grain traffic was found to be affected by the interaction of several factors such as: the world and domestic grain supply/demand conditions; the agricultural policies of major grain producers, particularly the traditional Seaway market countries; the Soviet-North American grain trade situation; the capacity of the grain transportation system in both Canada and the U.S.; U.S. agriculture and foreign aid policy; development and modernization of Great Lakes - Seaway port and grain-handling facilities; and finally, vessel efficiency and comparative cost of transportation, both inland and by water.

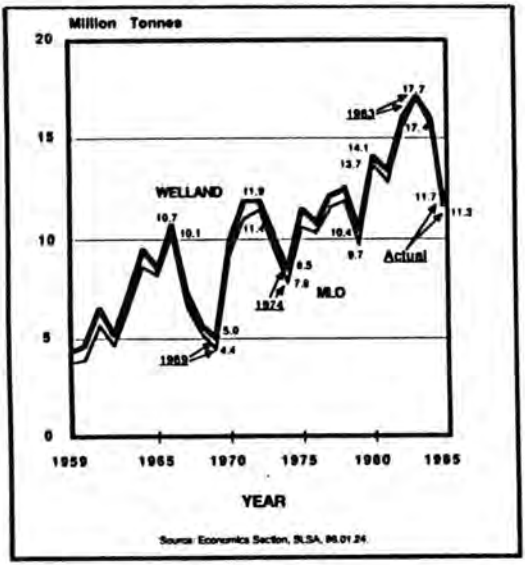
THE CANADIAN GRAIN TRAFFIC

Canadian grain, which accounted in 1984 for about 67% of the Seaway grain movements, is exported from three major terminals: the Pacific terminal; the Eastern terminal (Thunder Bay, St. Lawrence ports and Atlantic ports); and the Churchill terminal. Wheat is the most important component of the Canadian grain movement, accounting for 82%, followed by barley (12%), and corn (4%). In contrast, the U.S. grain traffic which represented 33% of the total grain flows, is composed of about 40% wheat, 30% corn, 13%

soybean, 10% sunflower and 8% barley.

Since the opening of the Seaway in 1959, the Canadian grain traffic increased steadily from about 4 million tonnes to the record level of 17.7 million tonnes in 1983. Nevertheless, this cargo movement suffered a major decline in 1969 when the traffic dropped to 5 million tonnes from about 11 million tonnes a year earlier. Less dramatic declines occurred in 1974 and 1979 when the traffic decreased to 8.5 and 10.4 million tonnes respectively. Most recently in 1985, this movement dropped sharply from 16 to 11.7 million tonnes. The strong fluctuations in this traffic were usually the result of major changes in the world and domestic grain supply and demand situation, and/or the interruption of navigation on the Seaway system as a result of strikes and accidents (see Figure 2).

FIGURE 2: CANADIAN GRAIN TRAFFIC THROUGH THE SEAWAY - MLO & WELLAND

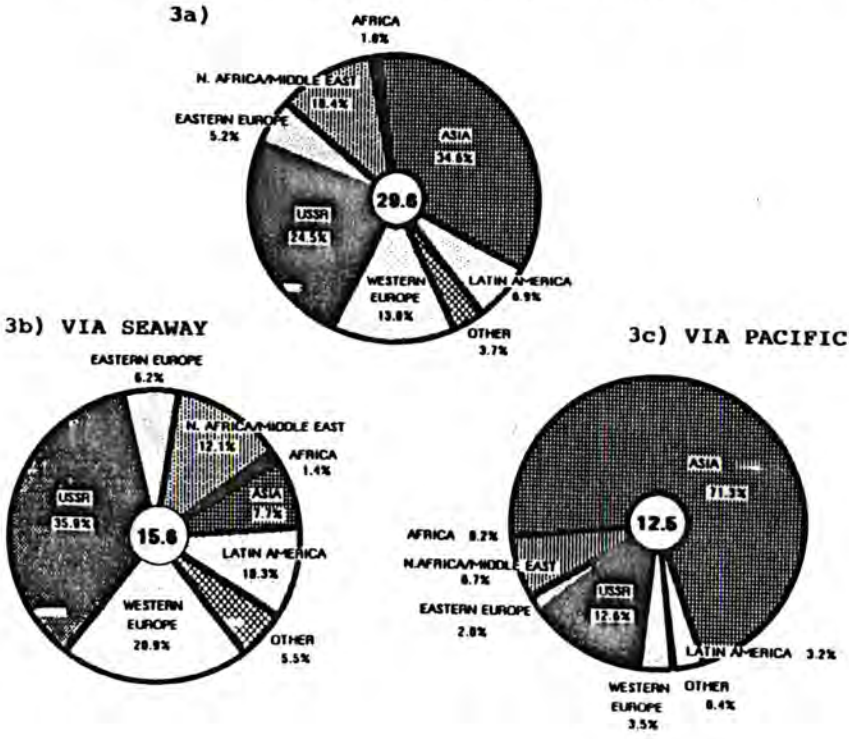


For example, last year, the sharp decrease in demand for the North American grain - a result of stiff competition in an over-supplied world grain market - drastically reduced the Canadian and U.S. grain exports. In addition, serious supply problems in Canada, caused by two consecutive years of drought conditions, worsened the already weakened Canadian grain position. Consequently, Canadian grain exports through the Seaway dropped by about 5 million tonnes. Despite these declines the Canadian grain

traffic tends to bounce back, continuing its general historical upward trend. The competitive position of the Seaway for the movement of Canadian grain can be assessed by examining the role it plays in the Canadian grain industry. In 1983-84, wheat accounted for about 72% of the total Canadian grain exports, followed by barley (18%), rapeseed (5%), rye (2.5%), flaxseed (1.7%) and corn (1.4%).

The market for this grain is well diversified. As can be seen on Figure 3a), the Asian market imported about 34.6% of the Canadian grain exports, followed by the U.S.S.R. and Eastern Europe (29.7%), Western Europe (13.8%), North Africa-Middle East (10.4%), Latin America (6.9%) and all others (3.7%).

FIGURE 3: CANADIAN GRAIN EXPORTS BY DESTINATIONS



Source: Economics Section, SLSA. 86.02.03

Meanwhile, figure 3b) shows that for the same year, the Eastern block market (U.S.S.R. and Eastern Europe) accounted for 42% of all Canadian grain exported through the Seaway, followed by Western Europe (21%), North Africa-Middle East (12%), Latin America (10%), Asia (8%), and all others (5.5%). By comparing Figures 3b) and 3c), we notice the similarity between the export market of the Canadian grain and that of the Seaway. This is true in terms of diversification as well as in structural composition.

In contrast, Figure 3c) demonstrates that the grain market using the Canadian Pacific outlet is concentrated in Asia, which represented 71% of all grain moving from this outlet in 1983-84. Market diversification for this Western outlet is far below the Canadian and Seaway levels since its next biggest grain market, (the Eastern Block) represents only 14.6% followed by North Africa-Middle East (6.7%) and Western Europe (3.5%).

Furthermore, the position of the Seaway within the Canadian grain export industry is strengthened by the fact that in 1983-84, the Seaway was used to move 80% of all Canadian grain exported to Western Europe, 78% of all the grain exported to the U.S.S.R., 64% to Eastern Europe, 62% to North Africa-Middle East, 78% to Latin America, 79% to all other countries and even 12% of all Canadian grain exported to the Asian market.

It has often been thought (since the early 70's), that domestic competition for moving Canadian grain exports should develop from the Pacific route/mode - since most of the increase in world grain demand was expected to be in Asia, traditionally a non-Seaway grain market. Consequently, it was anticipated that the Pacific outlet share should gradually surpass that of the Seaway.

However, if we examine the historical performance of the competing routes in Figure 4, we notice that, except for 1985, the Canadian grain exported through the Seaway, since 1974, has always exceeded that of the Pacific route. Moreover, its percentage share of total grain exports was kept at an average above 50%, while the Churchill and Atlantic outlets decreased gradually (see Figure 5).

FIGURE 4: CANADIAN GRAIN EXPORTS BY OUTLET

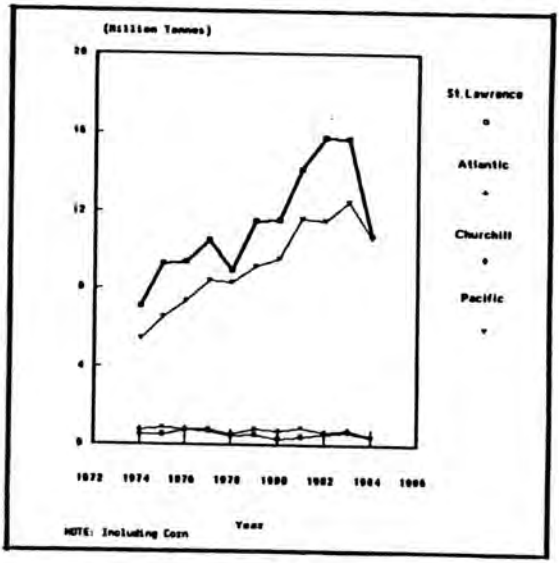
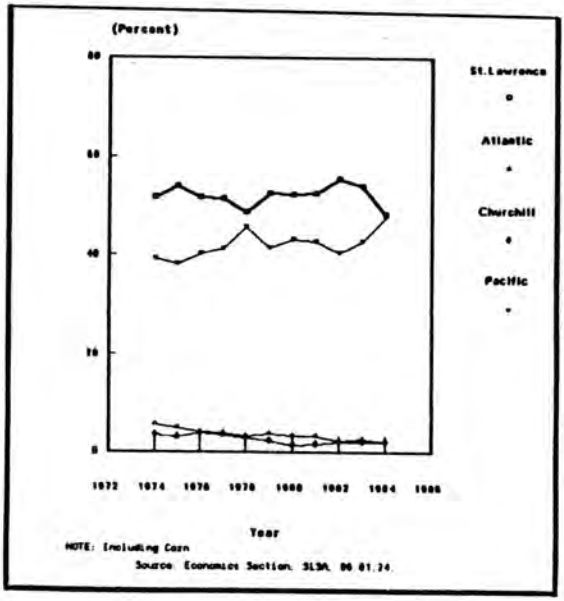
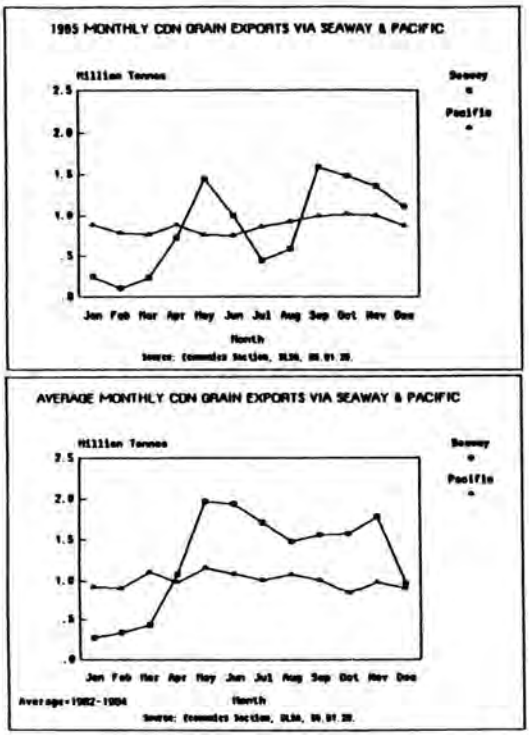


FIGURE 5: OUTLET SHARE OF CANADIAN GRAIN EXPORTS



At this point one might ask what happened in 1985? The answer to this question has been partially explained earlier in the paper. Further explanation of the situation can be seen in Figure 6, which demonstrates that once the waterway is open to navigation, the average monthly Canadian grain exports via this outlet ranges between 1.5 and 2 million tonnes. Comparable figures for the Pacific outlet are usually around 1 million tonnes. In contrast, in 1985 an unusual drop in grain exports via the waterway occurred during the period between June and August (below 0.5 million tonnes). It is therefore, quite evident that last year depressed demand for Canadian grain exports was the main reason for this decline, since an equivalent increase was recorded after a Soviet-Canadian grain deal was concluded in the fall of that year. It is also clear that the Seaway absorbed most of the deficit in the Canadian grain exports.

FIGURE 6



The sensitivity of the Canadian grain traffic to the demand from traditional Seaway market (the U.S.S.R., Eastern and Western Europe) is well illustrated in Figures 7 and 8.

FIGURE 7: SELECTED CANADIAN WHEAT EXPORTS

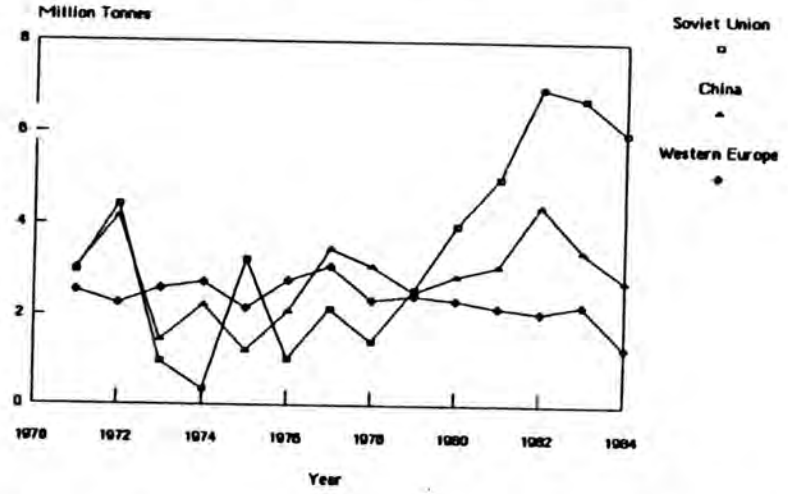
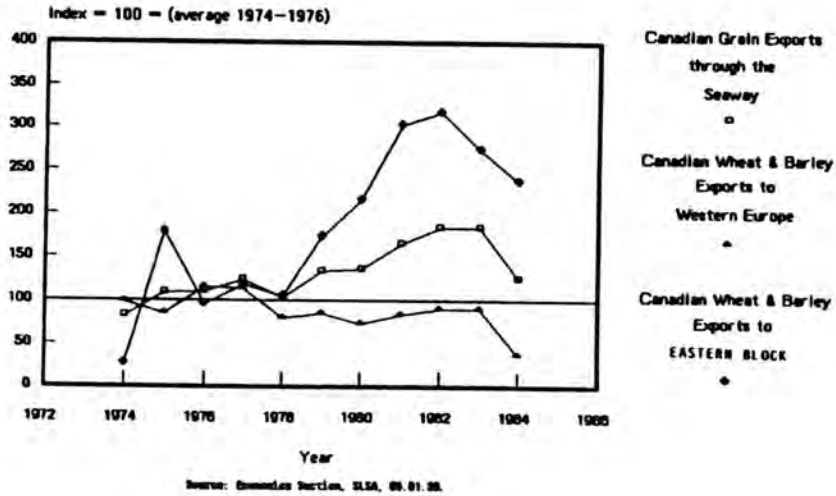


FIGURE 8: FACTORS AFFECTING CANADIAN GRAIN EXPORTS THROUGH THE SEAWAY



The Soviet Union has become, in recent years, the most important market for imported wheat, exceeding by far the other importing countries, including China. Therefore, since the Seaway is used to move more than 75% of the total Canadian grain exports to the Soviet Union, the level of its Canadian grain traffic has reflected the demand trend of this market. Moreover, the Chinese market - which represents more than 40% of Asia's wheat imports - did not grow in importance as was anticipated a decade ago. This could explain the failure of the Western Canadian terminal to by-pass the Seaway's share of the total Canadian grain exports.

THE U.S. GRAIN TRAFFIC

U.S. grain is exported from four coastal areas: the Great Lakes, the Atlantic, the Gulf and the Pacific. Our analysis indicates that the amount of U.S. grain moving via the Seaway depends upon the demand of Seaway traditional markets as well as the capacity of the U.S. grain transportation system. Moreover, we found that in years when world grain demand was high and the economic situation was robust, the U.S. transportation system suffered from capacity problems and the Seaway grain share showed some growth. But with the decrease in demand for petroleum products in the last few years, the available capacity of the U.S. system increased and consequently the Seaway share diminished.

Figure 9 shows that since the opening of the Seaway in 1959, U.S grain traffic through the waterway increased from about 3 million tonnes to the record level of 15.8 million tonnes in 1978. Although the general trend of this movement appears to be upward, this traffic has fluctuated sharply in the form of three major cyclical patterns. The latest decline started in 1979, reaching a bottom level in 1985, when traffic was only 5.3 million tonnes.

The reason for this downward performance is illustrated in Figure 10 which reflects the sensitivity of U.S. grain traffic to the decline of U.S. corn exports to the Soviet and Eastern European Bloc as well as the decrease of U.S. wheat exports to Western Europe; both are major traditional consuming centres for U.S. grain using the Seaway route. More specifically, the decrease of this traffic in 1985 was due to fierce competition, particularly from subsidized E.E.C. grain exports, and the apparent failure of the U.S. grain export enhancement program (BICEP) to counter the European program. Consequently, total U.S. grain exports declined by 23%, and U.S. grain traffic through the Seaway dropped by about 2.7 million tonnes to 5.3 million tonnes. Meanwhile, the Mississippi-Gulf route lost

about 17 million tonnes and grain traffic via the U.S. Pacific outlet shrunked by 7 million tonnes.

FIGURE 9: U.S. GRAIN TRAFFIC THROUGH THE SEAWAY - MLO & WELLAND

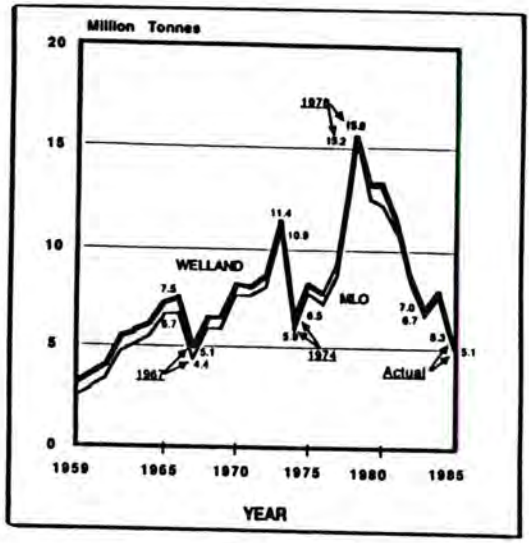
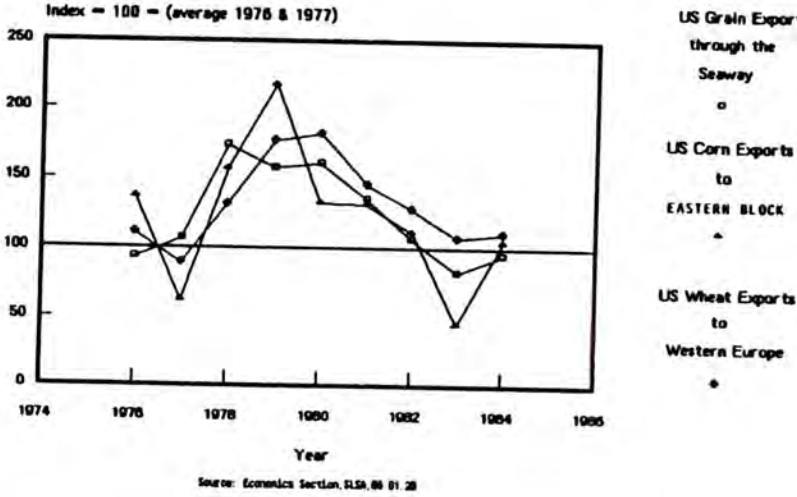


FIGURE 10: FACTORS AFFECTING U.S. GRAIN EXPORTS THROUGH THE SEAWAY



THE IRON ORE TRAFFIC

The Seaway iron ore movements originate primarily from the Quebec-Labrador region. The ore is then brought south by rail to lower St. Lawrence ports and then moved by vessel to Canadian steel mills on Lake Ontario and to U.S. steel mills on Lake Erie. Part of this iron ore continues by rail to the Pittsburgh-Johnstown-Youngstown region. Substantial tonnage is also carried downbound through the Welland to the Hamilton area from U.S. and Canadian mines in the iron ore ranges local to Lake Superior.

This traffic faces direct competition from three major alternative routes/modes; Quebec-Labrador ore transported by ocean vessel to U.S. Atlantic ports and then by rail movement to U.S. mid-region steel mills; U.S. Mesabi ore moved by vessel from Duluth-Superior to U.S. Lake Erie; and South American ore shipped by ocean vessel to U.S. Gulf and Atlantic ports.

Iron ore traffic through the Seaway increased from 5.6 million tonnes in 1959 to a record peak in 1977, when 20.2 million tonnes passed through the M.L.O. section as the result of labour disputes in the competitor U.S. mines of Lake Superior. In the following years, the traffic gradually declined until 1982 when it reached only 7.4 million tonnes. This was the lowest level since 1963 and was caused by the prolonged economic recession which severely depressed the automotive and steel industries in the U.S. in that year. Despite the slight recovery of 1984, when the traffic reached 11.4 million tonnes, it was evident that a new fundamental change in the dynamics of the U.S. steel industry has developed (see Figure 11).

Several factors determine the size of the iron ore traffic. Most importantly is the demand for finished iron and steel products in the U.S. and Canada. These, in turn, depend upon the general economic condition and the steel usage factor in endmarkets. Other important factors include the share of domestic and imported steel in the total supply; steel-making technology (yield and furnace mix); material uses as well as the performance of steel mills located within the Seaway region.

Beside these demand factors, the size of the iron ore movement via the waterway depends on supply conditions as well as the ability of the Seaway to compete with alternative routes and modes. The latter factor will depend upon the efficiency of the waterway and is reflected in the total transportation charge it offers. Nevertheless, our analysis indicates that the impact of the transportation cost is usually diluted by the vertical integration in the production, distribution and consumption of iron ore.

FIGURE 11: IRON TRAFFIC THROUGH THE SEAWAY
- MLO & WELLAND

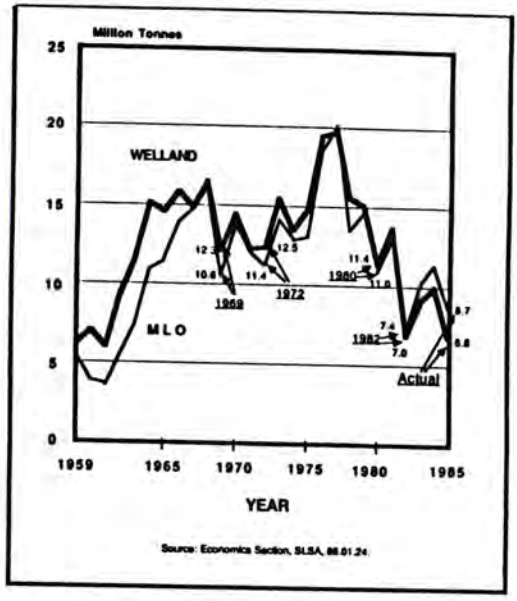
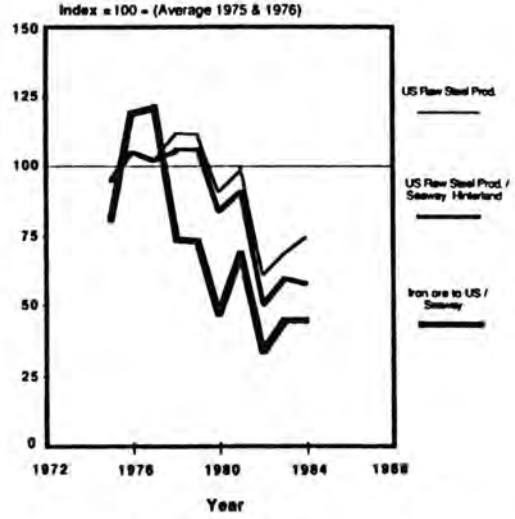


Figure 12 shows that although the performance of the Seaway iron ore traffic has been gradually decreasing - a result of declining raw steel production in the Seaway hinterland (see Figure 13) - it has maintained its competitive position vis-à-vis alternative routes and modes. Moreover, Figure 12 demonstrates that the fundamental changes in the steel industry which occured during that period, has negatively affected the performance of all the competing routes.

FIGURE 12: U.S. STEEL PRODUCTION & SEAWAY IRON ORE TRAFFIC



Source: Economics Section, SLSA, 86.01.24.

FIGURE 13: U.S. IRON ORE RECEIPTS BY ROUTE



Source: Economics Section, SLSA, 86.01.24.

CONCLUSION

The environment in which the Seaway competes is dynamic and is a function of a multitude of factors including. the general economic situation, the institutional environment, the forces of supply and demand of the centres it serves, the transportation costs charged by the alternative modes/routes and the service-reliability levels that these route/mode offers. Therefore, it is imprudent to assess the economic viability of the Seaway on the behaviour of one factor or on the basis of traffic fluctuations at a specific period of time.

The decline of the Seaway traffic since 1979 was found to be the result of depressed economic situations and/or decreases in demand/supply of the Seaway's traditional producing and/or consuming centres, rather than from the loss of traffic to other alternative modes and routes. During the same period, most of the Seaway competitors have experienced similar and sometimes worse performance.

While world and regional economic conditions as well as unpredictable accidents may cause periodical fluctuations in Seaway traffic, it is important to foresee that the viability of the waterway is linked to and insured by the fact that it is strategically located within the world's largest agricultural and industrial region and is exposed to a worldwide diversified market. More specifically, future development in the Canadian grain export industry should be reflected in the level of Canadian grain exported through the Seaway, since the waterway is more adequately exposed to the world market for Canadian grain than its domestic competitors.

ACKNOWLEDGEMENTS

The author gratefully acknowledges the assistance provided by S. Miguel and E. Riach.

CANADIAN GREAT LAKES SHIPPING: PROBLEMS AND TRENDS

by

Peter Yee
University of Toronto - York University
Joint Program in Transportation

1.0 Introduction

In recent times, shipping on the Great Lakes has received a great deal of public attention. This represents a change in sentiment, as lake shipping in the past has seldom attracted interest or evoked concern from the public about the strategic significance of this resource to the industrial and agricultural sectors of the Canadian economy. That such concerns should surface now may be indicative of the gravity of the problems on the lake and that, perhaps, there are still more to come. On the other hand, it could be the case that, since public reaction tends to lag behind the occurrence of events, these problems are on the way to being resolved by market forces and government action. Whatever the course of events, it is expected that when the dust settles, the lake carrier industry will have experienced a fundamental change.

This paper is a brief survey of the changing conditions on the lakes, the problems associated with change, and the trends that may emerge in the future. A short review of the background to the current situation is provided first as an introduction to the main discussion.

2.0 Background

Since the opening of the new St. Lawrence Seaway in 1959, Great Lakes shipping has enjoyed a relatively long period of growth and prosperity. The enlargement of seaway locks and canals to allow the passage of vessels of maximum length of 222.5 metres to the upper lakes enabled raw materials to be transported in bulk and at low cost to major industries in the region. The emergence of Canada as a major grain exporting nation and the development of Labrador iron ore with concomitant demand by steel mills in the Great Lakes region brought about a spectacular growth in downbound grain traffic and upbound ore traffic that maximized vessel utilization. As well, other bulk commodity traffic such as coal, building materials (e.g.,

gypsum, stone and cement) and tanker products (e.g., petroleum, chemicals, etc.) increased substantially during the period. The growth in traffic on the lakes can be shown by Seaway statistics from 1959 to 1984. Exhibit 1 shows that the tonnages lifted by lakers transitting the Montreal-Lake Ontario and Welland Canal sections of the St. Lawrence Seaway increased steadily during the period, except for the interruptions caused by economic recessions, notably in 1974 and 1982. In particular, the economic downturn in 1982 was rather severe, and since that time traffic levels have not reached the peak level achieved in 1980. Over the entire period, traffic increased by more than twofold.

The federal government played a major role during this period by offering shipbuilding subsidies and fiscal incentives, such as accelerated capital cost allowances and investment tax credits, to the lake carriers in the purchasing and financing of new vessels. The federal role also included, as required by the statutes of Parliament, the maintenance and improvement of the system of ports, locks and canals on the waterway, which as a result facilitated safer navigation and faster port turnaround times for vessels. Furthermore, as the decade of the seventies came to a close, the Canadian Wheat Board entered into long term contracts with shipowners for the carriage of grain at attractive rates, and this gave industry the incentive to invest in new vessels. Under these relatively favourable conditions, the Canadian laker fleet went through a major rebuilding program which modernized the fleet with large and efficient vessels; in the early eighties alone, twelve new vessels were commissioned at a substantial investment of approximately $400 million. As a result, more and more seaway-sized vessels transitted the waterway over the years (see Exhibit 2).

Even during this period of growth, there was constant pressure from alternative modes and routes, such as the Western Canadian rail movements to British Columbia ports and the Mississippi barge movements to Gulf of Mexico ports, which keenly competed with the waterway for an important share of a large and critical North American transport market. Under these circumstances, industry did not always approve of the government's policies regarding seaway tolls, pilotage fees, port charges and ship safety regulations. Industry viewed these as burdensome costs on the lake shipping business, and the periodic increases in charges, particularly in the 1970s, were not welcomed since they increased vessel costs and eroded operating profit margins. Government, on the other hand, viewed these policies as desirable and equitable, as the cost of providing and maintaining the waterway's facilities was rising sharply with inflation and, in keeping with the principle of cost recovery, higher revenues were needed to

Exhibit 1

Seaway Traffic

	Commodity (000 tonnes)				Traffic Share	
	Agric. Prods.	Mine Prods.	Manufs. Others	Total	Laker (%)	Ocean (%)
Montreal- Lake Ontario						
1959	6831	7410	4552	18682	68.4	31.6
1965	15997	13851	9508	39356	68.3	31.7
1970	17961	15956	12504	46421	70.8	29.2
1975	19441	16530	7583	43554	71.5	28.5
1980	26920	14891	7642	49454	70.2	29.8
1981	24673	17857	8038	50569	72.0	28.0
1982	24516	10673	7583	42815	68.1	31.9
1983	24449	13081	7531	45060	69.7	30.3
1984	23650	14802	9053	47505	66.0	34.0
Welland Canal						
1959	7999	12141	4840	24981	18.1	18.9
1965	16762	23636	8063	48462	78.5	21.5
1970	19203	27682	10233	57119	79.3	20.7
1975	20782	26903	6608	54294	80.4	19.6
1980	28256	24017	7331	59606	79.0	21.0
1981	25746	25358	7746	58850	79.2	20.8
1982	25403	17354	6266	49024	76.7	23.3
1983	24969	18095	7082	50145	76.2	23.8
1984	24566	21170	8180	53196	74.3	25.7

Source: The St. Lawrence Seaway Authority

Exhibit 2

Tonnage Lifted by Vessel Length

(000 tonnes)

	-0-62m.	63-93m.	94-124m.	125-155m.	156-186m.	187-217m.	Over 217m.
Montreal-Lake Ont.							
1959	52	6696	2277	3073	2341	3276	963
1965	45	2190	3625	6744	8599	7797	10352
1970	29	1521	3264	4699	9569	7569	19766
1975	41	284	1972	3384	8659	10864	18348
1980	2	235	1606	4298	11165	8670	23474
1985	5	68	1309	3074	9209	4962	28875
Welland Canal							
1959	52	6173	2306	4790	4015	6259	1383
1965	46	2581	3089	7450	10946	10551	13797
1970	24	1451	2628	4447	10850	9498	28220
1975	34	430	1879	3008	9891	11731	27319
1980	2	466	1976	3981	12640	8964	31573
1984	2	99	1522	2806	9225	6097	34164

Source: The St. Lawrence Seaway Authority

meet expenditures. Since this was an environment in which the lake shipping market was strong and shipowners had the pricing leverage to protect their margins, these issues were not as fiercely contested as might have been the case in weak markets.

However, the downturn in the business cycle in 1982 brought forth a series of repercussions that many in the industry were not prepared for. The downturn lasted longer and was more severe than expected. With falling industrial production, commodity flows declined steeply and shipping revenues were significantly reduced. The loss in revenues, combined with a highly leveraged financial situation and high interest rates, took its toll on the industry. As a result, lake carriers that were least able to weather the storm were forced to leave the industry. In all, three companies - the Soo River Company, Quebec and Ontario Transportation Limited - ceased operations during this period, while another - Halco Inc. - was reported to be in financial difficulties.

3.0 The Present Environment

With the departure of three lake carriers, the industry today is smaller. There are now 15 Canadian companies owning and operating approximately 150 vessels with a total cargo capacity of about 3.1 million tonnes. Ownership of the fleet is dominated by three large companies - Canada Steamship Lines Inc., ULS International Inc., and Algoma Central Railway - followed by smaller companies which own mainly bulkers (Misener Shipping Ltd., Nipigon Transport Ltd., N.M. Paterson and Sons Ltd., Halco Inc., Desgagnes Group Inc., P&H Shipping, and Carryore Ltd.), and oil companies which own tankers. The dry-bulk fleet is comprised mainly of bulkers (1.7 million tonnes) and self-unloaders (1 million tonnes) with average ages of 26 and 15 respectively. Clearly, the self-unloader fleet is much younger and ownership is concentrated entirely in three major carriers, namely, Canada Steamship Lines Inc., ULS International Inc. and Algoma Central Railway. The bulker fleet is rather old - in spite of about 7 new buildings in recent years - and the vessels are owned by all lake carriers, except the oil companies. The old lakers, by and large, consume more fuel and require larger crews and, therefore, are less efficient to operate than new ships. In other words, the cost of operating old lakers is much higher than new ones.

The lake shipping market is still depressed. Commodity volumes have not returned to the levels experienced in the early eighties. In particular, grain exports suffered a setback last year when western Canadian production was affected by bad weather. At the same time, the world grain trade has weakened due to poor demand and low

prices. However, shipowners on the lakes who were able to sign long term contracts with the Canadian Wheat Board in the late seventies and early eighties, have been protected by contract rates of about $16.00 per tonne. This rate is high, in comparison to last season's depressed spot rate of $10.90 per tonne. However, these contracts are due to expire this year and the next.

The depressed shipping market is also characterized by an excess supply of vessels. As long as declining freight rates remain above the avoidable cost of vessels, shipowners will resist the pressure to scrap vessels. However, the situation is improving as shipowners have begun to scrap vessles from the fleet. The scrappage rate in future will be strongly influenced by industry's expectation on how fast and how far rates will fall. Already, there is a growing expectation amongst shipowners that the shipping outlook will continue to be poor and may deteriorate further. This may accelerate shipowners' decisions on scrappage.

In view of the poor market conditions, the financial position of industry has also been adversely affected. In a report prepared by Touche Ross and Company (1984) for the Dominion Marine Association, it commented that the working capital of industry has deteriorated (current ratio of .9) below the generally accepted level of safety (current ratio of 2).[1] Industry, therefore, does not have a comfortable amount of working capital to meet its obligations, expand its operations and take advantage of opportunities in the short term. Also, the debt/equity ratio of industry has risen (to 1.7) and lake carriers are highly indebted (long term debt of $385 million). Furthermore, the level of return on capital employed is unattractive (9.8 percent) and compares unfavourably with other capital intensive industries such as steel (15.8 percent) and paper (11.5 percent). By any measure, the industry is financially weak.

The one positive development that has materialized so far in the shipping environment is that the current business cycle has helped shipowners keep vessel costs down. Declining interest rates, low inflation and falling oil prices have helped shipowners reduce financing costs, stabilize crew wages and expenses on stores and supplies, and cut fuel costs. These come as a major relief to the industry at a time when operating profits are under constant pressure from weak shipping demand. As long as the disinflationary trend persists, shipowners will be able to keep vessel costs under control. However, note also that a disinflationary environment has a tendency to diminish the ability of shipowners (and other producers of goods and services) to raise prices.

In recent months, government has also announced several new policy directions. One is "Freedom to Move", where the intention is to deregulate the transportation industry and set market forces to work. Lake shipping is, by and large, free from economic regulation and, therefore, not affected directly by the proposed policy change. However, it is with respect to change in other modes, especially rail, that will indirectly affect the future of lake shipping. Since "confidential rates" is chosen as one of the main instruments of the proposed new policy, the concern is whether as a result of new rate making practices, Great Lakes/St. Lawrence Seaway traffic will be diverted to other modes and routes.

Another new policy direction is contained in Bill C-75 which amends the Canada Shipping Act. While the bill contains many provisions, the one on the imposition of charges for services provided by the Coast Guard is of particular interest. At the moment, the bill has not articulated how the charges are to be apportioned among the different marine users, nor what the levels will be. Given the Coast Guard's annual expenditures of approximately $600 million, the manner in which charges are levied will be of considerable concern. It is noted that the lake carriers' experience with user charges on the waterway is already a long one as the St. Lawrence Seaway Authority, Harbour Commissions, Canada Ports Corporation, and pilotage authorities are mandated to operate on a financially self-sufficient basis. Some of these agencies, especially the St. Lawrence Seaway Authority, have incurred operating deficits recently, and under the government's policy of budget deficit reduction, this trend may not be allowed to persist. In this event, government-imposed charges on the waterway are bound to increase and will impact on vessel costs.

Clearly, the lake carrier industry is now at a critical juncture. The present environment has many cross-currents that would take the industry some time to adjust and stabilize.

4.0 Emerging Trends

In the next few years, lake carriers will not beable to escape the process of restructuring in their industry. During this period of change, the industry will have to innovate and seek new opportunities in order to protect and enhance its competitive position. The industry will in the end be different from the one that exists today. The following observations are made on the events that may emerge in future.

The economy will continue to improve and as it enters the expansionary phase of the business cycle, basic industries (e.g., steel, mines, energy, etc.) in the Great Lakes region will experience growth. Raw materials, such as iron ore, coal, and other commodities, that are transported by lakers to these industries will strengthen. As a result, the lake carrier industry wi'l benefit from an unusually long business cycle without expecting an imminent economic downturn in the near future. However, export grain tonnages on the waterway will experience softness until the world grain trade improves again. Since grain is the major commodity on the lakes, the net change in total tonnage available to lakers will in all likelihood decline moderately.

In the absence of visible improvement in commodity flows, it is expected that the industry will not experience upward pressure on freight rates in the near term. In particular, since the long term grain contracts that have protected the industry from depressed shipping conditions will be expiring later this year and the next, the new freight rates for grain will in all likelihood fall significantly. This will dampen industry's prospects for higher rates.

At the same time, industry will continue to benefit from the disinflationary effects of the business cycle. Vessel costs stemming from financing, crew, fuel and stores and supplies will experience downward pressure and may decline. However, government-imposed charges will rise, particularly as a result of increases in Seaway tolls and new charges by the Coast Guard. This will negate the potential cost savings that can be gained from the disinflationary environment.

Under these conditions, the financial position of industry will continue to be weak, but debt servicing will become more manageable as interest rates decline. Industry's working capital, long term debt, and return on investment will not show any improvement in the near term and this situation will persist until later on this decade.

These events will convince industry of the need foran orderly scrappage of vessels. Since a substantial part of the bulker fleet is more than twenty-five years old and the avoidable cost of these vessels is much higher than new vessels, shipowners may be forced to accelerate the decision to scrap more old vessels from the fleet as freight rates decline. Moreover, these old vessels can be retired from the fleet since they have earned the required returns on investment during the favourable shipping conditions in the sixties and seventies. As a result, a

policy of scrappage may eventually bring supply back into balance with demand.

In the end, the structure of the industry will be different from the one that exists today. Industry will be more concentrated, with Canada Steamship Lines Inc., ULS International Inc., Algoma Central Railway and, perhaps, a fourth carrier as the main companies on the waterway. The creation of a fourth major carrier out of existing smaller companies is a possibility, given the problems of industry and the particular advantages associated with fleet size. Some of the economies that can be realized include a significant reduction in administration (one management instead of three or four independent ones) and lower unit costs for fuel and stores and supplies through volume purchasing. Of course, the emergence of such a carrier will depend on whether existing small companies can agree with one another concerning the new arrangement. Since ownership of vessels is regarded with pride, it is difficult to conceive of corporate takeovers or mergers. What may happen is that small carriers retain ownership control of the vessels, but a ship management corporation is set up to manage the combined fleet. In other words, ship management is divorced from ownership and the objective of management is to deploy the assets to their best use.

Finally, shipowners must diversify their trades or carve a niche in the market-place if they are to thrive. The Great Lakes trades must be regarded as a mature market and shipowners would better serve their interests if they diversify away from the lakes by venturing into ocean or coastal trades. This policy is already being pursued by shipowners and this trend will grow stronger over time.

FOOTNOTE

1 Touche Ross & Co., Great Lakes Shipping: A Financial Profile 1979-1983 (Montreal, October 1984).

GOVERNMENT INTERVENTION AFTER DEREGULATION: ASPECTS OF THE U.S. EXPERIENCE RELEVANT TO CANADA

by

Denise M. O'Brien, Esq.
Partner, Hamel & Park
Washington, D.C.

In the nineteenth century, when the U.S. rail system was in its heyday, a prominent American writer expressed his view that "[r]ailroads . . . are positively the greatest blessing that the ages have wrought out for us."[1/] Today, with the demise of private train travel, the "rationalization" and consolidation of the intricate network of hundreds of rail lines into approximately six major systems, and the substantial deregulation of freight rates in the Staggers Rail Act of 1980,[2/] the breathless enthusiasm that characterizes that statement is largely forgotten. Many might agree instead with Henry David Thoreau's observation: "We do not ride on the railroad; it rides upon us."[3/]

No one, not even the most ardent supporter or strident critic of deregulation, could deny that the U.S. rail system has improved its dismal financial situation since 1980. Some, most notably shippers or shipper groups, would argue that this improvement was effected at the expense of those who have been gouged by unreasonable freight rates and are now unprotected by their former champion, the Interstate Commerce Commission ("ICC" or "Commission"). Others, principally the railroads, contend that the improved financial picture results from lessened regulation and improved efficiency. The tension between these competing interests reflects the current differences that exist between carriers and shippers.

With the changes wrought by deregulation have come changes in which railroads and shippers deal with one another. Gone forever are the days of routine rate protests, complex rate bureau procedures, five-year long abandonment cases, and 10-year long merger hearings. U.S. railroads are run more like private industry than ever before — although subject to a greater degree of public regulation than most enterprises.

This paper does not attempt to analyze, or even describe, all of the changes since 1980. Instead, it focuses on the way railroads treat their shippers, as exemplified by the recent experiences of "captive shippers," and the way railroads treat each other, resulting from restrictions placed on their collective activities.

© 1986, Denise M. O'Brien

To place these two matters in their proper perspective, the paper commences with a brief overview of the events preceding passage of the Staggers Act; highlights certain principal features of that legislation; analyzes the Act's effects on "captive shippers" and collective rail carrier activities; and concludes with a comparison of the changes suggested by the Honorable Don Mazankowski, Canada's Minister of Transport in "Freedom to Move" with recent U.S. deregulatory initiatives.

1.0 BACKGROUND AND EFFECT OF THE STAGGERS ACT

Immediately prior to passage of the Staggers Act, the United States seemed to be confronted with the imminent demise of its freight railroads. The 1970's had ushered in an era of difficulties for carriers, which for the first time saw a marked decline in their prosperity. More than 20% of the U.S. rail system was being operated in bankruptcy; 43,000 miles of track were under "slow orders" due to deteriorated conditions attributable in large measure to deferred maintenance; and an abysmal rate of return on investment of about 2.0%, despite double-digit inflation, prevailed. It seemed inevitable that, without major changes in the U.S. railroads' financial picture, replacement of plant and equipment would become extraordinarily difficult, if not impossible. Rail customers, especially those who shipped heavy-loading bulk commodities, were threatened with devastating effects on their own businesses.

The possibility of administrative relief seemed remote. The pre-Staggers Act ICC, which was required by the "4R Act" of 1976[4] to operate within strict time constraints in rendering decisions, had loosened its tight grip on rate reasonableness and other issues inhibiting railroads' managerial discretion. Nevertheless, the agency's reach remained pervasive. The railroads seemed to be chafing under the hand of regulation.

The Staggers Act permanently changed the U.S. railroad picture. By instructing the ICC to allow railroads to attain "revenue adequacy",[5] while concomitantly providing safeguards to those shippers over whose traffic railroads were determined to have "market dominance,"[6] the Act attempted to strike a balance between railroads' and shippers' needs.

Since enactment of the Staggers Act, the ICC has carried out its deregulatory mandate with unparalleled administrative zeal. While the overall effects of Staggers are difficult to quantify, large Class I railroads, buoyed by the prospect of increased returns on investment and freed from the regulatory restraints that they believed previously had hindered marketing efforts, have expressed firm support for the Act and its implementation.[7] Smaller railroads, on the other hand, which are increasingly encircled by rail megasystems with single-system pricing capabilities and little or no incentive to maintain or enter joint rate or route relationships, have argued for reforms in some of the Act's provisions, such as that which allows carriers to cancel participation in noncompensatory joint rates.[8]

Shippers' experience also has been mixed. Some shippers, especially those who deem themselves "captive" to the rail mode, believe the ICC has

not done enough to protect their interests. They object to the definitions of "market dominance" that the ICC has propounded and the courts have upheld and the methods by which the agency measures "revenue adequacy" and rate reasonableness, which have, for the most part, resulted in upholding rail rates, even those that exceed variable costs by a wide margin.[9] Other shippers, apprehensive that loss of rail service will affect their ability to do business, have objected to the abandonment of huge portions of the railroads' systems with the ICC's blessing.[10] Still others, satisfied with their ability to contract for more favorable freight rates,[11] have banded together to ensure that Staggers not be reformed.[12] The views of these disparate groups have recently coalesced in administrative proceedings and before the U.S. Congress. Before proceeding to a description of current activities, however, it is necessary briefly to review the principal reforms effected by Staggers.

2.0 STAGGERS ACT'S STRUCTURE

The Staggers Act was divided into seven titles, the first four of which addressed generic problems confronting U.S. railroads. Prefatory to the various titles was a section in which Congress found, inter alia, that,

- Most transportation was competitive, and nearly two-thirds of the nation's intercity freight was transported by modes other than railroads;
- Many government regulations affecting railroads had become unnecessary and inefficient; and
- Earnings by the railroad industry, the lowest of any transportation mode, were insufficient to generate necessary funds for capital improvements.[13]

The Act's goals, written in light of these findings, included: assisting the railroads to rehabilitate their systems; reforming federal policy so as to preserve a safe, adequate, economic, efficient, and financially stable rail system; creating a regulatory process balancing the needs of carriers, shippers, and the public; and finding ways to aid in the rehabilitation and financing of the rail system.

Title II of the Act, Railroad Rates and Intercarrier Practices, contained most of the controversial features of the Act affecting captive shippers and collective ratemaking, the two subjects of this paper. Among Title II's provisions was a section dealing with market dominance. The ICC was required to find, in its market dominance determinations, that the rail carrier establishing the challenged rate did not have market dominance if it could prove that the rate resulted in a revenue-to-variable cost percentage less than a sliding scale of percentages, commencing at 160% and culminating in the cost recovery percentage during each 12-month period beginning on or after October 1, 1984.[14]

The ICC also was instructed to revise its standards and procedures for determining "railroad revenue adequacy" and to initiate a proceeding to determine whether and to what extent product competition should be considered in determining the reasonableness of rail rates.[15] The Act made suspensions of rail carrier rates much more difficult; it specifically stated that differences between rates, rules, or practices which result from different services cannot be considered violations of the Act. The ban on unlawful rate discrimination, which had been a fertile source of litigation, was rendered largely a thing of the past.[16]

Two other important features of Title II insofar as carrier-shipper relations were concerned were its clarification that contract rates between shippers and carriers were lawful and to be encouraged,[17] and its section expanding and refining the ICC's exemption power wherever regulation was determined unnecessary to prevent "abuses of market power," regardless of the presence or absence of effective competition.[18]

A principal change effected by Staggers in intercarrier relationships was its modification of rate bureau activities. Among the Act's major reforms were its prohibition on carriers' discussing, voting, or agreeing on single-line rates proposed by another carrier and its prohibition on discussing joint-line rates unless a carrier "practicably participated" in a movement.[19] After January 1, 1984, discussions of a joint-line rate where there were two routes between the same endpoints also were prohibited, except with a carrier that formed part of a route.[20]

3.0 CAPTIVE SHIPPERS' PROBLEMS WITH STAGGERS

Staggers was not a "simple" deregulation of the railroad industry. Instead, it represented a simultaneous recognition of two conditions. On the one hand, Congress recognized that, in large parts of the rail industry, competition prevailed. In many cases, rail carriers competed with other modes of transportation that were unregulated and therefore able to be more innovative and flexible. On the other hand, however, Congress recognized that sometimes competition would be insufficient to protect the legitimate interests of shippers, small carriers, and the public; for categories of traffic thus affected, complete deregulation was unjustified by industry conditions.[21] Regulatory protection still was necessary for these entities' interests. The underlying purpose of the Act was to move toward much greater reliance on market forces rather than regulation to govern rail carriage, but to temper that move with a policy of retaining regulation where the market would be insufficient to protect shippers and the public from abusive railroad practices.[22]

In particular, Staggers attempted to foresee and address the problems of shippers dependent on the rail mode; the key remedies provided to captive shippers by the Interstate Commerce Act are the ICC's ability to impose maximum rates under the market dominance provisions of 49 U.S.C. § 10709 (1982) and the reciprocal switching or terminal facility sections of 49 U.S.C. § 11103 (1982). An indirect method of achieving similar results in some

circumstances is through the ICC's authority to prescribe through routes, joint rates, and the division of joint rates, pursuant to 49 U.S.C. § 10705a (1982).[23]

"Captive" shippers in a "deregulated" environment may also rely on antitrust remedies. In order to obtain relief under the antitrust laws, an allegedly captive shipper must demonstrate that a market for antitrust purposes can properly be defined to include the captive shipper's shipments and that such a market has been, or is likely to be, unlawfully monopolized by the rail carrier. If a captive shipper can demonstrate monopolization of that market by a rail carrier, the antitrust laws would provide both treble damage remedies (where not precluded by the so-called "filed rate" doctrine first enunciated by the Supreme Court in Keogh v. Chicago and N.W. Ry., 260 U.S. 156 (1922)), and equitable remedies (where not precluded by the Clayton Act, 15 U.S.C. § 1 et seq. (1982)).

The result has been that disgruntled shippers no longer turn routinely to the ICC for relief, choosing instead to negotiate settlements with their serving carriers,[24] or to pursue legislatively that which they cannot achieve administratively.[25] One notable exception has been the Commission's decision to institute a proceeding in 1984 for all entities affected by Staggers to air their grievances.[26]

Two significant problems identified in this proceeding by captive shippers have been: (1) the Commission's treatment of product and geographic competition in its market dominance determinations; and (2) the cancellation of joint rates, joint routes, and reciprocal switching services by individual railroads (which has become generically known as "competitive access").

3.1 Administrative Treatment of Captive Shipper Issues

On October 31, 1985, the Commission served two important decisions in rulemaking proceedings addressing these problems. In Ex Parte No. 320 (Sub-No. 3), Product and Geographic Competition, the Commission revised its product and geographic competition standards for determining market dominance in rail rate cases. The rules contain a new provision stating that a railroad demonstrating geographic or product competition with respect to a receiver of goods does not, without additional proof, establish the existence of effective product or geographic competition with respect to a producer, or vice versa. The rules also modify the existing standard with respect to allocating the burden of proof in market dominance determinations by imposing on a railroad seeking to establish its lack of market dominance the burden both of identifying such competition and proving its effectiveness.

In Ex Parte No. 445 (Sub-No. 1), Intramodal Rail Competition, the Commission established criteria for scrutiny of "competitive access" issues, including, but not necessarily limited to, cancellation of joint rates and through routes and reciprocal switching decisions. Among other things, the new rules require a railroad to give 45 days' notice of all cancellations and to provide an explanation and justification of a proposed cancellation of a through route or joint rate to an affected party who requests it. The rules

also provide for ICC suspension of a proposed cancellation of a through route or joint rate if the cancellation would eliminate effective rail competition and the protesting shipper or carrier has made significant use of the route or rate in question.

3.2 Legislative Treatment of Captive Shipper Issues

Despite these administrative changes, a new bill, H.R. 4096, was introduced in the U.S. Congress on January 30, 1986 as a revised version of H.R. 1190, legislation proposed by Consumers United for Rail Equity ("CURE"), a well-organized group of shippers who seek changes in the ICC's implementation of Staggers.[27] The new bill takes a different approach to the issues confronting "captive" shippers from that proposed in prior legislation. Among the important features of the bill are the following:

- o A shift in the revenue adequacy test that might not yield railroad investors a rate of return equal to the current cost of capital, which is currently the standard followed by the ICC in its revenue adequacy proceedings;
- o A change in the Act's market dominance provision;
- o Analysis of rate reasonableness without reference to railroad revenue needs;
- o Compelled establishment of joint rates and reciprocal switching charges at levels beneficial to captive shippers;
- o Curtailment of the ICC's authority to exempt railroads from regulation;
- o Tightening of the abandonment criteria to make abandonments more difficult; and
- o Restoration of the states' authority to hold intrastate rates below the level of interstate rates.

The principal features of the new CURE bill are those involving revenue adequacy, market dominance, and rate reasonableness — the major issues confronting captive shippers in the United States today.

The newly proposed regulation, if adopted in its present form, could have a major impact on the recently revised market dominance standards. The bill's two significant exceptions to the Commission's market dominance rule are the prohibition on consideration of geographic or product competition at an origin and the prohibition on consideration of import coal in determining the existence of geographic competition. The bill further provides that, if a person challenging a rate demonstrates that the railroad does not encounter effective transportation competition, the ICC shall presume market dominance unless the railroad proves that effective product or geographic competition exists.

The legislative activities regarding "competitive access" issues have not been as well publicized as the proposed CURE legislation. These issues are vitally important to captive shippers, however, as well as smaller carriers which maintain they have been the victims of larger carriers' rate and service actions.

Two possible solutions to competitive access issues are S. 447 (three co-sponsors) and H.R. 1140 (26 co-sponsors), introduced by Senator DeConcini (D-N.M.) and Congressman Seiberling (D-OH), respectively, which would amend the Sherman Act[28/] by making it unlawful for a railroad to monopolize or attempt to monopolize by denying a shipper, its agent, or another rail carrier the use of its track for the shipment of bulk commodities where the track is the sole means of connecting with the tracks of a competing railroad for reaching the destination of the shipper. A violation would not occur if the railroad permitted another railroad to offer services "on reasonable terms determined in accordance with generally accepted principles regarding just and reasonable rental of track."

If the railroad fails to offer use of its track, or if no competition results, then the railroad owning the track with the sole means of connection must offer the shipper rail rates based on a fair return on that proportion of investment in the sole facility which the shipper's traffic bears to all traffic using the facility. The measure further prohibits a railroad from conditioning the use of the sole facility with the use of other facilities or from threatening to end service over a sole facility for a shipper asserting its "rights."[29/] The legislation is now pending in the U.S. House of Representatives.

4.0 APPLICATION OF ANTITRUST PRINCIPLES TO CARRIER ACTIVITIES

Since the advent of deregulation, a number of changes have occurred in the ways railroads do business with one another and with their shippers. None of these changes is more noteworthy than the application of antitrust principles to collective activities that formerly were subject to regulation.

4.1. Effect of Removal of Collective Ratemaking Immunity on U.S. Carriers and Shippers

Traditionally, U.S. railroads made their rates collectively through the auspices of the railroad rate bureaus.[30/] As a result of administrative decisionmaking and statutory proscription, however, the railroad rate bureau in the United States has largely been emasculated.

Several recent prohibitions on railroad rate bureau activities have substantially affected railroads and shippers in the United States.

Prohibitions on Single-Line Rates. As a result of pre-Staggers Act decisions and the codification of proscriptions on multicarrier activities at 49 U.S.C. § 10706, no proposal filed with a rate bureau to change a rate or rule may apply to single-line rates.

Contract Rates. The ICC has determined that railroads do not have antitrust immunity for the handling of contract rates; today, no discussion or agreement on contract rates is allowed under rate bureau procedures. See 364 I.C.C. at 644; 364 I.C.C. 787.

Deregulated Traffic. In prior exemption orders on perishables traffic (361 I.C.C. 211 (1979)), and TOFC/COFC traffic (364 I.C.C. 731 (1981)), the Commission stated that, with respect to deregulated traffic, railroads no longer had immunity to discuss and agree on charges.

Competitive Routings. As a result of the limitations with respect to "practicable participation" in routes, carriers that form a route between points cannot discuss, agree, or vote on a rate change proposed by competitive carriers that also form a route between the same points. Only those carriers that form a route can participate in the determination of what the rate over the route should be.

The effect of removal of collective ratemaking immunity on U.S. carriers and shippers has been to individualize ratemaking and pricing determinations. Rate bureaus, which formerly were the clearinghouses for information and meeting places for collective action, were compelled to scale back their operations to allow discussions principally of direct connectors, general rate increases, and broad tariff changes.

One of the most important effects of deregulation has been the increased significance of carriers' ability to offer single-system pricing capability. The ICC's liberal interpretation of the consolidation provisions of the Interstate Commerce Act, as amended by the Staggers Act, has spawned a flurry of major merger and consolidation projects among larger Class I railroads.[31/] In addition, the railroads have attempted to enter the "one-stop shopping" realm of intermodal ownership by acquiring motor common carriers and barge lines that previously had been independent.[32/]

5.0 COMPARISON OF PROPOSED CANADIAN DEREGULATION LEGISLATION WITH SELECTED ASPECTS OF THE U.S. EXPERIENCE

The Sixth Report to the House of the Standing Committee on Transport, dated December 18, 1985, endorsed in major respects the Government's paper entitled "Freedom to Move." While acknowledging the difficulty of proposing specific changes, the Report concurred with "Freedom to Move" in general terms. At this writing, the legislation proposed to amend the National Transportation Act has not been approved.

5.1 "Captive" Shipper Relief

The Standing Committee aptly characterized the "captive" shipper issue as "one of the most vexing questions" it was called upon to consider. Report, p. 23. The Committee nonetheless concluded that Section 278 (the maximum rate provision) of the Railway Act be repealed. One of the chief criticisms

of Section 278 was its lack of usefulness to the shipping community, evidenced by its infrequent invocation. In this respect, Canada's proposed legislation appears similar to the maximum rate provisions of the Interstate Commerce Act.

The other forms of relief suggested for "captive" shippers — legislated joint-line rates (Report, p. 24) and expanded interswitching limits (id.) — have no precise counterparts in U.S. deregulation legislation as it presently exists. It will be interesting to watch Canada's experience with these proposed remedies, in order to ascertain whether the problems of "captive" shippers are more readily resolved than in the United States, where a vocal minority of shippers maintain that Staggers has not protected their interests.

5.2 Collective Activities

To complement the introduction of confidential contracts, "Freedom to Move" proposed, and the Standing Committee agreed, that Section 279 of the Railway Act be repealed. Section 279 allows railways in Canada to set common rates on traffic moving between centers served by two or more railways.

This proposed action is consistent with U.S. legislation and administrative action, which have narrowly circumscribed the scope of permissible collective activities by railroads in the ratemaking context. The rail situation in Canada, with two predominant railways, differs dramatically from that in the U.S., however. It is difficult to predict, therefore, whether economies presumed to be available in the absence of collectively set rates may be achieved in the Canadian milieu.

6.0 SUMMARY OF CONCLUSIONS

The Staggers Act was a comprehensive piece of legislation that substantially deregulated the day-to-day activities of U.S. railroads. Its most significant reforms were achieved in the area of railroad ratemaking and in its mandate to the ICC to assist the nation's freight railroads in the attainment of "revenue adequacy."

Notwithstanding the substantial reforms effected by Staggers, there remain areas of unresolved controversy. Some "captive" shippers have maintained that the effects of Staggers on their own businesses have been far from beneficial. In addition, the parameters of acceptable collective activities on the part of railroads have not been precisely defined; the U.S. court system may be compelled to adjudicate the lawfulness of collective activities undertaken under color of right.[33/]

The reforms suggested by "Freedom to Move" adopt some of the same conclusions that the U.S. Congress reached prior to passage of the Staggers Act, but suggest different or alternative means by which to achieve deregulatory objectives. For example, Canada has suggested increasing regulation in some areas, such as prescribed joint rates and expansion of compulsory interswitching limits, perhaps to obviate some of the problems that the U.S.

has encountered post-Staggers. These suggestions, if implemented, could require a greater degree of regulatory oversight to ensure compliance with the legislation's purposes.

The extent to which the post-Staggers Act U.S. environment and the post-"Freedom to Move" Canadian environment will parallel each other is uncertain at this point. It appears that, if the U.S. experience is at all relevant, the changes that are suggested with respect to captive shippers and collective activities may require more, not less, government intervention, at least at the outset, and a willingness on the part of regulators and legislators to "fine-tune" solutions to meet problems that inevitably will arise in order to achieve desired objectives.

March 20, 1986

FOOTNOTES

1/ Nathaniel Hawthorne: The House of Seven Gables.

2/ Staggers Rail Act of 1980, Pub L. No. 96-448, 94 Stat. 1895 (1980). The provisions of the Interstate Commerce Act, as amended by Staggers, may be found at 49 U.S.C. Subtitle IV (1982).

3/ Walden II.

4/ Railroad Revitalization and Regulatory Reform Act of 1976, Pub. L. No. 94-210, 90 Stat. 31 (1976).

5/ The revenue adequacy provision of the Interstate Commerce Act is now codified at 49 U.S.C. § 10704(a)(2) (1982).

6/ Section 10709(a) of the Interstate Commerce Act (49 U.S.C. § 10709(a) (1982)) defines "market dominance" as "an absence of effective competition from other carriers or modes of transportation for the transportation to which a rate applies."

7/ Frank N. Wilner, Railroads and the Marketplace, Association of American Railroads' ("AAR's") Information and Public Affairs Dep't, February 1986.

8/ See 49 U.S.C. § 10705a (1982), which codifies the joint rate cancellation and surcharge provision added by Staggers.

9/ See, e.g., Petition of the Denver and R.G. W. R.R. and Salt Lake, G. & W. Ry. for Review of a Decision of the Public Service Comm'n of UT, Finance Docket No. 39060, entire Commission decision served November 14, 1985 (rates at 208.7 percent of variable costs upheld); E.I. duPont de Nemours & Co. v. St. Louis S.W. Ry., Finance Docket No. 37014, entire Commission decision served March 30, 1979 (rates at 209 to 235 percent of variable costs found reasonable); and Trainload Rates on Radioactive Materials, Eastern Railroads, 362 I.C.C. 756, 775 (1980), aff'd mem. 646 F.2d 642 (D.C. Cir. 1981) (rates at 213.8 to 255.7 percent of variable costs prescribed). But see Omaha Public Power District v. Burlington N. R.R., Finance Docket No. 38783, Office of Hearings decision served January 15, 1986, in which the Administrative Law Judge found the challenged rates unreasonable and recommended reparations.

10/ In accordance with applications filed under the new abandonment criteria set forth in Section 402 of Staggers, some 14,000 miles of rail line have been abandoned during the last four years. Remarks by former ICC Chairman Taylor before the Transportation Committee of the National Governors Conference, Washington, D.C., February 24, 1986, at 5.

11/ The AAR Information and Public Affairs Department estimated on March 17, 1986 that over 35,000 contracts are currently on file with the ICC pursuant to 49 U.S.C. § 10713 (1982), and 49 C.F.R. Part 1039 (1985).

12/ The "Committee Against Revising Staggers" is more popularly known by the acronym "CARS." It boasts several of the nation's largest shippers and shipper associations among its 300 members, including the American Retail Federation, Archer Daniels Midland Company, Bethlehem Steel, Carnation, Continental Grain, Crown Zellerbach, General Motors, Georgia Pacific, Procter & Gamble, Quaker Oats, and Sears, Roebuck & Co.

13/ H.R. Rep. No. 96-1430, 96th Cong., 2d Sess. at 3 (1980).

14/ See 49 U.S.C. § 10709(d)(2) (1982).

15/ The ICC's implementation of this provision of Staggers has had a long and tortured history. See Ex Parte No. 320 (Sub-No. 3), Product and Geographic Competition, entire Commission decision served October 31, 1985. See also Ex Parte No. 320 (Sub-No. 2), Market Dominance Determinations, 365 I.C.C. 118 (1981), aff'd sub nom. Western Coal Traffic League v. ICC, 719 F.2d 772 (5th Cir. 1983) (en banc) cert. denied, 104 S. Ct. 2160 (1984).

16/ The "rate discrimination" provision, codified at 49 U.S.C. § 10741 (1982), states that:

> (a) A common carrier providing transportation subject to the jurisdiction of the Interstate Commerce Commission under subchapter 1 of chapter 105 of this title may not charge or receive from a person a different compensation (by using a special rate, rebate, drawback, or another means) for a service rendered, or to be rendered, in transportation the carrier may perform under this subtitle than it charges or receives from another person for performing a like and contemporaneous service in the transportation of a like kind of traffic under substantially similar circumstances. A common carrier that charges or receives such a different compensation for that service unreasonably discriminates.

17/ Section 208, codified as 49 U.S.C. § 10713 (1982).

18/ 49 U.S.C. § 10505 (1982). The Commission's exemption power has been one of its most important tools, resulting in deregulation of many commodities as well as traffic moving in boxcars. The following commodities are listed in 49 C.F.R. § 1039.10 as deregulated: farm products, with the exception of grain; sunflower seeds; fresh fish and other marine products; fresh meat; fresh dressed poultry; processed poultry;

creamery butter; condensed, evaporated or dried milk; cheese and special dairy products; processed whole milk; hides and skins; animal refuse, tankage, or meat meal; citrus pomace; shelled walnuts; cottonseed hulls; cotton linters; butter and honey mixed; honey, comb, granulated, or strained or heat-treated to retard granulation; freeze-dried poultry; freeze-dried meat; freeze-dried salad ingredients; fresh and salted meat and products mixed, not hung; fresh and salted meat and products mixed, hung and not hung; stemmed or redried tobacco; cotton, carded, dyed or not dyed, but not spun, woven or knitted, but including cotton lap; mattress felt, nec, cotton, jute or sisal, not finished; felts, cotton, nec; wool, nec scoured; flax fibre; cotton linters, bleached or dyed; and beeswax.

The following additional commodities are exempt under 49 C.F.R. § 1039.11: frozen meat; frozen poultry; ice cream or related frozen desserts; frozen fruits, vegetables, or fruit juices; frozen specialties; and frozen processed fish or seafood.

19/ See 49 U.S.C. § 10706 (1982).

20/ Ibid.

21/ See the discussion in Coal Exporters Ass'n of U.S. v. United States, 745 F.2d 76, 81 (D.C. Cir. 1984), cert. denied, 105 S. Ct. 2151 (1985), reviewing and reversing ICC decision in Ex Parte No. 346 (Sub-No. 7), Railroad Exemption — Export Coal, 367 I.C.C. 570 (1983) (exemption of export coal transportation). See also BRAE Corp. v. United States, 740 F.2d 1023 (D.C. Cir. 1984), cert. denied, 105 S. Ct. 2149 (1985).

22/ The history of the Staggers Act reflects the legislation's compromise nature, designed to accommodate carriers' desires for relaxed regulation with shippers' wishes for retention of regulation where necessary. See, e.g., 126 Cong. Rec. S14005 (daily ed. Sept. 30, 1980) (comments of Sen. Exon); id. at S14003 (comments of Sen. Cannon); id. (comments of Sen. Long); id. at H10086-H10087 (comments of Rep. Rahall); id. at H8555-8556 (comments of Rep. Loeffler); id. at H8550-8551 (comments of Rep. Rahall).

23/ See Answers of Acting Assistant Attorney General Phillip D. Brady, U.S. Department of Justice, Office of Legislative and Governmental Affairs, to questions submitted by Senator DeConcini, dated November 27, 1985, at 1-2.

24/ For example, Section 229 of Staggers expressly stated that a rate not challenged in a complaint filed within the 180-day period beginning on the effective date of the Act, or challenged unsuccessfully, "shall be deemed lawful . . . ." As of March 17, 1986, some 754 of the 864 complaints filed had been dismissed at the complainants' request — most because of negotiated settlements. See Ex Parte No. 421, Complaints filed Pursuant to the Savings Provisions of the Staggers Rail Act (Section 229).

25/ A report by the U.S. General Accounting Office issued January 1986, entitled "Shipper Rail Rates: Interstate Commerce Commission's Handling of Complaints," states that the ICC had found market dominance in 61 of the 81 post-Staggers cases identified. In 40 of the 61 cases (66%) the railroads' rates were found reasonable. In 10 cases (16%) the railroads' rates were found unreasonable. Several cases had had no ruling on the issue of rate reasonableness because the Commission had decided to await the adoption of its coal rate guidelines before adjudicating the cases.

26/ Ex Parte No. 456, Staggers Rail Act of 1980 — Conference of Interested Parties, entire Commission decision served September 10, 1984.

27/ Joining CURE in seeking reforms in Staggers have been the Edison Electric Institute and the Consumer Federation of America.

28/ The Sherman Act, July 2, 1890, c. 647, 26 Stat. 209 (1890), is codified at 15 U.S.C. § 1 et seq. (1982).

29/ The House Judiciary Monopolies and Commercial Law Subcommittee approved H.R. 1140, the "Railroad Anti-Monopoly Act of 1986," on March 13, 1986. If passed, the Act would make it a violation of the Clayton Act for a rail carrier to deny a shipper or receiver or another established rail carrier, on reasonable terms, the use of a sole railroad facility for the shipment of a bulk commodity if such denial has the effect of "monopolizing."

30/ See Section 5a Application No. 2, Western Traffic Ass'n — Agreement, 276 I.C.C. 183, 185-91 (1949). The rate bureaus' major purposes were identified during the course of the Staggers Act's legislative history as to facilitate negotiation of collective rates and to ensure rate uniformity. H.R. Rep. No. 1035, 96th Cong., 2d Sess. at 119-21 (1980).

31/ Union Pacific Corp. — Control — Missouri Pacific Corp. and Missouri P. R.R., 366 I.C.C. (1982) (ICC approved consolidation of Union Pacific, Missouri Pacific, and Western Pacific Railroads), aff'd in part and remanded in part sub nom. Southern Pacific Transp. Co. v. ICC, 736 F.2d 708 (D.C. Cir. 1984), cert. denied, 105 S. Ct. 1171, 1172 (1985); Norfolk Southern Corp. — Control — Norfolk & W. Ry., 366 I.C.C. 171 (1982) (consolidation of Norfolk & Western and Southern Railways approved); St. Louis S.W. Ry. — Purchase (Portion) — Chicago, R.I. & P. R.R., 363 I.C.C. 319 (1980) (ICC approved Cotton Belt's purchase of Rock Island's "Tucumcari" line); Burlington Northern, Inc. — Control & Merger — St. L. S.F. Ry., 360 I.C.C. 784 (1980) (approval of BN's control of Frisco), aff'd sub nom. Missouri-Kansas-Texas R.R. v. United States, 632 F.2d 392 (5th Cir. 1980), cert. denied, 451 U.S. 1017 (1981); and CSX Corp. — Control — Chessie and Seaboard C.L. Industries, Inc., 363 I.C.C. 518 (1980) (consolidation of Chessie and Seaboard Systems approved).

32/ CSX Corp. — Control — American Commercial Barge Lines, Inc., ICC Finance Docket No. 30300, entire Commission decision served September 7, 1984 (CSX's takeover of American Commercial Barge Lines, a barge line allegedly competitive with system roads, approved) aff'd sub nom. Crounse Corp. v. ICC, U.S.C.A., 6th Cir., slip op. dated January 23, 1986; and Norfolk Southern Corp. — Control — North American Van Lines, Inc., ICC Finance Docket No. 30500, entire Commission decision served May 13, 1985 (approval of Norfolk Southern's acquisition of NAVL, a major household goods carrier), petition for review pending, U.S.C.A., D.C. Cir., Nos. 85-1397, et al., Int'l Bhd. of Teamsters v. ICC.

33/ In Square D Co. v. Niagara Frontier Tariff Bureau, Inc., 760 F.2d 1347 (2d Cir.), cert. granted, 106 S. Ct. 57 (1985), the Supreme Court is considering whether to abandon the judicially-created doctrine that damage claims cannot be brought by shippers with respect to rates filed with the ICC. The case represents another attempt to erode ratemaking principles that have been deemed anachronistic in a deregulated environment.

MARKET ENTRY REFORM: THE TESTS

by

Thomas G. Keast

1.0 Introduction

The purpose of this paper is to examine the existing and proposed statutory provisions which, through administration by regulatory agencies, control entry by carriers into the market for the supply of transportation services. Regulatory reform in the U.S. has led to the introduction of different entry tests designed to lower the barriers to entry which have been historically thought necessary. In Canada, federal government initiative has pointed straight in the same direction. This paper reviews the role of entry tests in regulatory administration and examines the interpretation of those tests. The greatest degree of anticipated change in Canada will be seen in the motor carrier and aviation modes. There is no doubt that U.S. jurisprudence in these areas will provide a guiding light for Canadian regulators.

2.0 The Purpose of Entry Regulation

The purpose of regulatory control of entry to the marketplace by carriers wishing to provide transportation services is an elusive and multi-faceted notion. It is a matter of public policy usually involving the balancing of the key influences of the day. These can change. When motor carrier regulation was introduced in Canada in the 1930's it was designed to address the public nuisance aspect of trucking, the perceived need to protect the

* Mr. Keast is a partner in the law firm of Richards Buell Sutton in Vancouver and a Research Associate with the Centre for Transportation Studies (U.B.C.)

railways from the diversion of traffic to road transport and the desire by truckers themselves for more orderly competition within their mode.(1)

Through managerial innovation, technological change and government investment in highways the motor carrier industry has contributed substantially to the changed face of Canadian transportation economics. The need to protect the railways is no longer a dominant concept in federal policy. No longer is the need felt to protect carriers from competition amongst themselves when it is perceived that such restriction can support sub-optimal pricing and inefficient operations.

In looking back a quarter-century to the McPherson Royal Commission the Minister of Transport observed in the opening paragraphs of Freedom to Move, the federal government's 1985 blueprint for reform, that the industry had matured. In more detail he said:

> "To meet the demand for both freight and passenger service, the Canadian transportation system has matured and become more diversified since 1967. The various modes have established markets and now have less need for the regulatory protection offered by governments so often in the past. Transportation now requires a less restrictive regulatory environment if it is to meet the challenges of the coming years. Greater competition between carriers will provide shippers and passengers with a wider choice of services and lead to a more efficient and effective transportation system."(2)

The Minster in effect sees the transportation industry as able to withstand the vagaries of open competition. But the real momentum for change is generated outside of Canada. He states:

> "Canada now faces a period of economic renewal with economic growth expected to be solid. Our producers, confronted with increased competition in world markets, need efficient transportation. Our transportation system subject to increased competition from a deregulated U.S. system, requires more freedom and flexibility to respond successfully to market pressures."(3)

Central, then, to relaxation of entry control is the notion of maturity and the widespread need to exploit the benefits of competition which mature markets for the provision of transportation services are perceived to be able to generate. Freedom to Move concludes that markets must be made more accessible to willing entrants. Since the current market entry test of 'public convenience and necessity' ('PC&N') has been interpreted in such a way

that the effect of a new entrant on existing carriers is a central factor, the test has to go. Existing carriers will be expected to meet the challenge of any carrier fit to operate and, indeed, they seem ready to do so.

In addition to these considerations the view has evolved over the last decade that the traditional barriers to entry are administratively cumbersome and therefore expensive. Again, from Freedom to Move:

> "Regulations, and the agency that administers them, should become more flexible, more accessible to Canadians and less legalistic."(4)

The collapse of entry criteria from a public interest level to a fitness level is intended to make the entry application a more objective exercise and, therefore, reduce the cost of the administrative process accordingly.

3.0 The Method of Regulation

The theory and practice of economic regulation by government begins with the constitutional power of government and ends with appellate control either by the courts or the executive branch of government. Within its constitutional power a government develops policies. These policies may include elements which demand that certain economic activity be curtailed or controlled in order to achieve stated policy goals. The body of law surrounding the creation of, delegation to, operation of, and appeal from, regulatory agencies falls in the category of administrative law.

The delegation of decision-making authority to administrative agencies has become popular because of the attractiveness of having this function in the hands of individuals who have special knowledge or expertise in a given field. In addition, in most cases, decisions are needed expeditiously and agencies, given the delegated authority, may make their own rules to promote responsiveness and efficiency in decision-making both in terms of cost and timing.

3.1 The Power

The enabling legislation must empower the agency to make a decision. For example, the Aeronautics Act:

> S.16(1) The Commission may issue to any person applying therefor a licence to operate a commercial air service...

Restraint on doing business as a carrier is implemented through the gateway of licensing which, in law, is the instrument by which one is allowed to engage in a

particular activity from which they are otherwise prohibited. This prohibition may arise out of common law property rights, such as the law prohibiting trespass to private property, or from statute law, such as the prohibition from engaging in commercial air service without a licence.

There are several tools available to legislators in narrowing the scope of the licencing requirement or allowing for the exemption of certain activity from the licence requirement. For example, S. 16(2) of the Aeronautics Act states that the Commission shall not issue licenses to those who are also engaged in other modes of transport unless the Governor-in-Council is of the opinion that it is in the public interest or, by S.16(3), to any extra-provincial carrier in which a provincial government has a debt or equity interest.

Most transportation regulatory statutes provide for exemption from the licencing requirement. The Aeronautics Act delegates to the C.T.C. the power to exempt certain activity from the PC&N requirement if, in the opinion of the Commission, the exemption is in the public interest. Motor carrier statutes in Canada also provide for exemptions of both a statutory and discretionary nature. In the latter case the exemptive power has historically been used sparingly.(5) However recently, with increased momentum in favour of deregulation, the discretionary power to exempt is being employed as a means of collapsing entry barriers for certain commodities and services.(6)

3.2 The Task

Once it is established who a licence can be issued to the delegating statute will usually say why an agency should or should not issue it. S. 16(3) of the Aeronautics Act:

> 16(3) The Commission shall not issue any such licence unless it is satisfied that the proposed commercial air service is and will be required by the present and future public convenience and necessity.

The way in which an agency is statutorily instructed may vary. For example, the Motor Carrier Act of B.C. instructs the Motor Carrier Commission as follows:

> 7(2) Upon any application for a licence, the Commission may take into consideration, amongst other matters,
>
> (a)any objection to the application for a licence made by any person already providing transport facilities, whether by highway, water, air, or rail, on the

routes or between the places which the applicant tends to serve on the ground that suitable facilities are or, if the licence were issued, would be in excess of requirements, or on the ground that any of the conditions of any other licence held by the applicant have not been complied with;
(b)the general effect on other transport services and any public interest which may be affected by the issue of such licence;
(c)the quality and permanence of the service to be offered by the applicant, and the fitness, willingness, and ability of the applicant to provide proper service.

By contrast the Motor Transport Act of Alberta merely instructs the regulatory agency in that province as follows:

S.18(1) The Board may issue an operating authority certificate authorizing intraprovincial or extraprovincial transportation of goods or passengers.

The difference in styles between these statutes is clear. On the one hand discretion is broad and completely uncontrolled except by the common law pertaining to jurisdiction and procedural fairness. On the other, the legislature has provided some indication of the matters which the regulatory agency may consider. In between, but still giving considerable discretion, are the idiomatic tests such as PC&N, public interest or fit, willing and able. As another mechanism for discretionary control it is open to the legislature to list factors which the agency shall consider. This approach is not common in statutes regulating economic activity for the simple reason that the restraint on discretion becomes too great.

3.3 The Direction

In general terms the delegation of broad discretion gives wide scope to the agency and allows flexibility in adapting decisions to changing economic needs. What is gained in flexibility is lost in predictability.

In a 1983 report entitled Responsible Trucking the Ontario Public Commercial Vehicles Act Review Committee, comprised of shipper, carrier, consulting, academic, and government representatives contrived a combination of fitness and market tests. Said the Committee:

"We propose that the test of public necessity and convenience on entry be abandoned.

In its place we recommend a fitness test be employed, to be supplemented in appropriate circumstances by a market test. Both would employ declared standards, which would make them clearer and more objective than the test of public convenience and necessity."(7)

The recommendations of the Committee were incorporated into legislation which has not yet become law.

Thus, the direction in Ontario is towards a manipulation of the procedural aspects of entry administration to achieve what is anticipated to be relaxed entry. This approach was adopted in the U.S. by the Motor Carrier Act of 1980('MCA/1980'). That statute, instead of the traditional requirement that an applicant prove PC&N, provided that an applicant must prove a threshold case of fitness and utility of the proposed service while objectors must prove that the applicant's entry into the market is inconsistent with PC&N. This procedural restructuring of the entry test has the advantage of preserving the public interest criteria while shifting the obligation to objectors to demonstrate a "public harm which outweighs the benefits which are presumed to flow from a grant of authority."(8)

Nevertheless the federal government is looking beyond this reverse onus approach. In aviation the public interest element is to be eliminated while in the motor carrier industry the federal government, in conjunction with the provinces, is studying the socio-economic effects of eliminating PC&N in favour of a fitness test.

3.4 The Legal Significance

But what is the legal significance of the idiomatic test? The test of PC&N has been widely used by legislators as the single criteria for granting licences for utilities, transportation enterprises and other commercial endeavors regulated for various purposes (i.e. cemeteries). The question of whether the test is a question of fact or opinion may not be relevant to the parties to the agency hearing but it does become significant when the availability of an appeal is considered.

In 1957 the Supreme Court of Canada examined the phrase to determine whether it was a question of fact to be decided by the agency or the expression of an opinion based on findings of fact. The Chief Justice of the Supreme Court of Canada found as follows:

"The Court of Appeal was confined to such particular

questions of law or fact...It is not merely a matter of procedure; it goes to the jurisdiction of the Court of Appeal, and that jurisdiction does not include the substitution of that Court's view as to public convenience and necessity for those of the Board..."(9)

In support of the Chief Justice, and in a separate judgment, Mr. Justice Rand said:

"It was argued, and it seems to have been the view of the Court (of Appeal), that the determination of public convenience and necessity was itself a question of fact, but with that I am unable to agree: it is not an objective existence to be ascertained; the determination is the formulation of an opinion of the Board and of the Board only."(10)

On that basis the appeal of a decision of an agency deciding PC&N was limited to errors law or of jurisdiction i.e. findings of fact from which jurisdiction is taken such as the finding that a proposed service is a "commercial air service" and therefore requires a licence.

In 1958 the Supreme Court of Canada again examined the phrase in the context of an application to establish and operate a new cemetery in British Columbia. The regulation of cemeteries required a certificate of PC&N under the Public Utilities Act of that province. The Public Utilities Commission issued the certificate. The Act allowed for appeals on questions of law or jurisdiction and such an appeal was successful. On further appeal the Supreme Court of Canada, through Mr. Justice Abbott, made these remarks:

"The term 'public convenience and necessity' appears to have been brought into the statute law in Canada from the United States and a great many decisions were cited to us indicating the meaning given to the term in that country...

The phrase also appears in The Municipal Franchises Act, R.S.O. 1950, c. 249 (considered by this Court in Union Gas Company of Canada Limited v. Sydenham Gas and Petroleum Company Limited), in the Aeronautics Act, R.S.C. 1952, c. 2, and I have no doubt in other provincial and federal statutes, and it would, I think, be both impracticable and undesirable to attempt a precise definition of general application of what constitutes public convenience and necessity. As has been frequently pointed out in the American decisions, the meaning in a given case should be ascertained by reference to the context and to the objects and purposes of the statute in which it is found.

> As this Court held in the Union Gas case, supra, the question whether public convenience and necessity requires a certain action is not one of fact. It is predominantly the formulation of an opinion. Facts must, of course, be established to justify a decision by the Commission but that decision is one which cannot be made without a substantial exercise of administrative discretion. In delegating this administrative discretion to the Commission the Legislature has delegated to that body the responsibility of deciding, in the public interest, the need and desirability of additional cemetery facilities, and in reaching that decision the degree of need and of desirability is left to the discretion of the Commission."(11)

Thus a determination of PC&N is an opinion based on findings of fact. Clearly where an appeal is limited to questions of law or jurisdiction the Board's opinion is final and beyond reach of the courts. This vacuum of appellate relief has, in some statutes, been filled by provisions allowing for appeal to the Cabinet or to the Minister responsible.

In an early B.C. Motor Carrier Commission case Commissioner Martin Taylor made this observation about the idiomatic test of PC&N:

> "It is a curious aspect of the regulatory system with which we are concerned that the principles on which it is to be operated are neither apparent from the two statutes concerned, the Motor Vehicle Transport Act and the Motor Carrier Act, nor have they been laid down in recorded decisions rendered by the Courts, the Lieutenant-Governor in Council, or our predecessor Commission during the 43 years which have elapsed since motor carrier regulation was introduced in this Province by the Highway Act of 1930."(12)

It is apparent, then, that the idiomatic test which requires the formation of an opinion by an agency narrows the scope for appeal and, correspondingly, broadens discretion. The criteria test, even though permissive, should have the effect of guiding the agency to the main principles perceived by the legislature as significant. The definite trend in regulatory statutes is towards the inclusion of criteria in order for the legislature to provide a message to the agency and, no doubt, to improve the quality of administrative decision-making.

Of further significance in narrowing the scope of appeal is the Canadian government's stated intention to eliminate appeals to the Minister in licensing matters.(13) Hence, a test requiring the expression of an opinion would only be subject to appeal to the courts on

questions of law or jurisdiction of which the opinion expressed is neither.

4.0 Entry Tests

The scope of this paper is limited to examination of entry tests which have been in use or are contemplated in the U.S. and Canadian process of regulatory reform. Those considered will be the traditional 'public convenience and necessity'; the 'fit willing and able' test which is familiar to many but has been more decorative than operative; and the combination of the two, with procedural modification, which is the now popular 'reverse onus'.

4.1 Public Convenience and Necessity

We have alraedy seen that the idiomatic test of PC&N represents the expression of an opinion by the regulatory agency. The mild astonishment already cited as befalling the B.C. Motor Carrier Commission with respect to the absence of definition was echoed by analysts of Air Transport Committee decisions between 1973 and 1978:

> "This task is made difficult by the fact that the ATC (Air Transport Committee) has enunciated few specific fixed principles which govern its actions. Decisions are made on a case-by-case basis, with the circumstances of each case measured against the requirements of various acts and ministerial policies."(14)

Nevertheless, it is fair to say that the test, both in the aviation and motor carrier modes, has balanced stability of existing operations with the demand for the proposed service.

In particular, the following factors have been considered within the context of PC&N in Canadian motor carrier regulation:

(a) residency of the applicant carrier;
(b) existence of competitive pricing;
(c) uniqueness of service;
(d) fuel conservation;
(e) employee considerations;
(f) effect on other modes;
(g) shipper needs;
(h) quality of proposed service;
(i) degree of competition desirable;
(j) financial strength and experience of applicant.(15)

It is difficult to say, given the varying quality of reasons provided by the various provincial boards, what the general rule is for the application of PC&N. It is

clearly open to the regulators to fix on any one or more of such factors, deem it/them to be of over-riding importance in the circumstances of the particular case and fulfill their statutory duty to form an opinion beyond reach of appeal. In other words flexibility based in wide discretion can make predictability difficult. This is particularly evident in the few years prior to the MCA/1980 when the I.C.C. embarked on a deregulatory course based on their re-interpretation of the PC&N test.

4.2 Fit, Willing and Able

In perpetuation of the human inclination for triads the market entry test of 'fit, willing and able' has emerged in the United States as the threshold for motor carrier entry. Ignoring the possible cardio-vascular connotations of this phrase it would appear to have evoked some regulatory interpretation in the United States of a fairly specific nature. It has not, however, proved to be fertile ground for protestants who have a vested interest in the maintenance of the status quo and who would seek to have new entry, or extensions to existing authorities, denied on the grounds that the applicant is unfit, unwilling or unable to provide service.

Prior to the MCA/1980 the entry test for interstate motor carriers was that of PC&N. In 1980 a reverse onus test was adopted whereby applicants must establish a threshold case of fitness and public need.

In Canada the fit, willing and able test has had some presence in regulatory statutes but no judicial consideration (supra, Part 3.2). In the Aeronautics Act, S.16(5), a fraction of the fit, willing and able test appears in the requirement that the operator of a commercial air service have a certificate from the Minister of Transport certifying that the holder is adequately equipped and able to conduct a sale operation as an air carrier. Under the aviation reform section of Freedom to Move the intention is to replace PC&N with fit, willing and able to be implemented as follows:

> "Fitness will be measured by standards not of financial or economic viability, but of technical competence and safety. The primary prerequisite for licensing will be the possession of valid Department of Transport operating certificates, attesting that the carrier is adequately equipped and able to conduct a safe operation. In addition, airlines will be required to carry liability insurance, the amount of which will be specified in regulations."(16)

At present the material required in support of an application is specified by the C.T.C. and includes extensive requirements for financial information and

operational detail. Under Freedom to Move the continuing need to file financial information in the aviation sector will be abandoned in spite of arguments pointing to financial strength as a prerequisite to safe operations and regulatory compliance. Existing carriers will argue for its retention in order to erect a barrier to those who may seek to exploit peak demand in lucrative markets.

The test of fit, willing and able allows the regulatory agency latitude in requiring financial information. For example, again in the aviation sector, the U.S. Dept. of Transport interprets fit, willing and able as requiring the identification and credentials of key personnel, including their regulatory compliance record, a pro forma income statement and a description of the fleet and the applicants equity therein.

In contrast to the U.S. D.O.T. interpretation of fit, willing and able in the aviation sector is the I.C.C.'s interpretation in interstate motor carrier regulation. Since the early days fit, willing and able has been present in the enabling statute but largely subsumed in the PC&N test. In its Final Rule published on Dec. 31, 1980, the I.C.C. succinctly summarized the fitness jurisprudence that had developed prior to the MCA/1980:

> "To determine fitness we have historically considered the financial fitness of an applicant, applicants willingness to adhere to Commission regulations, and the carriers ability to perform service in a safe manner for the protection of the public."(17)

Surrounding these three branches of the fitness test as applied in the motor carrier context there has historically grown a certain amount of jurisprudence.

4.2.1 (a) Fitness

The word 'fit' or 'fitness' is often used as shorthand for the 'fit, willing and able' test and appears to have no specific meaning. A firm can be financially fit or able or both; a firm may have a poor safety record and be unfit to operate a service, unable to operate a proper service or unwilling to operate safely. Thus 'fit'seems to encompass questions of both willingness (compliance) and ability (financial).

4.2.2 (b) Willingness

While it may be obvious that a carrier is either willing to provide service or not, there are several aspects of this concept which rate recognition. The first is the applicants actual willingness to operate. If the carrier, and in particular one trying to show PC&N, satisfies the test then he must operate. Should he show

no immediate plans to do so but merely the desire to accumulate authority he may be refused. The desire to collect licences will diminish with ease of entry and the devaluation of licence authority.

The most significant aspect of willingness is that of compliance with the statute and regulations. The chronic laxity of enforcement in the motor carrier industry has given rise to numerous instances of the denial of authority both in Canada and the U.S. on the grounds of a previous record of non-compliance or illegal operation. In the U.S. the jurisprudence has been unequivocal:

> "It is well settled that the determination as to whether this burden has been met must be made upon a full consideration of the nature and extent of the past violations shown; the mitigating circumstances, if any, shown to exist and to have existed; whether applicants conduct represents a flagrant and persistent disregard of the provisions of the act and of the carriers certificates or permits; whether the applicant has made a sincere effort to correct its past mistakes, and whether the applicant is willing and able to comport in the future with the statute and the applicable rules and regulations of the Commission."(18)

The issue of compliance and previous illegal operations arose recently in Ontario when the Ontario Highway Transport Board denied an application for an international operating authority because of alleged violations of the provincial motor carrier statute. An appeal to Cabinet was successful with a direction to the Board that an applicant should not be denied a licence if he "demonstrates a genuine and conscientious effort to comply."(19)

Quite naturally the willingness of a carrier to comply is accentuated in cases involving passenger services. The I.C.C. stated in 1980:

> "While it is axiomatic that a finding of fitness is a prerequisite to a grant of motor carrier authority, such requirement is designed to offer some assurance that operations will be conducted in a lawful manner and protects the public from any carrier whose prior conduct demonstrates an unwillingness to operate under regulatory requirements."(20)

The fit, willing and able test provides the discretionary latitude to forgive past regulatory indiscretions and, indeed, the I.C.C. appears willing to do just that in its all out effort to lower the barriers of entry.

4.2.3 (c) Financial Ability

Prior to 1980 the significance of a carrier's financial strength appeared to be related by the regulator to the ability of the carrier to render an adequate and efficient service. Presumably the absence of a sound financial basis would threaten the longevity of the proposed service and, particularly in the absence of willing entrants, could threaten the viability of shippers relying on the service. Small carriers starting out have been recognized as likely to be financially thin and many operate with leased equipment.

The I.C.C. has been liberal in its application of criteria for financial fitness to the extent that it has recognized that revenue from the proposed operation will be available to the carrier to alleviate any financial pressure which may arise from low initial capitalization.

Since 1980, however, the I.C.C. has dropped the requirement for financial information as part of the carriers threshold case because they do not see it as having any useful purpose. In expressing concern that the requirement for satisfactory financial information could create too high a threshold for smaller carriers the I.C.C. justifies discarding the requirement by leaving the rewards of financial success and the consequences of failure to the marketplace. Market failures, given ease of entry, will be quickly replaced.

Furthermore the I.C.C. saw a test of financial fitness as unreliable in that failure arose among the fit despite positive findings in that regard. But it did not completely abandon its interest in these matters. The I.C.C. recognized an obligation to examine any customer abuses arising from financial activity of the carrier.

4.4 Whither Fitness?

In the Canadian motor carrier sector it is not yet clear what direction federal-provincial efforts will point with respect to financial fitness. Ontario seems committed to its retention while there will likely be those provinces who prefer the U.S. approach. In the absence of agreement the federal government may go further than the provinces in following the American lead. This appears clear in the aviation mode where fitness under Freedom to Move will not include considerations of financial and economic viability but only technical competance and safety.

In the U.S. the I.C.C. has been criticized for interpreting the MCA/1980 too liberally and not enforcing adequate fitness standards. The Commission has shown its willingness to give operating authority to carriers whose

safety records are unacceptable to the Bureau of Motor Carrier Safety by styling them as conditional authorities. Whether this results in legislative intervention remains to be seen.

4.4 Reverse Onus

As previously mentioned some regulatory statutes combine PC&N with fit, willing and able. In those cases elimination of PC&N collapses the entry barrier to only one element of the several which already existed. Due to the preoccupation of regulatory agencies with PC&N the separate identity of fit, willing and able as an entry criteria was often lost. Reverse onus is shorthand for what is really a hybrid of the fitness and PC&N with procedural modification designed to ease entry.

The reverse onus test currently employed in U.S. motor carrier regulation requires the applicant to prove fitness and that the proposed service will serve a useful public purpose, responsive to a public demand or need. The onus to do this is on the applicant. This done, the I.C.C. must issue an authorizing certificate unless it finds, based on evidence presented by the objectors, that the transportation to be authorized is inconsistent with PC&N. The onus, then, has been reversed so that the objectors must disprove PC&N.

On the face of it this test preserves the public interest content on both sides of the test however the application of it by the I.C.C. has shown that proof of fitness virtually creates a presumption of responsiveness to a public demand or need. As expected the reverse onus structure has caused a significant decline in the number of opposed applications and an equally significant increase in the issuance of operating certificates.

The U.S. test retains the idiomatic content and continues the investment of wide discretion in the I.C.C. For its part the I.C.C. has markedly changed the kind of evidence it will consider and accept in dealing with the public interest factors as it re-aligns itself under new U.S. transportation policy. Given such wide discretion, the need for the development of jurisprudence on a case-by-case basis continues.(21)

In Canada, in 1985, a form of reverse onus test was outlined by the Council of Ministers Responsible for Transportation and Highway Safety. This form of test required the agency to decide whether evidence presented on any of a number of specified criteria established reasonable grounds to believe that granting the application would be potentially detrimental to users, public, social and economic development or interprovincial and international commerce. If a positive finding is made

a public hearing would be ordered presumably to determine whether the potential detriment was real.

One prominent member of the Canadian Transportation Lawyers Association commented on this test as follows:

> "This procedure, in our opinion, is actually more complicated then the existing procedure... The burden of proof is shifted to those opposing an application and, therefore, there is an implicit presumption that the granting of an application would be beneficial... An opposing carrier would have to present evidence on the factors listed... to rebut this presumption. At this stage it appears that such evidence will have to come from expert witnesses, particularly economists, as well as industry carrier witnesses. This will tend to increase the costs and length of hearings."(22)

It appears that the reverse onus structure does not reduce the need for statutory interpretation or offer procedural simplification. What it does achieve is a reduction in the number of contested cases by shifting some of the cost and obligation in entry challenges to the objectors.

5.0 Conclusion

The styles of composition of entry tests generally fall into either the 'idiomatic' or the 'criteria' category. Sometimes, out of what is likely an abundance of caution on the part of legislators, the two are mixed. The former delegates wide discretion to the regulatory agency and, while dimensions of this discretion have been explored by the I.C.C., the same breadth of discretion available to Canadian agencies has not been used liberally.

The introduction of a fit, willing and able test will narrow considerably the kinds of factors which the agency is likely to consider. However, any apprehension about the potential abuse of discretion by the regulatory agency can be put to rest. On this, Freedom to Move has the last word:

> "In the context of legislation and government policy, the Regulatory Agency will continue to make decisions based on the circumstances of specific cases."(23)

> "The government proposes to assume responsibility for policy, and to provide clear direction. Therefore, the Minister will be empowered to issue policy directions to the Agency on matters falling within its jurisdiction. This provisions is a means to ensure that regulatory action is compatible with government policy. Policy directions, when approved by the

Governor-in-Council, will be tabled in the house and be binding on the Agency."(24)

References

1. Nix, F.P., Clayton, A.M., "Motor Carrier Regulation: Institutions and Practices", Working Paper No. E/I 1, Economic Council of Canada (August, 1980), Chapter 2.

2. Government of Canada, Freedom to Move: a framework for transportation reform, July, 1985, pp. 14-15.

3. Freedom to Move, p. 14.

4. Freedom to Move, p. 1.

5. Nix and Clayton, supra Note 1, p. 36.

6. Messrs. Green Spencer, "An Analysis of Motor Carrier Regulatory Changes: Developments and Prospects", January 10, 1986. See also Freedom to Move, p. 26.

7. Province of Ontario, Public Commercial Vehicles Act Review Committee, Final Report, 1983, Responsible Trucking, pp. 17-18.

8. Interstate Commerce Commission, Ex Parte No. 55 (Sub-No. 43) Final Rule, 45 F.R. 86771, p. 86776.

9. Union Gas Company of Canada Limited v. Sydenham Gas and Petroleum Company Limited, [1957] S.C.R. 185 at pp. 188-189.

10. Ibid, p. 190.

11. Memorial Gardens Association (Canada) Limited v. Colwood Cemetery Company et al., [1958] S.C.R. 353 at p. 357.

12. Province of British Columbia, Motor Carrier Commission, P. Dickson Trucking Ltd., p. 20.

13. Freedom to Move, p. 58.

14. Gibberd, J.D., Hariton, G., Wesley, P., An Analysis of Air Transport Committee Decisions 1973 - 1978, October, 1979, Canadian Transport Commission, Economic and Social Directorate Research Branch.

15. Nix and Clayton, Chapter 6.

16. Freedom to Move, p. 26.

17. Final Rule, supra Note 8, p. 86782.

18. Ross Neely Express Inc., 131 M.C.C. 878 (1979) pp. 883-4.

19. Isenberg, M., "Public Necessity and Convenience Revisited", Canadian Transportation and Distribution Management, Vol. 87, No. 10, October, 1984, p. 67.

20. Latin Express Service, Inc., 132 M.C.C. 294 at p. 297.

21. Pre-Fab Transit Company, 132 M.C.C. 409 at p. 414, decided January 9, 1981.

22. Green Spencer, supra Note 6, p. 19.

23. Freedom to Move, p. 53.

24. Ibid, p. 52.

FINAL OFFER ARBITRATION: HARD-HITTING ADVICE TO CANADIAN TRANSPORTANTS

Richard Lande
Donald T. Weckstein

For so many years, transportation researchers have carried with them the uneasy feeling that their families do not really understand what their jobs entail. We mutter phrases like "cross-subsidy" and "market contestability" to the inquiring eyes of our children, all the while knowing that the roles of policemen, rock stars and bus drivers are much more comprehensible. The days of local anonymity are over. The tonic which will put glamour into our profession has been found. It is deregulation.

People's Express and Laker's Airbus started making transportation exciting to the public and the stigma of unexplained careers began to disappear as the prospect of cheap airfares aroused everyone's interest. But the inclusion of final-offer arbitration as one of the elements to be contained in the new Canadian transportation law may well advance us yet another notch into the same league as professional baseball, where this institution has existed for some time.

What do we know about the arbitration process which is being envisaged by Minister Mazankowski's policy advisors?

1) Confidential contracts will not be subject to arbitration.

2) There will be approximately 8 criteria from which the arbitrators are to base their decisions.

3) The disincentives for a shipper to go to arbitration would be the obligation of shipping his product at the railway's proposed rate for a year and the knowledge that he could have had a lower rate had he accepted the railway's confidential contract offer during negotiations.

4) Arbitration will take no longer than 90 days, and permit no appeal.

However, there are some very important questions about this arbitration format which must be discussed.

1) Since 1/3 of the Canadian railway freight revenues derive from U.S. traffic, how are American shippers to make use of arbitration without being compelled to break international through rates into proportionals at the border?

2) Doesn't the exclusion of confidential contracts from arbitration limit its potential to domestic rate disputes? In other words, won't the eventual publication of the arbitrator's final decision drive international shippers away?

3) What is the role of precedent, either from previously published rates or from other arbitration decisions, to play in the arbitrator's decision? How is inconsistency to be avoided?

4) What would happen if the shipper's final offer was for a different volume or number of routes than the railway's offer? Is the arbitrator supposed to determine his own jurisdiction?

5) Since no evidence other than that exchanged during railway-shipper negotiations will be acceptable before the arbitrator, will the results not be to formalize negotiations in consequence, and advantage those who bring rail-cost consultants' reports, other arbitration decisions, etc. into the negotiation process at its inception?

6) How will the shipper choose between an arbitration proceeding and an expedited section 23 NTA appeal?

7) Will the concept of "market dominance" which has been developed in the U.S. (Ex Parte 320 sub. 3) to include product and geographic competition, replace the Canadian terminology for "captive shipper"?

8) What will be the penalty in the event the arbitration exceeds its duration of 90 days? (The ICC has taken an average of 18 months to reach a decision on market dominance, whereas the statutory delay is 90 days).

This article will investigate the final arbitration process as it is used in U.S. professional baseball currently with a view towards uncovering any structural weaknesses which have arisen there.

FINAL OFFER ARBITRATION

The concept of final offer arbitration is generally accredited to Prof. Carl Stevens who in 1966 proposed this form of compulsory "interest" arbitration as operating as a strike substitute, compatible with collective bargaining.[1]

The distinction between an "interest" dispute and a "rights" dispute was explained by Dr. A.W.R. Carruthers, past president, Institute for Research on Public Policy:

> "A rights dispute conventionally describes a case in which a party claims he has a legal right which another party has infringed. The term is used in contrast to the term interest dispute, in which each party is seeking to convert a mere interest into a legal right which can then claim the protection of the system. Grievances are archtypical rights disputes. Disputes over the negotiation of a collective agreement, and which conventionally lead to the right to strike, are archtypical interest disputes. They are both, generically, labor disputes; yet they are different as chalk and cheese."[2]

Final-offer arbitration is therefore a form of compulsory interest arbitration when the parties must resort to formal impasse procedures. Two studies of the Canadian Public Service Staff Relation Act (PSSRA) were done covering the eight rounds of settlements by Treasury Board units of 500 or more employees for which the arbitration mode was selected, from the inception of the Statute in 1968 through 1979.[3]

In the 1968 round, 82.9% of the settlements were achieved without resort to formal impasse procedures. However in subsequent rounds, voluntary settlements were reached only in 74.5%, 56.4% and 46.2% of the negotiations, respectively. The cases which required settlement by arbitration, steadily increased. Thus, bargaining seemed to have become ancillary to arbitration.

In the next four rounds, the cases requiring settlements by arbitration were 32%, 60%, 45% and 60%

respectively. Thus, the general trend toward greater reliance on arbitration points to the conclusion that compulsory interest arbitration may well give rise to a "chilling effect" to the free collective bargaining process.

With few exceptions, interest arbitration has not been widely employed in the private sector. One major exception has been the use of "final-offer" arbitration to determine individual salaries of major league baseball players.

Unlike collective bargaining in most other industries, the Major League Baseball Players Association and the Players Relations Committee of the Major League Baseball Club Owners negotiate a minimum salary rather than actual salaries to be paid to the player-employees. Each player is then free to attempt to negotiate his season's salary with the club employing him. For the first time, in the 1973 master agreement, interest arbitration was made available for determination of the salaries of eligible players (employed more than two years) who could not reach agreement with their clubs.[5]

As one of the originally selected baseball arbitrators, Tom Roberts, has stated:

> "Major league baseball salary arbitration is different.... No other form of arbitration compares to baseball salary arbitration in substance, format, and the criteria imposed upon the neutral."[6]

The process works as follows: The eligible player or, in certain circumstances, the club may file for arbitration if agreement is not reached on the player's salary for the next season. All arbitrations are scheduled prior to the February opening of Spring training. Arbitrators are chosen from a previously agreed upon panel and sit as a sole neutral. The arbitrator must choose either the club's or the player's submitted offer and fills that in on two copies of previously executed contracts complete in every detail except for the salary. The Arbitrator may not choose a third or in between figure, and there is no further bargaining between the parties after the arbitrator's award has been made. The parties are encouraged to continue bargaining up to the time of the arbitration, however, and frequently do settle during the period between filing for arbitration and the hearing.

The figure submitted to the arbitrator need not be the same as the last offer which that party made to the other party in bargaining. Indeed, the arbitrator is not permitted to be told the amount of such last offers. In 1980, Chicago Cubs' pitcher Bruce Sutter, according to information published in the Los Angeles Times.[7] had sought $400,000 from the Club while their last offer was $350,000. Apparently thinking he had little to lose (only a mere $50,000 that they were apart in bargaining), Sutter submitted a bid for $700,000 to the arbitrator. The arbitrator selected Sutter's figure rather than that of the Club: Sutter got a windfall; Baseball salary arbitration almost came to an end.

The actual decision is made by the arbitrator subjectively determining a figure he thinks appropriate based on the submitted evidence and then choosing the bid of the player or club which comes closer to his figure. Thus, in 1981. Ted St. Antoine thought that Ed Farmer of the Chicago White Sox was worth $400.000 for the season. The Club submitted an offer of $300.000 and Farmer a bid for $495.000, which being $5000 closer to the arbitrator's estimate. was awarded. When Farmer had a poor 1981 season. St. Antoine had to acknowledge his disappointment and noted that maybe Farmer was getting compensated for a superlative 1980 season.[8]

Having awards come back to publically haunt the arbitrator is one of the unique aspects of baseball salary arbitration. After one pitcher won a king's ransom from Arbitrator Roberts and performed miserably in his first Spring training appearance, a Los Angeles newspaper sports page headline asked:

> "What do you suppose Tom Roberts is thinking now?"

Baseball salary arbitration is also different regarding the criteria which the arbitrator may, and may not, consider. The Arbitrator considers the player's contributions to the club during the prior season including his overall performance, special qualities of leadership and public appeal: the length and consistency of his career contributions, his prior compensation record, any physical or mental defects, the recent performance of the club including its league standing and attendance, and comparative baseball salaries. In this last regard the arbitrator receives, in strict confidence, a tabulation of every major league player's salary for the past season, broken down by years of major league service. The arbitrator is also supplied with performance averages

for every major league player, and the parties spend a good deal of time explaining - or attempting to explain away - the importance of batting, fielding, and earned-run averages, as well as won-loss percentages, number of extra-base hits, slugging percentages, etc. For arbitrators who would rather play with statistics than words in collective bargaining contracts, baseball salary arbitration presents ideal working conditions.

Matters which the arbitrator may not consider include the financial position of the club or player; offers made by either party prior to the arbitration; the parties' cost of presentation including attorney and representatives' fees; salaries paid in other sports or occupations; and testimonials, press comments or similar materials except recognized annual player awards for playing excellence. This last prohibited category has given rise to difficult line drawing, and contentiousness over innovative evidence of performance including video-tapes not previously screened or approved by the other party.

Each party is given an hour for initial presentation and a half-hour for rebuttal and summation, although the arbitrator may extend the time for good cause such as lengthy cross-examination of witnesses. Party representation typically includes attorneys and/or agents for the player, the club, the Players Association, the Leagues Player Relations Committee, and statisticians for both sides.

The arbitrator may render a bench decision but is to make every effort to issue an award within twenty-four hours, which in practice is usually done by telephone with the filled in contract thereafter mailed to the league president. There is no written opinion or stated rationale.

How has the system worked? It has accomplished one of the principal purposes of "final-offer arbitration". Serious bargaining is engaged in by the parties in attempts to avoid having the arbitrator determine the salary issue. In the first year of available arbitration, 1974, only 10.8% of the 500 players eligible for arbitration filed for it, and almost half of those cases were settled before award. In 1975, only 3.2% of the eligible players had their salaries settled by an arbitration award. The procedure was not available in 1976 and 1977, and in 1978 and 1979, 9.3% and 12.7% respectively, of eligible players carried through the process to award.

In 1983. 88 cases were filed, and of those, 58 of 66% were settled prior to award.

In the first three years of usage, the clubs prevailed more often, 61% to 38% of the 54 arbitrations, perhaps, according to Arbitrator Peter Seitz, because the clubs were better prepared and made more impressive presentations than most of the players.[9] More recently, however, both sides presentations have become more professional and the players' arbitration-batting averages have improved. In 1979, they won 57% of the 14 arbitrations, and while winning only 13 awards versus the clubs' 17 in 1983, the players' victories included a modest raise for 20 year old Fernando Valenzuela from $350,000 to one million bucks! (The club had reportedly offered $750,000). Overall, from 1974 through 1983, players have won 45.5% of the 167 arbitration awards as against the clubs' 55%. Thus, the process does not seem to have unduly favored either side.

Despite these statistics, management representative more often express dissatisfaction with salary arbitration. Baltimore Orioles General Manager Hank Peters was quoted by USA Today (May 18, 1983, p. C-1) as saying that "there seems to be no rhyme[10] or reason to the awards, and they become precedent-setting awards which affect every club in baseball. People with no real understanding of the game are making decisions that affect it profoundly." Yet, it may be recalled that the parties themselves prohibit the arbitrator from writing an opinion and giving a reason, let alone, attempting a rhyme, to support the award. And the selection of the arbitrators on the panel is made by the parties, who apparently prever persons with national stature as arbitrators and a reputation for neutrality while opinions differ among the parties as to the importance of knowledge of baseball.[11] Concern has also been expressed by representatives of the clubs with less limited means that some very high salary awards would impose unfair financial hardships. But again, the parties have stipulated that the arbitrator may not consider the financial position of either the club or the player.

While the availability of salary arbitration probably has increased the bargaining power of the players, not all management representatives are unhappy with the system. Arthur Rutkowsky interviewed Attorney Jim Garner of the Cleveland, Ohio firm that represented the National League. Garner felt that the arbitration process had been useful in encouraging the parties to evaluate their figures to make sure

reasonable bids were given to the arbitrator and that this process has encouraged more realistic bargaining.

Not surprisingly, arbitrators such as Roberts and Seitz, who have experience with the process, find it working satisfactorily. In conclusion, baseball salary arbitration, appears to have made more hits than errors, and most of the latter can be avoided in the future by collective bargaining of the parties to revise and improve the system rather than to scrap it.

[1] (Stevens, Is Compulsory Arbitration Compatible with Bargaining 5 Ind. Rel. 38 (1966).)

[2] (Feuille and Long, Final Offer Arbitration: Sudden Death in Eugene 27 Ind. & Lab. Rel. Rev. 186 (1974).

[3] Carruthers, A.W.R., The Cuckoo's Egg in the Mare's Nest - Arbitration of Interest Disputes in Public - Service collective Bargaining: Problems of Principle, Policy and Process, Proceedings of the National Academy of Arbitrator, 1977, page 15.

[4] Rutkowski, Arthur, D. - report to A.B.C. section of Labour & Employment Law 1985 Committee on Arbitration Law of Collective Bargaining.

[5] Ibid

[6] (T. Roberts, Arbitrating in Baseball, Proceedings of the National Academy of Arbitrators 173 (BNA, 1983).

[7] Feb. 16, 1980, p. C-3, Col. 1.

[8] Sports Illustrated. v. 56, No. 4, p. 46, Feb. 1, 1982.

[9] 29 Arbitration J. 98 (1974).

[10] May 18, 1983, p. C-1.

[11] T. Roberts, supra, at 176.

Richard Lande is a transportation lawyer who teaches at Concordia University in Montreal.

Don Weckstein is an arbitrator and former team of San Diego Law School.

ALLOCATING SCARCE RUNWAY CAPACITY VIA SLOT AUCTIONS

J.R.G. Brander/B.A. Cook/J.E. Rowcroft
Dept. of Economics, University of New Brunswick

Considerable congestion has arisen as a consequence of the deregulation of the U.S. air transportation system. While there are few airports which are congested all of the time, numerous airports suffer congestion at peak periods of the day. Similar problems will arise in Canada should airline deregulation proceed as Mr. Mazankowski's **Freedom to Move** paper (1) suggests that it might. As many as six of the major Canadian airports may well be affected.

Peak load or congestion pricing is the most viable economic solution to the excess demand problem. Its adoption would reduce the demand for congested airport facilities, increase the efficiency of the airports system, and in addition, increase the revenue earned by the airport system and hence the proportion of total economic costs recovered from users. An earlier paper (2) argued that the most practicable means of implementing such a pricing system is periodic auction of airport capacity through sealed tender bids. This paper focuses on that auction process as applied to one congestion problem: runway capacity (that is, landing slots). Other congestion problems exist. These include terminal gate and holding room capacity; other internal airport space (such as airline counters); and airport roadway and parking facilities. While all three appear to be amenable to the present analytical framework, they are not addressed here.

The paper begins by discussing the applicability of the common property model to the industry, and describing the common property outcome. The next section of the paper provides the rationale for the adoption of the auction approach as an alternative to the more conventional peak pricing methodology. It is also discusses the factors which the firm will consider in determining its bid price for a particular slot. The auction process is then discussed. A final section draws conclusions from the analysis.

Background to the Problem:

In those cases where the bulk of the relevant

infrastructure is provided by the public sector, there are many parallels between deregulated transportion systems and common property systems. A common property system is characterized by unrestricted (open) access to all who care to use it. This results in some form of adverse interaction among system users which generates "external" costs such as congestion, or in the case of natural resource systems, depletion. In considering a deregulated transportation system in this context, access would be open to any firm wishing to participate (since firms would no longer have to prove public convenience and necessity). The passenger pool is the common property which firms seek to exploit. Service scheduling, that is head-to-head scheduling, tends to develop as each airline attempts to maximize its passenger load factors, and hence its revenues and profits. This competitive tool leads to an excessive number of flights on the more profitable links in the system, and as a consequence, leads to over-exploitation of the available passenger stock. The resultant congestion is a direct consequence of the scheduling of more flights than are necessary for the available passenger pool.

Airlines can easily reallocate their productive capacity (that is their fleet) among routes, and will shift capacity in response to differing profit opportunities at the time of schedule changes. There is a rising opportunity cost of such fleet reallocation for each airline considered in isolation. This is the case because of the sequence in which capacity will be reallocated. The least profitable route will be given up first, then the second and so forth. Each reallocation, then, results in a greater loss to the airline, or, turned the other way around, results in a smaller net gain.

The model can be briefly described as follows (3). The existence of economic rents (perhaps the Marshallian term "quasi-rents" is preferable) in a market will lead to additional flights as long as access is open and landing slots are available. Given a constraint on passenger availability, these additional flights result in an increase in revenue passengers which is less than proportional, implying falling productivity for the carriers (measured in terms of revenue passengers per flight). Thus, for a given market demand for flights, the value of both the average and marginal flight yield curves are negatively sloped for the industry. On the cost side, it is assumed that each carrier has a rising marginal cost per flight. This marginal cost includes a fixed landing fee imposed by the airport plus the opportunity cost to the carrier of using its equipment on this

particular link plus the direct operating costs of the flight. Operating costs may be constant or rising depending upon the efficiency of the operators. These effects result in a positively sloped marginal cost function for the industry. Due to the open access nature of the industry, carriers on the link then equate the value of the average flight yield to marginal cost. This is rent-dissipating rather than rent-maximizing behavior. Rents are dissipated because individual carriers do not consider the effect that their flight will have on the productivity of the flights of other carriers in the industry. There will be more flights than are economically efficient, and congestion will result. On the other hand, rent-maximizing behavior in the industry would see carriers add additional flights on the link only as long as the value of the marginal flight yield exceeded the marginal cost. This maximizing behavior occurs when the link is characterized by exclusive rights rather than free access. These effects are demonstrated in Figure 1.

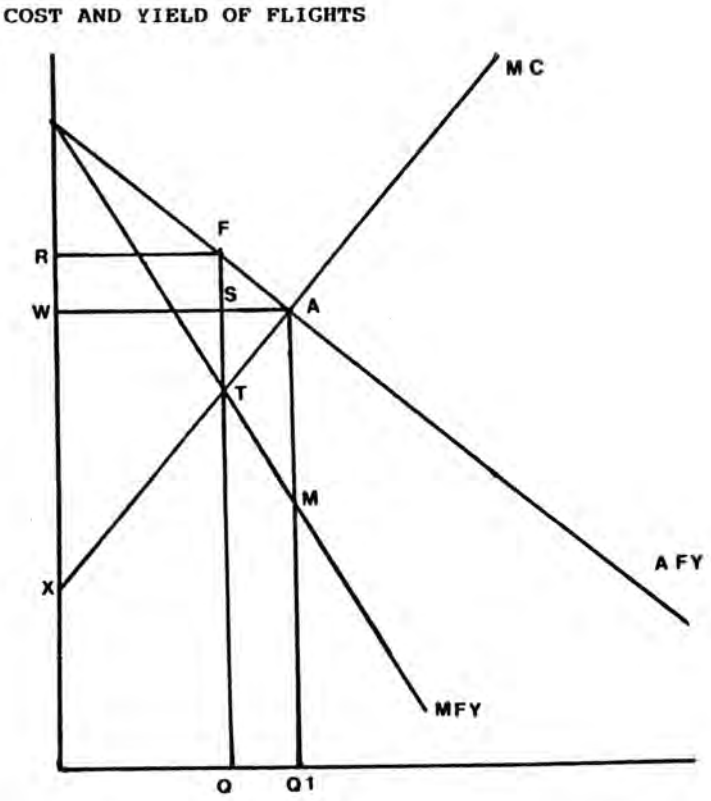
The downward sloping value of marginal flight yield and value of average flight yield curves at the industry level are labelled MFY and AFY respectively. MC refers to the marginal cost of flights in the industry. The optimal number of flights is OQ* where marginal cost is equated with the value of the marginal flight yield. Intramarginal rents of XTSW and resource rents of RFSW accrue to the industry. The resource rent is attributable to the existence of an exploitable passenger stock while the intramarginal rent is due to operator efficiency. Under open access, the equilibrium number of flights will be OQ1 and rents of MTA will be lost on flights between Q* and Q1 because MC is greater than MFY. While additional intramarginal rents of STA will accrue in moving from Q* to Q1, all resource rent is effectively removed. This represents inefficient exploitation of the passenger resource.

Where there is a constraint on the availability of landing slots at less than Q1, the common property outcome is unattainable. However, some economic rents remain, and lead the airlines to demand airport expansion so they may be exploited. If capacity is expanded, the common property outcome follows. What is required is some policy action to remove this excess demand for landing slots.

Solutions to the difficulty are to be found on both the supply side and the demand side. On the supply side, it is, of course, possible to expand the airport system, thereby reducing the short-run excess demand

FIGURE 1

OPEN ACCESS AND OPTIMAL EQUILIBRIA



for runway slots to zero. Through time, however, the problem of congestion will reappear as market size increases. Furthermore, given that this approach reduces resource rents to zero, it is an inferior solution from the perspective of society. The demand side alternative is to employ the price mechanism to control use of the congested facility at peak periods. It appears that the easiest method of accomplishing this is to employ an auction mechanism in which an individual slot is allocated for a predetermined period of time to the highest bidder. Both the auction mechanism and the periodicity of the slot auctions need to be explored.

The Essence of the Argument

The public provision of airports permits the airlines to earn economic rents or profits by exploiting the available passenger stock. In situations where the industry is unregulated, the common property outcome leads the participants to attempt to overexploit both the available passenger stock and to demand increases in airport capacity, at least at the largest hubs. These congestion effects generate social costs which the participants are able to externalize in the absence of market clearing prices. In the real world, the problem is more complicated than this.

The introduction of congestion pricing into the airlines system would result in a two part price for the use of airport landing slots. Following Borins (4) and others, the first part of the price is designed to pay the full economic costs of the infrastructure in accordance with the principles established in the National Transportation Act (1967). To this would be added the second part, a congestion toll of sufficient magnitude to remove the excess demand for landing slots. Each must be discussed in turn.

Given the policy objective of full cost recovery, the revenues earned by the airport network must be equal to the full economic cost, (of providing them) including the opportunity cost of capital. This can be considered as the base price, one which must be paid regardless of the time at which a landing slot is employed. In establishing it, a life cycle approach should be employed, that is, the focus should be on the recovery of cost over the life of the facility as opposed to cost recovery in a specific year. The justification for this position is that airport investments are lumpy, and this lumpiness creates excess capacity early in the life cycle as demand for the use of the capacity catches up. Insisting on full

cost recovery every year would result in a user fee which was initially pegged too high (because of the excess capacity) and which decreased over time (thereby exacerbating the developing congestion problems) (5). Were it not for the problems of congestion and traffic peaks, the job would be finished, for all slots would be of equal value to their users, and a uniform price would be all that is required. The fact that there are varying levels of traffic over the course of the day means that landing slots do not have uniform value to their users, but vary in value with the traffic volumes. Landing slots at busier airports are more desirable than at other airports. Landing slots at some times of day are preferred to those at other times of the day. A congestion problem emerges as a consequence of behavior which is both time and location specific. To ration the available capacity, some price action is required.

The preferences for particular slots are, of course, related to profitability. It is possible to distinguish two broad market segments facing the industry on any given link. There is a recreational market which is price sensitive, though apparently not time-of-departure (or arrival) sensitive. The demand curve for this market segment does not shift over the course of a given day. The business market is the reverse. That is, business travellers are not overly price sensitive, but are sensitive to departure times, wanting to arrive at destinations in the early morning or during the evening. As a consequence, there are at least two separate demand curves for business travel which can be referred to as peak and off-peak. The revenue potential for a flight at peak exceeds the revenue potential for off-peak periods. Given that the airline costs differ only slightly or not at all for flights during the two periods, peak period profit potential will be greater as well. Finally, there is a positive relationship between potential profit on a given flight and the value to the airline of a landing slot at the appropriate time.

Both congestion and the value of specific landing slots are thus time and location specific. Congestion pricing is the most efficient means of dealing with this problem, and can be justified on two grounds. The traffic management argument suggests that the overall utilization of the airport facilities can be improved by reallocating flights from peak to off-peak periods. Furthermore, there is the ability-to-pay argument. Airlines can afford to pay a higher price at peak than off-peak. Variable pricing of landing slots in both time and space is therefore consistent with both the desire to improve the overall efficiency of the airport

system and the objective of making the airport system financially independent of government.

It remains to decide upon the optimal method of setting the congestion tolls. One means of setting the variable landing slot fees would be to have the airport administration estimate the marginal social costs of congestion and to establish a set of prices equal to that amount. While feasible, at least in principle, the task of estimating the set of optimal peak load prices would be a monumental task. This is a consequence of the number of airports in the system, and the large number of runway landing slots at each. For example, if the capacity of a particular airport were 40 landing per hour, and that airport operated 16 hours per day, there would be a potential for 640 different landing slot prices. If there were 10 congested airports in the system, 6,400 prices would have to be estimated and periodically updated. Fortunately, there is an easier way of resolving the problem. As argued elsewhere (2), the most efficient means of getting to the optimal runway slot price quickly is the auction approach. The value of these slots to individual airlines is most easily estimated by the airlines themselves, since they already possess most, if not all, of the requisite information on both the cost and revenue sides. Furthermore, the auction mechanism is the optimal means of allowing the airport authorities to extract the maximium fraction of the economic rents which their facilities generate for the airlines. Finally, the approach permits the price system to perform its rationing function.

While it may seem strange to treat the landing slot as a commodity, such an approach is easily justified. There exists a fixed supply for slots as well as a set of demand functions which vary over the course of the day. Consequently, a market exists and it is possible to speak of a market-clearing price, one which equates the supply of and the demand for slots.

With respect to the procedure to be used, a review of the auction literature suggests that a wide variety of auction schemes could be employed. (6) The first of these is discriminatory bidding, a system in which the highest bidder wins, and makes a payment of the amount of that bid. A second is competitive bidding, a system in which the highest bidder wins, but pays an amount equal to the final bid of the second highest bidder. Both types can be carried out with oral bidding or sealed tender bidding. Auction mechanisms can also be classified as "English" or "Dutch". With the former, the price is bid up until only one bidder remains. The latter is also known as the "flower auction", and

differs in that the price declines from some arbitrarily set starting point until one bidder decides to make a bid. At that point, the auction stops. Various combinations of these characteristics are possible, and the initial task is to decide upon the format to be employed.

Remembering the twin objectives of maximizing the revenues of the airport system and reducing the demand for landing slots, the initial step is to choose between the discriminatory and competitive auction approaches. Both approaches are equally efficient in resolving the congestion problem in that both reduce the number of contenders for a particular landing slot to one. Considered from the other perspective, that of maximizing the revenues of the airport system, the competitive bidding process is inferior in that it will tend to result in lower revenues for the airports. Given the two policy objectives, the discriminatory bidding approach is preferable on this basis alone.

More serious, however, is a second (at least potential) problem. In a competitive auction there is the possibility that some airlines could use their financial power to exploit the slot auction process as an exclusionary competitive tool. In such a situation, an airline could place an artifically high bid for a particular slot, knowing full well that it would never have to pay the price of the bid. It would, under this approach, pay the amount which the second highest bidder had offered. No financial penalty is therefore attached to submitting overly high bids. One is tempted to suggest that one means of dealing with this problem is to establish a rule requiring the successful airline to utilize its slots for some minimum fraction of the time. Such action, however, would preclude those living in the areas adjacent to airports from purchasing slots during early morning/late evening periods with the express intention of preventing airline operations during those periods. Such regulatory interference with the market is unwarranted, and should be rejected out of hand. There seems to be little point in abolishing one air transportation regulatory regime only to begin establishing new rules of conduct for the carriers.

Overall, given the two objectives of government policy relating to this transportation sector, and by implication, the desire to remove as many of the monopolistic elements as possible, the weight of the argument lies on the side of discriminatory bidding. This is the auction approach which will be assumed in the balance of the paper.

The question as to whether the bidding process should be oral (that is, open) via sealed tender must be considered as well. The major argument in favour of open bidding is that the auction participants acquire knowledge and information more quickly than seems to be possible with the closed bidding method. Hence, the advantage of the open bid would be that the long-run equilibrium rent-sharing position would be attained more quickly. Against that is the administrative unwieldiness of open bidding given the number of slots, airports and participants. Were the auction to be a one-shot proposition by which the individual airlines would be granted perpetual property rights, open bidding would be preferable. However, given that the auction would be carried out immediately prior to the seasonal schedule changes (i.e. two or three times per year) the administrative considerations dominate the decision. Thus the auction should be carried out via sealed bidding, and the results of the bidding for each slot should be made readily available to all those wishing to take part in subsequent auctions. The decision in favour of closed bidding also effectively eliminates the "Dutch" auction which is essentially oral in nature.

The mechanics of slot allocation under the auction system may be outlined as follows. Each carrier would (presumably) prepare a draft schedule incorporating those links and time slots which it wishes to fly in the next period. On the basis of such a draft schedule, it prepares and submits its bids for those landing slots which it desires. Following Reece (7), negative bids are not permitted. The airport authorities rank the bids for each slot, awarding the property right to the highest bidder. Successful airlines can then finalize their schedules for the next period. Unsuccessful airlines have the choice of modifying their schedules, or entering a slot aftermarket in an attempt to obtain those slots necessary to permit them to adapt their draft schedule. The slot aftermarket is a mechanism which can be utilized between auctions to permit airlines to buy and sell slots (8). The preparation of bids becomes an integral part of the airline business, and will account for some increase in airline costs. Given its importance, it needs to considered in some detail.

The argument may be presented in a nontechnical fashion as follows. In an airline system, each carrier is a profit maximizer, and each can attach an expected value of profit to each landing slot which it might acquire. It does this on the basis of past experience with the particular market structure which it serves coupled with detailed information about its own cost

structure, route structure, aircraft availability, and profit potential of other links in the system which it might fly. This latter, of course, provides it with information about the opportunity cost to itself of reallocating a flight from one link in its system to another. Different airlines will, of course, attach different values to a given slot. They will do this for two reasons. On the demand side, there exists at least the possibility that different airlines will have different perceptions of the market on that link, particularly in connection with other routes which they wish to serve. On the supply side, cost differences among airlines are possible and this will have an impact upon expected profitability of particular landing slots as well. Using this information, each airline will prepare its bids for those slots for which it wishes to compete.

A landing slot remains unsold (and consequently unused) if no positive bid is entered. Given that the auctions occur at discrete intervals, unbid slots should remain the property of the airport authorities, and could be disposed of by them at (or above) some predetermined upset price (which could, for example, be established as the average price of such slots in the previous auction).

Toward an Auction Mechanism

To illustrate the essence of an auction mechanism a simple model of a single airport is employed. During a peak peroid the expected flight yield is summarised by:

$$AFY = p = a - bQ \qquad (1)$$

where Q is the total number of departures during the period and p the revenue received by a carrier for a single flight, recognising that as Q increases, both fare and loading factor diminish. m carriers operate at least one flight during the period and each carrier has a marginal cost per flight of $f_i + gq_i$. In addition to operating expenses, this cost includes a fixed landing fee imposed by the airport(s) and the opportunity cost to the carrier of using its equipment on this particular link. The cost differences between the carriers are captured by the intercept term f_i and the differing volumes, q_i. While the common slope g is partly a matter of algebraic clarity, it may also be argued that, in the long run, two carriers with the same commitment q_i will face essentially the same alternative opportunities in a deregulated system.

If all carriers maximise their individual expected profits from peak operation, the derived demand for slots is given by:

$$Q = (a - c - f)m \,/\, [b(m + 1) + 2g] \qquad (2)$$

where c is the congestion premium paid to the airport per flight, and f is the average of the f_i for each carrier. Individual demand for slots by each carrier (q_i) will be dependent on the relative cost of the airline's operation on this link:

$$q_i = Q/m + (f - f_i)/(b + 2g) \qquad (3)$$

Thus, carriers with below average costs capture a larger portion of the traffic, as might be expected. The marginal cost of an additional flight on this link is:

$$MC = c + f + 2gQ/m \qquad (4)$$

which is the MC curve of Figure 1 moved upwards by c.

Under an effective capacity constraint on airport slots, n, equation (2) solves immediately for the congestion premium:

$$c = a - f - [b(m+1) + 2g]n/m \qquad (5)$$

and the market share of each carrier follows by substituting n for Q in equation (3). Airline revenue per flight is given p directly by equation (1) as:

$$p = a - bn$$

and each carrier has a total expected economic profit of π_i where:

$$\pi_i = (b + g)q_i^2$$

$$= (b+g)[n/m + (f-f_i)/(b+2g)]^2 \qquad (6)$$

Airport revenue is equal to cn which represents a transfer of profit from the carriers to the airport (9). Since the total number of flights (n) and hence the average flight yield (p) are unchanged by the imposition of the congestion premium, there is no net welfare loss. Apart from the transfer of profit, the effect of the premium is to limit the number of carriers operating within the given period. Thus no airline will operate if its basic marginal cost, f_i,

exceeds f_{max} where:

$$f_{max} = f + (b + 2g)n/m \qquad (7)$$

since this would generate negative economic profit from equation (6). By definition such a carrier would not be covering its opportunity cost and would reallocate its equipment to different routes (10). f_{max} determines the limiting cost for a carrier to enter, or remain in this market. For any operating carrier:

$$f_i < f_{max} = f + (b + 2g)n/m$$

$$\text{i.e.} \quad f - f_i > -(b + 2g)n/m \qquad (8)$$

which implies that the airline operates a positive number of flights and earns positive profit from equation (6). Total airline profit over all carriers is:

$$\frac{(b + g)\ \Sigma(f_i - f)^2}{(b + 2g)^2} + (b + g)\frac{n^2}{m} \qquad (9)$$

Through the auction mechanism the airport appropriates some economic rent, leaving the carriers with a rent from the variance in operating costs and a return to their limited monopoly power as suppliers of air transportation.

In the subsequent off-peak period it may be assumed that the residual unsatisfied peak demand is combined with the recreational demand. Since airport capacity is not fully utilised, no congestion premium will be generated at auction and c = 0. However the number of carriers operating in this period will not be greater than m and will, in general, be less (11).

From the preceding argument it is readily shown that c represents the average of the profits earned by each carrier on its last flight in the peak period. This is also true in the off-peak periods since airlines continue to offer more flights until the marginal economic profit is zero. Thus the auction solution presented here mimics the traditional peak load solution in which all customers pay the marginal operating cost (included in f_i) and peak purchasers pay an additional premium which aggregates to the marginal capital cost (12). In this case the congestion premium represents the marginal valuation of an additional slot.

In a large network of air travel with several destinations being served during each time period, equation (1) must be disaggregated into the demand for flights on different routes. Moreover the traffic pattern at one airport will interact with those at other nodes in the system and the practice of 'hubbing' will also cause recursive relationships within the network. However the auction price of a slot will continue to reflect the full value of the marginal slot to each carrier subject to the optimal scheduling which the airline itself carries out. Thus c can be regarded as the result of a complex adjustment process throughout the travel system capturing the net value of the marginal slot at the location concerned. As such it is directly analogous to a shadow price and provides important and ongoing information on the relative values of additional capacity at each location in the network.

Conclusion:

The common property outcome of a deregulated air transportation system results in the dissipation of all economic rent other than intramarginal rent. (In order to reduce the pressure on airport capacity, some form of congestion pricing is required.) A review of the auction literature leads to the conclusion that an auction of available runway landing slot capacity would be the most efficient means of imposing peak load pricing.

A discriminatory bidding approach was adopted in the paper. Under this bidding system, the individual slot would be awarded to the airline making the highest bid, and a payment of this amount would be made to the airport authorities. This approach reduced the number of flights on a link, and maximizes the revenues earned by the airports. The auction should be carried out immediately prior to the seasonal schedule changes, and conducted via sealed tender bids.

The auction mechanism allows the airports to extract some of the economic rents from the airlines, and also to limit the number of carriers competiting for peak period slots. The amount of rent remaining with the individual airline is a function of its relative efficiency. Having lower costs, the most efficient carrier will continue to earn intramarginal rents. At the other extreme, the marginal carrier will recover only its opportunity cost of capital. The auction mechanism mimics traditional peak load pricing since all users pay an amount equal to the marginal operating costs while the peak load user pays an additional premium.

References

1. Transport Canada Freedom to Move (Ottawa, Transport Canada, 1985).

2. Brander, John R.G. and B.A. Cook, "Airport Congestion: The Search for Efficient Solutions", a paper presented to TRB Annual Meeting, Washington, D.C., January, 1986.

3. (For a detailed discussion of the model see:) Brander, John R.G. and B.A. Cook, "Airline Deregulation and Airport Congestion", TRF Proceedings, 1985.

4. Borins, S.F., "Effects of Non-optimal Pricing and Investment Policies ... ", Transportation Research - B, Vol. 16B, 1982.

5. Brander, John R.G., "Toward a Theory of Rational Road Pricing", (Transportion Research Forum, New Orleans, 1982).

6. Ramsey, J.B., Bidding and Oil Leases, 1980 (especially ch. 4). See also: M. E. Levine, "Landing Fees and the Airport Congestion Problem", Journal of Law and Economics, Vol. 22, 1969 and W. D. Grampp, "An Economic Remedy for Airport Congestion", Business Horizons, 1968.

7. Reece, D.K., "Competitive Bidding for Offshore Petroleum Leases", Bell Journal, Vol. 9, 1978.

8. Koran, D. and Ogur, J.D. Airport Access Problems: Lessons Learned from Slot Allocation by the FAA, (Washington, FTC, 1983).

9. It should be noted that this solution maximises revenue to the airport only if $n < (a-f)m/2[b(m+1)+2g]$. Immediately after an expansion this condition may not be fulfilled and revenue maximisation would result in unused airport capacity. However, subsequent expansion of demand is likely to bring the two solutions into agreement.

10. If carriers assign specific fleets to an airport the derived demand for slots is segmented. Under plausible conditions all but the highest cost carrier will utilise assigned fleet capacity in the short run. In the long run airlines may be expected to readjust their fleet allocations to the optimal levels given by equation (3).

11. With constant airport capacity c will not alter the allocation of flights or of passengers between peak and off-peak periods. The number of peak departures (n) and the AFY in both periods are unchanged. Only the number of carriers is reduced by the exclusion of those which cannot afford to pay the value of the landing slots they would otherwise use.

12. Steiner, P.O., "Peak Loads and Efficient Pricing", Q.J.E., Vol. 54, 1964.

MANAGEMENT AND PLANNING OF AIRPORT GATE CAPACITY: A NEW MICROCOMPUTER BASED GATE ASSIGNMENT SIMULATION MODEL

Dr. Salah G. Hamzawi

Chief, Airport Planning Quantitative Systems,
Airports Authority Group - Transport Canada
Ottawa, Canada

ABSTRACT

A major issue facing airport authorities and airlines today concerns the availability of airport gate capacity. This paper outlines the problem and argues the valuable contribution that could be made by computer modelling techniques in the search for efficient solutions. The role of microcomputer technology as a highly attractive medium for developing such models is also examined. As an example application, the paper presents a description of a microcomputer-based model developed recently by the author as a planning and operational tool for simulating the assignment of gates to aircraft and evaluating the effectiveness of operational options to improve the gate utilization.

This is the first of a series of papers planned to report on a set of microcomputer-based models currently under development which will form an integrated package of tools for use in the planning and operational management of airport landside capacity. The other models simulate the assignment of apron Passenger Transfer Vehicles (PTVs), the flow of traffic in air terminal arrival areas (including assignment of baggage claim devices), the flow of traffic in terminal departure areas, the peaking (seasonal, daily, hourly, etc.) of passenger and aircraft traffic, and the measurement of overall airport capacity utilization.

THE AIRPORT GATE CAPACITY PROBLEM

A common source of aircraft delay occurs at the terminal gates due to lack of gate facilities or inefficiencies in gate utilization. Until recently, the option of "building more gates" has been the common solution. In the past, when regulation of the air industry provided a relatively "stable environment" for planning facility expansions, options of this type posed little problems as the airlines' financial and market stabilities were taken for granted. Gate expansion was perceived as an important part of the carriers' long-term presence at an airport. With deregulation, significant uncertainties have been introduced. One of the immediate and critical impacts of deregulation on airport capacity is the lack of sufficient gates, particularly at busy airports, to accommodate the operations of both new entrants and incumbent airlines. This has been accompanied by rapid changes in the carriers' operational strategies in terms of the aircraft they use, the routes they serve, the frequency of service they offer, the fares they charge, and the hubs they develop for their operations. As Long-

term airline tenure may no longer be taken for granted, the risk associated with building more gates has become rather high, and airport operators are finding it less attractive to continue operation with large blocks of dedicated (exclusive use) gate facilities.

As the industry undergoes this rapid and dynamic change, airport authorities are reluctant to commit substantial capital investments in facility expansions because of these uncertainties. In the mean time, more new airlines (e.g. commuters) are emerging and more and more airport operations are being crowded into facilities which were not originally designed to handle these increased traffic volumes. The result is a worsening level of service in terms of congestion and delay and occasional system breakdown as demand approaches or exceeds capacity.

While at traffic-saturated high-density airports physical expansion of facilities may be the only effective long-term solution, there are a a number of methods[1] which could be considered for alleviating airport capacity constraints. One such approach which deals with the specific problem of gate capacity shortage outlined above is to optimize the allocation of existing gates. For example, gate utilization could be increased by adopting a "common use" gate allocation strategy whereby use of any gate is not confined to a particular air carrier or flight sector. While this option is becoming more and more attractive today, and while it has been applied effectively at many airports around the world, its implementation may not be immediately feasible at certain airports in North America where airlines have been awarded long-term leases on gates and control of their use including ownership of aircraft loading bridges. The objective of maximizing the utilization of gates has become nonetheless, increasingly important as new carriers emerge and incumbent airlines continue, under deregulation, to alter their scheduling patterns, modify their air service network and seek to optimize their aircraft fleet mix and requirements.

Having outlined the gate capacity problem as a major operational and planning issue, the object then, in the context of this paper, is one of seeking effective contributions that could be made by sophisticated computer models towards the development of efficient solutions. In the following Section, an overview of the usefulness of such techniques in airport planning, design, and operation is presented together with an assessment of the role of microcomputers. This is then followed by a description of the Gate Assignment Simulation Model.

USE OF COMPUTER MODELS IN AIRPORT PLANNING AND OPERATIONS

The 1980's represent an era of significant changes in the planning and management of air transportation on the part of both airport operators and air carriers. Restraints on monetary resources, uncertainties in future traffic demands, changes in the type and cost-structure of air services, and more significantly, the impacts of deregulating the air industry are adding complexities to the tasks of planning, design, management and operation of the air transportation facilities and services. Effective performance of these tasks in such an uncertain environment entails the development of innovative tools and techniques to be employed in those areas to increase efficiency and productivity.

As part of the application of technological innovations to increase the capacity of airport facilities and reduce traffic delays, development and use of computer models to assess the level of service and evaluate possible options for alleviating congestion have been widely recognized. Though use of computer models in airport planning and design has already advanced the state of technical art in this area, innovative and cost-effective applications of computer models can be realized in many areas of airport capacity management and operation.

For example, such models could be used to simulate the movement of aircraft on the runways, taxiways and apron; the daily assignment of gates or PTVs to aircraft; the flow of pedestrians in the air terminal building and the flow of vehicles on the ground transportation system. Not only are these techniques highly useful in the planning and design (sizing) of facilities[2], they are also invaluable in evaluating the effectiveness of operational solutions aimed at improving the capacity or managing the demand itself.

These models are by necessity detailed and complex in order to reflect the many intricacies and sub-system interdependencies involved in airport operations. For example, traffic flow management systems which "dynamically" control the volume of aircraft traffic to or from a busy airport are based on elaborate computer models that continually adjust the aircraft arrival and departure times at all airports in the system in order to minimize aircraft delays. Recent emphasis on scheduling and gate/slot allocation at many busy airports has necessitated a high degree of precision in measuring airport capacity. This has led to a continuing need for the provision of real-time hourly measurements or predictions of capacity and delay. As another example, the use of computer models to perform (and predict) the gate allocation requirements for present (and future) aircraft traffic is necessary in order to effectively evaluate, recommend, and implement practical options to respond to the shortfalls of gate capacity and/or landing and take-off slots. Similarly, computer simulation of the (dynamic) traffic flows through the various processors of the terminal building is essential for the proper evaluation of their operational performance and level of service as well as for the sizing of needed additional facilities.

These and many other applications can only be undertaken efficiently through use of computer models. This is due primarily to the need for treating the inherent uncertainties in the levels and characteristics of the traffic demand and the intricate and often complex procedures governing the operation of airport facilities. These complexities are becoming compounded in the deregulated environment as a result of the highly dynamic nature of the market and the rapidly changing service patterns of the airlines. The need to incorporate some flexibility in the development of future facility requirements or current operational plans promotes further dependence on computer models to test the many assumptions and options involved.

ROLE OF MICROCOMPUTER TECHNOLOGY

Until recently, most computer applications in air transportation have been performed on the mainframe and/or minicomputers. Use of micro-

computers has been initially slow partly due to their past limitations (relative to mainframe and minicomputers) in terms of processing capacity and speed, and data storage capability. Recent advancements in those areas and other related improvements have led to a vital role to be played by the microcomputer in a variety of airport applications. The present growing use of microcomputers is expected to continue into the future at a faster rate as the technology continues to evolve.

As airport application models are becoming more and more emphasized, a number of "general-purpose" microcomputer software packages are being conveniently used for a variety of analyses. Microcomputer implementations of "specialized" systems (such as Computer-Aided Design and Drafting) are also becoming available for engineering design applications. Microcomputer-based models dealing with specific applications, such as the one presented in this paper, whether already developed or now under development, enable the simulation and testing of multitudes of operating scenarios and a large number of configurations of airport components. Sensitivity analyses can then be carried out to determine how level of service and other operational performance measures are impacted by various design modifications, revisions to the planning standards used, and changes to the facility operating procedures (e.g. gate allocation policies); thus resulting in extensively tested plans.

Features such as colour graphic displays, electronic spread sheets, user-friendly full screen-editors, etc. which are cost prohibitive in a mainframe computer environment, are conveniently and economically offered by the microcomputer. These features make the microcomputer technology well suited to meet the interactive and simulation capability requirements of airport application models. The relatively low cost of a microcomputer, its convenience, user-friendliness, and ease of access are further important user considerations. All these factors combined have made microcomputer applications highly attractive. In the following Section a computer model developed for allocating the scarce resource of airport gate capacity is presented and serves as an example application of the microcomputer technology.

THE GATE ASSIGNMENT SIMULATION MODEL

This model is implemented as an interactive microcomputer program that simulates the arrivals and departures of commercial aircraft at the terminal apron as described by an input flight schedule and assigns gates to these flights. In the context of this paper, a gate position refers to the area of the terminal apron designated for the parking of an aircraft in order to load and unload passengers and to perform aircraft ground services such as refueling, baggage handling, cleaning, servicing, etc. In addition to its potential use as an operational tool for the day-to-day gate assignments, the model can be used as a planning tool to enable the determination of the appropriate number and size of gate positions required for new facilities as well as the evaluation of the gate utilization of existing ones. Its interactive capability permits convenient and efficient evaluation of the effects of various gate assignment strategies, gate capabilities, and changes in volume and mix of aircraft traffic on gate utilization and level of service (i.e. experienced delays) to aircraft and passengers.

MODEL THEORY:

The assignment algorithm involves a queueing system in which aircraft are considered for gate assignment on a "first-arrived-first-assigned" basis but with priority given to larger aircraft in order to minimize passenger delays. An alternate assignment discipline is also allowed. The model can "look ahead" within a user-specified time window (say 5 minutes) and as a result may deny offering a certain gate to a given aircraft in favour of a later (yet-to-arrive) one which is considered to be "more deserving" of that gate (for example, if the later flight is a B747 while the earlier one was a B737). In this case, the earlier aircraft is assigned another gate, or if none available, it joins the queue. The simulation thus continues till the end of the day.

The assignment of gates to aircraft is based, in addition to the times of aircraft arrival and departure, on a number of operational factors including: the aircraft-gate size compatibility; the gate access to Government inspection services (passport control, customs, etc.); the strategy adopted for the assignment of each gate: airline exclusive, preferential or common use; maximization of the usage of certain gates (e.g. to minimize passenger walking distances); and minimization of aircraft and passenger delays. Other user-controllable parameters which also affect the allocation of gates include the time separation (buffer time) between successive assignments of the gates, the maximum allowable gate occupancy times by aircraft size and flight sector, and the maximum "tolerable" aircraft delay for gate access. The model's overall framework is outlined in Exhibit 1.

MODEL INPUTS:

These include the folowing:

- A Flight Schedule indicating for each flight the airline's code and flight number, the aircraft size, time of arrival, time of departure, and the requirement for Government inspections both upon the aircraft's arrival and before its departure.

- A description of each available gate in terms of the maximum aircraft size it can accommodate, its accessibility to Government inspection facilities for both enplaning and deplaning passengers, and the strategy adopted by the airport operator in assigning that gate. A number of strategies are permitted by the model which include airline exclusive use, preferential use (equal and priorized airline preferences), and common gate use.

- A specification of the maximum time an aircraft of a given size and flight sector [domestic, trans-border (e.g. Canada-U.S.A.), other international] is allowed to occupy a gate before towing it off to another gate or to a remote parking position in order to permit usage of the gate by another aircraft.

- A specification of the "buffer time" allowed between successive assignments of gates. This time clearance reflects mainly the aircraft maneuvering times at the gate (push-in and push-out).

- A specification of the maximum "tolerable" aircraft delay time for gate access beyond which certain actions would be necessary (such as towing an aircraft off its gate to another gate or to a remote stand in order to accommodate another without a gate).

MODEL OUTPUTS:

The model outputs include the following:

- A tabular description of all gates, as per input data.

- A tabular description of all flights, as per input flight data, including a specification of the gate assigned to each aircraft and the delay, if any, in obtaining that gate.

- A fully-labelled coloured plot (Gannt chart) showing the daily assignment of all gates, including remote parking positions.

- A listing of unassigned flights, for which certain arrangements may be required [e.g. ground loading, use of PTVs, pushing back another (gated) aircraft, etc.]

- A coloured plot of the total number of gates in use at any time during the operating day.

- Coloured plots of gate utilization. The utilization of a gate is determined by the model in two ways: the percentage of time the gate has been in use, relative the whole day or any specified time frame, and the total number of aircraft handled over the course of that period of time. The two measures complement each other as, for example, an aircraft could needlessly occupy a gate for an extended period of time (i.e. using it merely for parking) thus resulting in artificialy high time-utilization.

Exhibits 2 through 6 present a partial sample of the outputs described above. These can be directed by the model to three output devices:

- the monitor's screen (monochrome or colour)
- a dot-matrix printer (Epson type)
- a colour plotter (Hewlett Packard or IBM type)

MODEL FEATURES:

The model is developed in a modular form and is fully interactive. Through the model's built-in user-friendly editor and menues, the user can key in the input data via the keyboard or import an input file into the program. If desired, the user can easily edit (override) the model assignment results, e.g. by specifying the gate to be assigned to a particular aircraft, imposing a delay on a certain flight(s) in order to accommodate a particular aircraft, etc. Changes to the inputs can also be made conveniently on the screen (for example, a flight's departure or arrival time could be delayed, a cancelled flight could be deleted, a diverted flight could be added, the size of an aircraft could be altered, the attributes of any gate could be re-specified, etc.). With the strike of a single key the model can then

re-perform any of several tasks as directed by the user including full -day assignment, partial assignment (i.e. starting with a specified flight thus leaving undisturbed the assignment of preceding flights), flight schedule sorting by all pertinent attributes, checking for any flight conflicts that could have been created by user (manual) changes to the model's assignment results, tow an aircraft off/on a gate (e.g. to accommodate an incoming aircraft with no gate to go to), view the gate assignment (Gannt) chart and other outputs on the screen, or make further input/output changes. The model could be run as many times as desired within the same session.

The time taken by the program to perform the assignment varies, depending of course, upon the number and characteristics of flights and gates. For a sample 200 aircraft movements (100 arrivals and 100 departures) and 15 gates, the assignment time on the IBM/AT was less than 30 seconds.

The model has been designed and programmed to run on any member of the IBM microcomputer family or any IBM-compatible machine with a minimum of 256K of memory. Use of a colour monitor (regular or enhanced) and/or colour plotter is optional.

CONCLUSIONS

The problem of airport gate capacity has been outlined and shown to be major a issue facing airport authorities and airlines particularly at high-density airports. Use of computer models offers a capability for conducting efficient planning and operational management of airport capacity. The utilization of microcomputer technology would further enhance this capability.

The computerized gate assignment model presented here provides not only a practical system for efficient handling of the day-to-day gate assignments, but also a valuable means of developing effective longer-term solutions to the problem of gate capacity allocation.

REFERENCES

1. Hamzawi, S.G., "Airport Capacity Management and Planning Techniques: Methods to Relieve Airport Congestion", (Forthcoming)

2. Hamzawi, S.G., "Techniques of Airport Terminal Planning in CATA: An Airport Capacity Utilization Model", 10th Annual Conference of the Institute of Transportation Engineers, Calgary, Alberta, (June 1985).

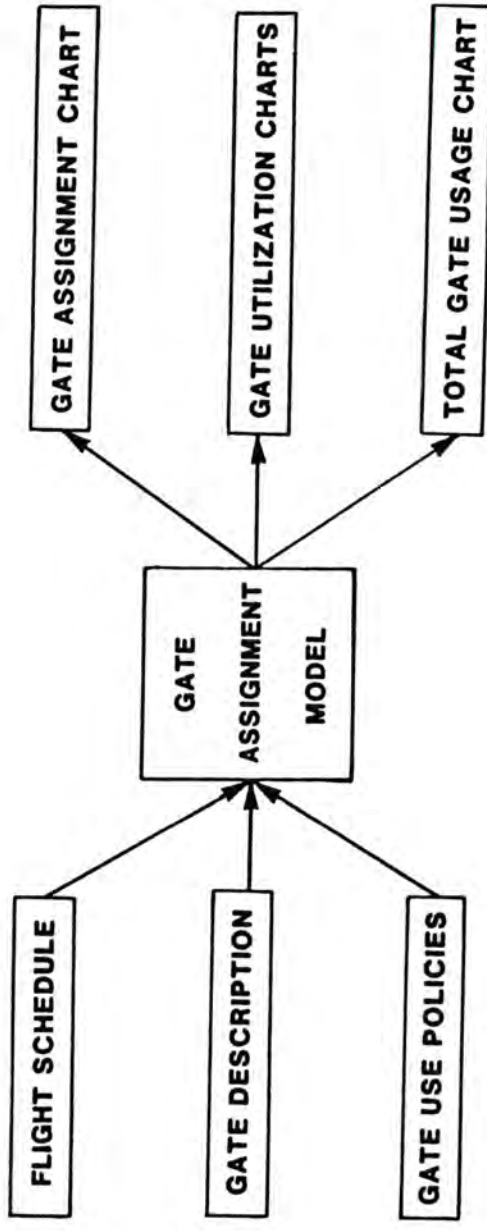


EXHIBIT 1 MODEL FRAMEWORK

MONTREAL (DORVAL) INT'L AIRPORT
AIRCRAFT-GATE ASSIGNMENT - 1991

CARR-FLT#	A/C	SEC/QIS	IN AT	OUT AT	EPAX	DPAX	BCU	GATE
AC114	B	DD/NN	18:00	18:40				18-36
AC118	B	DD/NN	18:09	19:10				19-38
AC122	B	DD/NN	18:15	18:55				3-3
AC123	B	DD/NN	18:15	19:00				5-5A
AC124	B	DD/NN	18:19	19:15				6-5B
AC125	B	DD/NN	18:25	19:25				7-5C
AC130	C	DD/NN	20:30	21:05				3-3
AC131	B	DD/NN	20:46	21:20				4-4
AC135	B	DD/NN	21:30	22:15				3-3
AC136	B	DD/NN	22:00	22:25				4-4
AC137	B	DD/NN	22:00	22:35				5-5A
AC138	B	DD/NN	22:05	22:40				6-5B
AC139/140	C	OT/XY	ORIG.	06:55				29-21
AC140/139	C	TO/YX	23:45	TERM.				29-21
AC149/150	C	TO/YX	22:30	TERM.				29-21
AC150/149	B	OT/XY	ORIG.	07:30				27-17
AC155	B	TT/YY	08:05	08:55				27-17
AC157	C	TT/YY	08:45	09:45				29-21
AC158/159	B	TO/YX	10:50	TERM.				30-21A
AC159/158	B	OT/XY	ORIG.	09:00				30-21A
AC163	B	TT/YY	08:45	09:30				28-19
AC165	B	TT/YY	10:40	11:35				27-17
AC171	B	TT/YY	13:10	14:10				27-17
AC176	C	TT/YY	14:40	15:25				31-23
AC181	B	TT/YY	16:45	17:50				27-17
AC188	C	TT/YY	18:15	19:15				29-21
AC191	B	TT/YY	20:05	20:55				27-17
AC192/193	B	OT/XY	ORIG.	16:10				28-19
AC193/192	B	TO/YX	21:40	TERM.				27-17
AC195/196	C	OT/XY	ORIG.	06:55				31-23
AC196/195	C	TO/YX	16:35	TERM.				31-23
AC198	C	TT/YY	14:35	16:05				29-21
AC201	B	TT/YY	21:00	21:45				28-19
AJ044	A	DD/NN	09:00	19:00				25-40
AL147/148	B	TO/YX	21:24	TERM.				37-20
AL148/147	B	OT/XY	ORIG.	07:10				37-20
AL167	B	TT/YY	11:20	11:50				37-20
AL175	B	TT/YY	14:20	14:50				37-20
AL186	B	TT/YY	17:59	18:35				37-20
CP031	B	DD/NN	07:55	08:40				15-35
CP048	B	DD/NN	09:05	09:45				15-35
CP050	B	DD/NN	09:10	09:50				16-37
CP052	B	DD/NN	09:15	09:45				17-39
CP064	B	DD/NN	10:30	13:50				15-35
CP066	B	DD/NN	10:55	11:30				16-37
CP079	B	DD/NN	13:10	14:05				16-37
CP081	B	DD/NN	13:20	14:15				17-39
CP092	B	DD/NN	15:10	15:55				15-35

EXHIBIT 2

OTTAWA INTERNATIONAL AIRPORT
AIRCRAFT-GATE ASSIGNMENT - 1991

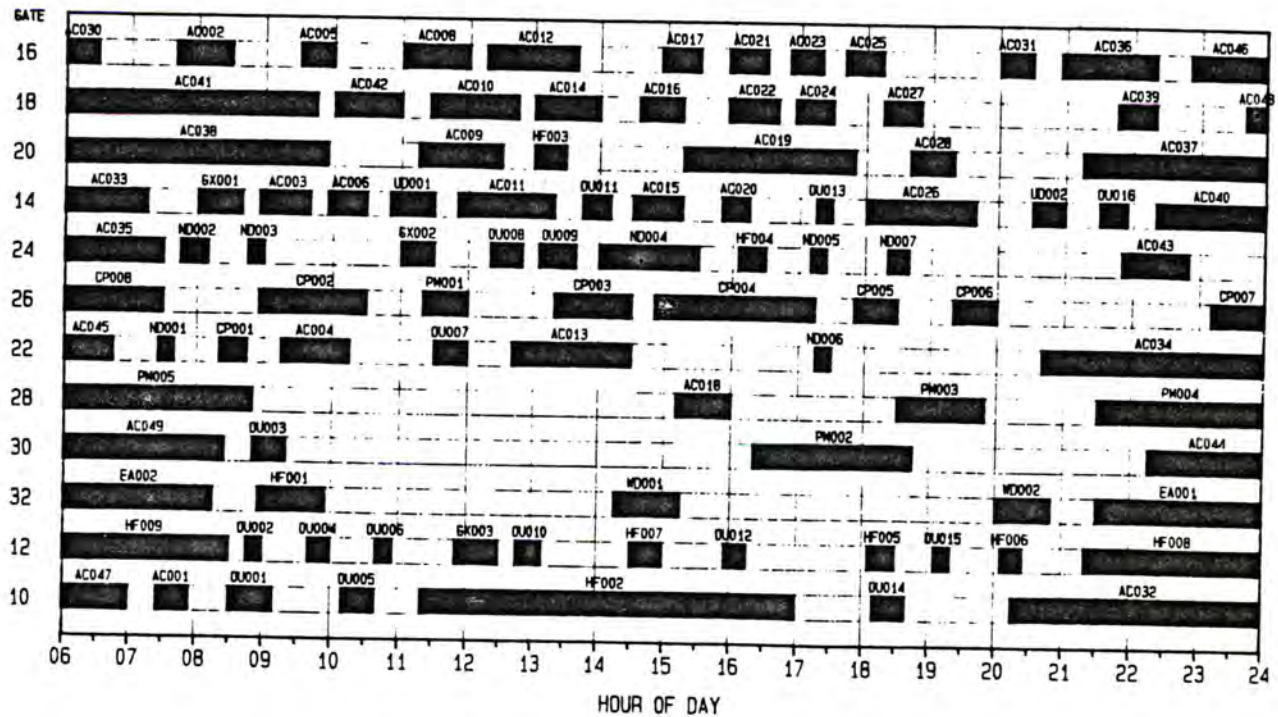


EXHIBIT 3

OTTAWA INTERNATIONAL AIRPORT
AIRCRAFT-GATE ASSIGNMENT - 1991

EXHIBIT 4

OTTAWA INTERNATIONAL AIRPORT
AIRCRAFT-GATE ASSIGNMENT - 1991

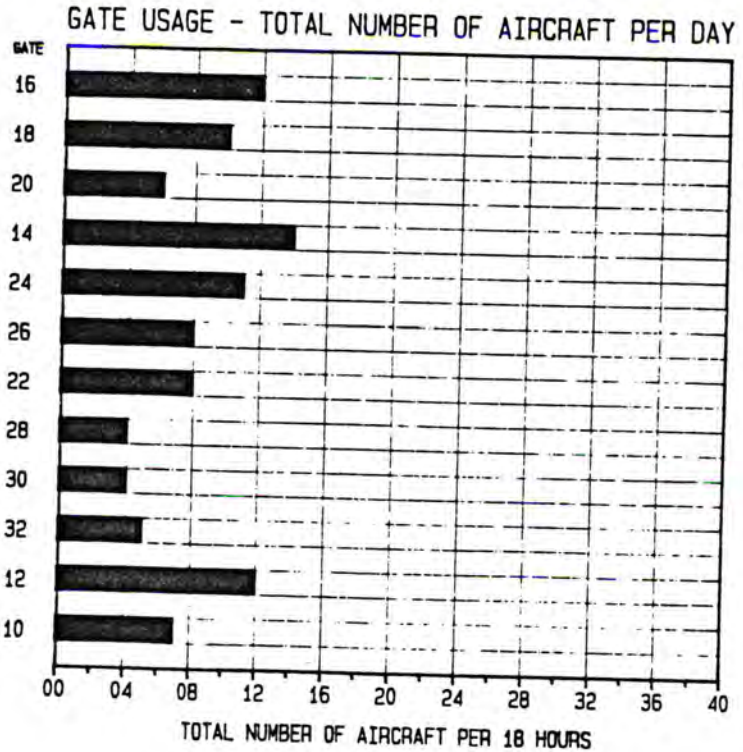
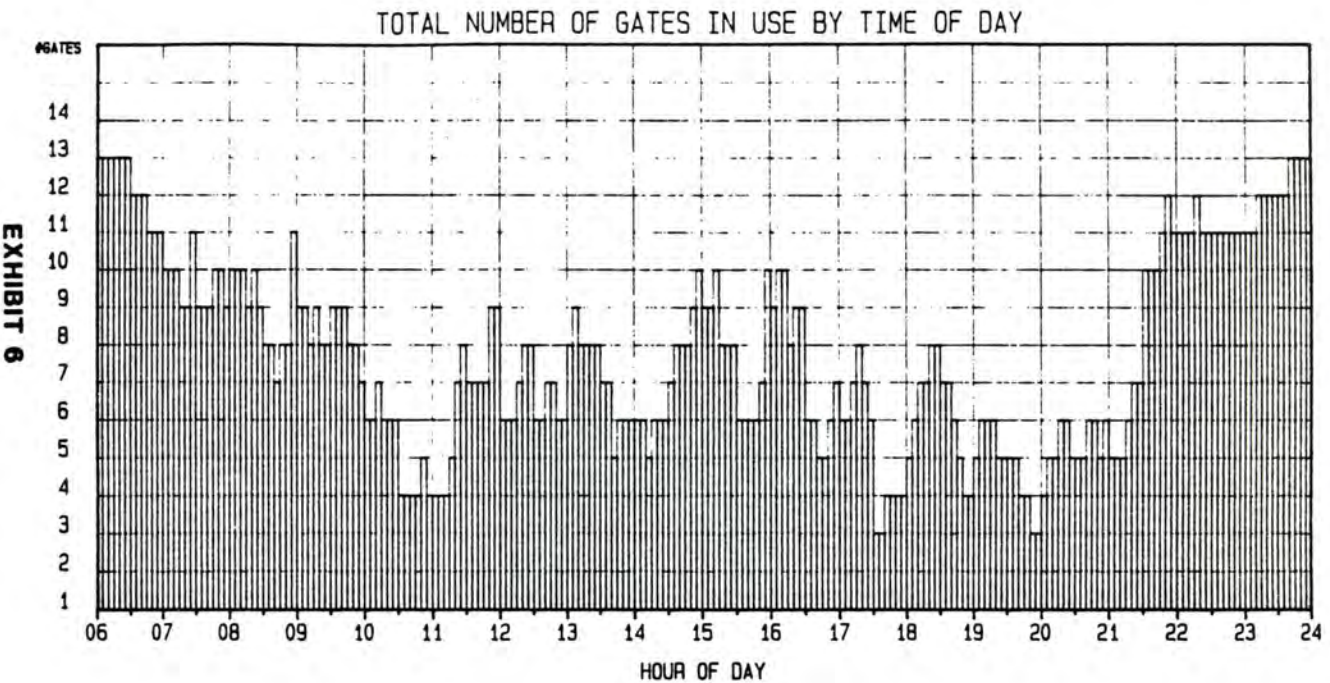


EXHIBIT 5

OTTAWA INTERNATIONAL AIRPORT
AIRCRAFT-GATE ASSIGNMENT - 1991

EXHIBIT 9



A DISAGGREGATE AIR FARE AND COST MODEL FOR FORECASTING AVIATION TRAFFIC

by

Richard Westler - Transport Canada
John Spacek - Sypher Consultants

I. Introduction

Forecasts of airline passenger demand at individual airports are required by Transport Canada for airport planning purposes and to estimate revenues which will be generated by airport operations. The forecasts of air travel are developed with the use of the Transport Canada Passenger Origin-Destination Model (PODM). This model forecasts traffic on a route by route basis and sums the passengers who are originating and destinating at each airport across the country. PODM is essentially a long term forecasting model which requires forecasts of various socio-economic variables such as incomes, air fares, population, etc.

To provide the necessary forecast fare levels, an air carrier fare and cost model was developed incorporating an improved methodolgy for fare forecasting. Previous forecasts of air fares were developed through a cost model approach, however, with the advent of deregulation, a more sophisticated means of modelling fares was required to take into account the changing market environment. In order to accommodate these changes a two stage cost and fare model was developed to determine costs of operation on a route by route basis and to take account of the market based parameters which also impact air fares.

The airline fare and cost model is programmed on Lotus 1-2-3 for easy access and manipulation of the data. This hands on approach allows complex sets of calculations to be undertaken in a quick and efficient manner to determine cost and fare impacts of changes in airline costs and operations without a detailed knowledge of each of the elements contained in the model.

II. Structure of the Model

The airline fare and cost model develops fare forecasts on the basis of seat mile costs for various aircraft types operating in short, medium and long haul markets. The model is further divided into operations in the Domestic, Transborder and Other International sectors. Other factors beyond costs are taken into account in the development of the fare forecast outputs. These include anticipated return on sales, load factors, discount fares and operating costs for low cost operators. An overview of the airline fare and cost model is shown in Figure II-1.

The model develops forecast fare equations for the target years 1986, 1991 and 1996 using 1981 CTC cost and performance data as the basis. The air carrier costs are allocated into distance related and trip related. The historical relationships between distances and distance related costs are used as a starting point to develop the forecasts. These are linear cost functions. The airline cost model was developed for nine aircraft types analyzing 27 different cost elements for conventional cost carriers. In addition, aircraft operating costs were developed for low fare carriers using U.S. experience in a deregulated environment.

III. Cost Data Acquisition & Manipulation

1. Data Sources

The data used to provide the foundation for the modelling of the cost structure of conventional full-service carriers was obtained from carrier data provided to the Aviation Statistics Centre, Statistics Canada under statutory requirements. A review of the available data indicated that 1981 data was the most complete and accurate for the use of the model, and that two of the carrier filings would be required; Statement 16 and Statement 3. Due to the confidential nature of this data, only the methodology of the data manipulation will be discussed and outputs of the model will be shown using fictitious figures.

Data from six carriers were analyzed: Air Canada, CP Air, Pacific Western, Nordair, Quebecair and EPA. Defined routes ranged from individual city pairs, to complete daily routes for individual aircraft, to one route for the entire fleet of a carrier. In 1981, Statement 16 was the carrier filing for each route providing revenue and expense information.

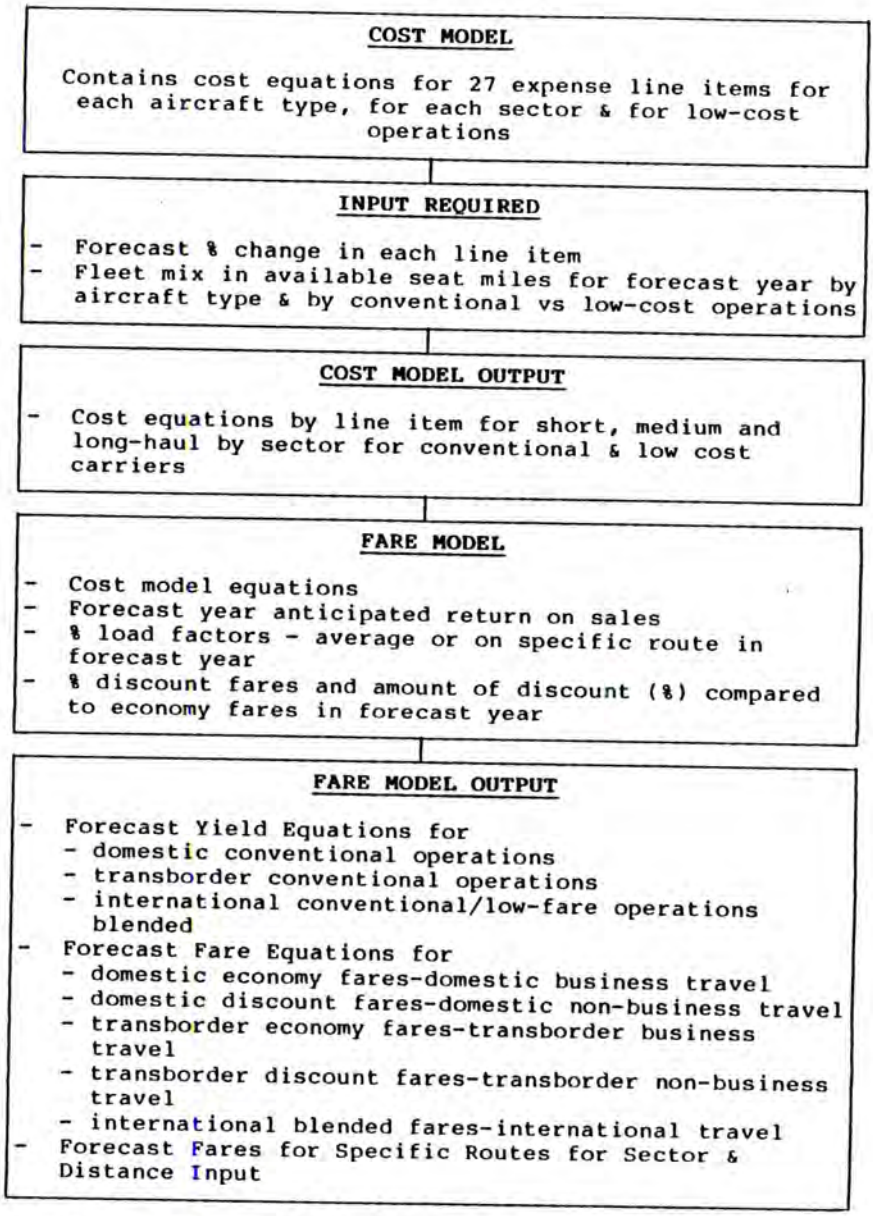


Figure II-1. Overview of the Cost & Fare Model

Statement 3 provided for each route: traffic information including hours flown by aircraft type; distances flown by aircraft type; annual departures by aircraft type and annual passenger, cargo and mail traffic.

The information on these two statements, when combined and manipulated, would provide sufficient data to carry out linear regressions for each distance related line item by aircraft type, by sector. This approach, however, does require substantial data collection. With nine aircraft types and 3 sectors and a rule of thumb of 10 data points per aircraft type per sector, 270 route-aircraft combinations were necessary to provide a complete data base. The matrix of Figure III-1 illustrates the aircraft-sector matrix.

AIRCRAFT TYPE	SECTOR		
	DOMESTIC	TRANSBORDER	INTERNATIONAL
DC 8			
DC 9			
B 737			
B 727			
B 747			
B 767			
DC 10			
L1011			
HS 748			

Fig.III-1 The Aircraft and Sector Data Collection Matrix

It became immediately apparent from a review of the Statement 16 filings that there would be insufficient data to provide the full 270 data points.

With these constraints, a total of 155 aircraft route filings were obtained as the basic working data for the model; that is, 155 Statement 16's and a smaller number of Statement 3's (many of which contain information on more than one aircraft type) were collected.

2. Data Manipulation

Statement 3 data and statement 16 data are provided on an annual basis such as total annual flight crew salary allocated to the aircraft for a particular route and total annual distance flown by an aircraft type on a particular route. To be useable in developing the model equations, it was necessary to manipulate this data into a uniform cost per available seat base for each line item, and to pair these costs per available seat to the related route distance and time per trip. These data pairs could then serve as inputs for regressions of cost line items against distance and cost line items against block time.

Figure III-2 summarizes the manipulation process.

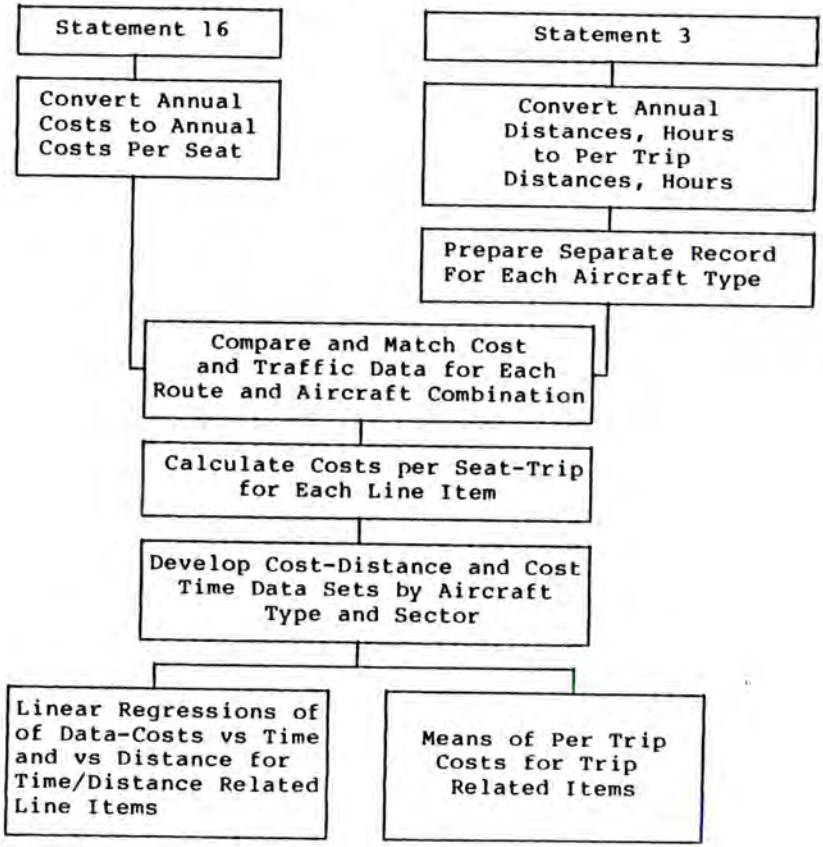


Fig. III-2

The line items as reported by the carriers were divided into time/distance related and trip related according to the allocation methodologies established by the CTC and used by each carrier.

3. Statistical Analysis

For each aircraft type and sector, the distance and time related line items were regressed against distance and time separately using the NWA STAT-PAC software ONEVREG. For some aircraft types insufficient data was available for individual sectors, so sector data were combined (e.g. DC9 international and DC9 transborder).

In most cases, the regression of the data points yielded a fit that is adequate for the development of the model. Unusual data points were rejected prior to regression with the objective of keeping the model as generally applicable as possible.

The trip-related line items for existing types of operations were simply analyzed to obtain means and standard deviations by aircraft and by sector. In most cases the standard deviations were in the range of 10-40% of the means. The data for the international sector, however, often showed wider deviations in such costs as fees, as would be expected.

Overall the fit of the regressions for the distance related items and the standard deviations for the trip related items proved that the approach taken was valid. The reporting practices of many carriers, however, has caused the resulting model to be dependent on the data from Air Canada and PWA, and individual line items will reflect the cost allocation practices of these carriers. Taken as a whole, however, the direct operating costs and indirect expenses should be representative of the industry.

IV. The Cost Model

1. The 1981 Model

The cost model is simply an analytical framework utilizing Lotus 1-2-3 which manipulates the cost data by aircraft type and sector into overall costs per available seat fo the aircraft fleet. The model then forecasts cost per seat in future years based on forecasts of real cost increases of the various cost components. Figure IV-1, Cost Model Overview, summarizes the cost model framework. The following section describes the step-by-step process of determining the forecast costs per seat.

The first activity of the cost model is the input of the costs developed through the regression and averaging activity. These costs are developed by aircraft type for each sector and are defined as variable (to distance) or fixed (to the flight cycle).

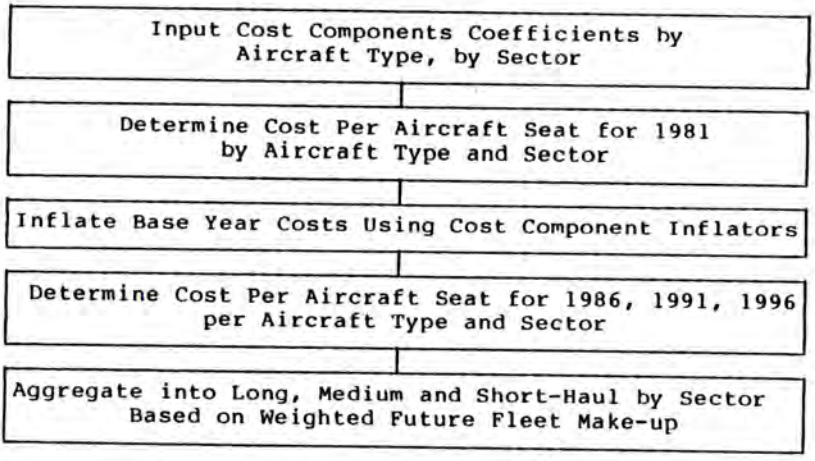


Figure IV-I. Cost Model Overview

The model determines the cost per aircraft seat by calculating the variable costs by line items using the input regression calculated for the desired trip length. The results are summed to obtain the total variable costs for the trip. The fixed costs are simply summed for each trip as they are constant to each flight cycle no matter what the distance.

SECTOR : DOMESTIC
CARRIER :
AIRCRAFT TYPE : DC9
AVERAGE SEATS : 100

COST COMPONENT		1981 INTERCEPT VALUE	1981 COEFFICIENT	MILES	1981 COST PER AFT SEAT
VARIABLE (TO DISTANCE)					
FLT CREW SALARY	:	1.812	0.0052	300	$3.37
CREW CYCLE EXP	:	0.152	0.0005	300	$0.30
FUEL & OIL	:	4.279	0.0172	300	$9.44
ACFT DEPRECIATION	:	0.675	0.0010	300	$0.98
ACFT INSURANCE	:	0.053	0.0001	300	$0.08
ACFT INTEREST	:	0.110	0.0002	300	$0.17
OTHER AC OPS	:	0.830	0.0023	300	$1.52
CABIN CREW SAL	:	0.968	0.0027	300	$1.78
CBN CREW CYCLE	:	0.215	0.0007	300	$0.43
OTHER INFLIGHT	:	0.209	0.0009	300	$0.48
ACFT MAINT LAB	:	1.822	0.0023	300	$2.51
INVTY PROCESS	:	0.622	0.0008	300	$0.86
TOTAL VARIABLE	:	11.747	0.0339		$21.92
FIXED (TO OPERATION)					
LAND & NAV FEE	:	0.86			$0.86
FOOD & SUPP	:	4.54			$4.54
PSGR INSURANCE	:	0.09			$0.09
MTCE SUP/PUR	:	1.06			$1.06
OTHER AC MAINT	:	0.60			$0.60
GEN TERM CHARGE	:	0.59			$0.59
OTHER AIRPORT	:	3.58			$3.58
ACFT SERV. PAX	:	4.14			$4.14
GRND EQUIP/FAC	:	0.15			$0.15
TOTAL RESERV.	:	3.90			$3.90
CITY TICKETING	:	0.59			$0.59
PAX COMMISSION	:	5.32			$5.32
ADVERTISING	:	2.16			$2.16
PLANNING/ADMIN	:	4.21			$4.21
TOTAL FIXED	:	31.79			$31.79
TOTAL COSTS	:	43.54			$53.71

Figure IV-2. Cost Summary - DC9 - 300 Mile Trip

An example of this step's output is shown in Figure IV-2 for a 300 mile flight. The variable cost per seat for the trip totals $21.92 and the fixed cost is $31.79 for a total cost of $53.71.

2. Forecast Parameters

The base year costs are inflated to target years (1986, 1991, 1996) via annual escalations of each line item. The inflators are real or constant dollar increase forecasts. The actual indices are variable in the model and can be adjusted to reflect expected changes and to undertake a sensitivity analysis.

The model calculates the cost per seat in each forecast year in the same manner as was done for a previous step. The only difference is the application of the cost inflators to forecast the line items before the costs are summed into variable, fixed and total costs by aircraft type, by sector.

Long, medium and short-haul forecasts are obtained for each forecast year based on aircraft type and the forecast of the future year's fleet make-up. A summary of long, medium and short-haul aircraft types are as follows:

Short-Haul	Medium-Haul	Long-Haul
DC9	L1011	B747
B737	DC9	L1011
B727	B767	DC10
X125	B737	B767
HS748	B727	B737
'50'	X125	B727
	DC8	DC8

The future fleet make-up is based on a forecast of the passenger fleet for the forecast years. The future fleet make-up is adjusted for the aircraft types for the relative seats and utilization.

The transborder sector model uses the same fleet except for the deletion of the HS748. The international sector only uses the long-haul fleet.

3. Cost Forecasts

The model now calcultes the cost per seat for each forecast year given a city-pair distance. The distance is first checked to determine which set of cost equations (i.e. long, medium or short-haul) is to be used.

V. The Fare Model

1. Cost-Fare Relationship

The fare model is an analytical framework which estimates fares for specific distances given the cost per seat for the aircraft fleet as well as the principle factors which determine system fares. The first step in the development of the framework is the development of a 1981 model base which can then be calibrated and used as the basis for forecasting future fares given controlling variables which are adjusted to reflect future expectations.

The starting point for the fare estimation exercise is the recognition of the factors which affect and determine fare levels. In general, fares are a function of:

- seat cost;
- return expected/required;
- aircraft load factors;
- mix of regular economy fare and discount fare passengers;
- sector of travel;
- length of trip; and
- fleet mix.

Starting from first principles, the fares have been estimated based on the following:

For an aircraft which operates on a specified route, the fare is a function of the cost per seat plus a mark-up to provide a profit/return to the operator. For example, if a one aircraft fleet (e.g. DC9) operated at capacity over one route (e.g. 300 miles), the fare would be determined as follows:

Cost per seat = ($43.54 + .0430 Distance*)

Fare per seat = [$43.54 + .0430 (Distance)] x (Margin)
= ($43.54 + $12.90) X 1.06
= $59.83

Recognizing that aircraft do not, on the average, operate at full capacity, the fare must be adjusted to compensate for the empty seats to ensure that the total expected return is achieved. This is carried out by factoring up the fare relative to the average load factor. Based on the above example, this would be done as follows assuming an average load factor of .65:

* DC9 Domestic Equation

Fare per seat = Full Load Fare ÷ Load Factor
= $59.83 ÷ .65
= $92.05

Therefore, the operator must now charge $92.05 to obtain the same overall return.

Finally, the operator must make further adjustments to this fare structure if discount fare travel is to be offered. To obtain the same overall financial return, further adjustments must be undertaken. The challenge is to estimate the discount fare and the expected number of people travelling on the discounted fare. In the preceding example, the operator is offering an average 40% discount off the economy fare. At this level, it is expected that 30% of the traffic will travel on discount fares. To obtain his original target rate of return (defined as margin over cost), the fares must again be adjusted. This is done as follows:

Eco. Fare Per Seat = Prev. Eco. Fare ÷ Weighted Economy/Discount Factor

Where the Economy/Discount Factor is:

(Y Fare X Fare Load Factor) + (Discount Fare X Discount Fare Load Factor)

Where Discount Fare Load Factor = Discount Fare (Function of Economy Fare) X Discount Load Factor

Again, given the above example, the economy fare would be:

Eco. Fare Per Seat = $92.05 ÷ ((1 X .70) + (.6 X .30))
= $92.05 ÷ .88
= $104.60

The discount fare would be:
Discount Fare = .6 X Economy Fare
= .6 ($104.60)
= $62.76

In all cases, the operator will receive the same overall return over his system: (rounded)

1. Full load full fare basis = 100 seats X $60.00 = $6,000
2. Partial load full fare basis = 65 seats X $92.00 = $6,000

3. Partial load, economy and discount fares =
   45.5 seats X $105.00 = $4,775
   19.5 seats X $ 63.00 = $1,225
   65.0 seats $6,000

Therefore, the fare model calculation basis is as follows:

$$Y\ Fare = \left[\frac{\text{Cost Equation X Distance}}{\text{Load Factor}} \text{ X Return}\right] \div \left[\frac{\text{(1 X Economy Fare Load Factor) + (Discount Fare X Discount Fare Load Factor)}}{\text{Economy Fare}}\right]$$

The fare analysis is a general framework which reflects the relationship of the controlling variables. The inputs are general averages which represent the overall status of the individual inputs. It is important to note that the controlling variables are in fact inter-related and in reality, a fare equation of this format would be interactive. For example, an increased return would raise the economy fare and ultimately should lower the load factor. Therefore, in this model, the user should reflect the overall impact in the setting of the variables.

2. Calibration

The fare model was calibrated by comparing estimated fares against 1981 actual fares for a range of city pairs. City pairs were chosen to represent the range of distances for each sector.

3. Forecast Parameters

The 1981 model forecasts future fares based on the future years cost forecasts, the values estimated for the determining variables in the fare equation, and the proportion of discount fare operators in the system. The cost forecasts are developed in the cost model based on future fleet forecasts and the real cost inflators used on the cost components of fuel, labour, interest and other costs. The development of the other influencing factors are outlined in this section.

The fare parameters are the factors which enter the fare equation. They are the return (or margin), load factor, proportion of passengers on the economy fare, and the average discount for discount fares compared to the economy fare. The method used to determine the values of these parameters is the same as used for the determination of the low cost operators market shares. That is, the future structure of the industry and its market is defined and the 1981 base values adjusted to reflect this change.

In assessing where these factors are going over the forecast period to 1996, it is important to note that there is presently an assumption base built into the model. This relates to the forecast of real cost increases and the level of low cost operator activity. Real costs have been forecast to decrease (labour and fuel) or remain at zero (interest and other costs) throughout most of the forecast period. This means that airlines will be more efficient and productive than past trends have indicated. In addition, the low-cost operator impacts are inputted to the fare impact through the forecast of low-cost operators market share. Therefore, it is important that this effect is not "double-counted" at the fare factor stage. Fare parameters are developed recognizing their system average basis and the over-all assumption of future activity.

In addressing this future outlook, the impact will be different for the domestic sector versus the transborder and international sectors. Therefore, the fare parameters are developed accordingly.

Domestic Sector

The principles used in determining the parameters for the domestic sector are as follows:

- In the short term, instability will exist in the airline industry but will be less than that in the U.S.
- In the long term, stability will exist in the airline industry.
- The Canadian domestic market is much less competitive than the U.S. market.
- Compared to the U.S. experience, potential and existing Canadian operators do not face a substantial used aircraft market.

- Some regulation will always remain.
- The discount fare market in Canada is presently as well developed as the U.S. market under deregulation.

The future factors are as follows:

Returns over the future are expected to reach past levels. Air Canada is presently operating at a 1% rate and do not forecast a significant change in the near term. Load factors are forecast to rise marginally in the near term and level at 67%. The proportion of travellers using discount fares will continue to increase and level at 50%. The average discount fare will continue at its present level through the period.

Transborder and International Sector

The principles used in determining the parameters for the transborder and international sectors are as follows:

- Stability will continue to exist throughout the forecast period.
- Transborder traffic has always and will continue to be seen as a high profit market.
- These sectors will continue to be regulated.

VI. Deregulation Impact

1. Introduction

With the passage of the Airline Deregulation Act of 1978, and the advent of deregulation in the United States, a new group of airline operators have emerged. As a group, these operators have offered low fares as an entry strategy for acquiring immediate market shares. These "low fare" airlines have been characterized in the industry as "low cost" airlines.

In the U.S., there have been nineteen new jet operators, two ex-charter operators, and four former intra-state carriers which have initiated scheduled domestic operations since the passage of the Deregulation Act. In the last few years, several of these carriers have ceased operations (e.g. Pacific Express) merged with other operators after experiencing financial difficulty (e.g. Muse) or merged with other airlines to simply expand their base of operations (e.g. Air One).

It is a reasonable expectation that the Canadian deregulation environment will allow for the same general phenomena in Canada. In fact, this is already evident with the new City Express Low fare flights in the Ottawa/Toronto/Montreal triangle which have since been matched by Nordair due to traffic erosion.

In order to accomodate this pattern in Canada, the cost and fare model must have an integrated ability to handle so-called "low-cost/low-fare" operators. The approach used is to address the cost relationship between low-cost and traditional operators in the U.S. and apply that cost relationship to the Canadian system.

The new airlines have become a major force in the U.S. They are typically lower cost operators than their traditional counterparts due to:

- simplicity of operations;
- lower input costs;
- no-frills service; and
- higher labour productivity.

2. Methodology

The methodology used to determine the low-cost operators' cost characteristics versus those of the traditional carriers is summarized in Figure VI-1. The method followed six basic steps:

i. Select Aircraft Types

The first step was to select the aircraft types which dominate the low-cost carriers' fleets. For 1981, the major aircraft types were DC9's, B737's and B727's.

ii. Determine Low-Cost Carrier Operating Costs

The line items used by Air Canada (and other Canadian operators) are not directly comparable to the CAB terms used for U.S. carrier filings. A review of the cost elements was undertaken and the comparable CAB cost elements defined. For the mix of aircraft operated by low-cost operators, a cost per available seat per block hour was calculated.

iii. Determine Traditional Carrier Operating Costs

This step parallels the analysis undertaken for the low cost operation; that is, calculate the per seat per block hour cost for each aircraft type and average the costs to obtain a traditional carrier cost.

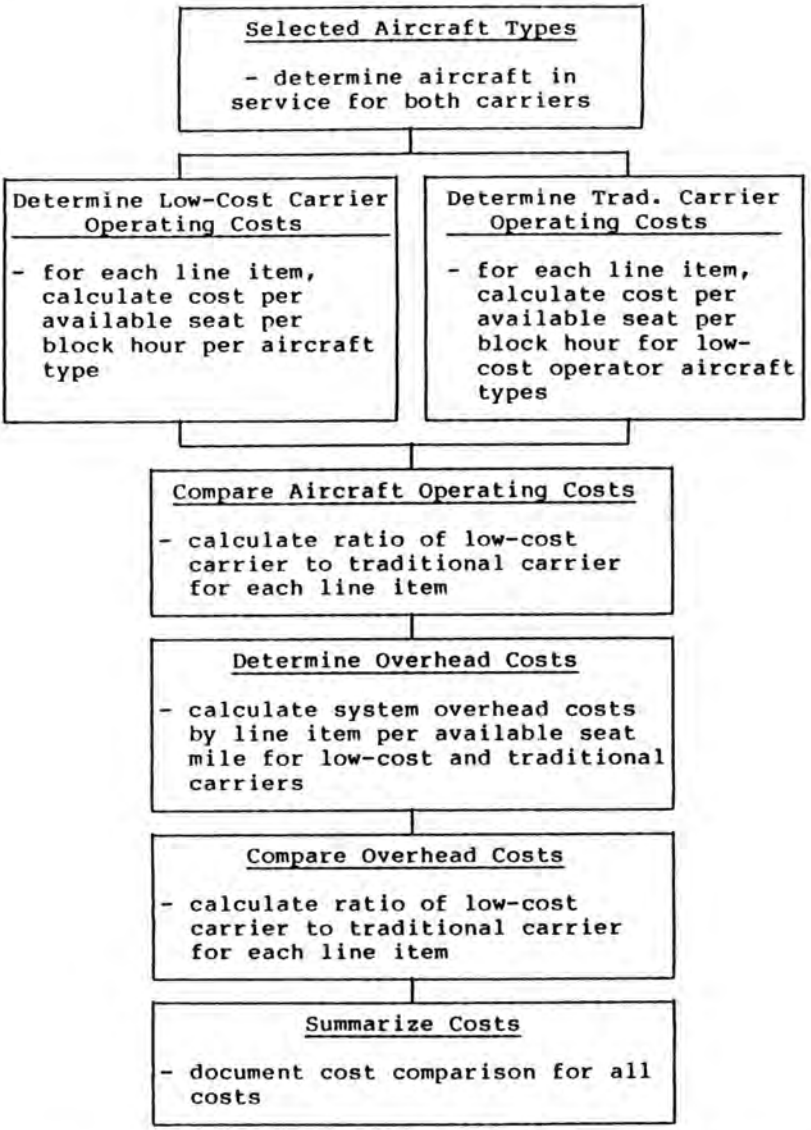


Figure VI-1. Overview of Low-Cost Carrier Analysis

iv. Compare Aircraft Operating Costs

The two cost profiles were compared and a ratio of costs calculated. This indicator represents the ratio of a cost element that a low-cost operator incurrs as a function of a traditional operator's cost. An example for a DC-9 is as follows:

	Average Cost Per Seat Per Block Hour		
	New York Air (1981 $)	U.S. Air (1981 $)	Ratio
Flying Operators			
Crew	.57	3.62	.16
Fuel and Oil	6.59	7.89	.84
Insurance	.12	.10	1.20
TOTAL	7.29	11.62	.63

v. Determine Overhead Costs

Overhead cost determination is based on the individual carriers system overhead costs by line item as declared to the CAB for their balance sheet and income statement filings. The overhead costs were divided by the individual carriers total available seat miles to obtain overhead costs on an available seat mile basis.

vi. Compare Overhead Costs

The overhead costs were assembled for the low-cost and traditional carriers used in the operating cost analysis and averages for both the low-cost and traditional operators calculated. As with the operating costs, ratios were calculated for low-cost operators as a function of traditional operators' cost profile.

VII. Conclusion

The overview of the model presented here describes in general terms the operation of a comprehensive framework which simulates and forecasts air carrier costs and fares. For traditional operators, the model is based on actual operating and cost data in the Canadian environment. For low cost operators typical of U.S. style deregulation, the model forecasts costs and fares based on U.S. air carrier operating cost experience applied to Canadian carriers. The overall flexibility of the model in accommodating the inclusion of the host of variables which impact on fares have made this model a valuable policy-oriented tool.

EMPIRICAL BAYES ESTIMATES OF DEMAND FOR TRANSPORTATION MODE: A PROPOSED METHODOLOGY AND IMPLICATIONS FOR NETWORK SCHEDULING

by

T. J. Tomberlin, K. Buyukkurt, and M. Buyukkurt

Concordia University

1.0 Introduction

Theoretically, routing and scheduling of urban area transportation networks should be based on consumer preferences as well as a consideration of operating costs and availability of resources. Although there has been considerable research on transportation mode choice, attempts to relate the estimated probabilistic choice models to network scheduling issues have been scarce. (Daganzo 1979, Manski and McFadden 1981, McFadden 1976). Estimates for different transportation modes in different subareas of an urban community can be compared with the current scheduling of public transportation networks to identify the subareas where consumer preferences are poorly matched. Such information in conjunction with the data regarding operating costs and available resources can be used to the improve quality and scheduling of existing public transportation services. In order to make these subarea comparisons, a methodology for predicting consumer preferences for a large number of subareas needs to be developed.

The various choice models suggested in the transportation literature have dealt with estimation of parameters and prediction of probability of choice for different modes of transportation at the aggregate level. These models include logit, probit multinomial logit, multinomial probit and dogit, among others (Currim 1982, Daganzo 1979, Gaundry and Dagenais 1979, Manski and McFadden 1981, and McFadden 1976). Analysts who have recognised the importance of segments, for example subareas in a geographically deliniated market or "benefit" segments as defined in marketing, have partitioned the total sample into subgroups, and then have carried out estimation and prediction at the subgroup level (Currim 1981, Hauser and Urban 1977, Westin and Watson 1975).

This method of prediction at the subarea level can be improved by considering techniques which have recently become available in the area of multiple parameter estimation. (Rubin 1981 and Morris 1983). In the words

of Morris (1983), these methods "borrow strength from the ensemble." That is, prediction in a subarea is improved by borrowing strength from data set as a whole.

Within this framework, we explore the application of empirical Bayes techniques via logit and multinomial logit models to the task of improving multiple predictions. In section 2, we consider a set of potential models which could be employed for this purpose. In section 3, we consider the problem of obtaining data for purposes of prediction, and map out directions for further research.

2.0 Models for Prediction

We propose to estimate consumer preference among a set of transportation mode alternatives, by subarea, using a combination of special purpose sample survey data and publicly available census data. Typically, the sample design for such a special purpose survey would be multi-stage, with a nested structure of primary sampling units (PSU's), secondary sampling units (SSU's) within PSU's, and finally, individuals within SSU's. Obtaining global estimates of choice probabilities using such samples is a problem which is well understood by survey practicioners. See, for example, Cochran (1963). However, only recently have researchers begun to consider ways of using thinly spread sample survey data for the purpose of drawing inference about small subgroups of the population.

Currently available estimation techniques for small domains have been reviewed by Purcell and Kish (1979). Although often applied to estimating counts such as unemployment or mortality statistics, most of the available techniques were designed primarily for continuous variables. Examples include the regression models of Ericksen (1974), the synthetic estimation techniques of Gonzalez and Hoza (1975), the prediction models of Holt, Smith and Tomberlin (1979) and Laake (1979), and the James-Stein methods of Fay and Herriot (1979).

Here, we adopt a model-based prediction approach similar to that used by Holt, Smith and Tomberlin (1979) and Laake (1979), but we concentrate entirely on models built for discrete response variables. By including random effects corresponding to small geographic subareas of the population, we propose to obtain empirical Bayes estimates. These methods, like those of Fay and Harriot (1979), are sometimes referred to as "shrinkage estimates".

2.1 Fixed effects logistic models

In order to facilitate an introduction to the proposed methods, let us limit consideration to the case where there are two transportation mode choices, for example, bus vs. subway. Let the symbol p with appropriate subscripts represent the probability of an individual choosing to take the subway, and $q = 1 - p$ the complementary probability of preferring the bus. Let the vector $\mathbf{X}$ represent a set of characteristics associated with individuals, such as age, sex, income and distance from home to nearest subway station. Let the symbol ν denote i,j,k, where i represents PSU, j represents SSU within PSU, and k represents an individual within SSU. A typical logistic model might assume the following form:

(1) $\quad \text{logit}(p_\nu) = \boldsymbol{\beta}\, \mathbf{X}_\nu ,$

where, the logit function is defined by

(2) $\quad \text{logit}(p) = \ln(p/q) .$

For a more detailed discussion of logistic models, see Haberman (1978). In model (1), the logit is allowed to vary depending on individual characteristics, but note that there is no local area effect. Further, the absence of the subscript ν on the vector of regression coefficients, $\boldsymbol{\beta}$, indicates that the relationship between the logits and the individual characteristics is the same for the whole population. For example, this would imply that the effect of distance from the nearest subway station would have the same effect on the probability of choosing the subway over the bus for residents of the downtown core as it would for those living in outlying suburban areas. Model (1) allows for only that variation in transportation mode preference from area to area which can be explained by variation in the makeup of the individual characteristics $\mathbf{X}_\nu$.

By introducing a local area effect, the model could be improved to allow for variation beyond that due to differences in the $\mathbf{X}_\nu$. One such model would be

(3) $\quad \text{logit}(p_\nu) = \boldsymbol{\beta}\, \mathbf{X}_\nu + \gamma_i$

Here, the geographic parameter, γ_i depends only on the ith PSU. The additive form means that there is no interaction is between the effect of the vector of individual characteristics, $\mathbf{X}_\nu$, and the PSU effect γ_i.

A more realistic model might permit the effect of any particular factor, such as the distance from the nearest subway station, to vary from PSU to PSU. A general framework for such models would be obtained by allowing the vector of regression coefficients $\boldsymbol{\beta}$, to vary among PSU's, as with the

following model:

(4) $\text{logit}(p_v) = \beta_i X_v + \gamma_i$

Models (3) and (4) have the advantage of increasing realism, but the disadvantage that only data within the local area which constitutes the ith PSU can be used to estimate the local area effect, γ_i in either model, and the vector of coefficients β_i in model (4). Furthermore, for either of models (3) or (4), the possibility of estimation for local areas corresponding to PSU's not included in the sample is not immediately obvious. A major reason for introducing random effects into these models, as we suggest in Section 2.2 below, is to allow for a compromise between models such as model (1) and models (3) and (4).

Once a model such as (1), (3), or (4) has been fit to the data, there remains the task of applying this model to obtain estimates of numbers of consumers preferring the various modes of transportation for each of the subareas. This can be accomplished in the following manner. Information regarding the vector X_v must be available in an aggregate form for each of the subareas under consideration. In particular, if $\bar{x}_i$ is the mean of the X_v vectors for the ith subarea, then the proportion of consumers preferring the subway over the bus for subarea i would be obtained by simply applying the estimated model to this mean vector. For example, if model (1) were being used, the logit of the predicted proportion would be given by

(5) $\text{logit}(\hat{p}_i) = \hat{\beta}\,\bar{x}_i$.

The predicted proportion itself would be obtained by inverting the logit transformation as follows,

(6) $\hat{p}_i = \exp(\hat{\beta}\,\bar{x}_i) / [1 + \exp(\hat{\beta}\,\bar{x}_i)]$

Finally, the total number of consumers preferring the subway, m_i, could be obtained by merely applying this estimated proportion to an estimate of the population of the subarea, n_i,

(7) $\hat{m}_i = n_i \hat{p}_i$

Notice that this requires up-to-date, detailed information regarding the individual characteristics for small areas. For urban areas, information on demographic characteristics is generally available down to the block level from the preceeding census. In Canada, the census is taken every five years, so that reasonably up-to-date, detailed information is readily available. Any other information which can be obtained in aggregate form for relevant geographic subdivisions, can be included in the model. For example, average distance from the nearest subway station could be easily obtained by

inspection of maps.

2.2 Random effects logistic models

As mentioned earlier, models (3) and (4) suffer a serious drawback. Any such model which attempts to allow for variation among subareas more than that which could be ascribed to variation in the individual characteristic variables $\mathbf{X}_v$, requires that sufficient sample survey data be available from each of the subareas under consideration. Estimation of the local area specific parameters associated with such fixed effects models is based on data obtained from the corresponding local areas.

In addition, standard estimation techniques for these models are based on the assumption that individual choices can be considered as independent binomial observations. This assumption fails to incorporate the intraclasss correlation among the p_v from the same SSU or PSU. Even though this independence assumption is generally false, as long as the sample size is sufficiently large, the estimates themselves will be consistent. However, estimates of the sampling variability associated with these estimates will be overly optimistic.

One way of addressing both of these problems in a way which allows data from subareas to be used to an extent which is appropriate and which yields a valid assessment of the reliability of estimates obtained, is to incorporate a series of nested random effects into these logistic models with components of variability corresponding to each stage of the multi-stage sample design. Such a model might look like,

(8) $\quad \text{logit}(p_v) = \beta \mathbf{X}_v + \gamma_i + \gamma_{j(i)}$,

where the γ_i are regarded as being drawn from a Normal $(0,\sigma_1^2)$ population and the $\gamma_{j(i)}$ from a Normal $(0,\sigma_2^2)$ population. These random effects imply that individuals from the same PSU have a common element entering into their p_v, and the same occurs for the nested class of individuals in a common SSU.

Estimates of consumer preference based on random effects models such as (8) are obtained using an empirical Bayes framework. Once values of σ_1^2 and σ_2^2 have been obtained, it is possible to produce approximate normal posterior distributions for the p_v. These distributions contain factors which automatically, and correctly weight sample consumer preferences observed at the various levels of the multi-stage design. Furthermore, a

posterior distribution is obtained for the logit p_v's corresponding to individuals in PSU's not included in the sample. For such individuals, this posterior depends entirely on the model-based prediction obtained as a function of the individual characteristic variables in $\mathbf{X}_v$.

The basic mathematical development facilitating approximate computation of the posterior means and variances appears in Laird (1975, 1978). Initial experience with variance estimation for a non-nested model is found in Miao (1977) in a study of regional variation in leukemia incidence rates. In a study predicting automobile accident rates, Tomberlin (1982, 1986) used similar nested random effects models for Poisson data. In that study, estimates of variance components were obtained using maximum likelihood methods, and subsequent empirical Bayes predictions of individual accident rates were demonstrated to be superior to the more commonly used fixed effects model alternatives. The methodology for analysing these nested random effects logistic models has now been firmly established.

2.3 Multinomial logistic models

As noted earlier, there are usually more than two transportation modes available to consumers. For example, in addition to public bus and subway, one might choose to travel by commercial taxi, or private automobile, or by any combination of these alternatives. In order to obtain estimates for a range of choices, we must consider expanding the logistic models described in (1), (3), (4), (5), and (8) to models which are appropriate for multinomial response variables.

One formulation for multinomial logit models is presented by Amemiya (1981). In this formulation, one category, for example the subway, is chosen as a base category. The log odds ratio of favoring other categories as opposed to the base category are then modeled as linear functions of the vector of individual characteristics, for an analog of a multivariate multiple regression model. For example, let p_{mv} be the probability of individual v opting for the subway. Then if p_{kv} is the corresponding probability for some other mode of transportation, we have,

$$(9) \qquad \log(p_{kv}/p_{mv}) = \text{mlogit}(p_{kv}) = \beta_k \mathbf{X}_v .$$

Just as with the ordinary logit model (1), the maximum likelihood solution for the parameters β_k requires a non-linear optimization algorithm. Computer programs for estimation of the parameters in (9) are available in

standard statistical software packages such as SAS, though the convergence properties of these procedures can be somewhat more problematical.

Analogous to the nested random effects models described in (8), we have the following multivariate model:

(10) $\text{mlogit}(p_{kv}) = \beta_k X_v + \gamma_{ki} + \gamma_{kj(i)}, k \neq m,$

where the vector of γ_{ki}, γ_i is regarded as drawn from a multivariate Normal $(0,\Sigma_1)$ population, and the vectors of $\gamma_{kj(i)}$, $\gamma_{j(i)}$ are considered as being drawn independently from a multivariate Normal $(0,\Sigma_2)$ population.

Without further research, it remains unclear just how accurately the covariance matrices Σ_1 and Σ_2 can be estimated from a typical special purpose consumer survey, nor is it clear how sensitive the final empirical Bayes estimates of disaggregate consumer preference would be on these estimated covariance components. However, such models do capture the levels of variation which a priori judgement strongly suggest must underlie such survey data.

3.0 Implications for Further Research

Several models have been suggested for predicting probabilities of transportation mode choice for subareas of a larger market. These models are based on empirical Bayes techniques, and are expected to improve prediction accuracy by using information available from other subareas. Just how much improvement and under what conditions such an improvement is possible can be studied by empirical comparisons (Carter and Rolph 1974) or by Monte Carlo experimentation.

Improved models for choice probabilities and census data associated with subareas can be used together to estimate demand for various modes of transportation from each subarea to specified destinations, for example, the central business district. Such estimates for all subareas would present the geographic distribution of demand. An overall comparison of subarea demand levels with currently allocated public transportation alternatives may be helpful in signaling scheduling problems. It should be noted, however, that a proper analysis of scheduling and networking issues should consider frequency and timing of trips to multiple destinations. The suggested models, in their current forms, do not address such crucial issues.

Further research in random effects models of choice probabilities seems warranted. First, empirical Bayes parameter estimation methods should be developed for each of the models discussed. Next, an empirical

study based on data collected via a multi-stage sample design should be conducted to estimate the parameters of the suggested models. Finally, using disaggregate census data, these models can be employed to estimate demand for the various transportation modes. Creative ways of incorporating information on the frequency and timing of trips to specific destinations is likely to lead to useful application of these models for transportation network design and scheduling.

References

Amemiya, Takeshi (1981), "Qualitative Response Models: A Survey," The Journal of Economic Literature, 19, 1483-1536.

Carter, Grace M. and Rolph, John E. (1974), "Empirical Bayes Methods Applied to Estimating Fire Alarm Probabilities," Journal of the American Statistical Association, 69, 880-885.

Cochran, W. G. (1963), Sampling Techniques, New York: Wiley.

Currim, I. S. (1981), "Using Segmentation Approaches for Better Prediction and Understanding from Consumer Mode Choice Models," Journal of Marketing Research, 18, 301-309.

Currim, I. S. (1982), "Predictive Testing of Consumer Choice Models Not Subject to Independence of Irrelevant Alternatives," Journal of Marketing Research, 19, 208-222.

Daganzo, C. (1979), "Multinomial Probit: The Theory and Its Applications to Demand Forecasting," New York: Academic Press.

Ericksen, E. P. (1974), "A Regression Method for Estimating Population Change in Local Areas," Journal of the American Statistical Association, 69, 867-875.

Fay, R. E., and Herriot, R. A. "Estimates of Income for Small Places: An Application of James-Stein Procedures to Census Data," Journal of the American Statistical Association, 74, 269-277.

Gaudry, M. J. I. and Dagenais, M. G. (1979), "The Dogit Model," Transportation Research, 13B, 105-111.

Gonzalez, M. and Hoza, C. (1975), "Small Area Estimation of Unemployment," Proceedings of the American Statistical Association, Social Statistics Section, 437-443.

Haberman, S. J. (1978), Analysis of Qualitative Data, New York: Academic Press.

Hauser, J. and Urban, G. L. (1977), "A Normative Methodology for Modelling Consumer Response to Innovation," Operations Research, 25, 579-619.

Holt, D., Smith, T. M. F., and Tomberlin, T. J. (1979), "A Model-Based Approach

to Estimation for Small Subgroups of a Population," Journal of the American Statistical Association, 74, 405-510.

Laake, P. (1979), "A Predictive Approach to Subdomain Estimation in Finite Populations," Journal of the American Statistical Association, 74, 355-358.

Laird, N. (1975), "Log-Linear Models with Random Parameters: An Empirical Bayes Approach," unpublished Ph.D. dissertation, Harvard University, Department of Statistics.

Laird, N. (1978), "Empirical Bayes for Two-Way Tables," Biometrika, 65, 805-811.

Manski, C. and McFadden, D. (1981), Structural Analysis of Discrete Data, Cambridge, MA: MIT Press.

McFadden, D. (1976), "Quantal Choice Analysis: A Survey,: Annals of Economic and Social Measurement, 5, 363-390.

Miao, L. L. (1977), "An Empirical Bayes Approach to Analysis of Inter-Area Variation," unpublished Ph.D. disseration, Harvard University, Department of Statistics.

Morris, C. N. (1983), "Parametric Empirical Bayes Inference: Theory and Applications," Journal of the American Statistical Association, 78, 47-55, with discussion.

Purcell, N. J. and Kish L. (1979), "Estimation for Small Domains," Biometrics, 35, 365-384.

Rubin, D. (1981), "Using Empirical Bayes Techniques in the Law School Validity Studies," Journal of the American Statistical Association, 75, 801-827, with discussion.

Tomberlin, T. J. (1982), "A Statistical Perspective on Predicting Losses in Automobile Insurance," unpublished Ph.D. dissertation, Harvard University, Department of Statistics.

Tomberlin, T. J. (1986), "Predicting Accident Frequencies for Drivers in a Two-Way Classification", submitted for publication.

Westin, R. and Watson, P. (1975), "Reported and Revealed Preferences as Determinants of Mode Choice Behavior," Journal of Marketing Research, 12, 282-289.

TRANSPORTATION IMPACTS OF ACID RAIN MITIGATION MEASURES

by

Michael S. Bronzini
The University of Tennessee
Knoxville, Tennessee U.S.A.

and

Edward G. Altouney
Electric Power Research Institute
Palo Alto, California U.S.A.

Abstract

Substitution of low-sulfur coal for coal with a higher sulfur content has been suggested as a means of reducing sulfur emissions from coal-fired power plants. Making these substitutions causes significant changes in the national origin-destination pattern of coal movements in the United States. The Electric Power Research Institute Transportation Network Model was used to estimate the change in coal transportation costs which would occur if coal source substitution is adopted as a strategy for acid rain mitigation. National interregional coal flows forecast for the year 1995 were used in the analysis. Under a coal flow pattern designed to reduce sulfur emissions from coal-fired electric generating stations, the annual cost of transporting the coal to electric utilities is $US 950 million higher than in the base case. This represents a transportation cost increase of 6.7 percent, or an average of about $1 per ton. Some potential railroad capacity problems were also identified.

1.0 Introduction

Substitution of low-sulfur coal for coal with a higher sulfur content has been suggested as a means of reducing SO_2 emissions from coal-fired power plants, thereby attacking one dimension of the acid deposition problem. Making these substitutions causes significant changes in the national origin-destination pattern of coal movements. In general, coal must move longer distances and from different origin regions under a fuel substitution scenario. Thus, the impact of this strategy on coal transportation costs and rail capacity are relevant considerations when evaluating its costs and benefits.

The objective of this study (Bronzini and Aspinwall, 1985) was to estimate the impacts on the coal transportation system and on the

cost of transporting coal to electric utilities of one potential fuel substitution scenario. Total U.S. coal movements forecast for the year 1995 were included in the analysis.

2.0 Procedures

This study made use of a freight transportation network model and interregional commodity flow forecasts which were developed in previous research. The main effort was to reconcile model inputs from different sources and execute and interpret the model runs.

2.1 Transportation Network Analysis

The Electric Power Research Institue (EPRI) Transportation Network Model (TNM) was used to estimate costs. This model (CACI, 1982) includes a computerized representation of the entire U.S. intercity freight transportation network. All modes are represented, including rail, inland waterway, domestic deep draft, highway, and pipeline. The TNM routes shipments of coal and other commodities from origin regions to destination regions on a least-cost basis; totals the traffic load on each network element; and reports the time, energy, and cost incurred for this level of network utilization.

The 1990 version of the TNM database was used for this study. The networks defined in previous work for the years 1990 and 2000 are virtually identical, so the 1990 network provides adequate compatibility with the 1995 commodity flow forecasts. This version of the network contains 2,194 nodes, 3,619 links, and 334 intermodal transfer locations.

All costs in the 1990 TNM network are expressed in 1980 dollars. For this study, cost figures were adjusted to 1984, using the Producers Price Index (PPI). The term "cost" is used advisedly. The TNM estimates the average fully allocated cost (per ton or ton-mile) incurred by the provider of the transportation service, which may or may not be the same as the rate (price) paid by the shipper. Thus, to the extent that average rates depart from average costs, the model results will fail to capture the entire impact on coal shippers.

2.2 Coal Flows

Forecasts of interregional coal flows to all consuming sectors for the year 1995 were developed by ICF, Inc., using their Coal and Electric Utilities Model (CEUM). Forecasts were provided for two cases--a Base Case and a Fuel Substitution Case. Comparing the latter with the former, reduced coal production is expected in Northern Appalachia and the Midwest, and expanded production is expected in Central Appalachia and the West.

The origin and destination regions used in the CEUM are depicted in Figures 1 and 2. Flows between these regions were disaggregated to the Bureau of Economic Analysis (BEA) regions defined in the TNM

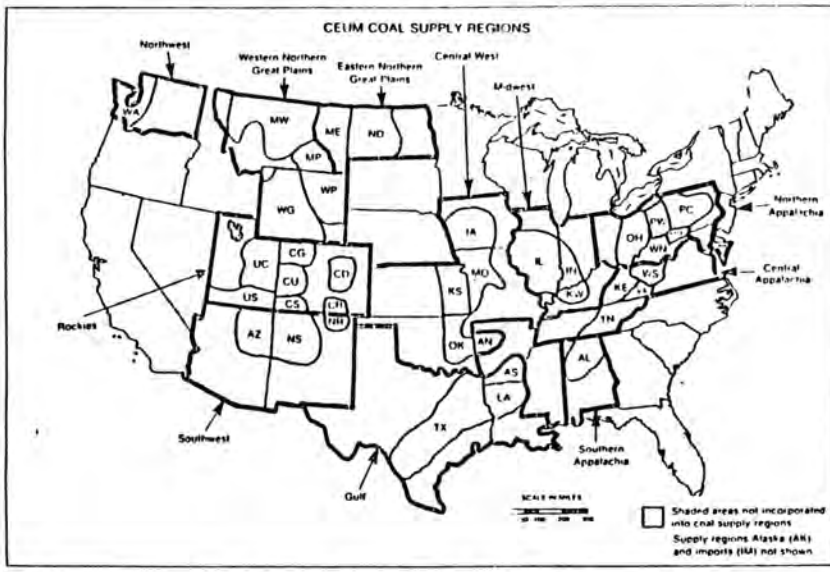


Figure 1. CEUM Coal Supply Regions



Figure 2. CEUM Demand Regions

database. There is nearly a one-to-one mapping between the CEUM regions and BEA regions, particularly for demand regions, but some BEA regions lie in more than one CEUM region. Appropriate allocation factors were developed for these cases. Coal shipments were separated into unit train and non-unit categories by interpolating between percentage allocations by region for 1990 and 2000 that were available from previous TNM runs. Finally, a number of "special regions" used in lieu of BEA regions for some coal shipments, again as defined for previous TNM runs, were introduced. The results of this processing were BEA-level interregional coal flows for each of the two cases, in the format required for input to the TNM.

2.3 Other Commodities

Flows of all other (non-coal) commodities are also required for proper use of the TNM. Forecasts of these flows for 1990 and 2000 were available from previous TNM runs. Table 1 gives the totals for each commodity group. The 1995 flows were obtained by linear interpolation.

Table 1. Non-Coal Commodity Flow Forecasts

Commodity	Total Flow, Kilotons 1990	2000
1. Farm Products	189,455	430,283
2. Forest and Marine Products	9,366	8,054
4. Crude Petroleum	504,555	770,838
5. Metallic Ores	186,615	365,570
6. Minerals	213,932	497,296
7. Food and Kindred Products	230,587	351,421
8. Textiles and Apparel	17,621	30,838
10. Chemicals	234,672	293,516
11. Lumber and Furniture	78,958	113,304
12. Machinery, Non-Electrical	24,750	45,077
13. Electrical Equipment	20,480	21,704
14. Transportation Equipment	27,934	58,599
15. Unidentified Manufactures	517,254	363,304
16. Paper and Paper Products	97,780	149,868
17. Petroleum Products	479,212	969,497
18. Primary Metals	113,877	214,814
19. Fabricated Metals	51,906	78,447
20. Miscellaneous	171,489	314,193

2.4 TNM Runs

Two runs of the TNM were made. Runs for the Base Case and the Fuel Substitution Case used the corresponding sets of coal flow forecasts. All other inputs were identical for both runs. Consequently, any differences in the TNM output are attributable solely to the differing coal flow patterns.

3.0 Results

The full results of this study are presented elsewhere (Bronzini and Aspinwall, 1985). Table 2 extracts some of the key statistics

Table 2. Summary of Transportation Impacts

Impact Measure	Base Case	Fuel Substitution	Difference (%)
Coal Traffic			
Tons (million)	1,291	1,277	- 1.1
Ton-Miles (billion)	722	798	+10.5
Average Haul (miles)	559	625	+11.8
Energy Use (trillion BTU)	375	423	+12.8
Cost ($US billion)	19.3	20.4	+ 5.7
Other Traffic			
Tons (million)	4,124	4,124	0
Ton-Miles (billion)	3,087	3,087	0
Average Haul (miles)	749	749	0
Energy Use (trillion BTU)	2,185	2,184	-0.05
Cost ($US billion)	115.5	115.5	0
Total Traffic			
Tons (million)	5,414	5,400	-2.6
Ton-Miles (billion)	3,809	3,884	+2.0
Average Haul (miles)	704	719	+2.1
Energy Use (trillion BTU)	2,560	2,606	+1.8
Cost ($US billion)	134.9	136.0	+0.8

Note: "Coal" and "Other" may not add to Total due to rounding. Costs are expressed in 1984 US dollars.

from the two runs and shows the percentage change from the Base Case to the Fuel Substitution Case. As noted previously, the cost figures have been adjusted to 1984, so they are consistently higher than the corresponding entries which appear directly in the computer output.

3.1 Impact on Coal Shippers

The first set of figures in Table 2 gives the results for coal traffic (sum of unit train and non-unit train coal). The second set of figures is for other traffic, and the third set is for total system traffic. The results for the non-coal commodity movements are nearly identical for both cases. This means that differences in system totals are due entirely to differences for coal shipments, and that coal shippers bear all of the impacts resulting from the change in the pattern of coal flows. Thus, attention can be focused on the upper portion of Table 2.

Comparing the Fuel Substitution Case with the Base Case, coal tonnage is down slightly but ton-miles are up by 10.5 percent, producing an 11.8 percent increase in the average haul distance from production regions to consumption regions. This occurs because there is reduced coal production in Pennsylvania, Ohio, Northern West Virginia, Tennessee, Alabama, Illinois, and Indiana, and expanded production in Southern West Virginia, Virginia, Eastern Kentucky, Montana, Wyoming, and Colorado. The longer hauls required to serve coal consumers produce a 12.8 percent increase in energy used for coal transportation and a 5.7 percent increase in coal transportation costs. This cost increase amounts to $US 1.1 billion annually.

3.2 Rail Capacity Problems

Small amounts of the input coal traffic are missing in the results for both cases because portions of the railroad system reached capacity before all of the coal shipments were routed. That is, coal transportation demand exceeds estimated rail capacity for some links in the network. The most severe problems occur on the mainline routes bringing coal out of Eastern Kentucky, Southern West Virginia, Wyoming, and Colorado.

The coal quantities involved are 6.3 million tons and 19.3 million tons for the Base Case and Fuel Substitution Case, respectively. Assuming that the railroads will institute procedures or make improvements to handle this additional traffic and adjusting costs in proportion to the additional tonnage, the following revised impact estimates are obtained.

	Base Case	Fuel Substitution	Difference (%)
Coal Traffic (Mtons)	1,297	1,296	-0.08
Cost ($US billion)	19.4	20.7	+6.7

Thus, based on total traffic, coal shipments incur a transportation cost increase of $US 1.3 billion.

3.3 Impact on Electric Utilities

What is the cost impact on the electric utility industry? Recent coal industry statistics and the ICF forecast used in the study indicate that approximately 73 percent of domestic coal shipments (including exports) are to electric utilities. Using this figure, approximately 947 million tons of coal are forecast to be shipped to electric utilities in 1995. If 73 percent of coal transportation costs are also allocated to utility shipments, the extra cost of moving coal to utilities due to fuel substitution will be approximately $US 950 million. This is an average increase in transportation cost of about $1 per ton.

It must be noted that the impacts discussed above are increases in the costs incurred by rail and water carriers. If coal transportation markets are competitive, the cost increase will be passed through to the utility with no change. If the markets experiencing greater demand are less competitive than the Base Case markets, however, the increase in coal transportation rates paid by the electric utilities may be greater than the estimated cost increase.

3.4 Implications of Rail Capacity Shortfalls

Some of the rail routes which became capacitated in these model runs were the principal lines serving the coal fields targeted for increased production in the effort to reduce power plant sulfur emissions. Consequently, there is a possibility that investment in increased rail capacity will be needed to achieve this. All of the capacitated lines are single track, and the 1995 TNM scenarios assume that they are all equipped with centralized traffic control (or have equivalent capacity). Thus, the investment needed will consist of additional sidings and segments of double track line. This is a relatively costly upgrading program and the railroads will probably insist that coal traffic should bear the brunt of paying for this capacity expansion. Thus, the coal rate impacts could be considerably greater than the cost impacts estimated above.

This result also has implications for how the fuel substitution strategy should be analyzed. The coal flow forecasting model should include the transportation capacity constraints on interregional coal flows identified in the transportation network analysis, and should use origin-destination coal transportation costs consistent with the costs estimated by the TNM. The network analysis should be extended to include a transportation market equilibrium solution and use of the more detailed EPRI Rail Routing and Costing System (Bronzini and Sherman, 1984), to investigate the nature and extent of the rail capacity problems. Finally, some recent EPRI sponsored work on railroad investment costs should be used to estimate the likely magnitude of the required railroad investments. All of this suggested work can be done now, but was beyond the scope of the present effort.

References

Bronzini, M.S., and Aspinwall, R., 1985, "Coal Transportation Impacts of Fuel Substitution to Reduce Power Plant SO_2 Emissions," Electric Power Research Institute, Palo Alto, CA (Draft, April, 1985).

Bronzini, M.S., and Sherman, D.M., 1984, Railroad Routing and Costing, Electric Power Research Institute, Palo Alto, CA (Draft, March, 1984).

CACI, Inc., 1982, Transportation Network Models for Energy Supply Analysis, EA-2324, Electric Power Research Institute, Palo Alto, CA (March, 1982).

Acknowledgements

This research was conducted by CACI, Inc., Arlington, Virginia and The University of Tennessee Transportation Center for the Energy Resources Program, Electric Power Research Institute, under Research Project 1219-3. The authors gratefully acknowledge the assistance of Ken Schweers of ICF, Inc., Roger Aspinwall of CACI, and Jim Grott of Southern Company Services in completing this study.

Transport Costs; Impact of Deregulation on Market Competitiveness

Neil Meyer and Robert Phelps 1/

The objective of this research was to estimate how changes in transport costs would affect which regions supply specific market areas with different products. The split among rail and truck transport mode was estimated and compared with actual data. To examine this issue, the transport of fresh table stock, frozen and dehydrated potatoes were examined.

The revised structure of the U.S. and Canadian Transport System is opening markets to some producers while closing markets to others. This paper defines the market supply regions for three products under alternative assumptions. A linear programming model was used to estimate the impact changes contract rates, switching charges, interline rates and gate closing would have on the ability of a producing region to supply regional markets. The changes in transport costs resulting from these system changes are expected to redefine the supply areas for given products. A related analysis of regional supply sensitivity looked at the truck/rail share of the interregional transport. How changes in truck rates and regulations affect a regions ability to compete in certain markets was evaluated.

The sensitivity to changes in rail or truck rates or rules were evaluated for effects on model share.

The simulated results were compared with actual data to note any differences. The implications for transport policy development was explained to assist Canadian and U.S. policy makers in evaluating the effects different alternatives are likely to have on the allocation of product demand to various supply regions.

For a copy of the paper or answers to specific questions, please call Dr. Neil L. Meyer at 208-885-6262 or write to the address below.

1/ Respectively, Associate Professor and Research Associate at the University of Idaho Agricultural Economics Department, Moscow, Idaho 83843

CANADIAN REGULATORY CHANGE IN THE RAILWAY INDUSTRY SOLUTION OR PROBLEM

by

J. W. TELFORD
TELCAN Management Consultants Inc.

1.0 INTRODUCTION

On July 15th 1985 the Honorable Don Mazankowski, Minister of Transport released "Freedom to Move" - A Framework for transportation reform. Canada once again embarked on a search for that elusive concept of transport policy that will meet the economic needs of industry, create safe, efficient and financially sound carriers and satisfy the political and economic aspirations of the diversity of regions that form this nation.

The objectives of "Freedom to Move" are ambitious. They are based on the belief that economic regulatory reform in transportation is needed in Canada if it is to "achieve economic renewal and growth and to meet international competition". One can not argue with the statement that "the transportation industry requires greater freedom to introduce innovative and expanded services to meet Canada's transportation challenges in the future". One can however ask whether the ideology that is presented can be implemented in a fashion that will work in the market place for both the carriers and industry and still support National and regional aspirations as represented by the Federal and Provincial governments.

This paper is directed specifically to the railway aspects of regulatory reform, and considers some of the problems and impacts on industry and the carriers in the new intermodal environment.

2.0 REGULATORY REFORM IN CANADA

2.1 General

The proposals presented in "Freedom to Move" are based on the ideology that a greater reliance on competition and the market place and a reduced emphasis on regulation can improve the performance of the transportation industry. The proposal presents concepts for regulatory change in all modes. It does not present a

full menu of proposed government action that will effect transportation.

Issues such as technical standards, safety standards, work rules, foreign ownership, competition and concentration, employment practices, crown corporations (including loan guarantees, loans, equity financing and recapitalization), corporate tax, fuel tax and dividends all affect the efficient and effective delivery of transportation service. They are left to separate consideration under other legislation.

Many of these other initiatives add to the cost and uncertainty related to the transportation industry. For example the Dangerous Goods Regulations lack compatibility with US regulations and add cost to the carrier for compliance. Air Safety Regulations give government additional powers of inspection and increased penalties. The Competition bill gives added power to the government to control mergers. The Investment Canada Act provides for government control over foreign acquisitions with assets over five million dollars but does not control new business and could allow new US trucking firms to incorporate and gain access to Canada removing much of our international trade from our control. Other government initiatives such as the reduction in the Transport Canada budget by 600 million dollars by 1990, the Rail Passenger Transportation Act that will change the terms under which VIA will use the railway facilities, the potential privatization of Canadian National and Air Canada and the almost certain divestiture of many of the major ports will have a major impact on the competitive nature of transportation and the cost recovery objectives for facilities.

The Legislation that will be presented to the House of Commons later this year must be judged in relation to the full impact of the series of initiatives that are being proposed. The uncertainty of how the legislation will be framed makes it impossible to judge the full impact of the changed environment that is being developed. The inter-relationships are far reaching. It is however a challenge to each of us in transportation to use our abilities to understand the potential results and make that understanding available to those who hold the destiny of both the operators and the users of transportation.

2.2 Proposed Railway Regulatory Reform

The concepts presented in "Freedom to Move" are based on the premise that the transportation industry has matured and that "The NTA and other transportation

legislation represent a philosophy of regulation that has become outmoded"(FTM page 1).

The general policy applies to all modes. It includes policy positions that indicate a reduction in government control, reduction in cost by creating greater efficiency, promotion of intramodal and intermodal competition, safety as a priority, creation of a regulatory agency which is smaller and more accessible, monitoring of the effect on those affected by the policy and provision of selective assistance, public subsidies for services provided as imposed public duties and creation of a new dispute resolving mechanisms such as mediation, final offer arbitration, a concept of reparations and a change to the current public interest sections to make them more effective.

Specifically, the rail mode is singled out for an interesting mix of deregulation and reregulation.

> The carriers will be given the authority to make confidential contracts and provide rebates to shippers. They will lose the right to exchange information and make collective rates (Section 279 Railway Act).
>
> There will be no appeals to confidential contracts and the railways will not have access to competitive agreements.
>
> There will be published tariffs available for movements that are not under contract. These tariffs will be available at the railways offices. Confidential contracts and tariffs covering shipments that qualify for subsidy under the Maritime Freight Rates Act or the Atlantic Freight Assistance Act will be filed.
>
> Common carrier obligations will be retained but authority to modify them under confidential contracts will be provided.
>
> The "captive shippers" clause 278 of the Railway Act will be repealed. Shippers captive to one railway carrier will have recourse to the normal appeal procedures and government will legislate a joint line rate concept that will give them access to the lines of a competing railway.
>
> Government will have the power to impose running rights and joint- track usage on the railways and set the level of compensation where it is in the national interest.

The railways will be permitted to apply to the Regulatory Agency for permission to use non-compensatory rates for development purposes. A sunset provision will repeal Section 276 of the Railway Act in five years.

The government will retain control over the abandonment of railway branch lines and extend that control to automatic entry for short line railways that meet the "fit, willing and able" test on lines where the railways have filed for abandonment. The transfer of control of branch lines between railways can also be directed under certain circumstances. Time limits will be placed on the procedures and the criteria for abandonment will changed.

3.0 ENVIRONMENT OF CHANGE

"Freedom to Move" presents a major philosophical change in the direction of transportation policy in Canada. It espouses the concepts of deregulation (less regulation) in a service industry that it defines as being "mature". While we cannot know the shape of the ultimate legislation we can look at the environment that is being created and consider some of the issues and impacts.

3.1 US/Canadian Background of Deregulation

We will not provide any extensive discussion of the merits or problems of the United States concept of deregulation. A few observations may assist in our consideration of the Canadian situation. While the Staggers Rail Act and it's predecessors have had a number of objectives, one of the main considerations was the rationalization of the rail system and the improvement of the financial condition of the rail carriers. The US system provided massive opportunities for consolidation of regional carriers and the abandonment of unproductive and duplicate facilities. The previous US regulatory system was based on concepts of regulatory control that took into consideration the competitive relationship between modes and the impact on market share of any rate proposal. In many areas the modes were not allowed to compete - they were regulated. The system rationalization and the new market segments in which they could compete provided the United States railways the latitude for the rate adjustments that we have seen under deregulation. Many of these reduced rates would have been in effect under an open market environment if it had not been constrained by the regulatory process.

Canada on the other hand as a result of the National

Transportation Act 1967 effectively deregulated railway freight rates. The market has been determining most of the price setting in this country limited only by a minimum compensatory cost base and in some cases by the right of the carriers to jointly set rates between competitive stations and exchange cost information. Rates generally are at the price which is dictated by motor carrier or potential pipeline competition or is the maximum that the railways consider that they can get in a market competitive environment.

The National Transportation Act authorized the payment of branch line subsidies in Canada to offset the cost of grain related lines that were uneconomic. The Grain Transportation Act changed the mechanism of payment and improved the level of contribution from grain for the railways.

3.2 Financial Considerations

The financial impact of any transportation policy change on the railways in Canada must be a prime consideration for government. In the 1950's and 1960's the railways were faced with increased motor carrier competition, massive diversion of traffic and a regulatory system that delayed the implementation of required rate increases. The result was increased subsidies which were completely out of control by the time the National Transportation Act was passed in 1967. Deregulation of freight rates and the provision of tied subsidies to cover services provided in the public interest improved the railways viability and allowed them to rationalize system and service concepts to reduce the cost base in relation to the service they were providing. Effectively the carriers reoriented their marketing thrust into areas where they had an inherent advantage. They moved out of direct boxcar LCL and and into intermodal, closed out local stations and increased their emphasis on high volume traffic. A review of traffic patterns since the NTA confirms the trend.

In the 1986 version of deregulation the rail carriers are once again faced with traffic diversion to the motor carrier or a decrease in revenues on truck competitive traffic of more than 20%. A recent Alberta government study of the contribution of the national traffic base to the overhead burden indicated that in 1982 the ratio of variable cost to revenue was 1.06. This level of contribution coupled with the volume levels that have been moving by rail in the Canadian economy has recently resulted in a rail profit level of plus or minus 5%. Under deregulation, with a 20 % reduction in competitive revenue the carriers will be forced to find greater

efficiency or increase rates on the captive segment where market competition will allow.

It also appears that a reduction in the Federal contribution to the railways may result from the Rail Passenger Transportation Act. Other changes could flow from the 1990 target of a reduction of 600 million dollars in the Transport Canada budget and the Nielson Task Force. The total impact must be of concern to both the rail carriers and the shippers who are captive to the mode.

3.3 Cost Reduction

Highlighting a few examples of potential cost reduction opportunities may put this aspect of the equation into context and be helpful. The railways have an inherent advantage in the movement of high volume traffic. They are not an economic mode on low density routes because of the high cost of infrastructure and motor carrier competition. The first major opportunity is therefore in the rationalization of plant. The new policy proposes speeding up the legal process but also adds a level of control related to joint use and joint running rights. It in no way forces the rationalization of the grain system and the use of truck transportation to improve total system efficiency. The improved time limits are good but the concept of Short Line Railways may only work with a division of revenues on the through route. We doubt that trunk carriers will see a net financial gain as a result of the change - only time will tell.

Implementation of technological change is inhibited by the inertia of an organization, lack of capital, regulatory restraints or lack of labor acceptance. Availability of capital affects the major areas of change such as electrification. A change of this nature is not on the horizon within current priorities so it does not present an immediate problem or opportunity. The Canadian railways have not always led the world in applying new technology but have a good record. Their major problems in implementation have been in the regulatory and the labor areas. A current example of the cumulative effect of the system is the lack of approval for the use of ETU's (end of train units) that remove the need for the caboose. This cost saving technological change has been challenged by labor and been under extensive testing as directed by the CTC. It has been in use in the United States for some time. Who has caused the delay? I would assume that all the players could be faulted to some extent but it is a good example of where problems arise when both safety and labor may be affected. Over time there will be improvements in cost as a result

of technological change but the problems of implementation should be addressed so that unnecessary delays are removed.

3.4 Productivity

Rail productivity has been accomplished in Canada through a combination of factors. The substitution of capital for labor in the railway industry has been emphasized as a result of work rules that limit the ability of management to directly adjust crew size and labor productivity. The replacement of steam with diesel locomotives, the development of automated classification yards, the installation of automated signalling systems, the continuing computerization of a broad range of systems and the purchase of automated maintenance equipment are all a part of this trend. The use of incentives to increase carload weights and the increase in the length of trains have also increased the productivity per man hour. One other factor that is often overlooked in research into rail productivity is the change in traffic mix. The movement of long haul low value goods and bulk movements of heavy loading products such as grain, chemicals, coal and lumber, particularly in western Canada, along with the trend to containerization and piggy-back have lowered the costs of production per ton mile and created the appearance of an increase in productivity.

Many of these opportunities have been exhausted. Other activities and trends will continue but at reduced rate of change. None appear to be directly affected by the new policy direction unless in the implementation process the carriers are given additional authority to control the cost inputs.

3.5 Potential Increased Traffic

The level of rail traffic is to a large extent related to the strength of the Canadian economy and international factors outside the carriers control. The price of rail transportation is a major consideration in developing new markets because of the relatively long distances to tide water from the point of origin. The current rate structure has since the passing of the National Transportation Act in 1967 allowed the railways the freedom to price, limited only by the compensatory cost floor. Where industry has made a case - rates for both domestic and international traffic have been adjusted to a level that, in the view of the railways, does let the product move at the greatest volume and net to the carriers. The railways view of the best level of rate to expand movement may not have been correct but there was nothing in the Act to prevent them making the decision.

The new policy does provide for confidential rates and that may result in some price reductions. It does not change the negotiators or the relative strength of the parties involved. Only the visibility of the outcome and the availability of the new rates to the balance of the shippers is affected. The other aspect of the new regime is intramodal competition. In this area may lie some real advantage. The effectiveness of this new tool will be dependent on the ease of application and the scope of the new rules. If the railways do decide to compete there will be rate reductions. If demand can be increased by price reduction there may be an expansion of traffic movements on the other hand there may only be a transfer of profit from the carrier to the industry.

4.0 RAIL CARRIERS - SOLUTIONS OR PROBLEMS

To present a considered opinion on the impact of the new freedoms on rail transportation we have to make some assumptions. What will happen in the economy? How will the intramodal and intermodal competition react? And most importantly what will the legislation contain? The difference between a legislative framework that looks good and the actual legislation can create a disaster.

We will not try to project the direction of the economy. If we remain in limited recovery all transportation modes will be hard pressed to stay in the black. All modes of transportation are now taking smaller levels of contribution over their variable cost and profit margins have been squeezed or are non existent.

The motor carriers as a result of the lower volumes of traffic that has been moving, the impending deregulation in Canada and the US deregulation are for domestic goods discounting class and FAK rates by 50% and commodity rates by 20%. Traffic moving across the border is moving at 25 to 40% of the Niagara Frontier Tariff Bureau rates (March issue Canadian Transportation and Distribution). These discounts are similar to those reported in the Nov 11 Fortune magazine which stated that average discounts in the US since 1980 were 18 to 20% and sometimes up to 40%.

Another aspect of the competitive environment in the United States is the restructuring of the motor carrier industry. Small truckers have increased by 12,400, bankruptcies have affected close to 100,000 employees and operating revenues of close to 4.5 billion dollars. At the same time the top ten carriers of LCL freight have increased their revenue share from 32 to 47% and their profit share from 48 to 69%. An example of the return on

common stockholders equity for a five year average since deregulation would be Consolidated Freightways 11%, Roadway services 17% and Yellow Freight Systems 10%.

In Canada we can expect much of the same type of change. Deregulated Alberta has long had a disproportionate number of small truckers. The nation as a whole has seen a growing trend to concentration that has accelerated with the down turn in the economy. Overall we will see improved profitability for those in the industry that learn how to control cost and bankruptcy of those that have not learned the management skills required to exist in a market economy. We will also see reduction of rates that will benefit industry. Under the new policy the Provinces must all take independent action to implement the concepts of deregulation. Will the final regulatory and legislative action result in meeting the Minister's objectives or will the time deadlines that are being gradually moved back, by some of the provinces, extend beyond all reason. Standardized requirements for equipment, safety, operations, weight limits, documentation and economic regulation are all required if the benefits are to be gained. Some of these issues are not part of the agreement, others including the control of the CN truck operations may create an impossible obstacle to accomplishing the very worthwhile objectives. As a result the truck competition may not become as extensive as some may believe and the competitive impact on the railways will be reduced.

So much for the change in the competitive environment and it's probability. The competitive influences that change will result in more of the rail traffic becoming subject to competition and a downward pressure on the railway freight rate structure. It will also create an interesting balancing act as the railways try to reduce rates on their intermodal service in response to competitive pressures and keep the rates on for-hire piggyback as high as possible while not forcing the long haul trucker back on the highway. Errors of judgment will be costly. The overall reduction in rail revenue in the competitive sector will have to be recovered by either an increase in market share or increased contribution to overheads from other traffic.

One the greatest areas of impact in the policy proposal is the removal of the right to exchange cost information and make collective rates coupled with a legislative requirement to provide joint rates that will provide industry with access to the line of the competing railway. If the carriers do decide to compete we will see a restructuring of the rate levels on many of the competitive routes that will more properly reflect the low

cost carrier rather than the global trade offs that were part of the former regulatory regime. In all probability such decreases will take the form of confidential contracts. This will benefit the preferred shipper with high volume or negotiating clout while not making public the level of adjustment to the other carrier.

The legislating of joint line rates is far reaching. It could impact on the viability of the carriers and their expectation of a return on the investments which have been made in the choice of route and capital assets. The policy framework appears to be all encompassing when it states "will have access to the lines of competing carriers" (page 7). The question is how? If it is an extension of the interswitching limits beyond the present four miles to - say the total of the industrial area of the urban community - that will only be a return to the principle on which the four mile limit was originally set in the early 1900's. The Board of Railway Commissioners, after a survey of all cities in the country reached the conclusion that a four mile limit would take care of the problem of access to competitive railways. The words in the 1985 policy appear to reach beyond the application of a historic principle which the carriers might find acceptable and one which would not make any great contribution to the level of intramodal competition for the resource based industry.

If the document does mean <u>all</u> "lines of the competing carriers" then we have in fact created true national and international intramodal competition. The next question is the level and type of rates. The traditional meaning of a "joint rate" has been a single factor through rate, agreed to by both carriers, to cover the movement of goods on a through route with the division of revenue a part of the agreement. A definition that does not fit the circumstances. A different approach is therefore necessary.

The question of the level of interline rates is not new to Canada. It was addressed by the Turgeon Royal Commission. In their 1951 report it was suggested that interline rates should only exceed the single line rate by the actual added cost to the carrier. This became law in 1952 when the Railway Act was amended and later was repealed by the National Transportation Act in 1967. The effect of the legislation was to extend the single line basis to the joint route with only the addition of the direct cost that could be proven by the railway. The United States is also wrestling with the problem of intramodal competition and the rate structure that should apply. One approach that is before Congress is a concept of proportional rates that would see a simple extension of

the cost/revenue relationship that a carrier was willing to accept to the originating or destination carrier. The concept would take rate determination out of the regulatory process and into the market place.

From a Canadian railway point of view the policy has a number of potential impacts. In its broadest sense it could open Canada up as an extension of the US system. With the lower US railway cost base, achieved through amalgamation and rationalization and depending on the pricing policy, we could see massive diversion of freight to the detriment of the CN, the CP and the Canadian ports. On the domestic side of the question we have the uncertainty of the direction and control of a Crown Corporation. How will CN behave without the formal restraints of a bottom line that is unattached to the federal treasury? For that matter how will CP act? Will we have effective competition or will we have tacit agreement to limited competition and a maintenance of the railway revenue base while doing battle with the motor carrier. The joint line rate issue is complex and if the new rules are to be effective each of these issues must be addressed along with questions of car supply and service.

Confidential rates are a new tool in the railways favor. There will no longer be a need to maintain a semblance of equity between shippers. The transparency of the rate structure was there and shippers either big or small could see when a competitor had gained an advantage. If they could ship in the same quantity they could probably arrange a similar rate level. With the proposed change each shipper is on his own and a new opportunity for revenue maximization is available to the carriers.

Two other areas should be considered. The government has indicated that it believes the transportation system is mature but in the rail mode they have not given the carriers the right to control their costs through the rationalization of many of the rail assets or the adjustment of operating rules and procedures. These are areas of potential cost reduction that would affect the viability of the carriers their ability to reduce rates and possibly the contribution that may be necessary from government. This a part of deregulation that would contribute to the objectives of the policy if it could be made acceptable to the various groups. I am not suggesting a right to chop out branch lines at will. Rather I am suggesting a rational decision process that will take advantage of the options that exist for the use of trucks on highways that are equally underutilized. I would agree with the policy that long regulatory procedures are not in our interests. But I would suggest that frozen branch lines that are outside the market

influences are not in congruity with the thrust of the policy or in the long term interest of the grain producers the grain marketing system or the carriers.

5.0 CANADIAN INDUSTRY - SOLUTIONS OR PROBLEMS

The industry side of the equation has a totally different aspect. For any manager that reads the popular press the level of rate reduction that has resulted from deregulation in the United States is not only substantial but 20 - 30 or 40% reductions in cost may sound like utopia. The more important question is how did the firms do in relation to their competition on specific lanes or at specific destinations? Did the profit margin improve? Were the firms able to penetrate new markets? Did their market share increase? Or did they just run harder to remain in the same place?

The market system created by deregulation of the transportation industry rewards innovative management. It rewards the good negotiator. It rewards the organization that has honed the tools of strategic management and can react from a base of knowledge available from an effective management information system and the ability to reorganize its functional control to take advantage of the new opportunities. It also rewards the companies that have been able to consolidate shipments and apply the tools of effective physical distribution and maximize the cost reduction in their total system. In summary the real benefits go to those that are prepared, who have done their homework, who have invested the time and effort to take advantage of the opportunity.

To be effective industry must have knowledge. It must know the carriers costs, how they relate to profitability, how the economy is affecting his revenues, how inflation or deflation will effect his costs and what type of escalation clause will protect it's interests. Industry must know the advantages that its competitors have that may give them an edge in the negotiations and a reduced transportation price. Is industry really ready for deregulation? Is Canada really ready to give you a chance in this high stakes game? I would say NO to both questions. In this country we do not have the statistical base in the transportation industry that our neighbors across the border had to assist them. We do not have access to railway cost information. We do not have a transportation inflation index or even a definition of what constitutes a typical basket of goods for various types of movements on which to apply inflationary adjustments. These tools must be developed. Some of them can only be developed at a national level by government.

Several aspects of the proposed changes related to price should be considered by the industrial community. With the lack of detailed information the impact is hard to judge.

The railways have an option to either negotiate contracts for absolute rates or rebates from the published rate. Most large shippers will take the confidential option, therefore the published rate will, because of a lack of negotiating clout on the part of the small shipper tend to drift upward to a level close to that of the next least efficient mode rather than the rate level that would normally be expected for the size of carload that is being moved. The US experience indicates that small shippers lack the volume of traffic to negotiate for the rebates that are readily available to his large competitor.

Transportation may in the eyes of the government be mature but Canada is a nation of small business. Each segment of our economy is dominated by a handful of national, international or world scale operations. These large scale operation have the potential for improving our international trade if they can become more competitive. The policy of deregulation is right for our times. I would suggest that policy adjustments exist to shape its implementation so that the small entrepreneurs, which government has declared produce most of our new employment, can have an opportunity to share in the benefit of the move to reliance on free enterprise in the transportation industry.

6.0 CONCLUSIONS

Freedom to Move and its implications is a step in the right direction. This paper only touches the surface of many issues and ignores others. It is a far reaching policy that must be evaluated in the light of all related policy initiatives. It will be impossible to judge in total until we see the flesh on the bones. There is no question that the policy will create reduced freight costs in the short run. It will also create a massive shake out period as carriers and industry develop new strategy and make their own policy decisions. There will be winners and losers in both industry and the carriers. If I had one suggestion to government it would be to reshape the deregulation concepts to ensure that rail and motor carrier management have equal opportunity to manage their costs and make their own pricing decisions and to ensure that both large and small industry have an equal opportunity to grow and prosper.

SOLUTION OR PROBLEM - TIME WILL TELL

THE IMPACT ON CANADIAN RAILWAYS AND SHIPPERS OF COST-BASED PRICING FOR RAILWAY FREIGHT

by

John A. Nash
CP Rail

1.0 Introduction

The enactment of the National Transportation Act and the consequential amendments to the Railway Act in 1967 produced a regulatory regime that has encouraged Canadian railways to differentiate the prices for their various commercial freight services on the basis of shipper demand for those services. This method of setting railway prices is economically efficient since it permits a railway to charge rates that both reflect the value of rail service and provide the opportunity for the railway to generate sufficient contribution from all movements to cover its total costs, including its cost of capital.

In the course of public debate in respect of the federal government's proposals for regulatory reform in the transportation sector set out in the position paper Freedom to Move(1) released in July, 1985, the Province of Alberta has proposed that railway rates be capped by a specified ratio of revenue-to-variable cost unless a railway could demonstrate "effective" competition for the traffic.(2) In other words, a rate above that ratio would be deemed "unreasonable" unless the railway could demonstrate otherwise.

This paper (a) restates the argument why demand-based differential pricing is economically efficient compared to a cost-based pricing system that pro-rates the constant or fixed costs of the railway among the various traffics and (b) addresses the proposal for maximum rate control advanced by the Province of Alberta.

2.0 Railway Commercial Viability

Any discussion of railway pricing practices must have as its starting point the recognition that the railways

are entitled to the opportunity to earn a level of revenues that will enable them to recover their total costs, including their cost of capital. A railway, like any other commercial undertaking, must compete for the resources that it employs in the provision of its services. If the providers of these resources do not expect to earn a return from their deployment in the railway enterprise equivalent to what the resources could earn in the next best alternative use, the resources will be withdrawn and employed elsewhere. As a simple example, a railway would not be able to attract employees if it were to offer hourly wage rates of $2.00 per hour while alternative occupations that required similar skills offered $10.00 per hour.

The economic principle described above is as relevant to capital as it is to any other resource. Unless a railway is afforded the opportunity to earn a return equal to its cost of capital - that is a return sufficient to attract and retain the funds necessary for the acquisition of the required plant and equipment - that capital will be denied to the railway and put to alternative uses where the returns are higher. For example, one would not expect a provider of capital to invest funds in a railway if the expected return were five percent per year while those same funds could be expected to earn 10 percent per year if placed in an alternative investment of comparable risk.

The perception by investors that a railway will be unable to earn its opportunity cost of capital will result in the inability of that railway to renew its assets at the end of their economic lives or to acquire assets for the purpose of modernization and the accommodation of anticipated increases in traffic. Over time, the railway will no longer be able to provide the required level of service and remain competitive due to the deterioration in plant and equipment. The ultimate result is the termination of service.

The chain of events described above has been experienced in both Canada and the United States. Prior to the enactment of the Western Grain Transportation Act in 1983, Canadian railways were required by law to transport grain to export positions at rates that were three cents per hundredweight less than those published by the Canadian Pacific Railway Company on September 6, 1897.(3) At the end of the 1970s, the costs to the railways of moving grain far exceeded the revenues from the traffic. Notwithstanding indirect federal government subvention in the form of car acquisitions, compensation for the operation of uneconomic branch lines and branch line rehabilitation programs, the losses incurred by the

railways on export grain were undermining the viability and effectiveness of the grain handling system at the cost of lost export sales.(4) In addition, the general shortage of funds as a result of the losses on grain was severely curtailing the ability of the railways to finance capacity expansions to accommodate anticipated increases in the volume of grain and other bulk commodities.

Similarly, the succession of railroad bankruptcies in the United States during the 1970s and the generally poor financial condition of the remaining carriers underscored the shortcomings of a regulatory policy that subordinated the commercial viability of carriers in favour of other considerations. In recognition of past failings in regulatory policy towards the railroads, the Staggers Rail Act of 1980 is explicit in its acknowledgement that the "revenue adequacy" of rail carriers is in the public interest and conducive to the promotion of a "safe and efficient rail transportation system".(5)

Freedom To Move proposes that the statement of national transportation policy objectives set out in section 3 of the National Transportation Act be revised to recognize that "transportation is a service industry designed to assist Canadian shippers in meeting the competitive demands of the future".(6)

While there is no denying that the railways fulfil a service function, it is equally true that if the railways are not granted the potential to be commercially viable (that is, the potential to earn a return equal to their cost of capital), then ultimately they will be unable to provide any service at all. The contemplated policy objective described in Freedom to Move cannot be achieved without the concomitant recognition that the prices charged by the railways for a given level and quality of service must provide for the commercial viability of the supplier of that service.

3.0 Demand-Based Differential Pricing

For a railway to be commercially viable, it is essential that it practice demand-based differential pricing whereby the prices for railway service and, more specifically, the recovery of the constant or fixed costs of the railway above the long-run variable cost of providing the service, vary among movements in response to differences in modal and market competition.

The economic rationale for demand-based differential pricing flows from three characteristics of the railway industry in Canada that together produce an economic environment unlike that of most other industries. These characteristics are:

(1) a railway produces a wide variety of different transportation services (for example, unit and solid trains of bulk commodities, single and multiple car shipments of merchandise traffic, hazardous materials transportation, and trailer-on-flatcar and container-on-flatcar services);

(2) the various transportation services are sold in marketplaces that have different demand characteristics; and

(3) a significant portion of total railway expenses are fixed or constant in that they do not materially increase or decrease with reasonable changes in the total volume of services provided, and are common to the production of the various transportation services.

These characteristics of the railway industry create an environment wherein a railway cannot set a cost-based price for each transportation service at a level that makes an equal relative or absolute recovery of fixed or constant costs and, simultaneously, sustain commercial viability. This is because such prices will be too high to attract substantial amounts of traffic that would otherwise be carried by the rail mode if the rates were reduced for that traffic. The loss of these movements will reduce the volume of traffic over which the constant costs must be apportioned to the point where the remaining traffic is also priced out of rail service, and the railway terminates service.

In contrast to a cost-based pricing method that allocates constant costs equally among all transportation services, demand-based differential pricing apportions these costs on the basis of the differences in the value of the transportation services to the shippers who use them. Value of service pricing is conceptually no different from the pricing of all resources consumed throughout the economy generally since it approximates the maximum price that a shipper is prepared to pay for the service rather than do without it. In the case of the railways where there are barriers to freedom of entry or exit into the industry, there does not appear to be justification for constraints on value of service pricing unless total railway revenues exceed total railway costs (including cost of capital) or where the revenues from a specific railway service exceed the stand-alone cost of providing that same service.

Differential pricing permits the railway to establish prices that optimize the volume of traffic over which constant costs are apportioned. Further, it yields a set of prices by which all shippers benefit from the economies of scope, scale and density inherent in multi-product railway service.

If one accepts that the value of railway transportation services differs significantly among potential purchasers of those services, the following simple example demonstrates that demand-based differential pricing, with its unequal recovery of constant costs, is an economically efficient method of establishing railway prices, and over the long term, yields the lowest transportation rate to shippers.

Assume that a railway has two types of potential traffic, A and B, and that, if both types of traffic moved by rail, each would incur a variable cost of $400, and that the railway would experience constant or unattributable costs of $250. Further assume that the value of the transportation service is $625 to Traffic A and $425 to Traffic B. Thus the railway could earn total revenues of $1,050 from the carriage of these traffics - an amount that is equal to its total costs.

If the railway's prices were cost-based, with an equal recovery of constant costs, then the rates would be set so as to produce $525 of revenues from each traffic. At this level, each traffic would yield $125 towards constant costs.

However, because the value of the transportation service to Traffic B is only $425, the traffic could not move at the cost-based rate and would be lost to the railway. Thus without Traffic B, Traffic A would have to pay rates that yield annual revenues of $650 ($400 of variable cost plus $250 of constant costs) if the railway is to sustain commercial viability. However, the value of the transportation service to Traffic A is only $625 and, therefore, the railway could carry this traffic only until such time as it eventually goes out of business since it would not be recovering the total cost of providing the service. In addition, the shippers of both Traffics A and B will pay higher transportation prices because of the enforced use of alternative modes in the absence of rail service.

In contrast, demand-based differential pricing will meet the rail transportation requirements of both traffics and, at the same time, permit the railway to achieve an adequate return on its capital. That is, if Traffics A and B each yield revenues to the railway that equal the respective values of rail service ($625 for Traffic A for a revenue-to-variable cost ratio of 1.56 and $425 for Traffic B for a revenue-to-variable cost ratio of 1.06), they will each be able to secure the most economical transportation prices, and provide sufficient revenues for the commercial viability of the railway.

The above example also demonstrates why the imposition of a rate ceiling incorporating a specified revenue-to-variable cost ratio that produces a level of revenues below the value of service to the shipper will, in the long run, deny the benefits of railway service both to that shipper and to those other shippers whose traffic is moving at rates below the revenue-to-variable cost ceiling. If the revenue-to-variable cost ceiling is placed at 1.50, Traffic A will produce revenues for the railway of $600 ($400 of variable cost times 1.50) which together with the revenues from Traffic B of $425 will yield total railway revenues of $1,000 . However, these total revenues would be insufficient for the railway to recover its total costs of $1,050. Over the short term, the quality and level of service would deteriorate because the railway would be unable to attract the capital necessary to replenish its assets and, eventually, in the absence of government assistance, terminate service altogether.

4.0 Implications of Province of Alberta Proposal

The Province of Alberta has proposed that railway rates be capped by a revenue-to-variable cost ratio initially set at a ceiling of 1.90. The maximum ratio would progressively decline to 1.50 in the fifth year and remain at that level thereafter. The maximum ratio is derived from the fact that long-run variable costs represent about 80 percent of the railways' total costs, so if all traffic moved at a revenue-to-variable cost ratio of 1.25, the railways would be commercially viable. A maximum ratio of 1.50 means that the railways could charge up to twice the implied average recovery of constant costs. A railway could charge a rate that incorporated a higher ratio if it could demonstrate "effective" competition for the traffic, while rates for traffic moving under contract could also embody a ratio higher than the prescribed maximum.

Over and above the consequences on both shippers and railways of a maximum rate ceiling as described in the preceding section, the proposal contains other implications that should be carefully scrutinized.

First, it postulates that the appropriate recovery of constant costs is tied to the variable cost of producing a given service. Variable costs are those costs causally related to changes in the volume of traffic such as the costs of fuel and crew wages; constant costs are the fixed costs of the railway that are not capable of assignment to any one particular service and that are incurred, for the most part, independently of reasonable changes in the volume of traffic. Bridges and tunnels, for example, are included in constant costs.

Constant costs are a quantum amount that is more a function of the size of the rail network than of the variable costs incurred to produce a given service. Because of this phenomenon, the lower the variable cost of producing a given service, the higher the recovery ratio towards constant costs that is required if the railway is to be commercially viable. For example, a railway will require a much higher recovery ratio of constant costs if all traffic moved at a variable cost of 2.0 cents per ton-mile than if the same volume of traffic moved at a variable cost of 5.0 cents per ton-mile given the same level of constant costs.

The fact that a rate is in excess of a prescribed revenue-to-variable cost ratio is not a priori evidence that it is out of proportion to other rates or is "unreasonable". For example, relatively higher constant cost recovery ratios do not automatically imply higher rates compared to those prices with lower ratios. A revenue-to-variable cost ratio of 1.75 would yield a rate of only 3.50 cents per ton-mile on a movement that incurred a variable cost of 2.0 cents, but a ratio of 1.25 would yield a rate of 6.25 cents where the variable cost was 5.0 cents. Further, due to the low level of variable cost associated with the move, a rate may incorporate a constant cost recovery ratio in excess of 1.50, yet still be insufficient for the commercial viability of the carrier if the railway were designed to carry solely that traffic. Whenever a rate is below the stand-alone cost of providing the specified service, regardless of its revenue-to-variable cost ratio, one of two conditions prevail: either (a) the rate is constrained by modal and market competition, or (b) the rate incorporates the economies derived from the joint utilization of the railway's plant and equipment with other traffics, the very benefits that value of service pricing yields.

The imposition of a maximum rate standard across all traffics based on the arbitrary notion that recovery of constant costs at twice the average required on movements overall is somehow "unreasonable" or "unfair" cannot be rationalized in economic terms. The determination of the fairness of a particular rate can be assessed only with reference to the attendant characteristics of the movement. Depending upon these characteristics, a rate for a commodity with a revenue-to-variable cost ratio of 1.60 can be just as economically efficient and fair as a rate for another commodity with a revenue-to-variable cost ratio of 1.40. It is, therefore, punitive to suggest that the overall level of railway rates be circumscribed by the imposition of a revenue-to-variable cost maximum rate standard.

Second, the imposition of a specified revenue-to-variable cost ceiling would introduce anomalies in the establishment of rates that are unrelated to the appropriate recovery of constant costs. This can be demonstrated with respect to car ownership. A shipper may pay a rate of, say, $12.00 per ton based on a variable cost of $8.00 per ton that includes a cost of $2.00 for car ownership. By electing to provide his own cars, the shipper would be able to receive a rate reduction of $3.00 per ton or $1.00 more than that implied from the transfer of the ownership cost of the cars from the railway to the shipper. (The new rate would be the $8.00 per ton original variable cost less the $2.00 per ton car ownership cost times the constant cost recovery ratio of 1.50, or $9.00 per ton.)

Thus, in the above example, the shipper who supplied his own cars would receive a net rate advantage of $1.00 per ton over a competing shipper supplied with railway-owned cars. This is notwithstanding the fact that the total variable cost of the competing movements is the same in both cases (regardless of how the variable cost is apportioned between the railway and the shipper), and that the level of railway constant costs would not be reduced by the implied $1.00 per ton savings attributable to shipper ownership of the cars.

Third, the Province of Alberta recognizes that its maximum rate proposal would put downward pressure on railway revenues, and in combination with other factors, "gives rise to a concern with overall railway viability". The Province therefore proposes that consideration be given "to identifying methods for improving railway contribution through increases in revenue or decreases in cost".(7) However, due to the mechanism of the proposed maximum rate standard, decreases in costs that fall into the variable component will exacerbate rather than improve the financial viability of the railways. This is because a $1.00 reduction in variable cost for a rate that is at the prescribed maximum will translate into a revenue reduction of $1.50 to the railway in spite of the fact that the level of constant costs will remain unaffected by the variable cost saving.

To illustrate, suppose a railway moves a given volume of a commodity at a rate that yields total revenues of $1,200. The variable cost of the movement is $800 and the railway's constant costs are $400, so the rate incorporates a revenue-to-variable cost ratio of 1.50 and the railway is commercially viable. If the railway were able to reduce the variable cost by 10 percent to $720 through the introduction of operating efficiencies, the prescribed revenues would fall to $1,080 ($720 times

1.50). However, if the level of constant costs were unaffected by the saving in variable cost, the railway would no longer be commercially viable. The railway would receive revenues of $1,080 and incur total costs of $1,120 ($720 of variable costs plus $400 of constant costs), a shortfall of $40.

The maximum rate standard proposed by the Province of Alberta would appear to offer few long-term benefits that are conducive to the provision of "an economic, efficient and adequate transportation system".(8) The issue of maximum rates is sufficiently complicated that it cannot be reduced to a simplistic revenue-to-variable cost ratio without incurring negative consequences for both the shippers and the railways. The adoption of a maximum rate standard such as that proposed by Alberta would undermine the benefits of value of service pricing, and ultimately result in deterioration in the quality of railway service to all shippers.

Footnotes

(1) Freedom to Move - A Framework for Transportation Reform, July 1985, available from Public Affairs, Transport Canada.

(2) The proposal is contained in Government of Alberta Supplemental Submission to the Government of Canada Concerning Proposed Changes to the National Transportation Act, November 1985, pp. 21-23. See also statement of Mr. Clarence J. Roth (Deputy Minister, Planning and Services, Department of Economic Development, Government of Alberta) to the House of Commons Standing Committee on Transport, December 2, 1985.

(3) The Crow's Nest Pass Agreement dated September 6, 1897 between the Canadian Pacific Railway Company and the Government of Canada specified, inter alia, that the railway would reduce its rates on grain and flour on traffic originating west of Thunder Bay and destined for Thunder Bay and points east by three cents per hundredweight in return for a cash subsidy to construct a line from Lethbridge, Alta. to Nelson, B.C. The agreement was subsequently entrenched in legislation as S.C.(1897) 60-61 Victoria, Chapter 5.

In 1925, the rates prescribed by the Crow's Nest Pass Agreement were legislated to apply to all railways subject to the jurisdiction of Parliament. In 1927, General Order No. 448 of the Board of Railway Transport Commissioners confirmed the application of the Crow's Nest Pass rates to grain and flour destined for Pacific Coast ports.

(4) A study prepared by Snavely, King and Associates for Transport Canada put the loss between the revenues received by the railways from statutory grain and the variable cost of providing grain service at $244 million in 1980. This loss is net of federal government subvention. Snavely, King and Associates, 1980 Costs and Revenues Incurred by the Railways in the Transportation of Grain Under the Statutory Rates, December, 1981.

(5) The Staggers Rail Act of 1980 (PL 96-448) declares that it is the policy of the United States Government, inter alia, "to promote a safe and efficient rail transportation system by allowing rail carriers to earn adequate revenues, as determined by the Interstate Commerce Commission".

(6) Freedom to Move, op. cit., p. 18.

(7) Government of Alberta Supplemental Submission, op. cit., p. 23.

(8) This phrase is the core of the statement of national transportation policy objectives set out in Section 3 of the National Transportation Act.

RAIL COST ORDER R-6313: PARAGON OR PASSÉ?

by

F.E. Collins and J.B. Best
Peat, Marwick and Partners - Management Consultants

1.0 Introduction

Finding out what it costs to operate a particular rail service is a subject of perennial interest in Canada. Obviously our railways have a need to know, and for at least some shippers, rail costs - and their impact on rates - are an area of considerable concern.

Increased governmental involvement in railways since the 1970's has also focused increased attention on rail costs. The creation of VIA Rail, the Prairie Branch Line Rehabilitation Program, the Terra Transport "experiment", and implementation of the Western Grain Transportation Act (WGTA) are examples of Federal government involvement. Provincial governments in Ontario and Quebec are also now deeply involved through their publically funded commuter services. These public sector initiatives involve hundreds of millions of taxpayers' dollars and generate much interest in rail costs.

With the impending regulatory changes Canadian railways will probably be giving even greater attention to service costs. If intramodal rail competition increases substantially, as sought by the government's regulatory reforms, the carriers will need to monitor closely the profitability of their various traffics.

2.0 History

Railways have conducted service cost analyses for many decades, in earlier times unfettered by regulatory methodological prescriptions. For example, records show that regression analysis was being used in costing in the 1930's and possibly earlier.

Public interest and involvement in rail costs came to the fore in the proceedings of the MacPherson Commission (circa 1960), notably in the work of Hay on grain costing. The Commission's findings led eventually to our present National Transportation Act (1967) which, together with associated changes to the Railway Act, created the Canadian Transport Commission (CTC) and empowered it to regulate railway costing. This legislation also specified where and how rail costs were to be used in rate-making and in the determination of subsidies for operation of uneconomic services.

In giving effect to their regulatory costing powers, the CTC took pains to ensure that their costing prescriptions were well thought out. A Cost enquiry was held (1967 - 1969) involving extensive preparatory work on the part of a technical committee, together with a full public hearing. Participants included four railways, the ten provinces, the Canadian Industrial Traffic League, the Canadian Trucking Association, two grain groups, and several other interested parties. The eventual result was CTC Order No. R-6313, together with the important companion document "Reasons for Order No. R-6313 Concerning Costs Regulations", both dated August, 1969.

Since its original formulation, the Cost Order has evolved somewhat, partially in response to a number of major investigations, as outlined below.

2.1 Commission on Cost of Transporting Grain by Rail

In 1975 the Federal government launched a special enquiry on the above subject headed by Commissioner Carl Snavely. This proceeding arose from railway claims that the historic Crow Rates under which they were obliged to transport grain were contributing to massive financial losses. The Snavely Commission examined the relevant rail costs in a comprehensive fashion, and generally exercised a full degree of freedom in determining whether individual methodologies were appropriate for costing grain.

Commissioner Snavely concluded that the railways were, indeed sustaining substantial losses in the transport of grain. Moreover, he made a number of specific recommendations for the modification to costing methods practiced under the CTC's Cost Order, some of which were subsequently implemented.

2.2 Allowance for Income Tax in Cost of Capital

In 1977 Canadian Pacific, supported by Canadian National, applied to the CTC for amendment of the Cost Order to permit an allowance for income tax to be included in the cost of capital for all purposes of the Railway Act. At that time an allowance for income tax was permitted in the rate provisions of the Act, but not for the determination of railway subsidies pursuant to Sections 256, 258 and 261.

In 1979 the CTC held a broad ranging hearing into this matter which concluded in favor of the railways' application. The CTC decision also provided that CN should have its own cost of capital rate for certain costing purposes, rather than using CP's, as was previously required. The Cost Order was amended accordingly in 1981. In fact, a new CTC document was produced entitled "CTC Railway Costing Regulations" which replaced Cost Order R-6313. Thus R-6313 has, strictly speaking, been superceded, although in common parlance R-6313 continues to designate the CTC regulations.

2.3 Revision to Uniform Classification of Accounts (UCA)

The UCA is the primary source of financial data for costing. The original UCA was adopted in the mid-1950's and closely paralleled the system used by the ICC at that time. Among other shortcomings, it was not designed with cost finding in mind. In particular, it did not support the requirements for specificity in costing which had emerged by the 1970's. This was recognized in Commissioner Snavely's 1976 report, which recommended that the UCA be revised.

Commencing in 1977 the CTC undertook a major revision to the UCA in which Peat Marwick and the authors of this paper were extensively involved. The CTC adopted a process similar to that of the 1967 Cost Inquiry (i.e., technical committee followed by hearing). The railways (Classes I and II), provinces and grain interests were all extensively involved.

Following a relatively short hearing, the RTC adopted in 1980 a completely overhauled UCA, with implementation phased over several years. The specification of appropriate costing-related geographic cost centres for certain accounts was a matter the CTC left to the subsequent implementation activity, and which was also accomplished through a technical committee process.

2.4 Cost of Capital Investigation

The determination of the appropriate return on funds invested to provide railway service is one of the most problematic areas of rail costing. Much of the Snavely work was devoted to this subject, as were the proceedings of the Income Tax Case and even the UCA case.

In the course of the UCA Hearing the panel Chairman - Mr. E. Benson (then President of the CTC) announced that a full investigation and hearing into Railway Cost of Capital would be conducted. Again, the technical committee/hearing process was adopted, and it involved essentially the same major participants as in the UCA case.

The technical committee began work in 1981, followed by a landmark hearing of some forty-four days over a nine-month period. The CTC's decision was rendered in July, 1985 and dealt extensively with the subject issues. The CTC concluded, among other major decisions, that there should be different cost of capital rates for major service groupings where the risks of such services differed significantly.

3.0 Character

R-6313 has a character all its own.

To begin with, the Costing Regulations are concise - only five pages in length. Several key principles are enunciated, the basis of application for various sections of the Railway Act is outlined, and several procedural mat-

ters are dealt with in this short text. To a first time reader the Costing Regulations appear spare and puzzling. The puzzle requires a surprising amount of information to unravel.

The first clue to the puzzle is the "Reasons" document previously cited. This provides the necessary background to understanding at least some of the methodological maze. The next major set of clues are the railways' costing manuals. These voluminous documents describe in some detail the methods actually applied by each railway in its costing work. The costing manuals are nominally in the public domain. However, obtaining copies of them can be difficult. Another helpful reference is the UCA manual; this is readily available from the CTC at a modest price. Beyond all of this, the documentation associated with the relevant CTC investigations and decisions plays a part in the constitution of R-6313 costing.

In reality, therefore, the CTC's costing prescriptions are not to be found in a single document. Rather, one must rely upon a great deal of documentation, and in some case on precedent and interpretation to understand how the rail costing system works.

Viewed from another perspective, R-6313 might be characterized as an economist's costing system. This is exemplified in Dr. Borts' definition of variable cost, enshrined in the "Reasons", as one of R-6313's cardinal principles:

> **"Variable cost may be defined as the long-run marginal cost of output, being the cost of producing a permanent and quantitatively small change in the traffic flow of output, when all resource cost inputs are optimally adjusted to change."**

That the Cost Order should have an economics flavor is hardly an accident; some of its main architects were economists, as are many present day costing practitioners.

4.0 In Praise of R-6313

Our Canadian rail costing system is, without a doubt, ingenious. It has gained considerable stature and has earned notable plaudits in its time. Generally regarded as conceptually and methodologically superior to its U.S. counterpart, it has occasionally been touted as the world's premier costing system.

R-6313 has survived a number of searching appraisals, in which the following verdicts were rendered:

Commission on Costs of Transporting Grain by Rail

> "The Commission's review and analysis of the procedures utilized by the railways to develop variable unit costs and to assign costs directly to specific services, led to the conclusion that overall these methodologies were valid for costing in general and grain costing in particular. The Commission fully agreed with the opinions expressed by repre-

sentatives of the railways and the provinces that overall the methodologies employed represent a degree of sophistication and precision that puts Canadian National and CP Rail at the forefront of railway cost ascertainment."(1)

Transport Canada Review of Passenger Service Costing

"The R-6313 principles with slight modification are found to be appropriate for costing any passenger service which employs existing equipment and operates at approximately current speeds."(2)

In our opinion, R-6313 has a number of fortes which have contributed to its success, notably:

1. R-6313 provides the flexibility for each railway to adopt costing techniques attuned to its particular operations and systems. Generally, this results in methods which are realistic in relation to the availability and quality of data. This feature contrasts with the ICC system which aggregates data from a number of railways, producing average costs not necessarily representative of an individual carrier.

2. R-6313 provides a logical separation between accounting operations and costing operations. That is, the Canadian system starts with the recording of source data in a detailed, but not unduly complex system of accounts. It avoids - in the accounting process - the arbitrary splitting of accounts, for example as between fixed versus variable; freight versus passenger. Rather, such separations are performed through costing analyses, the results of which can be reviewed annually through imperical testing.

3. R-6313's methods are based in large part on actual railway records and data. The CTC has avoided the temptation to adopt costs based on synthesized measures such as current value cost of capital. While arguments can be made in favor of such measures, the existing approach makes for objectivity and auditability.

Finally, R-6313 has, to date, largely stood the test of time. The costing system has been used since 1969 as the basis for some billions of dollars of subsidy payments and many rate-related proceedings. It seems to have gained more universal acceptance than the U.S. counterpart "Rail Form A". While some would argue that the results have fallen well short of ideal, R-6313 has, at least dealt in a workable fashion with a highly complex and demanding costing environment.

5.0 Contrary Minded

In spite of its manifold virtues, R-6313 is not universally worshipped. In fact, it has been the target of some deprecation, particularly in recent years. Some salient complaints are outlined below.

5.1 Complexity

R-6313 methodology is sufficiently involved and complex that only a handful of practitioners really understand it. This condition is aggravated by the nature of the Cost Order's supporting documentation which, as previously explained, is difficult to assimilate.

Some features of R-6313 which contribute to the complexity include:

- Large number of account groups and cost complexes;
- Extensive use of regression analysis;
- Cost pyramiding (i.e., multiple layers of costs in which indirect costs and overheads are successively tied to direct costs);
- Technical jargon.

As a result, many seeking to understand rail costing simply give up, lost the despair of seemingly myriad intricacies.

5.2 Foreign Concepts

Some of R-6313's underlying concepts appear strange and unusual to the conventional business mind.

R-6313 identifies either variable costs or avoidable costs; fixed (or constant) costs are usually not treated. Conventional business cost accounting identifies variable costs and fixed cost (sometimes termed period costs), and includes both components.

Return on capital is included as a cost component in the R-6313 scheme, reflecting an economist's notion of cost. The traditional businessman considers cost of capital, or at least return to equity capital as profit - not a cost. The ability to treat profit as a cost puzzles the every day entrepreneur, although on second thought it may have considerable appeal!

In sum, R-6313 excludes components conventionally included, and includes components conventionally excluded.

5.3 No Reconciliation with Financial Statements

Costs derived under R-6313 cannot be entirely reconciled with the carriers' accounts and financial statements for a number of reasons:

- Costs include return to equity capital;
- Some costs are derived using a multi-year averaging process (termed normalization);

- CN has been obliged to use CP's road property investment coefficient due to lack of suitable CN road property investment data, at least until very recently.

The inability to reconcile costs with the carriers' financial statements is a significant issue in the minds of some of R-6313's critiques.

5.4 Railways have Initiative for Change

The initiative for development and selection of specific methodologies has, for the most part, been left to the railways. While the CTC can, and occasionally does initiate and mandate methodology changes, the carriers are free to propose changes and are the source of most such changes. Proposals for change which originate outside the railways are frequently lost in the shuffle.

As a case in point, Paragraph 8 of the Costing Regulations states:

"Whenever specific costs are known or can be readily determined from company records, such costs shall be used in lieu of averaged or allocated costs."

While clearly a desirable principle, this particular provision has largely been applied by CN and CP to permit adopting of specific costs as they see fit. They have often done so on a selective basis. CN and CP have tended to opt for mixed specific and average costing for some types of costs. The tendency has been to identify the subsidized costs (e.g., passenger) on a specific basis, while not making a similar effort to identify and exclude the corresponding unsubsidized costs (e.g., freight). The latter are usually charged off as part of the common pool.

While CTC staff audit both railway methods and cost analysis results, a great deal of costing initiative remains with the railways. Some critics feel this is unduly beneficial to the railways' interests.

6.0 Recent Developments

Some recent developments suggest the winds of change are blowing. Initiatives for change are emerging from some highly placed sources.

Mr. Ron Lawless, Canadian National's President counselled change in the costing system as a desirable adjunct to the government's current transportation regulatory reform program.

"Part of the NTA overhaul should include an update of existing CTC costing procedures. Current formulas could be written into the Act along with a regular review process to ensure it remains up to date."(3)

As we understand it, Mr. Lawless is concerned that the government currently has undue freedom in specifying how rail costs are determined and

defined. For example, the new costing arrangements proposed for rail passenger service represent a departure from the railways' usual costing methods. While this is not a problem with R-6313 per se, Mr. Lawless would prefer to see the costing methodology firmly specified, and subject to change only with periodic technical reviews.

The recent CTC "Inquiry Into Railway Branch Lines" conducted by Commissioners J.M. McDonough, R.J. Orange, and D.H. Chapman considered the validity of R-6313 in determining branch line costs and concluded that R-6313's results were suspect:

> **"The subsidies paid have been based on a costing system which is not solely based on site-specific and auditable branch line expenses, but rather on what might have been a questionable and perhaps an inflated cost base for branch line operations and perhaps even for mainline operations."(4)**

The inquiry's report suggests that R-6313's use of averaged costs in lieu of a more detailed, specific accounting-type analysis is questionable.

> **"These costs are founded on a costing methodology which is based on railway system costs modified and allocated to the branch line and the on line movements in combination with costs directly incurred thereon. One knowledgeable railway accountant said of Order R-6313 '... it is an economist's dream and an accountant's nightmare ...'."(5)**

It would be incorrect to characterize these critiques as a wholesale condemnation of the CTC's Cost Order by its own commissioners. However, they did recommend that a critical review of R-6313 be undertaken.

> **"We recommend strongly that the Commission conduct a review within the next twelve months of the R-6313 branch line costing methodology to ensure:**
>
> **a) The acceptability of the methodology from an accounting point of view;**
>
> **b) The applicability of the methodology to branch line specific costing in the context of that costing reflecting the avoidable costs of branch line abandonment; and**
>
> **c) Any other matter relevant to the accuracy of the methodology."(6)**

Another notable recent development is contained in Bill C-97, the new "National Rail Passenger Transportation Act" which received first reading February 24, 1986. Bill C-97 makes no reference to R-6313, and incorporates a different approach to passenger costs. Unconditional compensation is provided for "direct costs" which are defined, in effect, as passenger specific costs plus a limited number of unit costs for operations considered to be directly passenger-related. Indirect costs (i.e., general administration, depreciation, cost of capital and various other overheads) are specifically excluded. However, C-97 provides for an incentive payment scheme whereby

the railways can recover at least a portion (if not all) of the excluded indirect costs, provided that a reasonable standard of service performance is achieved. Compensation of constant costs is precluded under any circumstances.

The costing régime of Bill C-97 is somewhat akin to a direct cost plus overhead scheme in which compensation of overheads is contingent upon performance. Although R-6313 is not cited in C-97, the bill does not explicitly eliminate R-6313. R-6313's methodologies seem necessary to identify the direct costs and the extent of the excluded indirect costs. This situation is understandable; the architects of C-97 were not in a position to develop an entirely new costing process, and were probably not asked to do so.

7.0 What Next?

Where are we headed? The authors have no crystal ball, and can but "see through a glass, darkly". Much depends on how strong the ground-swell for change is in relation to other priorities the government and its transportation regulators must deal with. It's premature to predict future directions, but some handwriting is starting to take shape on the wall.

R-6313 was a child of our 1967 National Transportation Act, and responded to the regulatory régime and the costing needs associated with it. Major changes have occurred since that time, including the creation and maturing of VIA Rail, and resolution of the crow rate problem with implementation of the WGTA. Canada is now awaiting major transportation policy and legislation changes. These changes may require or facilitate modifications to our rail costing system. If changes are to be made, they should begin with a careful appraisal of the new legislation together with an assessment of the regulatory and commercial environment which it will create.

Apart from the above, the need for something easier to understand is apparent. In this regard, a clear and coherent documentation of the present R-6313 system would be a worthwhile step forward. Beyond this, the introduction of more direct measurement and/or accounting based methods might be welcome, providing practical solutions can be found along these lines.

Chances are something akin to conventional "direct cost plus overhead" costing may emerge when the smoke clears. But we should not expect simplicity itself; the railway business is just too complex for that.

• • •

Rail Cost Order R-6313: paragon or passé? Clearly we do not live in a black and white world. We hold the Cost Order in high esteem, a veritable Cadillac of its time. Yet, we don't see too many 1969 Cadillacs on the streets anymore.

References

1 Report of Commission on Costs of Transporting Grain by Rail (1976) Volume I, p. 46.

2 R.L. Banks and Associates - Phase I Passenger Service Costing Report (August 3, 1977). It may be noted that one of the "slight modifications" suggested by Banks was the inclusion of an allowance for income tax in the Cost of Capital, an adjustment which was subsequently adopted by the CTC (see 2.2).

3 National Transportation Act - Lawless Presents a Shopping List to Mazankowski; Motor Truck Magazine, April, 1985.

4 Canadian Transport Commission - Report of the Inquiry Into Railway Branch Lines (June 28, 1985), pp. 35, 36.

5 Ibid. p. 29.

6 Ibid. p. 140.

REVENUE AND COST COMPARISONS FOR ALBERTA RAIL TRAFFIC

by

Ray Bassett
Garry Rosko
Transportation Services Division
Alberta Economic Development

Preface

The content of this paper is based on the results of a study conducted by the Transportation Services Branch of Alberta Economic Development. Various aspects of the study were assisted by inputs from individuals from outside the department. Specifically, the assistance of Gordon Seddon (Gordon Seddon and Associates), Darryl Howery (Stanley Associates Engineering), and Frank Trotter (The Trade and Transportation Group Incorporated) is gratefully acknowledged.

1.0 Introduction

The growth and development of the resource based economies of Western Canada is dependent on efficient and low cost rail transportation. While it is generally agreed that railway operations in Western Canada are efficient, there has been a persistent concern that railway prices penalize shippers' captive to the rail mode. This concern has been a consistent theme of western provincial governments every time national transportation policy is debated. The current review of national transportation policy launched by the release of the Freedom to Move discussion paper in July of 1985 is no exception.

The debate over the need for effective shipper protection as a part of railway regulation has been hampered by the absence of a quantitative basis for examining railway pricing practices. It is the purpose of this paper to present one such quantitative procedure and discuss the implications of the study results on the current debate over the proposed changes to rail regulation in Canada.

2.0 Background

The National Transportation Act allows the railways to "charge what the market will bear" for their services. These rates must at least cover the long run variable costs of their carriage as set out by Section 276 of the Railway Act. The railways' constant costs of operation (overhead costs) are to be recovered from rates which exceed variable costs. Their ability to collect a contribution

to constant costs (thus charge rates above variable costs) is largely governed by competition in the transportation market and the shippers' ability for pay, which in turn depends on the degree of competition he faces in the product's final market. In this pricing regime, it is expected that rates on higher valued goods will exceed those on lower valued goods. It is then concluded that higher value goods make a larger contribution to railway constant costs. What is not considered in these statements is that the costs of transporting the bulk commodities is significantly lower than for the higher value finished products. If the cost savings inherent in heavy car loadings and unit train operations are sufficiently large, then it can be expected that those shippers with both few economically viable alternatives to transporting their product, and who demonstrate an ability to pay higher freight rates will in fact make a proportionally larger contribution to railway constant costs. This latter statement can only be tested by an examination of both railway revenues and costs.

"Burden Study" is the term used to describe the process of measuring the contribution to constant costs made by rail freight traffic. It has its origin in the United States where the Interstate Commerce Commission conducted annual studies which compared carload revenues and costs by commodity classes and territories. The study described here is based on the U.S. experience. However, due to data limitations it was only possible to examine the contributions earned on traffic moving to and from Alberta and to compare this with contributions earned by the railways on a national scale.

3.0 Basis for Analysis

The analysis conducted in the Burden Study focussed on Canadian rail freight carload traffic moving to and from the Province of Alberta. Transborder traffic between Alberta and the U.S. was excluded from the analysis because of difficulty with allocating the appropriate portions of the through rate revenue to the Canadian railways.

Revenues received by the railways from Alberta traffic through the assessment of freight rates were calculated and the variable costs directly incurred by the carriers in the carriage of that traffic were developed. Two methods were then employed to calculate the contribution made to railway constant costs. Actual dollar contribution was determined by subtracting variable costs from revenues. Second, a ratio of revenue over variable costs, called a contribution ratio, was employed. The amount by which the contribution ratio exceeds 1.00 is the contribution to railway costs expressed as a percentage of the variable costs of carriage. For example, a contribution of 1.25 indicates that a contribution to constant costs in an amount equal to 25 per cent of the traffic's variable cost was collected. A contribution of 1.00 implies that revenue received is just equal to the variable cost of the traffic and there was no contribution to overhead costs. A contribution of less than 1.00 indicates that variable costs are not being recovered and therefore no contribution to overhead cost is made.

To put the results of the analysis in perspective, the contribution ratio and actual contribution of the Alberta traffic were compared with that determined for the Canadian rail freight system as a whole.

The movement of grain comprises a significant proportion of the total Alberta rail traffic Because the rate for transporting grain was determined by legislation and not the market place, it was desirable that the impact of this anomaly be fully determined in the analysis. Therefore, the analysis of the Alberta traffic was conducted separately for each of three scenarios. These can be described as follows:

Scenario I: This is the Base Scenario which incorporates the carriage of grain under the statutory (pre Western Grain Transportation Act) regime. The analysis addresses both the costs and user revenues directly attributable to this traffic, as well as the subsidy payments received by the railways under this regime.

Scenario II: This scenario also includes grain traffic, but under a compensatory (post Western Grain Transportation Act) regime. In this scenario the results were adjusted to reflect the fully compensatory movement (i.e. a 20 per cent cost contribution to overhead) of grain and models the impact of the Western Grain Transportation Act on the total contribution made by the Alberta traffic.

Scenario III: This scenario excludes grain traffic from the analysis thus providing an analysis of the contribution made by the traffic for which rates are determined competitively.

In each scenario, the total Canadian contribution is appropriately adjusted to allow comparison with results for the Alberta traffic.

4.0 Methodology

The contribution made by the Alberta traffic and that calculated for the system as a whole were determined via two separate methods, each of which employs consistent assumptions thus allowing a comparison of the results. This section outlines the methods used in the derivation of the Alberta and system total contributions, and where appropriate, discusses the major assumptions made in the analysis and their possible impact on the results.

4.1 Determination of Contribution of Alberta Traffic

The contribution to railway constant costs made by the traffic moving to and from Alberta was determined by costing and rating actual 1982 CNR and CPR movements. This procedure involved the organization of data obtained from the railways, sampling of data, costing and rating the sample and scaling these results to be representative of the population traffic. The details of this procedure are outlined below.

Data Organization. The traffic data used to calculate Alberta's contribution costs of actual railway movements in 1982 which was obtained from CNR and CPR. Traffic movement information on a tonnage and carload basis was organized into "cases". Each case is a unique combination of commodity type, origin, destination, car type, car ownership and domestic/import/export status. For each railway, traffic movements were organized into eleven major commodity groups from five different geographic directions as follows:

Commodity Groups:	Fuels and Chemicals; Construction Materials; Mine Products; Forest Products; Food Products; Manufactured Products; Pool Car; Motor Vehicles; COFC; TOFC; Statutory Grain.
Directions:	Intra-Alberta; Alberta to B.C.; B.C. to Alberta; Alberta to points east; Points east to Alberta.

Sampling. The total population of the Alberta data was comprised of 24,379 cases which made it impractical to calculate revenues and variable costs for every case. A stratified sampling technique was therefore employed. This method entails the stratification of the population by density (measured as the number of carloads per case), with a higher sampling rate being applied to the denser (more carloads per case) strata. Using this approach ensured that a larger proportion of the total information (in terms of tons and carloads) could be achieved for a given sample size than could be obtained through a purely random sample. The population data was thus stratified and sampled separately for each railway (CNR and CPR), and for each of the five geographic directions within each railway. A total of 958 cases were sampled, representing 3.9 per cent of the total population cases and 64.2 per cent of the total population net tons.

Scaling Sample Results. Sample results were scaled on the basis of the number of carloads sampled within each statum relative to the total carload population of that stratum. Thus in a stratum where 50 per cent of the population carloads were sampled, the scaling factor was two. Results for each stratum were then aggregated to the direction, commodity group and total railway level.

Costing the Sample. Sample cases were costed to determine the long run variable costs associated with the carriage of Alberta traffic. Long costing was employed to determine costs for unit train movements by applying railway unit cost coefficients to operating parameters for the various movements. Costing of statutory grain was undertaken by multiplying the applicable rate for a movement by the average crow multiple. Remaining movements were costed using the railways' quick costing manuals by applying the appropriate operating parameters to the listed coefficients. Care was taken in using the quick cost approach to avoid situations where it might be inaccurate.

Two adjustments were made to the railways' quick costing methodology as it was applied to the sample. The first allows for a cost saving for the switching of consecutive cars in a block. A second adjustment was made to reflect the incremental roadway maintenance cost incurred by the railways in the movement of heavy cars. This cost adjustment was applied on a per thousand gross ton miles basis to cars with a net weight of 90 tons or more.

Revenue Determination. Revenues associated with the Alberta traffic were calculated by rating the sampled cases from currently published freight tariffs. For the Scenario I calculations where grain traffic was rated at statutory pre-Western Grain Transportation Act levels, branch line subsidy payments received by the railways for the operation of uneconomic lines in Alberta were also included as revenues. These subsidy revenues were attributed to the Alberta total but were not allocated to geographic directions.

4.2 Determination of Total Canadian Contribution

As detailed data for the non-Alberta portion of Canadian traffic was not available, the procedure used to calculate Alberta costs, revenues and contribution could not be used for calculating Canadian system totals.

Revenue and Cost Determination. Railway total revenues were determined from the annual railway reports provided to the Canadian Transport Commission. Total railway costs include both operating expenses and capital expenses. Operating expenses were obtained from the annual railway reports and capital expenses were determined by applying each railway's approved weighted cost of capital rate to the asset base. The variable component of these costs was determined by applying the level of system variability reported in the Snavely Report on the costs of moving grain in 1980.

Both railways' revenues and costs reported in the annual reports included passenger services. These costs and revenues were removed from the calculations. In addition, system revenues were adjusted to eliminate outstanding branch line payments paid to the railways for claims from years previous to 1982.

For the alternate scenarios used in the Burden Study certain further adjustments to system revenues and variable costs were also required. System revenues for Scenario II, where grain is treated as moving at compensatory rate levels, were adjusted to reflect the impact of the Western Grain Transportation Act. Revenues were calculated as being equal to total variable costs of moving grain plus a contribution equal to 20 per cent of volume related costs. For Scenario III, where statutory grain traffic was excluded from analysis, the total revenue received and cost incurred as a result of grain movements were removed to allow calculation of the contribution of non-grain commercial traffic.

5.0 Alberta Traffic Share

The organization of Alberta's traffic data to calculate revenues, costs and contribution allowed several observations on the magnitude and composition of the province's outbound and inbound commodity movements.

On a gross ton mile basis, traffic into and out of the province constitutes 28% of the Canadian rail system's total traffic. (This Alberta traffic excludes international movements to/from the U.S.) Outbound traffic accounts for 22% while inbound is 6% of system totals. Alberta traffic totalled 38 million tons in 1982 with outbound traffic representing 18% of total system tons and inbound traffic 3%.

On a specific directional basis and using gross ton miles as the measure, 79% of Alberta related traffic originated in the province; 47% of Alberta's traffic moved to B.C., 30% to points east and 2% within the province. Incoming traffic represented a total of 21% of the province's traffic with 18% originating from points east and 3% from B.C.

On a specific commodity basis it was observed that the province's traffic consisted of 30% grain, 14% coal, 12% sulphur, 8% chemicals and 7% piggyback. Numerous other commodities make up the remaining 29%.

6.0 Results

6.1 Summary of System Contribution

Contribution ratios and dollar contribution amounts received by the two major Canadian railways were calculated for 1982 using the revenues and costs determined by previously described methodology.

For Scenario I the railways' combined contribution ratio was 1.06 or a $269.2 million contribution to overhead costs. Under the Scenario where grain is treated as having moved under fully compensatory rates, the contribution ratio increases to 1.16 and actual contribution to $684 million. Excluding grain in Scenario III produced a contribution ratio of 1.16 and a total contribution of $560.7 million.

6.2 Alberta Traffic Contribution

Scenario I: Including Non-compensatory Statutory Grain. The segment of Canadian traffic which originated in Alberta (including Intra-Alberta, Alberta to B.C. and Alberta to points east directions) made an estimated contribution of $103.9 million to railway constant costs and represents 39% of the total contribution received by the railways across the total Canadian system. The contribution ratio for Alberta originated traffic was 1.16 compared to 1.06 for the system as a whole.

Traffic destined for Alberta from outside the Province (inbound traffic) contributes $191.9 million to railway constant costs and represents 71% of the total contribution received by the railways in the total system. The contribution ratio for this traffic was 1.92, considerably higher than the 1.06 system average.

Taken together, Alberta total traffic made a contribution of $295.8 million (a contribution ratio of 1.34). The total Alberta contribution actually exceeds the $269.2 million received by the Canadian railways across their total system. This result suggests that losses incurred from the carriage of statutory grain and other imposed public duties in other geographic areas is greater than the contribution collected from commercial freight traffic in these other areas.

Figures 1 and 2 provide a directional breakdown of the contribution ratio and dollar contribution made by Alberta traffic for Scenario I where grain is included at non-compensatory pre-Western Grain Transportation Act rate levels. The results reflecting the total Alberta and Canadian contribution ratios and contribution have been adjusted to include consideration of payments made to the railways for branch line subsidies. Specific directional results for Alberta do not include these payments. The impact of grain is particularly evident for traffic from Alberta to B.C. For this direction railway losses on grain exceed revenues received from other commodity movements by approximately $29 million so that the overall contribution ratio is .93. Coal and sulphur are the other major commodity moves to B.C.

To a lesser extent, grain also impacts on overall contribution of traffic from Alberta to points east with a contribution ratio of 1.16. Chemicals, coal and food products are the other major commodity groups included in this direction.

It is interesting to note that traffic inbound to Alberta from points east, while a constituting small percentage of overall Alberta related traffic, contributes $169.3 million to railway overhead costs with a contribution ratio of 1.96. Major commodities in this direction include manufactured goods, intermodal traffic and mine products.

Major commodities moving within Alberta are limestone and fuels and chemicals while forest products, construction materials and intermodal traffic dominate as traffic types moving from B.C. to Alberta.

Alternate Scenarios. To determine the impact of grain on Alberta and total Canadian system contribution ratios and contribution levels, calculations under Scenario II were undertaken where grain was considered to move at fully compensatory rates. Scenario III provides results when grain is excluded from the analysis. Figures 3 and 4 illustrate the changes which occur through the different scenarios. As statutory grain is found only in the Alberta to B.C.

FIGURE 1
CONTRIBUTION RATIOS
By Direction
(Including Statutory Grain)

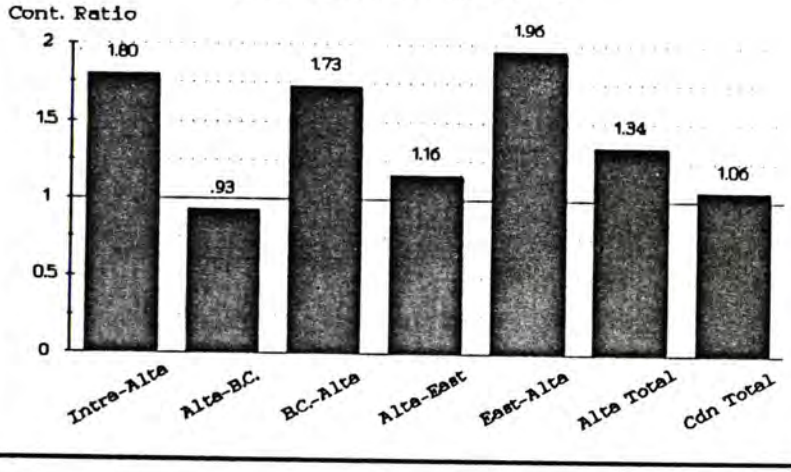


FIGURE 2
CONTRIBUTION
By Direction
(Including Statutory Grain)

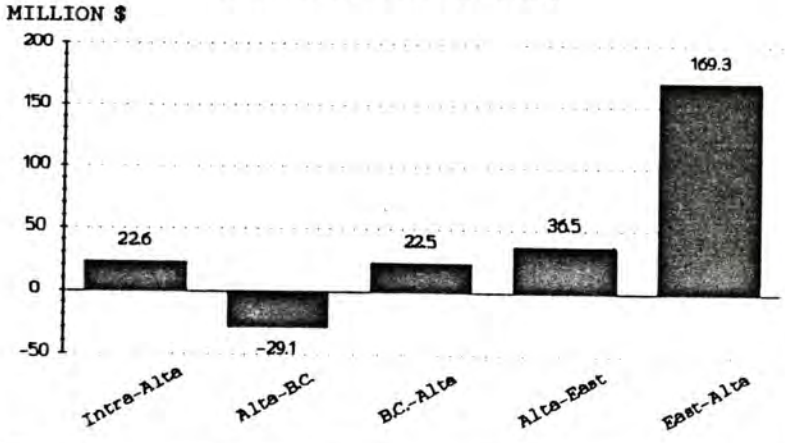


FIGURE 3
CONTRIBUTION RATIOS
(By Direction)

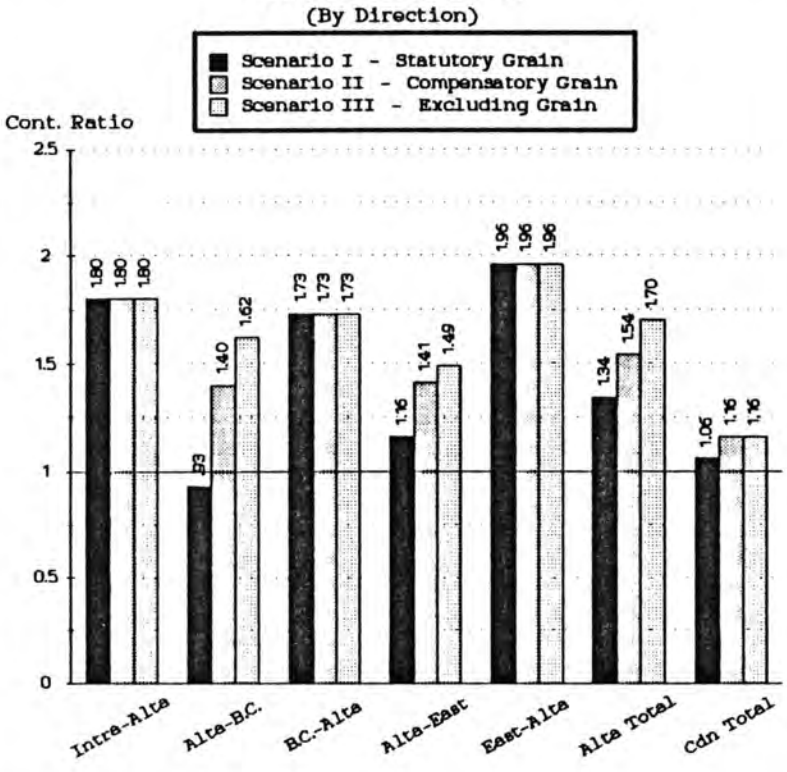
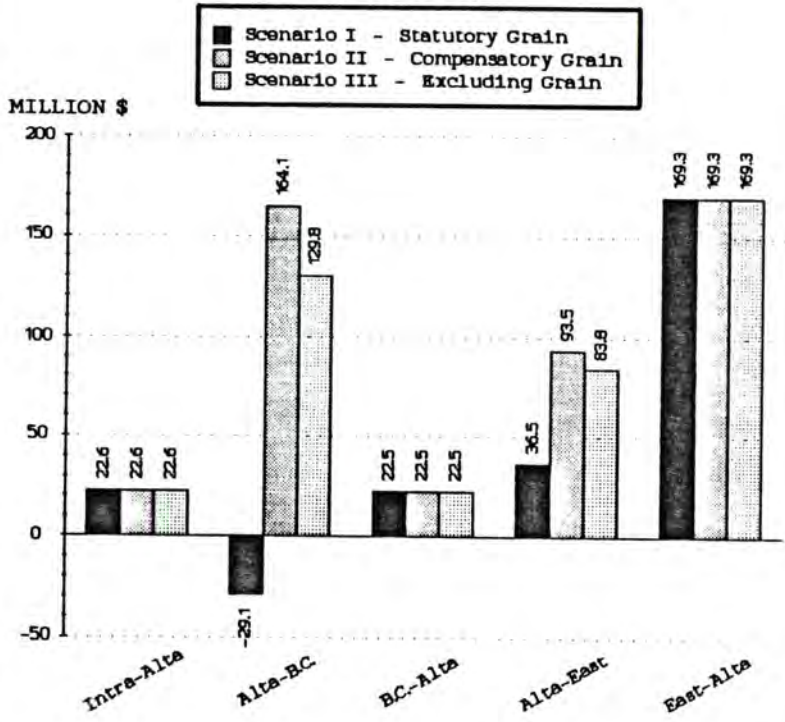


FIGURE 4
CONTRIBUTION
(By Direction)



and Alberta to points east directions, contribution ratios and actual contribution do not change for the other three directions.

Grain is most dominant in traffic flow to B.C. Therefore the most significant changes in contrbution ratios and actual contribution occur in that direction through the alternate scenarios.

With compensatory grain the contribution ratio for traffic to B.C. increases to 1.40 from .93 in Scenario I. Actual contribution for the direction increases from -$29.1 million to $164.1 million. Traffic moving to points east increases in contribution ratio from 1.16 to 1.41 and in actual contribution from $36.5 million to $93.5 million. Over all directions, the Alberta contribution ratio increases to 1.54 from 1.34 and contribution from $295.8 million to $472.1 million. Overall, the Canadian total system contribution ratio increases from 1.06 to 1.16, and contribution from $269.2 million to $684.8 million. The result under this scenario indicates that Alberta traffic is paying 70% of the contribution collected by the railways throughout their total system.

Under Scenario III calculations where grain is excluded from the analysis, Alberta actual contribution drops from the Scenario II results but the contribution ratio increases to 1.70 from 1.54. For the total Canadian system, overall contribution also drops while the contribution ratio remains constant at 1.16. Under this scenario alberta is paying 76% of the contribution collected in the total rail system.

Figure 5 provides a summary of Alberta's total contribution relative to the Canadian total. As a measure of relative contribution made by Alberta traffic, the dollar contribution is likely the best indicator of Alberta's position in the Canadian system. In all three scenarios Alberta traffic makes a very high contribution to railway constant costs.

7.0 Implications of Burden Study Results

The results of the study clearly show that the contribution earned on traffic moving into and out of Alberta greatly exceeds that earned, on average, by the entire rail system. It also can be said that railway viability is very dependent on the high contributions they earn from Alberta traffic. Furthermore, since the traffic mix in Alberta is very similar to that of the other western provinces (resource based bulk commodities dominate the traffic), it can be suggested that Western Canada is making a heavy contribution to railway constant costs. If this is the case it must follow that other parts of the rail system are only making minor contributions, and possibly in some instances negative contributions, to constant cost recovery. The implications of these observations on the legislative changes proposed in Freedom to Move are significant.

FIGURE 5

TOTAL ALBERTA CONTRIBUTION ($ million)

	Including Statutory Grain	Including Compensatory Grain	Excluding Grain
Alberta			
Outbound traffic	$103.9	$280.2	$236.1
Inbound traffic	191.9	191.9	191.9
Total	295.8	472.1	428.0
Canadian Total	269.2	684.8	560.7

First and foremost is the support the Burden Study results give to the arguments for greater shipper protection and increased intra-modal competition. While the study does not prove that existing rates are too high and out-of-line with the shippers ability to pay, it does suggest that, due to railway revenue requirements, there is very likely limited flexibility in the railways' ability to respond to changing market conditions. Carrier viability appears to depend on the revenues earned on captive traffic. With increasing competitiveness in world markets and the resultant decline in commodity prices the shipper ability to pay has changed dramatically. In order for them to maintain their competitive position they must be able to negotiate effectively with the carriers. An effective shipper protection package is essential to increase the bargaining position of captive shippers with the railways.

Changing world market conditions, improved shipper protection and an expanded scope for intramodal competition is likely to reduce the level of contribution earned by the railways in the west. However, it is not likely to change the current situation where a disproportionately large share of railway overhead costs are recovered from the west. In fact there is a possibility that the relative dependence on western captive shippers for constant cost recovery could increase. This occurs because there is a greater potential for intra-modal competition in central Canada which could result in significantly lower contribution levels than those that are currently being earned.

Reducing the overhead cost burden on the west is a necessary part of an overall effort to maintain the competitive position of western producers. However, this is a very difficult task requiring actions beyond those contemplated by Freedom to Move. What is required is both regulations to give shippers greater bargaining power with the railways as well as initiatives to allow the railways to reduce costs and increase traffic. Freedom to Move focuses on the first requirement but is weak on the second. Other actions which should be considered include:

1. Greater flexibility to the railways to allow them to reduce their operating costs by the elimination or simplification of regulatory approval procedures.

2. Identification, evaluation and compensation for services required in the public interest.

3. Reduction of excess capacity.

4. Greater use of shared running rights and joint track usage but to a much broader extent than suggested in Freedom to Move.

5. Retention of the minimum rate rule but with the use of a short run cost definition as a base in order to give the railways greater latitude in attracting traffic.

6. Review of government cost recovery and investment practices in competitive modes.

Many of these actions go beyond the scope of the changes proposed in Freedom to Move and consequently are not expected in the legislative package. This does not mean they should be ignored. They are essential if there is to be a least cost sustainable rail transport system in Canada.

The final area where the Burden Study should be considered in the review of the National Transportation Act is in the review process. Freedom to Move suggests that there be a review four years after the legislation is enacted. Such a review will be very difficult without some measure of changes which have occured. A burden study, conducted on a national scale, could provide invaluable information to the review process.

8.0 Conclusions

The analysis of the costs and revenues for Alberta rail traffic presented in this study has demonstrated quantitatively what has been suspected for many years. Alberta traffic, both in and outbound, pays a disportionately large share of railway constant costs. What is cause for concern is not just the magnitude of the burden on Alberta traffic, but the dependence of the railways on one region for their constant cost recovery.

Changes in world market conditions require that the railways dependence on the western resource traffic must be lessened. However, this is a difficult task requiring specific actions which go beyond those contemplated in Freedom to Move. The proposed changes in Freedom to Move represent an essential first step in lessening the overhead cost burden on the west and should be fully supported. However, additional future steps will be required to ensure that the rail overhead cost burden is more evenly spread across all rail users and that Canada is served by a least cost viable rail system.

Strategic Planning: The new darling of management tools for public sector transportation agencies

by

Merriene M. Duncan
Alberta Transportation

1.0 Introduction

Strategic planning joined the stable of management techniques used by private enterprise in the seventies and is rapidly being adopted by the public sector in the 1980's. This public sector move to strategic planning is occurring even while private enterprise is questioning the efficacy of strategic planning. But in Ontario, New Brunswick, Pennsylvania, and Massachusetts, transportation departments report good results from the process.

Senior management in government, concerned with changing mandates and decreased availability of funds in their domains, have begun implementing strategic planning so as to impose order on their transitions and ensure that the new directions meet arising public needs. When strategic planning is done well, private or public sector management is in a much better position to avoid developing problems and to capitalize on potential opportunities.

Undoubtedly we can benefit from the application of some kind of generic strategic planning to transportation department decision-making. However, we may do it more efficiently and effectively if strategic planning is adapted to the public sector needs, rather than being force-fed, as-is, through the system. In this paper we review standard strategic planning and consider some aspects of strategic planning which may be peculiar to the public sector.

2.0 Generic Strategic Planning

2.1 Objectives and purpose of strategic planning:

There are four common objectives for strategic planning: Make more effective decisions; provide top management control of multi-product, multi-division, multi-layered organization; provide a communication system; create a mechanism to allocate resources among alternative strategies. Various authors may word them differently, but the above generally reflects the norm.

Strategic planning is an attempt to bring order to complex, and often confusing, arrays of activities.(1) The first step is to determine what an organization should do, the goal being to be in the right business, rather than doing business right. By following the model outlined below, strategic planning then creates order through the strategic programming process. Strategic planning is not long range planning, which tends to set targets based largely on historical objectives and extrapolated trends. Strategic planning is not strategic management, which provides a broadly based, day-to-day approach for implementing, monitoring and correcting strategic directions of the organization. But strategic planning can, using the best knowledge available about the entire environment, provide the organization with consistent, cohesive, implementable strategic directions for the future.

2.2 Description of strategic planning model:

The strategic planning model has become fairly well standardized. A corporate mission is set. Environmental scanning delineates strengths and weaknesses of the organization and external factors that must be accommodated. Opportunity and threat analysis reveals potentials for improving the corporate position. Objectives are set which establish the broad guidelines for the organization. Strategic programming, or implementation planning, is developed and resources allocated in an iterative process that implements corporate objectives using available, but limited, resources.

A useful variation during strategic programing is formulating and evaluating alternate strategies for accomplishing objectives, ensuring that implementation plans are effective and efficient. Tilles offers criteria for evaluating strategies, though he cautions that "There is no such thing as a good strategy in any absolute, objective sense."(2) But with that proviso, the following checks should be made: internal consistency between goals, consistency with the environment, appropriateness in the light of available resources, satisfactory degree of risk, appropriate time horizon, workability."(3) Strategies that pass that test should then be compared for efficiency and effectiveness and the best ones adopted.

Three further points should be made concerning the strategic planning model. First, let us consider the centralized/decentralized functions. Broad, organizational objectives should be set centrally. Ideally, these objectives are realistic, but valid opportunities have not been missed by taking a too limited, or unimaginative, point of view. In fact, one of the chief benefits of strategic planning is that it encourages top management to

rigorously reassess organizational objectives on a timely, systematic and integrated basis. Implementation plans, however, must be developed at the operational, decentralized level, if they are to be realistic and if middle management is to be committed to them. To accomplish this, an iterative, feedback loop is used, bringing together top down directions and bottom up expertise.

Furthermore, wherever programming cuts across existing organizational boundaries, care must be exercised in developing appropriate cross-functional implementation plans to ensure cooperative effort. Through resource allocation, monitoring, and understanding the interaction points, the strategic plan can be effectively operationalized.(4) It is difficult to emphasize implementation needs too much. W. A. Dimma sums up a common result of poor implementation very succinctly, when he says, "A good strategy badly executed is as disastrous as a bad strategy badly executed."(5)

Finally, any projects approved after the plan is adopted should be consistent with the strategic plan, so as to sharpen the strategic focus and reinforce decision-making realism.(6) This requirement limits the CEO's ability to respond to new opportunities, but without this discipline, the planning exercise may appear to be an empty one to the rest of the organization.

2.3 Review of current criticism:

It is currently popular to be critical of strategic planning. A small sampling is included here. For example, W. A. Dimma says, brutally, "As a result of this latest new era, this onslaught of uncertainty and discontinuity, conventional strategic planning has suffered mortal wounds. For the most part, it has failed, it is inadequate and, worse, it is irrelevant."(7) Rosenberg and Schewe are equally damning, maintaining that "Top management and lower administrative echelons alike have lived with strategic planning long enough to recognize its major problems--its frail assumptions, its conceptual rigidity, and its overly elaborate structures. They have found strategic planning more difficult to implement than the theory would suggest."(8)

R. H. Hayes suggests the main thing wrong with strategic planning is that it is backwards. That is, instead of the normal ends-ways-means approach, he advocates doing means-ways-ends.(9) His argument is simple, that as the world shifts in unpredictable ways, objectives lose their attractiveness, and you need a means to move people beyond the immediate objectives. Using the example of a compass versus a road-map, he urges that organizations should

exploit opportunities as they arise by everybody being responsible for their prosperity. Though he doesn't describe it in those terms, he is really promoting strategic management, his compass concept being akin to the common-vision concept espoused therein. There are times, however, when a road map is more useful than a compass; likewise with strategic planning versus strategic management. The trick is to know what you need.

Finally, as a general--and valid--word of warning about all corporate planning, Russel L. Ackoff, in his book Creating the Corporate Future, purports that "A good deal of the corporate planning I have observed is like a ritual rain dance; it has no effect on the weather that follows, but those who engage in it think it does. Moreover...much of the advice and instruction...is directed at improving the dancing, not the weather."(10)

Well, there's more press to be had for criticism, at this stage, than for fan mail. Still, where there's smoke, there may be fire. Undoubtedly, there are problems with strategic planning. But there are also problems with every other management system yet devised, as often with unrealistic expectations for a miraculous cure for the organization's woes as with the system itself. And enough organizations are reporting better management results through strategic planning to make it worth consideration. Like any other approach, it will probably succeed if you understand it, know its limitations, work hard, and don't expect miracles.

2.4 How to improve the odds of succeeding:

What can you do to improve your odds of success? First, know what you want to accomplish with strategic planning, i.e., what are you trying to do? And why strategic planning? There are undoubtedly a good number of valid reasons for embarking on a strategic planning exercise. But since strategic planning has often entered management's jargon without necessarily being fully understood, it is awfully easy to end up in Ackhoff's dilemma, working on the dancing, not the weather. The point that is being made here is that the CEO would benefit from making a reasonably rigorous analysis of his problems and objectives, comparing those factors with what can be expected from strategic planning, and then deciding whether to proceed. It is necessary to do more than perceive that there is some kind of a problem and that strategic planning has worked elsewhere. This tendency, I believe, is at the root of some of the failures of strategic planning.

Second, the role of the CEO throughout planning and implementation is critical. He cannot hand the job over to a planner and sit back, feet on the desk, waiting for results. The CEO and other senior managers must grapple, themselves, with the issues embedded in planning and implementation if strategic planning is to succeed.

Third, in the same article in which they were so critical, Rosenberg and Schewe list some modifications which would improve strategic planning. It should be more flexible, participative, responsive, open to innovation, sensitive to exceptions; it should make better use of the information everyone has in their heads; and attention should be given to better employee commitment.(11) With the exception of the last, all are subject to management control, and employee commitment is influenced by management actions. Basically, if strategic planning is not treated as a rigid, mechanical exercise, but is developed to meet an organization's needs within the constraints of its own environment, it has an excellent chance of improving that organization's performance and perceived success. (12) Whether it does everything the organization needs, is another, and quite different, question.

3.0 Public Sector Strategic Planning

Throughout the discussion below, we will be looking at strategic planning for a government department, crown corporation, agency, or other component within a particular government. The CEO position is treated as being particular to that agency, though one could argue that the department is similar to a component of a large private sector corporation, and that the analysis should be done at the government-wide level, using the Prime Minister or Premier as the CEO. However, since within the Alberta government there is no organization that has been given responsibility for strategic planning for the government as a whole, the individual department is the appropriate unit of analysis. In a government which took a corporate approach, the department or agency would obviously have to fit within the larger framework.

3.1 "Factor Analysis":

If a government transportation department has difficulty implementing strategic planning, it may be due to the characteristics of strategic planning itself, it may be failure to properly follow the strategic planning process, or it may be attributable to not adapting strategic planning to the specific needs of the public sector. Management principles, and by extension planning for management, may be the same across public and private

organizations. But the environment, constraints, products, etc., vary. These factors, as used in strategic planning, are discussed here.

It is useful to recognize that most of these public sector factors fall into two basic groups. The first group is one that all bureaucrats are familiar with. These factors occur where there tend to be two data sets to contend with, the political and the technical. The second group occurs where there is a different method of doing business in government. Virtually all the inputs into the strategic plan fall into the first group, while implementation issues tend to fall into the second group.

Analyzing opportunities and threats, assessing the environment, setting objectives, reviewing options to meet objectives, identifying the changes in the variables, even identifying the product itself, produces two lists, the one political and the other technical. For example, transportation managers are increasingly concerned about maintenance and rehabilitation of a maturing road system, because their technical expertise tells them that the system is deteriorating, which is a threat to the objective of providing an excellent transportation system. But until the deterioration has become highly visible to the public, for the politician, "black on black" is not as effective as new roads for staying in office, a prime and realistic political objective.

Method issues, as well, may stem to some extent from political necessity, but they may also become ingrained, a government way of doing things. Thus, allocation of resources, management rewards, changes in top management (both political and administrative), are done differently in government. The differences, if not immutable, may seem so at times, and may have an impact on successful implementation of strategic planning.

The role of the public straddles the political/technical (or two-list) and method classifications. In the private sector the public indicates its preferences through purchasing products and services, creating the bottom line so revered there, but in the public sector, the public indicates its preferences at the ballot box, the political equivalent of the bottom line, and in between times communicates less forcibly in other ways. However, the government as a whole must be re-elected if it is to continue to govern. Rarely do governments rise or fall on the strength of the actions of individual departments, which are the delivery arms for the tangible and intangible products of the public sector. And since public goods can be defined in either technical or political terms, it may not be clear at times what the product is or what the

market is. Taken all-in-all, then, there is not a clear-cut, unambiguous method for tallying up the public's valuation of individual programs, i.e., "products", or public sector agencies. Moreover, the penalty for "product" shortcomings is unlikely to be swift and decisive, particularly where there is uncertainty as to whether the shortcomings exist. In short, the role of the public is crucial, but unfocused; the public need rarely identified definitively, but never ignored.

Finally, there is the question of who is the CEO. Is it the Deputy or the Minister? A case could be made for either. For strategic planning, the desired level of involvement from the CEO just about precludes the Minister, in most departments. But a DM does not make policy, the Minister does. Since objectives must reflect policy, the Minister must be integral to the process. A nice Catch-22 if there ever was one. There is no one answer. It is going to depend on the Minister, the Deputy, and the situation, with each case being decided individually.

3.2 Public sector guidelines for adapting strategic planning:

1. Don't fight, facilitate!
Let's look first at the environmental-wrap (strengths, weaknesses, opportunities, threats, and the external environment). We have identified the existence of two lists for each input into the environmental analysis. Unfortunately, the political list is subject to frequent changes. Nevertheless, the planner must include both lists in the analysis that is done. Without using both lists appropriately, the plan that is eventually developed will not meet the needs of the politician and will be scrapped, no matter how sound it is technically, or it will not be technically sound, which would be an abdication of the stewardship of public monies that the public service employee has a responsibility to the public for. By carefully assessing and integrating the political and the technical data, however, strategic planning can lead to a superior public sector product. It behooves the planner to facilitate political needs while not abandoning professional standards.

2. Get the Minister involved in objective-setting
The Minister should certainly participate in setting objectives. Use the data base outlined above to ensure that you and he have the best technical information available. Then use the Minister's perceptions of public desires to provide a surrogate for tallying up the public's valuation of programs, or "products". This will not be infallible, as most Ministers know too well, but it's likely the best

you have, unless a reliable public survey exists. The Minister also provides the corporate view for the government as a whole. As an aside, this approach solves one problem but may create another, since objectives obtained thusly are unlikely to wear the clear, focused, decisive label ascribed to objectives in descriptions of private sector applications. J. M. Mackay points out that "As a result of these realities, governments tend to state their goals in an ambiguous way. It gives them flexibility. Clear goals don't apparently generate much credit--or as much as they lose from those who oppose them." (13) Furthermore, he reflects, "As well as being unclear, governments shift their areas of emphasis and directions within policy arenas in response to political as well as environmental or market circumstances. All of this creates difficulties for the implementors--those who studied strategic planning." (14) But you're better off having this political, public interest input direct from the Minister. It also gives the technical people an opportunity to influence the political process. Done well, everybody benefits, so make every effort to involve the Minister in at least this part of the exercise.

3. Consider resource allocation rules before doing strategic programming

Resource reallocation in government may not be as easy to accomplish as in the private sector. At best, it can be a very slow procedure to shift personnel between uses, at worst, next to impossible. Shifting financial resources is similarly cumbersome. The methods of doing business in government, set up to protect the use of public funds and to ensure fair employment practices, do not readily lend themselves to a speedy realignment of changed government objectives with the requisite resources. Other implemenetation issues such as performance monitoring, staff incentive rewards, authority to act, etc., are similarly clouded within government. Even Ministers find their ability to act decisively constrained by legislative and procedural requirements. Thus public sector implementation considerations may well modify, in ways different than in the private sector, the strategic directions chosen. The best defense for the strategic planner in government is to know the rules, know how to work within them and around them, try to make them work for you, and not get ulcers about something you can't change.

4. Know your "product" mandate

A word of warning is perhaps in order here. Having differentiated public and private sector strategic planning, one should not assume that government is monolithic, that all government departments are the same. Some departments or agencies are charged with providing a concrete,

definable product. Others are in the policy area, accomplishing their objectives through influence and negotiation. Still others are in the social services area. The mission and objectives are certainly going to vary. The methods of fulfilling the objectives are going to differ. The environment is going to be less definable in the "softer" areas. The strategic planner is going to have to take these differences into account, and mold the process to the needs of the specific department. This point has already been made above in a different context, but bears keeping in mind when evaluating strategic plans from different departments. Even within government, strategic plans are going to look quite different from each other. The constant factor is the need to support, in an implementable way, the mandate of the department the plan is derived for.

3.3 Public sector pitfalls:

Even having done the above, there are still potential pitfalls, arising from three main sources: Trying to make strategic planning do double duty, the time horizon the public sector works to, and multiple realities. Double duty rationales may include two factors not common to the private sector. First is the need to communicate with the various publics. The corporate plan could be a vehicle for communicating with the public and convincing them of the legitimacy of the public sector agency's "products". But a corporate plan written as a public communication device may not be adequate or convincing within the agency as a guide for implementation; likewise an internally effective strategic plan may be a poor public communications vehicle. Two documents may be preferable.

A second "double duty" rational for initiating strategic planning in the public sector may be the attempt to bring the technical and political components of the system into better harmony. It is a pitfall only in terms of potentially unrealistic expectations. As discussed earlier, politics has a strong tendency toward the immediate, the pragmatic and the visibly positive. Technical staff tend to be logical and consistent in the application of their professional expertise. If a Deputy provides strategic directions based on his day-to-day discussions with the Minister, the emergent strategy is unlikely to provide a cohesive, consistent set of guidelines for the department to follow. So the Deputy may see a strategic planning exercise as a means to establish strategic directions from within the department, based on the best technical advice, so as to provide a guide to the Minister, or for His approval. But few Ministers have the time to be actively involved in the comprehensive strategy-divining exercise anticipated for strategic planning, so you'll be lucky if

you were able to get Ministerial input at the recommended objectives-setting level. Furthermore, even with an "approved" strategic plan, be prepared for the fact that it will be a rare Minister of the Crown who lives wholely by the dictates of even his own strategic plan, let alone, of yours!

Second, the time horizon problem is equally pernicious. In the private sector, strategic planning tends to look fairly far down the road. But the political time horizon rarely extends beyond the next election. This means that the longest you can plan for is about four years, and you lose a year each year until the next election. Quoting J. M. Mackay, again, "The essence of strategic [planning]... concerns taking actions now in light of their pervasive and critical long-term consequences. [But] for government, long term is very short. ... Consequently, tackling a major issue with long-term benefits and short-term implementation risks late in a government's term is 'strategically' unsound from a political perspective--even if it is 'necessary' from a bureaucratic view."(15) In transportation planning, twenty years--or longer--may be the long term you should be using, but it is not going to fit with any political cycle.

Third, strategic planning's potential usefulness may be undermined if plans are not reality-based or management thinks they are when they aren't. In the public sector there are a multitude of realities, including the various publics', the politicians', and the professionals' realities. It is extremely difficult to marry those realities in such a way that everybody in the organization is totally committed to the corporate strategy. Therefore the public sector manager must be extremely skillful if he is to succeed in coopting all the stakeholders into making the effort necessary to derive and implement the strategic plan.

Do these pitfalls contra-indicate strategic planning for the public sector agency? No, but they do add risk factors over and above those inherent in generic strategic planning. The fact that several public sector transportation agencies have succeeded is proof that it can be done.

4.0 Whither Alberta Transportation ?

Alberta Transportation began working toward strategic planning some months ago, basically using Ontario's MTC as the model. We have also embarked on two individual components of strategic planning, in the information management and human resource planning areas. Under the

auspices of the information management exercise, a great deal of effort has been expended establishing missions, objectives and critical success factors throughout the Department. Considerable information exists from the human resource planning exercise, as well. The Department is in an excellent position to capitalize on the general interest that has been generated throughout the department and the data base momentum that exists and to join the small group of provinces and states that have successfully utilized strategic planning to guide their efforts.

Alberta Transportation's proposed mission reads "To efficiently provide an integrated transportation system for the safe, efficient and effective movement of goods and people which supports the social and economic development needs of the public." (16) The supporting Departmental objectives are fairly ambitious and, properly implemented, will take the Department successfully into the 21st century. The next step is to begin integrating the individual efforts that have been made to date, and to develop an overall, cohesive, consistent set of plans which will guide the Department in the coming months and years as we move into this new era.

Aside from those outlined above, where are Alberta Transportation's potential problems? At this stage, we are anticipating an election under our new Premier, and the subsequent possibility of a Cabinet shuffle giving the Department a new Minister, with the potential for changing directions that that entails. There are also rumours of Departmental consolidations. Therefore the local political environment within which we are planning has a significant number of unknowns, but will be resolved fairly quickly. More problematic is the world oil economy, which is increasingly unstable, and which has a very profound impact on the province of Alberta, raising real questions about the availability of revenues and the priority needs of the citizens of the province. This source of uncertainty will last for the foreseeable future. Against these uncertainties, there is a maturing roadway system and need for expansion of the existing system. Difficult decisions will have to be made between rehabilitation and new or improved roads. As time goes on, the intermodal questions will also become more critical and require strategic decision-making.

The time is certainly ripe for strategic planning. It will not be an easy task, but if it is done well the rest of the work of the Department should be easier, and we can be confident that the transportation needs of the public in Alberta will continue to be met as efficiently and as effectively as possible.

Footnotes

1. Tilles, Seymour, "How to Evaluate Corporate Strategy," reproduced in Strategic Management, Editor, Richard G. Hamermesh, Harvard Business Review Executive Book Series, John Wiley & Sons, Inc., 1983, p. 83.

2. Ibid., pp. 83-94.

3. Lorange, Peter, Corporate Planning, An Executive Viewpoint, Prentice Hall, 1980, pp. 149-151.

4. Dimma, William A., "Competitive Strategic Planning," Business Quarterly, Spring 1985, pp. 24,25.

5. Lorange, Peter, op. cit., p. 147.

6. Harned, Ellis W., et. al., "Development of a strategic management process: A case study of the Pennsylvania Transportation Department, p. 16.

7. Dimma, William A., op. cit., p. 22.

8. Rosenberg, Larry J. and Schewe, Charles D., "Strategic Planning: Fulfilling the Promise," Business Horizons, July-August 1985, p. 54.

9. Hayes, Robert H., "Strategic planning--forward in reverse?", Harvard Business Review, Nov-Dec 1985, pp. 111-119.

10. Ackoff, Russell L., Creating the Corporate Future, John Wiley and Sons, 1981, p. ix.

11. Rosenberg, Larry J. and Schewe, Charles D., op. cit., pp. 60-62.

12. Steiss, Alan Walter, Strategic Management and Organizational Decision Making, Lexington Books, D. C. Heath and Company, 1985, p. 73.

13. Mackay, J. M., "Yes Virginia, there is....Strategic Management in Government," May, 1984, Adapted from a paper presented to Strategic Management Society, Paris, France, October, 1983, p. 5.

14. Ibid., p. 5.

15. Ibid, p. 5.

16. Currently in the planning process at Alberta Transportation.

TREATMENT OF RISK AND UNCERTAINTY IN TRANSPORTATION INVESTMENT PLANNING

by

David Lewis
James F. Hickling Management Consultants Ltd.
and
Ling Suen
Transportation Development Centre

1.0 INTRODUCTION

Those charged with planning large-scale, long-term investments often find life to be "just one damn thing after another." But whatever other troubles these planners have, they do not lack for technical advice on how to choose among competing projects. Numerous texts present the theory and practice of cost-benefit analysis, and public agencies and private firms now apply it routinely. Virtually absent from these techniques, however, are systematic ways of understanding the economic effects of political risk and social uncertainty -- the risk that political actions not included in the calculus of expected return will significantly erode that return and the uncertainty that governments' social policy will shift the basic institutional assumptions embedded in the estimation of benefits and costs.

Indeed, there is a large and growing class of investments for which political actions are as large a determinant of return as the customary economic and technical uncertainties. This is true for private investments as well as those of public agencies. For example, Parliament is now weighing changes to the regulations that govern the transportation of hazardous waste. Such changes would directly affect the return on investment of firms accounting for some $95 billion in sales. Similarly, federal energy policy provides the decision framework for planning private investments in coal roads and port facilities.

In public investments, however, two characteristics give political risk a special importance. First, rate of return is not the only consideration in choosing projects and deciding how they will be carried out. Government at all levels is equally (and properly) concerned with the distributional consequences of its investments -- the sense that the sacrifices and benefits are shared appropriately. Second, the checks and balances built into government decision-making afford generous opportunities for interested parties to influence the outcome, even after widespread agreement has apparently been reached.

There is also a growing class of investments for which social policies of government can have far reaching impacts upon the

fundamental assumptions underlying investment appraisals that rely upon conventional forecasting techniques. For example, health policies and various legislative initiatives are gradually encouraging greater activity among older persons, promoting longer working lives, independent living arrangements and more activity away from home. Investment planning for long-lived assets such as road capacity, and design decisions for public transport, could thus prove radically inadequate if they rely solely upon historic travel patterns to forecast the adequacy of such investments. More generally, forecasts based on the conventional techniques of "marginal analysis" -- price elasticities, income elasticities and the like -- will fail us to the extent that social change undermines the fundamental assumption on which they rest -- namely, that small changes in transportation price and quality will result in small changes in demand. Simply stated, marginal analysis, which presumes the status quo, will not anticipate institutional change.

This paper is about political risk and social uncertainty and how these factors can be included in formal investment planning. Two examples are presented, both developed by the authors as a means of integrating political and social factors into the appraisal of two current investment problems. The first example is air traffic control, technology now coming to the end of its design and technological life in the U.S., Canada, and Europe. The second example is transportation for disabled persons, a rapidly growing concern in virtually all nations.

2.0 AIR TRAFFIC CONTROL -- INTEGRATING POLITICAL RISK

The case at hand is the air traffic control systems of the United States and Canada now greatly in need of modernization. Recognizing this need, the Congress authorized in 1982 the first five years' funding for a (U.S.)$10.7 billion investment in advanced technology. Following suit, Canada's Ministry of Transport (Transport Canada) developed a compatable (Can)$3.2 billion National Airspace System Plan in 1983. That Plan now awaits Cabinet approval. The new automated systems would enhance safety, reduce traffic delays, and lower operating costs. However, its cost effectiveness depends strongly upon a consolidation of facilities and a reduction in staff. This raises a difficult political issue for the congressional and parliamentary committees that oversee this investment -- whether to resist the consolidation, thereby saving jobs in the short term but diluting the public benefits, or whether to allow the consolidation, thereby losing the jobs but achieving the full economic gains from the investment. The analysis develops quantitative measures of the risk associated with these decisions and integrates that risk with the other major uncertainties. The analysis presented here applies to the U.S. component, although the issues apply with equal force in Canada.[1]

2.1 The Problem

Air traffic control computers, radars, instrument landing systems and other equipment is a blend of several generations of technologies, much of which is labour-intensive and obsolete by modern standards.

It was designed to be efficient at lower air traffic volumes than exist today and much lower than those projected for the future. These limitations already cause delays for air travellers, as well as high operating and maintenance costs for the U.S. Federal Aviation Administration (FAA) and Transport Canada. As the skies become more crowded, the present system may not be able to maintain the highest standards of safety, and costs are likely to grow disproportionately.

A plan to remedy the situation, formally called the National Airspace System Plan, was presented to the Congress by FAA Administrator Lynn Helms in December 1981. Through automation, the plan would increase traffic-handling capacity, diminish the risk of midair collision, and reduce flight times by allowing aircraft to use more direct routes. Through facility consolidation and staff reductions, it would reduce operating and maintenance costs.

The Congressional Budget Office estimated the cost of modernization at $10.7 billion in 1982 dollars, as shown in Table 1. About 72% of this -- $7.7 billion -- is direct federal investment in advanced computer hardware and software and in the ground installations required for microwave landing systems -- a new technology for guiding landings in bad weather. The remaining $3 billion is the investment required of the airlines and other private owners of aircraft, who would need to purchase compatible transponders and other avionics. The present value of this investment at a 10% discount rate would be about $6.9 billion, $5.7 billion in federal investment and $1.2 billion in private investment. The bulk of the federal expenditures would run through 1989, while the private expenditures would run into the next century.

The quantifiable benefits from these investments would be quite large if all went as assumed in the FAA plan -- $60 billion (in 1982 dollars) in undiscounted savings, or a present value of $16 billion. These benefits would be distributed as shown in Table 2: 67% as reduced operating and maintenance costs, and shortened delays for aviation users.

If the new investment actually realized the planned benefits and costs, the annual rate of return would be about 24.3% -- well above the benchmark of 10% used by the U.S. federal Office of Management and Budget (Canada's Treasury Board also requires a 10% return on investment). The present value of these benefits would exceed costs by more than $9 billion. Equally important, the benefits would come early: benefits in the first year after completion would be nearly 15% of total costs including interest. This means that success would depend more upon near-term events than on distant and speculative forecasts. Nevertheless, uncertainties exist, and we must now turn to them.

Table 1. Cost estimates of the National Airspace System Plan, 1983–2005

Sources of costs	Total costs 1983–2005 (in 1982 dollars) Dollars (in billions)	As percent of total	Present value with 10% discount rate[a] Dollars (in billions)	As percent of total
Federal investment	$ 7.65	71.7%	$5.73	82.7%
Avionics costs to users				
Transponders and Traffic Alert and Collision Avoidance System	2.42	22.7	0.88	12.7
Microwave Landing System	0.59	5.6	0.32	4.6
Total	10.66	100.0	6.93	100.0

Source: Calculated by the authors from FAA data.
[a] Ten percent represents the minimum rate of return used by the Office of Management and Budget for capital investments.

Table 2. Benefit estimates of the National Airspace System Plan, 1983–2005.[a]

Sources of costs	Total benefits 1983–2005 (in 1982 dollars) Dollars (in billions)	As percent of total	Present value with 10% discount rate[b] Dollars (in billions)	As percent of total
Savings in FAA operating costs	37.09[c]	62.2	10.64	66.5
Fuel cost savings				
Air carriers	11.29	18.9	2.62	16.4
General aviation	5.07	8.5	1.13	7.0
Savings from Microwave Landing System				
Improved safety	0.28	0.5	0.08	0.5
Reduced disruptions	2.52	4.2	0.66	4.1
Reduced outages	0.24	0.4	0.07	0.4
Reduced ground and air restrictions	1.99	3.3	0.50	3.1
Reduced path length	1.12	1.9	0.30	1.9
Total	59.60	100.0	15.99	100.0

Source: Calculated by the authors from FAA data.
[a] Details may not add to totals because of rounding.
[b] The FAA estimates that savings in operating costs would total $24 billion by the year 2000. The CBO has projected another five years of savings to allow comparison of projections. However, the discounting of future costs makes this difference unimportant.

2.2 The Uncertainties

It seems a Law of Nature -- well known to defense contractors and builders of nuclear power plants -- that important uncertainties stand between the projected costs and benefits and the real outcomes. The key economic and technical uncertainties facing the air traffic control modernization are:

- Will air traffic grow as forecast?
- Will capital costs turn out as estimated?
- Will the investment become obsolete before the end of its economic life due to unforseen technological changes?
- Are the projected savings properly evaluated?

These economic risks create the background to which political risk must eventually be added. In particular, for the FAA plan to achieve its promised savings, the 25 enroute navigation centers and 188 airport approach facilities would be consolidated into about 30 facilities by the year 2000. In addition, the 317 flight service stations would be reduced to 61 by the year 2000. Staffing would be reduced proportionately -- from its authorized level of 37,122 in 1983, to 30,200 in 1985 and 24,200 by the turn of the century.

In the past, such changes have encountered opposition in the Congress and among aviation groups. For example, the House Appropriations Committee has refused to fund the consolidation program for en route centers without prior notification of which centers would be proposed for closure. Similarly, a 1981 FAA proposal to cut back its regional offices from eleven to six faced employee protest, state resistance, and congressional opposition. As a result, the FAA modified its consolidation plan, reducing the number of proposed 1983 closings from five to two.

There are strong grounds for believing that the current FAA proposal will encounter similar resistance. For one thing, the actual facility consolidations are voted on an annual basis through the appropriations process. This means that each year some members of Congress will be asked to approve immediate job reductions in their states or districts in exchange for long-term, widely shared benefits. Indeed, the very robustness of the FAA plan works against it. The efficiency gains from the plan would remain attractive -- though diminished -- if some of the system consolidation did not take place. Thus, each congressman has an incentive to support the plan and to resist the closing of facilities in his home district. There is evidence that similar problems could be encountered in Canada. For example, the benefits from automated light houses have suffered as a result of resistance to staff savings. If a large number of traffic control consolidations are resisted, the investment could become an economic failure.

2.3 Integration of Political Risk: A Monte Carlo Approach

To assess the economic and technical uncertainties of the plan, Table 3 explores the effect on rate of return of assumptions that

Table 3: Economic Evaluation of the National Airspace System Plan Under Alternative Assumptions

Assumptions	Annual Rate of Return (in percent)	Discounted Benefits Minus Discounted Costs (in billions of dollars) a	Ratios of Benefits to Costs a
FAA Assumptions	24.3	9.1	2.3
FAA Operating Cost Savings Delayed Five Years	13.9	3.1	1.5
Traffic Forecasts Under "Maturity Scenario"	21.3	6.8	2.0
Cost Overrun of 25 Percent with Maturity Scenario	17.1	5.0	1.6
Technological Obsolescence by the Mid-1990s, with Maturity Scenario	16.5	2.1	1.3

a. All benefits and costs are discounted to their present (1982) values at the rate of 10 percent per year. The analysis period is 1982 to 2005.

differ from those initially assumed. As the table shows, such uncertainties, when analyzed one at a time, are not great enough to radically diminish the projected economic return on the plan. However, there is ample reason to expect that political action will erode some of the savings from the air traffic control investment. It is difficult to estimate the extent of this erosion, but some scenarios can give a sense of its effect on the expected return. If, for example, the consolidation schedule was delayed by five years, the overall project would still be worthwhile -- with a rate of return of 13.9%. But if opposition to organizational changes simply reduced by half the projected savings in operating costs, then the FAA plan would not prove worthwhile -- the discounted federal investement costs would exceed the discounted savings by roughly $400 million.

It is instructive to explore singly the effect of outcomes that differ from assumptions. But in real projects, almost every important parameter has an outcome that differs from the one initially assumed. To be a useful guide to decision-making, analysis must integrate these differences into a unified risk analysis. One approach would be to compute the rate of return under "worse case" conditions. For example, combining the least favorable outcomes of all economic and technical assumptions would leave a rate of return of only 2.8%. But this approach has little practical value, because the likelihood of everything going wrong is almost as remote as the likelihood of everything going right.

A better guide to investment risk is the overall probability that the rate of return will fall below some hurdle rate -- in this case the OMB standard of 10%. This can be estimated by assigning a subjective probability distribution to each of the principal uncertainties, and then making repeated rate-of-return calcuations using assumptions drawn at random from each distribution. This procedure generates a probability distribution for the overall rate of return rather than a point estimate.

Table 4. Integrated risk analysis:a Monte Carlo Approach

Possible hurdle rates in percent	Probability of a return lower than hurdle rate (%)*	
	Moderate risk**	High risk***
2	0	0
6	0	6
10	16	42
15	76	94
20	99	100

Source: Calculated by authors -- probabilities rounded to nearest percent.

* The following are assumed:(1)Average capital costs are 25% higher than FAA assumptions, with a standard deviation of 10%.(2)Air carrier fuel savings fall 20% below FAA forecasts, with a standard deviation of 20%.(3)General aviation fuel savings fall 40% below FAA forecasts, with a standard deviation of 20%.(4)Benefits from the Microwave Landing System fall 25% below FAA forecasts, with a standard deviation of 25%.

** "Moderate risk" assumes that average productivity improvements are one-third below FAA forecasts, with a standard deviation of 15%. The distribution mean rate of return is 13.2%. The distribution standard deviation is 2.3%.

*** "High risk" assumes average productivity improvements to be one-half of the FAA forecasts, with a standard deviation of 15%. The distribution mean rate of return is 10.5%, and the standard deviation 2.9%.

On the basis of probability distributions that we estimated for productivity improvements, fuel savings, capital costs, and benefits from the microwave landing system, the FAA plan would have a 16% probability of falling below the benchmark 10% rate of return, and it seems virtually certain to fall below the 24% calculated from FAA assumptions. As shown in Table 4, the bulk of the probability distribution lies in the 10-15% range. This yields an expected value of 13.2% for the rate of return. Although this figure only manages to exceed the OMB 10% benchmark by a small margin, it is a result in which much greater confidence can be placed than in the baseline calculation.

3.0 TRANSPORTATION FOR HANDICAPPED PERSONS -- INTEGRATING SOCIAL UNCERTAINTY

3.1 The Problem

A wide range of possibilities exist for diminishing the travel problems of handicapped persons, including cash subsidies, adaptations to existing regular route bus and rail services, door-to-door vans and taxis (so-called "dial-a-ride"), specially adapted automobiles, and plans based on a combination of approaches, each tailored to the

different requirements of persons with different disabilities and income levels. The question of alternatives has become a source of great controversy. Those speaking on behalf of advocacy groups of handicapped persons maintain that special door-to-door services are discriminatory and that human rights legislation in North America protects them against such discrimination by guaranteeing their right to use the same federally financed public services available to everyone else. At present, policy at all levels of government, in both Canada and the United States, tends to favour separate door-to-door transportation. Many handicapped persons argue that such services are permissible, but only if they offer a standard of convenience "equal" to that of transit. Thus the common practice among operators of door-to-door service of requiring users to phone 24-hours ahead is regarded by some as discriminatory since bus passengers need not wait as long.

Much controversy has also arisen over costs. Those who favour door-to-door services often argue that they serve more people and cost less to provide. Others who favour transit adaptations argue either the reverse, or that cost is not an issue where civil liberties and integration are concerned.

There is no question, however, that either approach involves significant cost and that pursuing one would reduce the financial means available to pursue the other. As a result, the economic appraisal of alternative approaches has itself become a source of widespread interest, not just among policy-makers but also disabled consumers.

3.2 The Uncertainties

As in the case of the air traffic control example outlined earlier, important uncertainties stand between expected outcomes associated with the options and the real results. The key technical and economic uncertainties facing the choice between assessible mass transit and separate door-to-door served are:

- Will the extra time needed by wheelchair users to board mass transit vehicles via lifts and ramps slow down schedules to the point where existing passengers abandon the system or where the schedule fails to be opertional?

- What is the cost associated with alternative levels of door-to-door service, in particular the expense of reducing the time passengers must book ahead for service?

Together with technological uncertainty in the choice of lifts and other wheelchair boarding technologies and the chance of cost overruns, these are the technical and economic risks with which social and institutional uncertainty must eventually be combined.

The key social and institutional uncertainty (and thus concern) revolves around demand forecasts, travel habits being a reflection of nothing less than our role in society generally. Each approach to the

travel needs of disabled persons has its unique cost characteristics but all are closely linked to projected patronage. The cost of adapting public transportation facilities is broadly fixed, regardless of the use made of them by handicapped persons. The cost of door-to-door transportation, on the other hand, is relatively flexible; it depends heavily on the number of handicapped persons who use it. This means that, below a certain level of demand, plans that emphasize door-to-door services will cost less than plans requiring adaptations in mass transit systems. Cost-per-trip (a measure of effectiveness) displays a similar profile. Beyond a certain level of patronage, adapted transit service would appear more cost-effective than door-to-door service since cost-per-trip of adapted transit declines sharply as more people use it. Cost per trip of door-to-door service, on the other hand, is relatively stable, regardless of patronage.

The analytic challenge stems from the fact that as a society we are striving hard to improve the role of disabled persons in society. This makes demand estimates the most critical element in the investment appraisal and yet the most uncertain. The "most likely" projections of demand, those based on the best available analysis of past travel behaviour of disabled persons, offer the most probable near-to-medium term results of a given investment. They fail, however, to reflect the potential long term social and institutional changes in society that could sharply alter the travel opportunities and patterns of the disabled. For example, surveys indicate that disabled persons travel only half as often as the able-bodied, largely because of their chronically low rate of employment (generally in the range of 20 percent of working-age disabled persons versus 60 percent among the able-bodied of working-age). As employment among the disabled grows in response to government program initiatives, to medical advances that create further opportunities for independent living and to shifts in attitudes generally, their propensity to travel will grow disproportionately to that of the population generally.

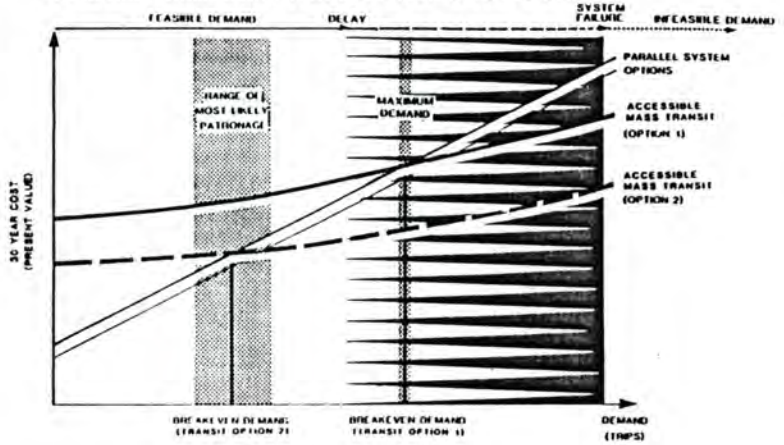
3.3 Integration of Social Uncertainty: A Scenario Approach

In view of the importance and uncertainty associated with forecasting the actual volume of disabled passenger-trips, we have developed a scenario framework designed to reflect a probability range of forecast demand and associated cost and operational impacts (Figure 1). The problem at hand is to appraise the cost and effectiveness of making mass transit systems accessible to the disabled (with lifts, elevators and ramps etc.) relative to the cost and effectiveness of providing door-to-door specialized public transport. First, the range of most likely demand (see Figure 1) depicts the potential near-to-medium term volume of disabled passenger trips. The forecast can be based on actual demand rates observed in accessible systems, suitably adjusted for any special factors in the system under study.

The second demand forecast developed under the evaluation framework, termed maximum conceivable demand (see Figure 1), represents a "scenario" -- or "what if" forecast. Under this approach, the major barriers that inhibit travel among the disabled

ASSESSMENT FRAMEWORK
- TRANSPORT FOR DISABLED PERSONS

FIGURE 1
GENERAL FRAMEWORK FOR EVALUATING TOTAL COST



GENERAL FRAMEWORK FOR EVALUATING COST EFFECTIVENESS

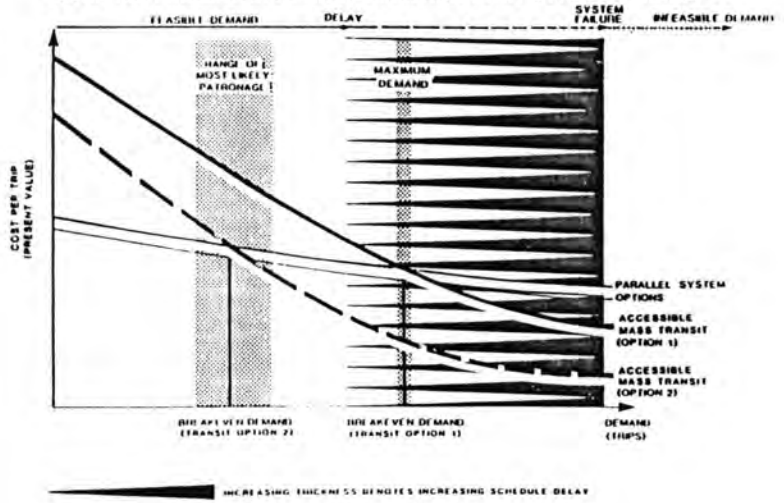


Figure 1 - continued

DEFINITION OF TERMS IN CHARTS

ECONOMY - TOP CHART

PARALLEL SYSTEM AND ACCESSIBLE MASS TRANSIT OPTIONS. Cost of alternative approaches and associated levels of service. Indicates comparative costs for alternative levels of service.

30 YEAR COST - PRESENT VALUE. Cash outlays for capital expenditures plus incremental operating costs for each option over 30 years, recalculated to reflect their present day dollar value. This allows direct comparison of options with different phase-in periods and life-cycle cost profiles.

FEASIBLE DEMAND RANGE. Volume of disabled passenger-trips by mass transit that will not inhibit viable operation. Indicates the level of patronage that can be accommodated either without causing delay in scheduled journey time or with progresivley increasing delay until the system fails to be operationally viable ("system failure").

INFEASIBLE DEMAND RANGE. Volume of disabled passenger-trips that will inhibit viable operation of mass transit systems.

RANGE OF MOST LIKELY PATRONAGE. Volume of accessible mass training passenger-trips by disabled persons most likely to occur in the short to medium term. Inidcates whether likely patronage lies in feasible range. Also indicates most likely 30 year costs for mass transit option relative to parallel approaches.

MAXIMUM CONCEIVABLE DEMAND. Long term, most optimistic volume of mass transit passenger-trips by disabled persons in a barrier free society. Indicates whether accessible mass transit opitons are feasible under most optimistic patronage. Also indicates most favourable possible comparative cost for accessible mass transit options relative to parallel approaches.

BREAKEVEN DEMAND. Volume of accessible mass transit passenger-trips by disabled persons above which its total cost is less than that of door-to-door approaches. Should be assessed in comparison with likely demand.

EFFECTIVENESS - BOTTOM CHART

COST PER TRIP - PRESENT VALUE. Cash outlays on capital expenditures plus incremental operating costs over 30 years, recalculated to reflect their present day value, divided by total passenger trips over 30 years ("discounted" to "present value").

BREAKEVEN DEMAND. as above, for cost per-trip.

today -- particularly low employment rates -- are assumed to be largely eradicated and their use of accessible bus or rail systems is assumed to approach that of the public generally. (Their use of such systems will still not equal that of able-bodied persons since the elderly represent a larger proportion of the disabled population -- about half -- than the representation of elderly persons in the population generally -- about a tenth. Elderly persons naturally travel less frequently, regardless of disability.) This forecast reflects long-term policy goals but obviously carries a lower (subjective) probability of occurance.

This approach is designed to allow the decision-maker to be fully aware of the degree of risk and uncertainty in the approach he decides to adopt, including any intangible qualities associated with the alternative approaches. The forecast range of most likely demand indicates the most probable operational and economic outcome while the maximum conceivable scenario depicts a much lower probability, long-term result. For example, the range of most likely demand might lie within the operationally feasible range but beneath the breakeven level, indicating that accessible mass transit is operationally feasible but not economic or effective relative to other approaches. The maximum conceivable demand, on the other hand might lie above the breakeven level (and within the feasibile range). In this case, the decision framework would expose the kind of risks and rewards associated with a decision to proceed with an investment in accessible mass transit -- e.g. little risk of operational problems, high risk of a relatively poor economic return in the foreseeable future and a small chance of a favourable economic return in the longer-term. The decision maker might be willing to take this economic risk in exchange for the chance -- albeit a low one -- of a higher return in the future and the associated social benefits of mainstream integrated service for the disabled. Under this decision framework, however, he does so in full knowledge of the potential risks and their general probability.

Another example would be a case where the likely demand occurs in the feasible range, but maximum demand occurs in the operationally infeasible range. Here the decision-maker is confronted with an additional element of chance if he chooses the accessible mass transit approach. For not only does he risk a poor economic return because of low demand but he also takes the chance that accessible mass transit operations will be severly disrupted if higher demand actually materializes. Perhaps his answer to this is the assertion that "roses do not come without thorns", a judgement based on certain intangible qualities he attaches to accessible rails. Again, however, the decision framework has revealed the risks so that policy decisions can be made with full information and disclosure; such is the role of decision analysis. This methodology is now being applied by the Transportation Development Centre in an investment appraisal of accessible commuter rail services versus alternative approaches.[2]

4.0 Conclusion

Conventional investment appraisal techniques typically present the decision-maker with the analysts' "best guess" at the return on investment. Estimates are often accompanied by ranges, but these typically reflect uncertainty in the interpretation of past quantitative data rather than the impact of possible institutional change or political actions (or the probability of such impacts). Such analyses will suffice in situations where institutional change is not a factor. There is a growing class of investments, however, where political and social factors create uncertainty; this paper presents various techniques for assessing their potential impact.

In the case of air traffic control, Monte Carlo analysis reveals that the risk that political action will reduce the economic return to the investment in new equipment actually dominates other risks. In the case of transport for the disabled, the methodology is designed to incorporate the uncertainty associated with the possibility of far-reaching institutional changes. And unless such risks and uncertainties are incorporated, unforeseen political or institutional change could well leave the decision-maker with "grief and pain for promised joy".

1. See also, David Lewis, Improving the Air Traffic Control System: An Assessment of the National Airspace System Plan, Congressional Budget Office, and David Lewis and David Bodde, Understanding Political Risk in Investment Planning, Journal of Policy Analysis and Management, Vol.3, No. 4, 1984.

2. To be published by the Transportation Development Centre later this year.

TECHNOLOGICAL TRANSFER POLICY IN APPLIED TRANSPORTATION RESEARCH

by

M.Teresa Carmosino*
ICIE - Cooperative Institute for Innovation

Lionello Negri**
National Research Council of Italy
Project on Transport Research

1.0 Introduction

In Italy, the research general scene appears extremely wide, various and fragmentary. Transportation research is fully influenced by these conditions especially because of the fragmentation and dispersion which characterize it in terms of technical scientific skills, financial resources and involved policy-making levels. First of all, this causes the lack of a global, complementary and intermodal idea of the transportation problems and their solutions.

In fact, duplication and/or overlapping of interventions and relative research plans are not infrequent cases with consequent falls in terms of profitability and unbalance in resources allocation.

In the last years, trends of unified approach to the transportation problems have been recorded at a governmental level. In operative terms, these tendencies drove to launch some systemic and wide-ranging research programmes (Project on Transport Research of the National Research Council of Italy, National Transport Research Plan, Transport General Plan, Technological Innovation Funds) beside some otherones oriented towards specific areas (Automotive Plan, National Road Agency ten-years Plan, National Railways Integrative Plan).

The main difficulties in carrying on transportation organic research plans regard mainly the coordination and management. This is even more evident if we consider that, in the present situation, the boundary lines between scientific basic research and applied research of industrial type (to cite the two exteme cases) get fainter and fainter.

The lack of a centralized coordination structure, provided peripheral ramifications for an active interconnection among the different transport research networks, negatively affects also the results transfer. In fact, apart from particular cases, the results transfer is exposed to inertia and delays of a variously evaluating range, however considerable, which influence the research programmes with regard to the originality, topical interest and quality of the contents.

2.0 The transportation research planning and coordination

The transport represents the means to meet, on resources demanding, the space-time mobility needs permitting the access to the various utility sources. A transportation act is a productive act. So, it is necessary to think of transport in terms of an integrated and open system. Consequently, we must conceive and carry out the transportation research, that is the first condition for development, as a system research.

First of all, it is necessary to verify the efficiency and effectiveness of the "research-innovation" dual concept which is effective if able to satisfy prefixed goals; it is also efficient if its results optimize the costs/benefits ratio as regards the involved resources and caused impact.

This requires a situation of compatibility and programmatic/productive harmony in public and private engagements. Hence, it is essential to grow up an interests convergence leading to define integrated development strategies which meet different demands such as social and strictly industrial. This consideration is particularly referred to the road transport area because it covers the main share of the Italian Gross National Product.

It is top priority to identify and adjust a set of instruments qualified for evaluating the level and potential of the various scientific and technological research bodies. In this context, management and exploitation of human resources, investments in patents, know-how and vocational training have a remarkable significance.

The research activities are characterized by different ranks of risk and uncertainty. The scientific basic research requests considerable funds in relation to uncertain and not always favorable results from the technological and marketing viewpoint. In fact, it has implicit and acknowledged distinguishing marks of indefiniteness and

unspecification. The basic research findings supply the input and advice for the operating programmes finalization that, in the trasportation case, after all develops through subsequent steps of feasibility analysis, marketing (and therefore competiting) tests, pre-industrialization and several scales prototypes realizations.

In Italy there are three meaningful research networks: state universities, National Research Council and other research public bodies, industries. Practically, existing bonds and obstacles of a substantially formal and bureaucratic kind and different time schedules make cooperation hard. One must fix what researches to assign to the various networks and the necessary information exchange mechanisms.

It is fundamentally important to have a unifying centralizing action of all competences and powers at governmental and political level. The resolution choice must be suggested not only by priority requirements in the view of an international complementary competitiveness/cooperation, but also strategically well-timed in order to avoid that the programmes become obsolete before their launch. Therefore, all procedures regulating the decisional processes should be simplified and, in particular, those that regulate the transition in the operative phase.

Presently, in Italy, the public support to transportation research is articulated by legislative and normative tools that act, with different boosting ranks, according to the general and sectorial planning policies. Besides basic research, carried out mainly by structures institutionally supported by the Government (i.e., universities) there are interventions aiming at fostering the development of applied research of industrial type.

As for the pursued goals, in order to have a real impact on the transportation quality, we need to translate in industrial "items" the research results and increase the competitiveness capacities in this direction. Sectorial interventions cannot promote a harmonious and balanced development of the transportation system. In fact, a more precise definition of the roles of the single transportation modes and integration possibilities and an effort towards the productive and managerial optimization allow us to improve the profitability and quality of the whole system.

In this view, the connection between the reseach world and the political institutional one is of great importance. The competences fragmentation certainly does not

favour the establishment of a unitary strategy, common to all transportation subsystems that often end up in presenting diversifications in the service level and unhomogenous evolution rhythms. Therefore, we need to define a unified and coordinate policy in transportation research. The phases of this "institutional recomposition" are mainly:

- investments planning;
- choice of the interventions time, lenght and intensity;
- continuous control of the investments effects and verification of the feed-back on the basis of prefixed criteria.

3.0 The technological innovation transfer

The word "innovation" is now part of the everyday transportation terminology. In any case, we have to think it in the widest meaning. In fact, the technological innovation is only the more evident and striking component of a wide range evolutionary process that requires unavoidable, intrinsic and above all suitable innovative actions of a structural, organizational and managerial nature. The phenomenon intensity and size are closely correlated with the characteristics of the social-economic-manufacturing context served by the transport system and they have an increasing trend directly proportional to the establishment of the socalled "info-society".

For a better understanding, we will first refer to a few concise definitions and general remarks.

The "Transportation Technological Innovation" (TTI) arises from the operative application of the research results through a set of mechanisms which we will refer to with the expression "Transportation Technological Transfer" (TTT). The results become part of the transport goods and services production following on industrialization and marketing processes.

Moreover, TTT is a tool to verify, in terms of quality-quantity, the profitability of the investments in Research and Development (R&D) field. This control is as much important as considerable public funds are involved.

The R&D transportation plans should be structured so that they can suitably support the specific functions at the different administrative and policy-making levels. It is fundamental that the research outputs are available at the decisional time supplying information contribution in any step.

The promotion of the new technologies exploitation is

a key focus in the transportation system growing logic especially if it is related to initiatives of boosting, consulting, cooperation and advice. The effectiveness and efficiency of the TTT network depend on the integration among the various operating administrations (central/local; departmental bodies; etc.).

With regard to this, it is essential to distinguish between horizontal and vertical TTT. The first one sets up among structures[1] characterized by a remarkable homogeneity while the second one affects the hierarchical organization by means of full-duplex flows.[2] Furthermore, while the horizontal transfer mainly concerns general technical and managerial problems and involves more specifically practical functions, the vertical one exists at a policy-making level and aims at normative, regulative and legislative subjects.

Thus, taking into account the TTT qualitative dependence on the structuring and formulation of the R&D programmes, it is fundamental:

- to determine the actual existence and importance of the problem;
- to define and characterize the problem in a complete and exaustive manner;
- to focus the activity on solutions marked by a high potentiality and high innovation demand convergence;
- to develop the optimum solution to test on the field and analyze its chances and forms of introduction and acceptance by the transport system;
- to spread punctually the research results for further tests and introduce the necessary improvements deriving from the application in the different utilization scales.

This requires to set up suitable procedures and operative networks for to foster the incorporation of each single (sectorial and/or local) R&D programme in a national plan that cares of the monitoring, collection, recording, updating, international comparability and dissemination of transportation data. Therefore, it is necessary to develop organizational models assuring a concrete, reliable, punctual and direct support to the local/compartimental decisions in accordance with the trends and the main lines at a governmental level. From this arises the need to create special Regional Agencies of modal and intermodal planning that collect and widespread the TTT and act as preferential information flow channels. The role of these Agencies is to provide a preliminary information and be the way for a more specialistic and detailed further information.[3]

From this viewpoint, it is evident that we must consider the research a simple phase propaedeutic to a subsequent development activity finalized to realize meaningful demonstration projects.

We can note that generally the TTT system effectiveness depends on the knowledge of users needs and specifications. Hence, it cannot exist only one and universal tool of TTI dissemination because of the transportation system and composing subsystems complexity. It is necessary a set of specific mechanisms (marked by different capacities, ranges of action, capillarities and permeativenesses) contributing, variously mixed, to realize a TTT system able to meet a wide share of the TTI demand.

In fact, the TTT must necessarily include the appropriate actions to adapt the innovation to the different scenarios and scales of enterprise and land. So, TTT flexibility and adaptativity are the necessary conditions for a positive and profitable use of the innovation itself.

Moreover, the TTT, fostering the TTI widespread knowledge and promoting the analysis of potential feed-back, supplies a tool of survey and determination of research demand. R&D is limited to explore choices for the solution of pratical problems while the main goals of the TTT are the research findings implementation and application. Well, if it is essential to planning the research activities so to reach the fixed objectives in the scheduled times, only the data given by a systemic TTT can define the transition point towards new problems as the preceding ones have been solved.

Summing up, we can outline the main tasks of the TTT network as follows:

- to aid and foster the development and the starting in use of better transportation facilities, means, modes, technics and equipments;[4]
- to stimulate the open discussion on technical results achieved;
- to contribute in determining and evaluating the needs and priorities;
- to provide ideas and trend lines for planning the future R&D and results dissemination;
- to aid the transportation industry (optimizing methodologies in mass production and management; advanced techniques of marketing and technological forecasting; technical and managerial education in the use of TTI, etc.);
- to choose the R&D programmes, marked by a high venture rank, that promises meaningful productivity increases

through the TTI application in transport and the support of the national choises and priorities (energy saving; enhanced safety; center city revitalization; environmental protection and land/transport integration; served area and service level growth; transportation means and systems profitability increase; times reduction; mobility for elderly and handicapped persons; etc).

An important subdivision in the TTT system concerns the different diffusion modes of the technological (or hardware) and methodological (or software) products.

The TTT is easier and more well-timed in the hardware diffusion case because it is mainly about product/process innovation (prototypes of transportation components, means and systems; feasibility and pre-industrialization studies; new technological cycles and production processes; etc.).In most cases, the researcher and user coincide. The sector's enterprises are directly involved in the research work and the fall-out on the production sphere is insured by some mechanisms and procedures typical of the enterprise itself (insite transfer). With reference to the Italian situation, it is possible to refer meaningful examples especially in the automotive field due to the international competitiveness high rank and governmental financial contribution in the road safety improvement and primary energy conservation in the vehicle traction.

Evident advantages are:

- information transfer in a real time from the R&D to the other company functions (particularly, production and marketing);
- continuous under way control of the solution practical effectiveness also with regard to the competing behaviour and dynamics of demand;
- synergic relationships among the different firm's functions in a unified view;
- continuous information feed-back flow to the R&D in assuring the constant agreement between research topics and operating needs;
- progressive development of new curricula and reconversion of those more strongly tending to the obsolescence.

Thus, it is advisable to consider that in the automotive area the innovation derived from TTT is not limited to the big industry. Innovation interests, in a direct and immediate way, also the small and medium-sized enterprises (especially the component suppliers ones) which benefit by ad hoc transferred know-how or carry out by itself (often on order) R&D activities. Concerning this, we can cite the

firms supplying on board equipments, auto accessories, microelectronic components, etc.

The innovation cross-fertilization is also a very expanded phenomenon. It constitutes one of the more efficient and flexible means through which the TTT carries on.

For example, we can mention the cooperation programmes between the automotive industry and:

- metal-working, plastics and chemical industry (new materials for vehicle lightening keeping equal safety and sound-deadening:composites, fiber reinforced composites, metalplastics, high strength low alloy steels, Aluminum alloies, ceramics, sintering materials, etc.);
- tyre industry (use of tyres with a minimum rolling resistance consistent with the common suspension units and able to assure handling and comfort performances comparable to those of the traditional tyres on the various road surfaces);
- electronic industry (sensors; engine control and governing systems with related software; storage battery with a high capacity and low weight for vehicle electrically and hybridally moved; etc.);
- automatized systems industry (CAD - Computer Aided Design; CAM - Computer Aided Manufacturing; FMS - Flexible Manufacturing System; DNC - Direct Numerical Control, etc.).

The software TTT is more difficult and complex: it requires longer times also on account of receptiveness lack from the Public Administration that is the preferential user (fare policy, safety regulation, environmental respect, services automation and informatics, etc.).Moreover, the methodological outputs transfer has not appropriate structures and offices.

At last, we can distinguish between the active and passive transfer.

The passive TTT lies in research results dissemination on users specific request (mostly through data and technical reports). Its effectiveness and quantity are extremely limited. In fact, it leaves out of any information action and integration with TTI interested client groups.

On its hand, the active TTT produces meaningful advantages. It involves together directly researchers, users and policy makers from the choice and statement of the R&D plans.

The "dialogue" and "understanding" between researchers and users are the essential conditions. The user doesn't need a finished product but a product optimized on the

basis of the demand requirements and possible solutions analysis. So, the researcher must be a-priori fully aware of the probable future process of implementation.[5] The implementation opportunities depend on the "communication" degree and type between R&D and users.

The researcher and user have to speak the same "language". Only in this way the research results may be available in the useful, clear and intelligible form to facilitate the diffusion, choice, adaptation and application.

The research/user touch requires to focus the transportation problems, define the priority scales and improve the TTT mechanisms by discovering and setting up special actions, if it's needed. Therefore, the task of the above mentioned Regional Agencies lies in facilitating those information exchanges and making contact among "right" operators.

In accordance with the existing literature, our direct experience proves that it is necessary to design the communication means/types and widespread channels as a function of the different user classes. The diffusion plan must be continuously improved. In fact, the meeting and agreement between the practical experience and technical scientific skill take to define and evaluate new channels and procedures for the TTI sharing.

Concluding, we can affirm that an effective TTT network is formed by basic elements and specifications such as:

- ready access to the information in a real time;
- periodical contacts among the research, industry, governmental and local administrations, etc. to organic planning;
- list of the common transportation problems to review according to the knowledge increase, to the user feed-back, etc.;
- information bulletins (TTT promotion at a general and not-skilled level);
- data bases supporting the information and technical knowledge banks;
- mass media channels

and by special ones:

- widespread technical documents distribution (often print reports assure the maximum diffusion);
- practical manuals;
- audio-visual products (slides, films, videotapes, etc.);
- case study reports;
- training, education and updating courses (for policy

makers, planners, managers, transportation operating personnel and technical specialists);
- interpersonnel contacts at the various levels up to the "face-to-face" ones when their expensiveness is justified;
- people transfer (R&D/Industry/Public Administration);
- Research, Development and Demonstration programmes;
- Research, Development and Engineering programmes;
- special promotion and implementation programmes.

The task of the TTT system is to individuate the optimum mixing of these elements for any case and precise need.

4.0 Conclusions

We think that the considerations set forth in the previous paragraphs supply sufficiently complete and exaustive idea of the transportation research in Italy and the problems related to the innovation introduction.

At this point, we feel appropriate to go back to a previously referred concept for some brief remarks.

The innovation is not a phenomenon limited only to the technological and productive sphere including also the organization and management supporting structures. The transportation system innovation/evolutionary change to be really effective, productive and most of all useful needs parallel (if not propaedeutic/preparatory) reconverting interventions in the social and cultural field. In other words, the innovation introduction must match an "education" action towards a new way of understanding, using and, after all living the transportation service.

Moreover, the research outputs transfer, which is the main vector for the innovation sharing and using, cannot exhaust in mere mechanisms of space-time widespread. In this sense, the transportation technological innovation transfer Agencies must carry on an essential "dampering" role that is to act as a connection means between the technological point of view and the social human one. We say "social and human" because the transportation system even if it is more and more (and correctly) conceived as a community type service involves the behaviours at the level of the single individual.

Endnotes

* Maria Teresa Carmosino is a transportation doctor

engineer, expert in "Transport Policy and Economy", senior researcher at the ICIE - Cooperative Institute for Innovation and scientific responsible of a research team of the Project on Transport Research of the National Research Council of Italy.

** Lionello Negri is a doctor mechanical engineer, expert in "Industrial Management", senior researcherat the National Research Council of Italy and member of the Head Office of the Project on Transport Research.

1. Some example are given by TTT channels among the regionals administrations (ANAS - National Road Agency departments, FS - National Railways, urban and local public transportation utilities, etc.), the public and private research bodies, the research centres and the production units.
2. We can cite the interactions between the central and local governments. Also, it needs to point out the significance of the "low towards upper" information flow. In fact, this stimulates the creative and partecipative behaviour fostering the understanding of the operating topics by the top management.
3. We feel that a good reference model is the US - Department of Transportation. For example, you can think of the Transportation Research Information Service Network and Intermodal Planning Groups.
4. It is necessary that the TTI has some intrinsic features. More exactly, the TTI must:
   - be referred to a widespread and acknowledged demand;
   - be practically and productively useful to a large transport operator range;
   - be advantageous in terms of time, money, work-force, quality, etc.
5. The applied research (but this consideration is generally valid for the whole research system) is not an end itsef. It constitutes the means for an end. This concept confirms the importance of the decisional function, the systemic approach to the transportation problems and strategical management.

References

Beimborn, A.E., and Schmitt, R.P., 1983, "Strategies for the effective use of transportation research results", World Conference on Transport Research: "Research for tranport policies in a changing world", Hamburg, 1983,

Conference Proceedings, pp. 1353-1363.
Businaro, U.L., 1984, "Lo sviluppo dei prodotti", Milano, Etas Libri.
Egan, W.P., 1983, "Demand for tranport research", World Conference on Transport Research: "Research for transport policies in a changing world", Hamburg, 1983, Conference Proceedings, pp. 1332-1344.
Galbraith, J.K., 1967, "The New Industrial State", Boston, Haughton Mifflin Co.
"International Conference for Technology Transfer", 1984, Brighton, Conference Proceedings.
"I problemi dell'innovazione tecnologica", 1982, Parma, Conference Proceedings.
Lindblom, C.E., and Cohen, D.K., 1979, "Usable Knowledge", New Haven, Yale University Press.
National Academy of Sciences, 1969, "Technology: Process of Assessment and Choice", Washington DC, US Government Printing Office.
Negri, Antimo, 1981, "Filosofia del lavoro", Vol.VII, "Novecento: ambiti problematici collaterali e affini", Milano, Marzorati.
Negri, L., 1984, "Supporto metodologico alla ricerca come strumento strategico per lo sviluppo", Rinascita della Scuola, (November/December, 1984), pp. 418-426.
Negri, L., 1985a, "Fondazione critica del rapporto scienza/tecnica e gestione della ricerca", Autostrade, (February, 1985), pp. 6-11.
Negri, L., 1985b, "Progresso tecnologico e sviluppo sociale", Autostrade, (March, 1985), pp. 7-16.
Negri, L., 1985c, "Scientific research and Technological Innovation in Road Transport", First International Congress on Continental European Gateways: "What transport for which regions?", Liegi, Revue belge du transport, (April/June, 1985), pp. 133-138.
Negri, L., Lozi, A. and Scognamiglio, A., 1985, "Policy and Management Problems in the Area of Transport Research", Transportation Research Forum: "Markets and Management in an Era of Deregulation", Jacksonville, Conference Proceedings, pp. 314-317.
Supernak, J., 1983, "International exchange of transport research: some methodological and ethical aspects", World Conference on Transport Research: "Research for transport policies in a changing world", Hamburg, 1983, Conference Proceedings, pp. 1364-1375
"Tecnologia Domani", (edited by A. Ruberti), 1985, Bari, Editori Laterza-Seat.

ANTI-COMBINES ISSUES AFTER "FREEDOM TO MOVE"

by

Harry Chandler
Bureau of Competition Policy
Consumer and Corporate Affairs Canada

1.0 Introduction

Competition and direct regulation are alternative public policies used to control the conduct and performance of industries in Canada. Historically, the transport sector has relied mainly on regulation to ensure adequate service to all areas of the country at a reasonable cost. The enactment of the **National Transportation Act** in 1967 increased the scope for competition within the regulatory framework by allowing inter-modal competition, although restraints on intra-modal competition were continued.

In July 1985 the Government of Canada released its Position Paper on the economic regulatory reform of transport, **Freedom to Move.** The Minister of Transport stated that he had been guided in developing specific proposals by the following principles:

(a) Less regulation, leading to less government interference, will encourage innovation and enterprise.

(b) Greater reliance on competition and market forces will result in lower unit costs, more competitive prices, and a wider range of services to shippers and the public.

(c) Canadians require a regulatory process that is open, accessible, and not excessively costly or time consuming.

Freedom to Move is therefore another major step towards replacing regulation with competition as the means to shape the transport sector. An important implication is that there will be a greater reliance on framework legislation which exists to protect and promote fair competition in all sectors of the economy. The principal such statute is the **Combines Investigation Act.** The

Government's proposals open up a number of new areas to the **Combines Investigation Act** and raise some interesting competition issues. This paper addresses these issues starting first with an overview of the **Combines Act.**

2.0 Combines Investigation Act

2.1 Introduction

The legislative history of the **Combines Investigation Act** (hereinafter **Act**) dates from 1889 when a federal statute made it a misdemeanor for any person to combine or conspire "... with any other person, or with any railway, steamship, steamboat or transportation company..." to unduly lessen competition. While a provision against conspiracy remains the cornerstone of the law, a wide variety of other competition issues are treated in the criminal and civil provisions of the Act. The legislation has been revised several times, most recently in 1976, and there is currently before Parliament Bill C-91 which proposes substantial changes to the manner in which competition law will be administered in Canada.

Parliament's jurisdiction in criminal law and the regulation of trade and commerce provides a constitutional base for federal competition policy legislation. The **Act** applies to virtually all business activities in Canada, rather than merely to interprovincial matters and international trade. Exceptions to this general application are discussed in Section 2.4.

2.2 Main Provisions

The current machinery establishes the Director of Investigation and Research as the official charged with the administration of the **Act.** In this role he has several investigative tools available to him including the use of Criminal Code search warrants, returns of information and hearings. Proceedings under the **Act** are either before the Restrictive Trade Practices Commission or the Courts. The remedies available include orders (issued both by the RTPC and the Courts), fines and imprisonment for criminal offences.

The main provisions of the **Act** can be separated into the following categories: reviewable practices, criminal offences, interventions.

The reviewable practices are covered at Part IV.1 of the **Act.** The activities covered by the sections therein include refusal to deal, consignment selling, market restriction, exclusive dealing, tied selling and the application of foreign laws and judgements to Canadian

companies. A detailed analysis of these sections cannot be made here but generally if the Director has available to him evidence that any of these practices is having or has had anti-competitive effects as described in the provisions, he can apply to the RTPC for an order to halt or alter the policy in question.

The criminal offences are found in Part V of the **Act** and include conspiracy, merger and monopoly, discriminatory and predatory practices, misleading or deceptive marketing practices and price maintenance. In the case of criminal offences, where the Director has reason to believe that an offence has been or is about to be committed, he is obliged to commence an inquiry and determine the facts. Inquiries can also be prompted by request by six Canadian residents or Ministerial direction. After the Director has completed his inquiry, the matter will be either discontinued, if the evidence does not, in the Director's opinion, disclose an offence, or referred to the Attorney-General for his consideration as to whether or not an offence has been or is about to be committed. Prosecutions under the Act are undertaken by the Attorney-General of Canada.

Finally, section 27.1 of the **Act** empowers the Director to make representations to federal boards in respect of the maintenance of competition. This authority has been used extensively in the transport field during the last few years.

2.3 Program of Compliance

A program has existed for a number of years whereby the Director invites business people to consult on proposed courses of action that may raise questions under the **Act.** While the Director has no authority to regulate business practices or decide the law, he tries to assist business people to avoid coming into conflict with the **Act** by studying matters they submit to him and indicating to them whether or not the adoption of proposed plans would lead him to launch an inquiry.

The program of compliance should be a very useful vehicle in easing the transition from a regulatory environment to one with greater emphasis on competition in the provision of transport services.

2.4 Bill C-91

The proposed amendments before Parliament will, if passed, substantially change the nature of anti-combines enforcement in Canada. The most significant proposals include:

(a) creation of the Competition Tribunal;

(b) subjecting mergers to civil rather than criminal law;

(c) establishing an abuse of dominant position section in place of the current monopoly provision;

(d) reform of the conspiracy provision on the issues of evidentiary requirements and mens rea and changing the export exemption;

(e) revised investigative powers for searches and hearings (in accordance with Charter of Rights);

(f) removal of Crown immunity.

2.5 Exemptions

There are two main exemptions to the general application of the **Act** which have resulted from the jurisprudence and are of particular significance for the transport sector. These are usually termed the regulated industries exemption and the Crown corporations exemption.

2.5.1 Regulated Industries

This exemption stems from a number of decisions under the Act dealing with its application to activities which are subject to regulation of one form or another. The leading decision is Attorney-General of Canada et al. v. The Law Society of British Columbia et al. [1982] 2 S.C.R. 307, 137 D.L.R. (3d) 1. In brief, the jurisprudence provides that where the activity in question is effectively regulated pursuant to valid federal or provincial legislation, then the **Combines Act** will not apply.

2.5.2 Crown Immunity

This issue was dealt with in R. v. Eldorado Nuclear Ltd. et al., [1983], 2 S.C.R. 551. Essentially, Crown corporations which are agents of the Crown are exempt from the application of the **Act** in respect of those activities which fall within the area of their Crown agency.

It should be noted with special reference to transport that neither Air Canada nor Canadian National are considered agents of the Crown and therefore both are subject to the **Act**.

3.0 Competition Issues

There are a number of issues which seem most likely to raise questions with respect to competition in the transport industries after the regulatory reform proposals of **Freedom to Move** (hereinafter **FTM**) are implemented.

A few general comments are in order first. Generally, the primary interests in the analysis of competition in transportation are the conditions for entry and exit. In many cases, a particular market will not be large enough to support a great many competitors but if entry to and exit from the market are relatively free from regulatory and economic barriers, a competitive discipline will be imposed on the participants.

A second general concern is that in many cases the legacy of regulation has been to allow a few firms to become dominant in a market (a result which may not have occurred if market forces had been allowed to determine market structure) and perhaps to foster closer relations among firms than might otherwise obtain. Clearly, the benefits of competition, upon which **FTM** relies, can only be obtained if the regulatory control of government is not replaced by private arrangements among carriers and if firms are not able to take undue advantage of their dominant positions.

Aligned with the foregoing is the fact that two of the largest transport companies in the Canadian economy are Crown corporations, i.e. Air Canada and Canadian National. Many of their competitors are very concerned that these firms will use their Crown ownership to enhance their market positions. In this regard, it must be emphasized that the Minister of Transport has stressed in his policy statement that this will not be allowed to happen and, as noted earlier in this paper, neither firm has Crown immunity from the **Act**.

The discussion that follows is necessarily brief. Potential competition issues in the air, rail, truck and water modes are highlighted.

3.1 Air

3.1.1 Computer Reservation Systems

The computer reservation system (CRS) has become an essential element in the distribution system for air transport. As such, access to a system is vital to the competitive position of airlines. The systems are very expensive to establish and operate and for the foreseeable

future it would appear that substantial economies of scale will obtain to system operators.

This market situation is magnified in the extreme in Canada where Air Canada's Reservec system is so dominant. Up to now, there have been no examples brought to light of Air Canada taking advantage of the position it enjoys in this market. The task force which reported on the existence of bias to the Minister of Transport in June 1985 found that Reservec was generally free from bias in its operations. As part of the **FTM** policy, the Minister of Transport has directed that Air Canada continue to operate Reservec in this manner.

It should be noted that Canadian Pacific's Pegasus system and American Airlines' SABRE CRS are making inroads in this market. These two factors, Ministerial direction and arising competition, can be seen as hopeful signs that Air Canada will not exercise its dominant position in this area in an anti-competitive manner. Also, the operations of CRS are not currently subject to regulatory control and therefore are subject to the application of the **Combines Act**.

3.1.2 Airport Access

Like CRS access, relatively free access to airport facilities is crucial to the maintenance of a competitive environment in air transport. At present, all aspects of airport operation are under the control of Transport Canada and not likely subject to the **Act**. However, the system of airport management is currently being examined with a view to making it more efficient and instilling some of the perceived benefits of market competition.

The main potential for abuse is the adverse impact on competition in air transport caused by the imposition of vertical restraints at airports. In particular, access to the facilities of an airport such as landing slots, gate and baggage handling facilities and counter space is crucial to effective competition. If dominant airlines were to attempt, in some manner, to restrict access to these for anti-competitive reasons, there may be a role for the **Combines Act** to play depending on the nature of the management/ownership system which is put in place.

3.1.3 Mergers

Subsection 27(5) of the **National Transportation Act** makes clear that mergers between airlines (and mergers in other transport modes) are subject to the provisions of the Act. This would continue under the **FTM** proposals.

Deregulation in the U.S. and the prospect of it in Canada have led to airlines forming mergers to consolidate their market positions. In the U.S. domestic market where there are five (5) major national carriers plus several strong regional carriers and where entry barriers are relatively low, mergers between airlines tend not to be significant in anti-trust terms.

In Canada, with its smaller number of carriers and greater concentration of market share, we need to be more alert to the potential consequences of mergers. This is not to say that mergers are necessarily anti-competitive; rather only that more caution is needed in the analysis.

3.1.4 Interairline Agreements

Under the **FTM** proposals, airlines, providing service within Canada, would be subject to the conspiracy provisions of section 32 of the **Act**. This section establishes the conspiracy offence for agreements or arrangements which are or would be unduly restrictive of competition. The section covers not only pricing arrangements between or among competitors, but also relates to market sharing, including agreements on frequency of service and type of aircraft for particular markets. Cooperative activities which do not involve a lessening of competition, such as documentation and baggage handling, would not raise a question under the **Act**.

3.1.5 International vs. Domestic Air Transport

FTM does not propose immediate changes to the nature of regulatory control of international air services. Consequently, there will be a bifurcation in the application of the **Act**. It will be an important matter to ensure that the type of agreements and activities which may be protected in the international sphere do not extend to domestic operations where they may be illegal under the **Act**.

3.2 Rail Freight

For the rail mode, two primary competition issues arise from the **FTM** proposals: competitive access and pricing behaviour.

3.2.1 Competitive Access

Unlike the other modes of transport, rail is one where the difficulty of entry may limit the ability of competition to foster the satisfactory performance of the industry. The proposals contained in **FTM** to promote

competitive access, including running rights and joint-track usage, are crucial. I would expect the Bureau of Competition Policy to be active in the regulatory forums available to promote this issue. Moreover, the proposal contained in Bill C-91 respecting the abuse of a dominant position may be another avenue to ensure that effective competition develops in the industry.

3.2.2 Pricing Behaviour

The proposal in **FTM** to remove the regulatory exemptions for collective ratemaking means that the pricing behaviour of the railways will now be subject to section 32 of the **Act**. This will be an important change in the nature of price formulation among Canadian railways because of the history of joint rate setting and the duopolistic structure of the industry. However, it is expected that the introduction of confidential contracts as part of the **FTM** proposal will put pressure on the railways to be competitive in their price setting.

The other aspect of pricing which may lead to a competition issue is the railways' behaviour vis-ā-vis their trucking competitors. There have been in the past allegations that the railways, particularly Canadian National, price below cost on shipments which are truck competitive and subsidize these losses with the rates charged to customers which are captive to rail.

3.3 Truck

The primary issues in trucking are the status of collective ratemaking and tariff bureaux under the **Combines Act** and the competition created by Crown and U.S. owned firms. There is also the delineation between the federal and provincial jurisdictions in the regulation of trucking and implementation of the Ministers' of Transport Memorandum of Understanding.

3.3.1 Collective Ratemaking and Tariff Bureaux

FTM does not explicitly deal with collective ratemaking and tariff bureaux; however, it may have an indirect impact. The Memorandum of Understanding which **FTM** proposes to formalize in legislation would eliminate extra-provincial rate approval in the couple of provinces where it still exists, and lower the regulatory barrier to entry into extraprovincial truck transport. The former reduces the likelihood of the "regulated industries" defence in a Combines prosecution. More importantly, the latter makes it more difficult for stable price fixing cartels to operate because of the pressure of new operators in the market.

3.3.2 Competition from U.S. Domiciled Firms and CN Route

Many privately owned Canadian trucking firms are concerned that their businesses are vulnerable to the competitive threats posed by CN Route and the very large American less-than-truckload specialists. They are of the view that these firms will, because of their financial strength, be able to force them from the market.

Special care must be taken in reviewing these concerns to discriminate between genuine anti-competitive behaviour and competition which reflects greater efficiency. The former is subject to challenge under the **Act**, the latter is not. It should be noted that large size does not guarantee efficiency in serving all markets. Recent economic studies have demonstrated that while these firms have an economic advantage in providing long-haul LTL service (generally over distances greater than 500 miles), the smaller generalist carriers have an advantage in providing a mix of TL/LTL services in shorter haul (under 500 miles, especially under 300 miles) regional markets.

3.3.3 Federal/Provincial Jurisdictions

In spite of the liberalization of trucking regulation proposed in **FTM**, some provinces may choose to retain comprehensive regulation on intra-provincial movements. Tight control over entry may not always be balanced by active regulation of rates. In these circumstances, tariff bureaux activities may raise questions under the **Act**.

Another potential issue is the extension of anti-competitive behaviour in intra-provincial markets to extra-provincial markets. While carriers may be left free to engage in this type of conduct by provincial transport boards in intra-provincial transport, no similar regulatory protection from the application of the **Combines Act** would apply in extra-provincial markets.

3.4 Water

In the area of international shipping, there are two main anti-combines issues which arise: the use of independent action and multi-modal rate setting.

3.4.1 Independent Action

While providing some protection from the **Combines Act**, the new **Shipping Conferences Exemption Act** proposed in **FTM** will allow the right of independent action by its

members. In monitoring the activities of the international liner shipping industry, care must be taken to ensure that conference members are not restrained from exercising independent action. A related issue is that independent action is not used to discipline carriers operating outside the conference.

3.4.2 Multi-Modal Rate Setting

Shippers often like to have one price quoted to them for shipments even when the shipment must be handled by more than one transport mode. Conference carriers often provide this service. However, it should be made clear that the exemption to inter-carrier agreements provided by **SCEA** is not extended to the non-water portion of the shipments. Those portions of the movement should be subject to the same application of the **Act** and/or regulatory regime as shipments being handled by only one mode.

4.0 Conclusion

Those involved with the transport sector should now more than ever pay attention to the application and administration of the **Combines Investigation Act** (and the amendments contained in Bill C-91). The reforms proposed in **Freedom to Move** place an heavy reliance on competition and smoothly functioning markets. The **Combines Act** is the principal general law of general application directed at these ends.

This paper has given a brief introduction to the **Combines Act** and has highlighted a number of potential competition issues in the major transport modes. The discussion has been necessarily cryptic. Interested parties are encouraged to communicate directly with the author.

ENTRY BARRIERS AND ANTI-COMPETITIVE BEHAVIOUR IN A DEREGULATED CANADIAN AIRLINE MARKET

by

David W. Gillen*
Tae H. Oum and Michael W. Tretheway**

I. Introduction

'Freedom to Move', a white paper providing a framework for reform in Canadian Transportation, will be translated into legislation in 1986. This ministerial discussion paper proposes a virtual deregulation of the domestic airline industry. The motivation for moving to a free market is to allow Canada to reap the positive benefits of competition, including lower fares, a broader offering of price-service quality combinations, improvements in productive efficiency, and greater innovation. Opening the industry up to greater competition can also have negative aspects. One potential negative factor is anti-competitive or predatory behaviour by firms. Such action would mitigate the benefits of deregulation. As the Canadian airline industry makes the transition to a free market environment, the issue of anti-competitive behaviour should be raised as such behavior will affect the ultimate success of the new policy.

Anti-competitive behaviour can take many forms. One form attempts to raise rivals' operating costs; raising fees for computer reservation or ground handling services provided to a competitor are good examples. A second form of anti-competitive behaviour creates marketing disadvantages for smaller carriers. For example, the dominance of a carrier in the allocation of airport facilities may create a significant marketing disadvantage for a smaller or new carrier. A third form of anti-competitive behaviour is with respect to capacity and frequency in city-pair markets. A dominant firm may drive rivals out of a market by flooding it with excess capacity. A fourth strategy is product innovation via devices such as frequent flyer programs, new classes of service or reservation systems with advance seat selection. The fifth form and the one which generally receives the most attention is predatory pricing. We define predatory pricing as a firm selling its product below cost with an intent to eliminate rivals and subsequently earn monopoly profits.

The need to examine anti-competitive behaviour in the U.S. before and during its deregulation was not evident, and, in fact, considered much of a non-issue. This conclusion was based on the idea that airline markets with their highly mobile capital and

lack of entry or exit barriers were "contestable". A firm would not find it advantageous to engage in predatory pricing. Carriers facing predation would quickly (and at no cost) transfer their resources to other markets. As soon as a successful predator raised prices in a newly monopolized market, other carriers would enter with their highly mobile capital and drive prices down to normal levels. More recently, several U.S. economists [Bailey and Punzar (1984), Levine (1984), Kahn (1984)] have raised issues suggesting anti-competitive behaviour could be a significant emerging problem in the U.S.

In Canada, there are several characteristics unique to Canadian air transport suggesting even greater concern for the potential of anti-competitive behaviour. First, Canada is dominated by a single carrier which serves roughly 50% of the domestic market. With this dominance, there is a greater incentive to predate because of both the greater expected success and lower costs of predation.

Second, the dominant carrier is Crown owned and the perceived costs of capital among its decision-makers may be lower than that in the private sector. This suggests that the expected cost of predatory behaviour may be lower for it.

Third, the Canadian market has a greater proportion of low density city-pair routes implying predatory pricing is more likely to occur than in the U.S. It has been suggested that the success of U.S. deregulation is due to its many markets which can support several carriers. There is concern, at least in some quarters, that the thin routes in Canada will only support single carriers and thus create a relatively larger incentive for predation. The low density and small overall size of the Canadian market also create incentives for agreements between carriers to provide "exclusive feed" with potential predatory consequences.

These issues, taken together, indicate anti-competitive behaviour could be a significant impediment in Canada to achieving the theoretical gains of airline deregulation. This concern is particularly great in the years just following the policy change, because it is in this transitional phase that existing and new firms may be most vulnerable to predation.

The purpose of this paper is to explore the potential for anti-competitive behaviour in Canadian airline markets arising from barriers to entry. It is the absence of entry (and exit) barriers that determines whether or not markets are contestable. Markets with entry barriers are less contestable and thus provide better opportunity for predation and subsequent monopoly behavior. The focus here is on the entry barriers themselves, rather than on the types of predatory behavior they elicit. The latter is worthy of a separate treatment. Because of a number of recent innovations in the industry, this paper will further focus its attention on product differentiation as a barrier to entry.

The next section briefly summarizes the traditional and new literature on barriers to entry. Section III examines potential entry barriers such as frequent flyer programs, travel agent buying power, computer reservation systems, airport access and shared designator codes. "Hubbing" and the strategic choice of network and service levels are also assessed, and how these are affected by the above issues. The conclusions are contained in section IV.

II Old and New Views on Barriers to Entry

The traditional industrial organization paradigm of "structure-conduct-performance" [Scherer, 1980] is a sequential theory, albeit with feedback effects. Elements of industry structure, such as product differentiation, were treated as exogenous. These boundaries elicit certain types of behaviour (conduct) which in turn affected performance measures, for example, profitability. More recent literature, rather than taking the sequential model, view the conduct or rivalry among firms as depending simultaneously upon the availability of substitute products, entry and exit barriers, and the bargaining power of both buyers and sellers. Thus, elements of industry structure, such as whether or not substitute products are available, will depend on industry conduct, which in turn depends on industry structure.

One element that is common to entry barriers, availability of substitute products and buyer bargaining power is product differentiation: how a product can vary in characteristics or attributes, whether real or perceived. Recent contributions [Caves and Porter, 1977] have characterized product differentiation as endogenous noting that it can be a source as well as a result of strategic behaviour. It is, they also point out, only one of many influences shaping performance as well as structure.

A product or service can be differentiated physically, geographically, by a means of attached or ancillary services, and by perception through advertising or built up good will. Each of these factors are akin to unit cost advantages because they provide a wedge between the incumbent firm's cost and price (as determined by a potential entrant's cost). This allows the incumbent firm to engage in "limit" pricing. Product differentiation is, therefore, an entry barrier, behind which the firm can earn supra-normal profit. An entrant must come into the industry at a higher price (or at sufficient volume if there are economies of scale) to overcome his cost disadvantage. In the absence of entry barriers, firms must keep their price-cost margins and their costs low in order to make entry unattractive.

Product differentiation is akin to geographic location advantages. According to recent writers, existing firms produce a number of products so there will be no point in product space an existing or new firm could move into and find profitable. The consequence of this behaviour is that the industry will produce a

broad array of products, but firms within the industry may only provide a subset of this array. The result may be a barrier to entry. The presence of scope economies is likely to make product variety a potentially successful entry deterrent strategy, since the additional cost of expanding a product line may be low.[1] There can also be threshold effects in advertising and promotion. One has to examine barriers to entry for new firms as well as barriers to cross entry into the product group of another firm in the industry.

In summary, product differentiation can create an entry barrier by essentially driving a wedge between the incumbent's costs and its price as determined by a potential entrant's costs. Product differentiation in a multiproduct firm can be used as an entry deterrent strategy. Contrary to the traditional literature, the ability for predation depends also on barriers to cross-entry when economies of scope are present among the products. Furthermore, firms with a variety of differentiated products have more ability to engage in predatory pricing on a subset of its products without revealing the true cost of each product. This could be a substantial entry barrier. Finally product differentiation through product proliferation can create a reputation effect which can deter entry from a subset of the products provided by an industry.

III Product Differentiation in Canadian Air Transport

The importance of entry barriers for airline markets is due to their determination of the contestability of those markets. Contestability is needed to promote efficient production and cost based fares in the absence of regulation. If a market is contestable, then prices should be the same whether or not there are actual competitors. It is the threat of competition rather than the presence of competition that prevents monopolistic practices. In view of the recent findings of Bailey and Panzar (1984) that prices in U.S. airline markets are lower with actual competition, it is important to determine whether product differentiation constitutes a significant entry barrier to actual competition.

There are a number of sources of product differentiation in airline markets. Canadian carriers already offer a range of fare classes from first class to business class, to no frills restricted service. These price-quality offerings cover a broad range in product space with little room for entry by carriers with a new, differentiated product.

Products can also be differentiated by attached services. Carriers offer frequent flyer programs to build customer loyalty. Shared designator codes allow a small carrier to gain from the reputation of a larger carrier and the larger carrier obtains the feed from the smaller carrier. Computer reservation systems, (hereafter CRS) can provide special services such as seat assignment.

A. Computer Reservation Systems

Computer reservation systems (CRS) control and assist in analyzing the vast quantities of market information in the airline industry. They also play the most critical role in the distribution of the airline's product. In the mid to late 1970s, CRS systems were brought directly into the office of the travel agents. Agents seldom have more than one CRS system in their offices, as one system provides information on flights of all carriers. The airline owning a specific CRS system in an agent's office has great potential for inducing that agent to favour its own flights, at the expense of its competitors.

Up to 80% of all airline tickets are booked by travel agents. Roughly 90% of all Canadian travel agents have a CRS system in their office. Of those agents which are automated, over 80% use Air Canada's RESERVEC system. Further, almost all of the largest travel agencies are Air Canada users. Clearly, Air Canada is in a position to potentially control a very substantial portion of total ticket sales in Canada.

There are several methods by which a CRS vendor (i.e an airline) can use the system to influence which airline the agent will book a passenger on. Foremost is the introduction of bias in the display of information on the CRS screen to favour the vendor. American Airlines has found that 53.5 % of all of its SABRE system sales come from the first line of the first screen displayed, and that over 90% of all sales come from somewhere on the first screen.[2] Further, U.S. airlines have testified that the introduction of bias in their systems increase their sales by up to 20%.[3]

In addition to the bias, there are more subtle ways in which an air carrier can use its CRS system to influence a travel agent's choice. For example, the CRS system can be used to monitor the bookings of specific travel agencies. This valuable information can be utilized to design incentives for that specific agency so that they will favour the vendor. Without any doubt, unless restricted by the government, a CRS vendor has substantial opportunity to influence and control travel agents, and thereby control the distribution of airline products. The airline with a widely-adopted CRS can raise fees for listing its competitor's flights, and thus raise its cost.

CRS systems create entry barriers at two levels. The first level is as an entry barrier into the CRS vendor market. Agents rarely use more than one CRS vendor. The vendor generally requires fairly long term contracts with the agent. This makes it difficult for the agent to change vendors. In addition, the sunk costs of training staff to use (and master) a specific vendor's system create another barrier to entry. Here in Canada, CP Air has been attempting to make major inroads into the CRS vendor

market. It has been largely unsuccessful, and the few agents it has been able to sign up are generally smaller.

In addition to entry barriers into the CRS vendor market, being a vendor of a CRS service creates a barrier to entry into the airline market. Carriers vending CRS systems have a marked advantage in selling airline services. This means that, ceteris paribus, an airline with a widely-adopted CRS system can have a lower cost structure or charge higher prices than its competitors.

B. Frequent Flyer Programs

These programs make business travellers repeat buyers of an airline's services by introducing a new incentive of maximizing personal benefit by patronizing a single carrier. The airlines have found these programs to be effective in building brand loyalty.

Frequent flyer programs have several costs associated with them. The first is the cost of starting up the program. This will include market research, advertising expenses, promotional materials and administrative expenses. The second is the cost of operating the program. Significant amounts of computer time are required and a large number of staff are required to process the millions of frequent flyer coupons. The third is the cost of actually providing the air travel award. If a recipient of a frequent flyer award used a seat that would otherwise have been empty, then this cost is very low. On the other hand, if the frequent flyer preempts someone who would have been willing to pay for the seat, then the opportunity cost of the frequent flyer program can be quite high.

There are also economies of network size in frequent flyer programs. Customers of a carrier with a wide geographic coverage will find it easier to accumulate points if they patronize such a carrier. Perhaps this carrier needs to give a bonus award only after every thirty trips. Customers of a smaller air carrier, on the other hand, will find it difficult to accumulate points for several reasons: the carrier flies to fewer destinations, and it might be flying shorter stage lengths and thus the consumer will be accruing fewer mileage bonus points. The small carrier may find it necessary to award a bonus more frequently, perhaps after every 15th flight, in order to retain the travellers, hence increasing his costs relative to the large network carrier.

Frequent flyer programs can be viewed as a method for raising the costs of rivals, especially smaller rivals. These programs have been extremely effective in both the U.S. and Canada. In the U.S., almost every carrier, including small third level carriers, have a frequent flyer program. In Canada where programs are just over a year old most airlines are already a member of a program or intending to join one shortly. Further, it is

often the case that small carriers may be required to pay a fee in order to join the frequent flyer program of a large airline.

Membership in the frequent flyer program of a large air carrier has probably become a prerequisite for entry of a new carrier. This can become a significant entry barrier if small new carriers are barred from membership in larger carriers' programs.

C. Use of Shared Designator Codes

Another recent development which differentiates a product and may constitute an entry barrier is the use of shared designator codes. The use of a major airline's flight designator code by a smaller airline has become quite common as carriers implement traffic sharing agreements. The sharing of a major airline's designator code with a smaller air carrier has several advantages for both. The major airline will now be seen by consumers as providing service to a larger set of cities. In addition, the major airline is able to obtain a larger share of the smaller airline's feed traffic. The smaller airline achieves an increase in traffic due to the perception by consumers that its flights are actually with the larger air carrier. Usually, agreements to share designator codes also involve coordination of schedules and certain guarantees on minimum service levels.

The use of shared designator codes has made its way into the Canadian airline industry. Air B.C., for instance, uses the designation of CP Air for its Victoria-Vancouver service as part of the Air B.C.-CP Air operating agreement. No CTC involvement was required for this agreement. In fact, the CTC appears to look with favour on the use of share designator codes. The anticipation is that the use of shared designator code will prove mutually advantageous and will increase the probability of the survival of many of the smaller regionals and commuters.

There are many ways in which the shared designator codes may be considered as an attempt to raise one's rivals' (actual or potential) costs. Consider the following hypothetical example. There are two commuter air carriers in a market: Shared Airline and Loaner Airline. Shared Airline enters into an agreement with a big airline. Because of this, Shared Airline enjoys a substantial increase in traffic. This of course causes a reduction in demand for Loaner Airline. To counter this, Loaner Airline may find it necessary to enter into an agreement with another big airline. Because all the Big Airlines already have aggreements with commuters, it may be necessary for Loaner Airline to pay a fee for this privilege, or it may have to raise its costs in other ways, such as by increasing its service quality, frequency or reliability in order to meet the requirements of the other big air carrier. Should the loss of traffic by Loaner Airlines be sufficiently large, it may be necessary for it to change its equipment or other operating procedures. This can be costly. At

the very least it will reduce its exploitation of density economies resulting in higher unit costs.

D. Airport Access

The U.S. deregulation experience teaches us that constraints on airport access, such as departure and landing slots, gates, terminal space (lounges for business class passengers, counter space) etc. could be a significant barrier to entry for new carriers. There are numerous cases in the U.S. where potential entrants were discouraged at major airports and were forced to adjust to less attractive departure times or to operate out of less attractive airports, or simply never became operational.

The major Canadian airports such as Toronto, Vancouver, Dorval and Calgary, experience peaking problems during the rush hours (7 am to 9 am; 4 pm to 7 pm). This type of airport congestion is likely to get much more serious in the future since deregulation is likely to increase airport activities significantly. This is because; i) deregulated airlines tend to fly more frequent services using smaller aircraft in an attempt to attract full fare business passengers, ii) lower fares and a wider variety of fares are likely to increase air traffic, iii) the movement toward hub and spoke networks will increase requirements for takeoff and landing slots at key airports, and iv) infrequent jet service in short haul routes tends to be replaced by high frequency turboprop service. Currently, the representatives of all of the existing airlines form Schedule Coordinating Committees at major airports in Canada, with one of the two major carriers (Air Canada and CP Air) taking strong leadership in allocating the landing/departure slots.

There is a real possibility that potential entrants might not obtain a fair deal from such committees in getting the landing/departure slots and timing of flights they desire. This is particularly so because many of the existing airlines are already moving to set up their hubs at major airports. By making available less desirable departure/landing slots, existing carriers can effectively shift down the potential entrant's demand curve, and thus make entry less attractive.

The current system of scheduling committee membership, particularly with the leading role being played by a major carrier, seems to invite potential abuse in a deregulated market place. Such behaviour would be especially unfair when one considers that the federal government subsidizes 56% ($678 million) of the total operating costs of the airport systems not including the cost of capital invested, ($1.2 billion in 1984).

There are other access problems that create some entry barriers in the airline industry. In recent years, an increasing number of airplanes have to wait after landing before they are assigned to a gate. This raises questions about the adequacy of

the current procedure for gate assignment in a deregulated environment. For example, at Vancouver International, Air Canada assigns those gates on the south side of the terminal, and CP Air assigns those on the north. There is potential for abuse in this procedure against smaller and new carriers. At most airports, Air Canada has historically received the most favourable gates, or has been successful in preventing a potential entrant from getting access to "its" unused gate space.

Frequently, the dominant carriers perform ground services such as aircraft maintenance, baggage handling, ticketing, servicing, fueling, etc. for smaller carriers. In the case of Toronto's Terminal 2, this has been formalized in a contract. Thus there is a potential for the dominant carrier to raise its smaller rivals' costs simply by charging higher fees for services.

E. Advertising as An Entry Barrier

Typically advertising activities have "carry-over" effects into the future. Therefore, once the money is spent on advertising it becomes a sunk cost to the firm. In other words, the firm would not be able to recover the carry-over and cumulative effects of advertising when and if it wishes to exit the market. These sunk costs become a barrier to potential entrants.

Since U.S. airline deregulation, there have been several changes in airline advertising activities. First, the airline industry has increased its advertising and promotional expenditure from about 1.1 cents per revenue ton-mile in 1978, to about 2.3 cents per revenue ton-mile in 1984.[4] Second, advertisements are focused more on discount fares (to attract discretionary travellers), and schedule frequency and frequent flyer programs (to attract business travellers) than the general image building of the past. Third, carriers rely increasingly heavily on local newspapers, radio and T.V., and less on national magazines. This is because the former allow last minute changes as market conditions change, and they can be targeted to specific geographic markets.

Similar changes have occurred in Canada since the regulatory liberalization process began in late 1970s. These are partly the result of the strategic movement on the part of the airlines to develop defensible niches. While the government should not intervene in sound management decision on advertising strategies, there are some disturbing trends in advertising of discount fares. Some advertising copies do not show restrictions imposed for qualifying discount fares, and virtually all advertisements do not reveal seat availability on various discount fares. It is clear that airlines use "bait and switch" tactics, hoping to get customers to call in because of the low fares, and then persuade them to fly on higher fares when the small number of discount seats are sold out. Such advertising misleads consumers by not

providing enough information necessary for making sound judgement. This issue needs to be dealt with for successful implementation of deregulation.

IV Conclusions

There is no question that Canadian airline markets are not perfectly contestable. We have identified a number of transitional and permanent entry barriers.

The next question is whether or not Canadian airline markets are reasonably contestable to discourage anti-competitive behaviour and other undesirable aspects of market competition. Again, the answer is no. There are two major concerns. First is the potential for abuse of unregulated computer reservations systems. At present, although there are some problems, the existing CRS system of Air Canada is not posing a major threat to competition in Canadian airline markets. Nevertheless, the potential for such abuse raises some concern. Second, is the potential for government owned air carriers to engage in behaviour that drives out existing competitors or frustrates potential competitors from entering, even if such behaviour is unintentional.

Having stated that there are at least two significant impediments to competitive behaviour in Canadian airline markets, one might ask whether or not Canadian air transport should be reregulated. The answer is no. Reregulation is a drastic solution which is likely to cause (at least in the long run) more problems than it prevents. A more intelligent solution is to prevent abuse by government owned air carriers and to give the competition enforcement authorities sufficient power to prevent anti-competitive abuse of computer reservation systems. The competition enforcement agency should also have the ability to monitor other entry barriers and to issue whatever rulings may be necessary to prevent them from being used for predation.

The potential for abuse by government-owned carriers can be handled in many ways. Ideally, they would be privatized. Baring this, the appropriate government body would pass legislation explicitly stating that the air carrier is to behave in a competitive manner. If non-economic objectives are to be assigned to the carrier, they must be subsidized explicitly. This can often be difficult to do because of the very nature of the political process. Privatization, without a doubt, is the best strategy.

Footnotes

* Associate Professor, School of Business and Economics, Wilfrid Laurier University.

** Associate and Assistant Professor, respectively, Faculty of Commerce and Business Administration, University of British Columbia.

1. See for example Schmalensee (1978).

2. U.S. Department of Justice (1983), "Comments in Proposed Rules of the Department Justice", p. 81. Note that these figures apply to a very biased system. In an unbiased system we might expect these numbers to be even higher.

3. Ibid.

4. Source is Air Transport Association of America.

Bibliography

Bailey, E. and J. Panzar (1984), "The Contestability of Airline Markets During the transition to Deregulation" Journal of Law and Contemporary Problems. Volume 44. No. 1. Winter pages 1 to 5/4 to 5.

Caves, R.E. and M.E. Porter (1977), "From Entry Barriers to Mobility Barriers: Conjectural Decisions and Contrived Deterents to New Competition," Quarterly Journal of Economics. Volume 41, No. 2, May, pages 241-265.

Kahn, A.E. (1984), "The Macroeconomics of Microeconomic Policies," an address presented to the Society of Government Economists and the American Economics Association, Dallas, Dec. 28, 1984.

Levine, M.E. (1984), "Deregulation in Practice: Three Views from one Participant," and address presented to "Issues over Entry Control in Canadian Domestic Airline Policy" sponsored by the Center for Transportation Studies, University of British Columbia, Vancouver, March 16, 1984.

Scherer, F.M. (1980), Industrial Market Structure and Economic Performance, 2nd edition, Chicago: Rand McNally.

Schmalensee, Richard (1978), "Entry Deterrents and the Ready to Eat Breakfast Cereal Industry", Bell Journal of Economics, 9 (Autumn), pages 305-327.

U.S. Department of Justice (1983), "Comments and Proposed Rules of the Department of Justice," reponse to the CAB Advance Notice of Proposed Rulemaking - Airline Computer Reservations Systems, Docket 41686, EDR 466 (November 17).

FAILURE IN THE PRIVATIZATION OF CANADIAN NATIONAL AND AIR CANADA

by

Wilbrod Leclerc
Faculty of Administration
University of Ottawa

1.0 Introduction

Despite the fact that the tide turned to deregulation and privatization some years ago, the present federal government, like a knight in shining armour, has emblazoned these words on its banner and sallies forth to change the world. This choice of motto is a direct descendant of the 18th century ideology of "laissez faire" and an imitation of U.S. and U.K. policies.

In the transportation field, the first steps have been taken in the case of De Havilland and Northern Transportation. The underlying current now appears to be carrying even the heavier companies like Canadian National and Air Canada in its wake. The success of certain large privatizations in the U.K. leaves no doubt that the privatization of Canadian National and Air Canada could also work if the market were able to absorb such a large offer. The question that remains is whether it should be done.

To answer that question, we will first compare private and public enterprise from the point of view of ideology, political interference and efficiency. Then, we will explore the question of regulating competition as opposed to using competition to regulate. Finally, privatization will be studied from the points of view of the control of management, the transfer of property, the economic effects, and the possibility of failure.

2.0 Private versus Public Enterprise

The amount of government enterprise in the Canadian economy, or in the economy of all the so-called western countries, always raises a number of important questions: should it exist? If so, to what extent? Under what

conditions? For how long? Is the problem a fundamental question of capitalist ideology versus socialist ideology?

The answers to these questions can be extremely complex and take us in many directions, but, for our purposes, let us limit our search to three areas which constitute the main thrusts of the criticism levelled at government enterprise. The first major criticism is ideological: in a capitalist economy, there should be little or no place for public enterprise. Secondly, when public enterprise does exist, it is subject to political interference, and thirdly, it is impossible for public enterprise to be as efficient as private enterprise because of political interference and the lack of a profit motive.

2.1 The Ideological Background

Since Adam Smith and the advent of "laissez faire" ideology, capitalists have believed supposedly that they should be left to fend for themselves, i.e., without government interference of any kind. They should be free to make all the profits that they can make. Despite their selfish aims, competition in the market place will insure the lowest prices and best quality for customers.

However, reality very early got the better of ideology and, especially with the growth of the railways, governments were asked to reduce the financial risks of private enterprises through subsidies, land grants, loan guarantees, guarantees of traffic, etc. This practice has become so widespread in industry today that few industries indeed can say that they get no government assistance. All this government help is usually requested in the public interest, i.e., to provide needed goods or services, jobs, stability, etc. Such government support is always welcome but any governmental efforts to directly provide goods or services, jobs, stability or to control prices, quotas, quality, pollution, etc., is frowned upon by purists and often called interference.

Imbued with the belief that pure capitalism did exist at the beginning and that it is an ideal to which we should return, many businessmen continue to think that public enterprise is acceptable as a temporary aberration when essential goods or services are not provided by private enterprise. However, they maintain that the government's role should be abandoned as soon as private enterprise is willing to enter the picture. For instance, many people believe that Air Canada should hand over a large part of its business to CP Air, or that as soon as a public airline can be established as a profitable enterprise, it should become a private enterprise. Others argue that the only reason why the quality of Air Canada

service even approaches a degree of reasonableness today is because of the presence of a competing CP Air.

In the transportation field, some Ottawa policy makers would like to see the transfer of many government operations back to the private sector in order to reverse our socialistic tendencies and return to a purer form of capitalism. If we examine this ideological confrontation in a worldwide historical perspective, we see that of the scores of new countries created since the end of World War II, not one approaches pure capitalism. Furthermore, in the so-called capitalist countries, we have seen a practically unbroken trend towards socialism and the welfare state. Most of the Western European countries have elected socialist governments to power at one time or another. Even Canada is no exception in this regard.

In the face such historical realities, it is difficult to accept the idea that governments should get out of business for a priori reasons related to capitalism. The hard fact is that we are just as socialistic as other capitalist countries in the western world and we need not undergo a purification process just for the sake of ideology.

2.2 Political Interference

It is usually assumed, without fear of contradiction, that political interference is undesirable. For instance, the member of parliament who tries to prevent Canadian National from abandoning a passenger service, or perhaps, for that matter, an entire branch line service that runs through his constituency, is assumed to be exercising political interference. Often there may be no passengers on these trains or the railroad may be handling only a few boxcars a year on the line.

It is true that some elected representatives indiscriminately support their electors whether their cause is justified or not. In this context, there are two related questions which should concern us. First, is so-called political interference always bad? Second, is it limited solely to government enterprises? Both questions have to be answered simultaneously because they are intermeshed.

Recent years have provided us with a host of examples of outside interference on the operations of both public and private enterprise especially in the newly discovered battleground of ecology. Some of the interference came from elected representatives of the people but most of it came from the people themselves through various pressure groups. Most of this interference related to operating decisions has not been viewed unfavourably by the public.

No difference has been made between the air pollution created by an INCO nickel plant and that created by an Ontario Hydro steam plant. Ensuing legislation has seldom discriminated between government-owned enterprises and privately-owned enterprises. Consequently, we are forced to admit that outside interference, political or not, on the operations of an enterprise has not been limited to publicly-run enterprises and has not always been bad. The problem, then, is one of the quantity and the effectiveness of the interference. Do we find more interference in government enterprises or does interference produce more results in government enterprises? Here the answers become more perplexing.

There are different levels of autonomy in government enterprises. Some are just as independent of the political process as private enterprise and others are not. This varying degree of independence, in the federal government at any rate, seems to have been wanted by the government itself. There are various types of federal crown corporations each with its own degree of independence from the government. Commercially-oriented enterprises such as CN and Air Canada have the highest degree of independence. They are run by professional managers just like their private counterparts.

The only appointments made by Governor in Council are usually those of the Chairman and the President, and most often they are made from within the companies. When outsiders are brought in, they are usually highly competent managers. We have seldom seen a defeated candidate, even a minister, or a party bagman appointed to one of those jobs. Of course, appointments to the Boards of Directors of these companies sometimes can be purely political plums that reflect geographical public interests more than business interests. But the owners are the Canadian people and the directors are chosen by their representatives. This is the system through which the "citizen-shareholders" vote for the directors of these companies.

It is true that Canadian Pacific directors, on the other hand, appear to be chosen for their business connections and the business that they can bring to the company. But it is impossible to state that the difference in the composition of the Boards has a significant effect on the competitive position of the two companies.

It appears then that the idea that management can be divorced from ownership in a crown corporation is just as applicable as in private enterprise. As a matter of fact, the public owner in a crown corporation is more protected than the shareholder of a corporation where the management

has control of the annual meeting through the proxy system. At least, in crown corporations the legislative process insures that the directors are appointed by owner-representatives, i.e., the Governor in Council. Similarly, this process is extended to cover some management positions. In addition, the corporation is accountable to a minister, the Treasury Board, and to Parliament through a standing committee of the House of Commons.

In general, however, management is usually inbred and largely independent of the political process. In such a situation, realistically, we could perhaps have the best of both worlds: well-managed enterprises and public ownership.

2.3 Efficiency

Quality of management is directly related to efficiency in operations. If there is a myth that must be challenged in this regard, it is the one that stipulates that public enterprise cannot be operated as efficiently as private enterprise primarily because of political interference. We have dealt with the matter of political interference in the previous section by showing that it can be kept at a level no greater than in private enterprise. We should now focus on the quality of management by comparing the two kinds of enterprises.

As long as a public enterprise does not have to hire so-and-so because he was recommended by his local member of parliament, there is no reason for either the work force or the management of a public enterprise to be of a lower quality than that of a private enterprise. Nevertheless, one other factor must be considered: public sector salary levels should be equal to those in private enterprise. Otherwise, the public organizations could have difficulty attracting and keeping good quality managers.

Comparisons are often made between management salaries in our two main railroads because the railroads themselves are comparable to a large extent. They are both very large, provide similar services, compete with each other and their productivity can be compared. Consequently, there is no reason to believe that Canadian National, as a railroad, is any less efficient than Canadian Pacific. This is true of any crown corporation as long as management is left to manage in a professional way.

3.0 Regulating Competition or Using Competition to Regulate

Rail and air transportation in Canada are classic

cases of oligopoly with a relatively homogeneous product. In both cases, the number of vendors or competitors is small. Furthermore, there is little difference between the service provided by one competitor compared to other competitors. While some competitors would raise howls of protest at such a thought, the proof of it is in the pudding. Clients shop around and almost always buy at the lowest price when it is deregulated. Price, more often than not, determines the seller in transportation.

Mature industries which sell roughly identical products always end up with price regulation or with price wars and excess capacity. The price problems are especially prevalent when a large proportion of total costs is made up of fixed or sunk costs. In the short run, this gives a lot of play on price because each seller tries to cover variable costs which can be low and make as large a contribution as possible to fixed or overhead costs. Short-run losses during price wars, of course, do lead to long-run failures.

When price wars lead to failures, takeovers, or mergers, competition decreases and monopoly control over prices becomes possible. In order to prevent such failures, the industry must find a way to control prices. Sometimes this can be done through government price regulation such as was common in rail transport for a long time, or through legal agreements as in liner conferences. At other times, price can be controlled through cartels. The aim is to have a price which is sufficiently high to ensure the survival of all members. In effect, this means that price must cover costs and minimum return for the least efficient member of the group. In such a case, the other members of the group presumably make a return which is higher than the minimum. It is unreasonable to expect that efficiency is exactly the same for all members of the industry.

Another characteristic of oligopoly markets with identical products is excess production capacity, a situation frequently seen in both rail and air. All the firms wishing to increase their share of the same market must each have excess capacity in order to supply the service should their hopes and sales efforts be realized. But when business goes down, such industries typically try to maintain prices and they lose business in the process. They seldom reduce their prices to attract more business. The result is large percentages of excess capacity in dry years.

If the competing oligopolists do try to lower prices, the competition and the overcapacity lead to price wars and the necessity to regulate prices in order to protect both clients and competitors from the abuses of price

wars. In transportation, price wars may benefit large clients but end up hurting the small client. In the rail wars of the past century, large cities served by many railroads saw their rates decline but small towns served by one railroad were hurt by high rates. In the recent air battles in the U.S. many smaller towns lost their service.

Price regulation initially was an outgrowth of competition. Its aim was to protect the consumer. But with time, the system evolved into a protection agency for the transporters. Regulation provided stability, markets, and, perhaps, inefficiency. A century later, we have gone full circle and are moving full steam ahead toward deregulation.

The dilemma is the following: the regulation of competition reduces competition and increases rates but using competition to regulate the market leads to concentration, loss of service, and high monopoly rates in certain areas. When there are advantages and disadvantages on both sides it is more difficult to make a decision.

What is the relationship between regulation and privatization? It may be easier to regulate nationalized companies. Or, it may be easier to accept regulation and nationalization together.

We have seen that the outgrowth of competition is regulation in certain types of industries like transportation. But nationalization is just as likely to grow out of the same situation. The nationalization of the Canadian National was the result of selling Laurier on competition and building two other transcontinental railroads to compete with the Canadian Pacific. Both new railroads failed and were nationalized at public cost but at no loss to the shareholders. This was the tribute paid to competition. Competition is not the answer to every economic problem. Today, it might be better to unite our two main railroads like the Northwest Company and the Hudson's Bay Company in the last century.

4.0 Privatization

In the same way that competition is just a mean to an end so is privatization just a mean to an end. In both cases, there exist other means. But in order to make a choice, one must have a clear idea of what is the end.

Economists like to group choices in three areas: what to produce, how to produce, and for whom to produce. Competition is supposed to provide the best answer to all three questions. Of course, we all know that it does not work that way because the system is not perfect.

Privatization is a choice related to how to produce. Like nationalization, it is a way to organize production. It is related to efficiency, production at the lowest possible cost. The question is then whether both of these choices can be equally economic. But the privatization of a public company is only possible if the company is profitable and will continue to be so. If not, the government can only try to sell the assets at fire sale prices or give them away. The major implications of such a choice revolve around questions such as the control of management, the transfer of property, the economic effects, and the will to let fail.

4.1 The Control of Management

Proponents of privatization hold that management is more effective and efficient through private enterprise than through government enterprise. Comparisons between the two can center on ownership and management.

In large private corporations where shares are broadly held, control falls usually to management through the proxy system. However, the situation can be similar in a profitable crown corporation if the management does not have to turn to government for funds and politicians do not interfere in its operations.

In such a context, a profitable government-owned Canadian National or Air Canada is not too different from a profitable privately-owned Canadian Pacific. Millions of taxpayer-shareholders in one case and hundreds of thousands of private investors in the other do not make an important difference. Contrary to popular belief, the voice of shareholders is probably stronger in the crown corporations.

In both types of enterprise, board members have only limited power over management. Real control ends up in the hands of managers. Relative efficiency will depend on whether or not the public sector attracts as high a quality of management as the private sector. Bad decisions are not the prerogative of one type of company. Both types have had their share of bad managers as well as their share of bad managerial decisions. Both types end up being managed by similar professionals.

As a result, privatization can only change the owners and probably not the managers. Shares of the company would be taken away from the taxpayer-shareholders, not necessarily with their approval, and sold to a smaller group of private shareholders who have decided to invest in this company. Such a change could look good were it not for the conditions under which the transfer of property takes place.

4.2 The Transfer of Property

A crown corporation can only be sold if the future promises some kind of benefits to private shareholders. The private sector rarely buys future losses except for fiscal reasons. In essence, selling a crown corporation means selling assets or future profits. The latter means changing the destination of profits from one group to another. Nothing can be fairer. Such transfers take place every day on the stock market.

The real problem raised by privatization is that taxpayer-shareholders who have paid for past losses or deficits are, in a sense, forced to divest themselves of future profits. Privatization makes sense only when there is hope for future profits.

The recent refinancing of Canadian National and Air Canada exchanged debt for equity thereby creating profits. Since then, even their managers have embarked on the privatization bandwagon in an attempt to snatch future profits from the pockets of the taxpayer- shareholders. Professional managers should be less concerned with changes in ownership and more concerned with good management.

4.3 Economic Effects

A change in ownership adds nothing to the real stock of capital in the country or to productivity. It is simply a transfer of funds from private pockets to government coffers.

Upon receipt of these funds, the government can choose to spend the funds, pay off some debts or reduce taxes. The budget effect would be minor, although an increase in spending could be inflationary. If the government chose to pay off debt, it would simply transfer funds from some citizens to other citizens with presumably little effect save for a reduction in debt and future interest payments. In that sense, the public must be willing to reduce its holdings of government bonds and increase its holdings of shares. Finally, if the government reduced taxes, it would leave more money in the pockets of citizens for them to spend, or save and invest. Government spending or tax reductions could be more inflationary than a reduction in debt. A fourth alternative, absolutely deflationary, would be the destruction of the funds through a central bank deposit which would reduce the supply of money.

Since the buyers of shares would be digging into their savings or their investment funds, privatization would reduce the funds available in capital markets, raise

interest rates and, in fact, through government use, transfer a good portion of these funds from investment to consumption with consequent inflationary effects.

Is this what Canada needs? A highly developed country needs increasing amounts of investment every year if it wants to avoid economic regression because the multiplier effect of additional investment has become relatively small and is decreasing. What both business and the country need is more investment in new and profitable businesses. Neither the country in general nor the business sector in particular stand to gain from a simple transfer of ownership.

4.4 The Possibility of Failure

Profits appear to justify privatization, but what would the government do if a partially or entirely privatized company eventually went bankrupt? A privatized Canadian National or Air Canada could again face bankruptcy. They could no more be abandoned to their fate by government than the New York Central, the Penn-Central, and many others. Even Lockheed and Chrysler were saved from bankruptcy by a U.S. government.

To some extent, because of the number and importance of federal crown corporations, Canada can be considered like one huge holding company, Canada Inc., with the federal cabinet acting as a board of directors. Large private holding companies, are often more decentralized than the federal holding. But, in the crunch, when it comes to large companies, whether they are public or private, it appears that most of them are considered part of the fold and must be saved at all costs. The list of saved companies, by any means, includes not only railroads and aircraft manufacturers, but, in recent years, Chrysler, Massey-Ferguson, Dome Petroleum, and banks. In the latter case, although the banks themselves have failed, the depositors have been saved regardless of size.

The will to let fail may be the key to the whole question. If we wish to assess the risks assumed by the shareholders of a privatized company, we only have to determine if the government would let that company fail. Historical experience shows that Canadian governments, including the present champion of privatization, seldom have the will to let fail.

In such circumstances, it is difficult to imagine what risks could possibly be assumed by shareholders in certain privatized Canadian companies. If the government has nationalized them before in order to protect jobs or to guarantee services, why not again in the future? How can profits paid to their future shareholders be

justified? Should not future profits remain in the hands of citizen-shareholders who paid for past losses and bear the burden of future risks?

5.0 Conclusions

Efficiency in a corporation is directly related to the quality of management and the process through which management is selected. In a crown corporation, the government's role should be limited to choosing one or a few individuals who will manage the enterprise and replacing them if not satisfied with their performance. At least, this is an advantage over private enterprise where shareholders can seldom exercise this right because management often controls its own appointments. Otherwise, commercial crown corporations should be managed like private corporations, that is, with the maximum degree of independence that can be given to a crown corporation.

An honest comparison shows that public operations in transportation can be just as efficient as private operations. Privatization cannot be justified by arguments of increased efficiency and less political interference.

Price regulation is not necessarily related to the ownership of property and privatization. It is just not necessary if there is enough competition between firms in all markets and no need to protect firms from the effects of price wars. The present trend to deregulation will leave competition as the only regulator of price. But only the future will tell if cutthroat competition and its effects can be replaced by civil competition in situations of oligopoly with a homogeneous product.

If efficiency is the end, then competition, deregulation, and privatization are only means to an end, and, to a large extent, unrelated to each other. The three need not be proclaimed in the same breath. Furthermore, they are not necessarily better means than monopoly, regulation, and public operation in transportation. The aim of a transportation service is efficiency and that is a question of costs, lowest costs, for a given level of quality.

There are no *a priori* reasons to believe that privatization would improve the quality of management. It is a simple transfer of property or a rerouting of future profits from the public purse to private pockets. There is no reason to believe that such future profits would be higher in a privatized company. Government-owned corporations in search of capital funds should abandon the privatization route, even the partial one, for the sake of

justice as well as economics. They should look to taxpayers for future funding so that future profits can go to those who supported them in harder times.

In the end the key to the whole question of the transfer of ownership from the public sector to the private sector is the will to let fail. Canadian governments, federal and provincial, have seldom had this will and do not have it now. Recent actions in many areas including banking show this to be true. It is absolutely impossible to envisage a government letting a privatized Canadian National or Air Canada go bankrupt and cease operations.

Since, in fact, the privatization of Canadian National and Air Canada could only take place at the taxpayer's risk, it should not be permitted to happen. The contribution of the private sector in the economy has dropped to less than half of the gross national product in many capitalist countries. To try to return to a good old 19th century private enterprise only system for ideological reasons does not appear to be a productive activity. To foster competition through deregulation is another matter, quite separate from privatization, and perhaps more productive.

References

Gherson, Giles, "For Sale to Caring Buyer: Slightly Used Crown Corporations", Financial Post, Report of the Nation, (November 1985), pp. 79-84.

Leclerc, Wilbrod, "One Railbroad for Canada", Policy Options, (Vol. 1, no. 3, Sept-Oct. 1980), pp. 55-57.

Leclerc, Wilbrod, "Privatization in transportation", Optimum, (Vol. 13, No. 1, 1982), pp. 104-110.

Martin, Paul E., "Why and How to Privatize", Policy Options (Vol. 5, No. 2, March/April 1984), pp. 22-25.

Paul, Samuel, "Privatization and the public sector", Finance and Development (Vol. 22, No. 4, December 1985), pp. 42-45.

STRUCTURE OF ROAD-USER TAXES FOR LARGE COMMERCIAL TRUCKS IN CANADA

by

F. P. Nix
University of Toronto/York University Joint Program in Transportation

1. Introduction

This paper describes the registration taxes, for-hire taxes, and fuel taxes for large trucks in twelve Canadian jurisdictions. In addition to containing tables showing the level of these taxes (summer 1985), a number of tables showing taxes per kilometre, per tonne, and per tonne-kilometre are included. These are based on a simple model.

The first occasion that road-user taxation for trucks became an issue in Canada was in the report of the Duff Royal Commission in 1932:

> "At the same time the trucks should pay a fair charge for the use of the right of way which is provided for them by the State, and it would seem doubtful if the scale of fees for registration in the various provinces, even when the gasoline tax is taken into consideration, does provide for a satisfactory contribution from these conveyers."[1]

From that date to the present, truck taxation has remained an issue in Canadian transport policy. As recently as February 1986, a workshop on trucking held in Toronto debated the subject.[2] Although there has been some research, there has never been an agreement on what constitutes a 'fair' share for trucks.[3] The existing provincial and territorial taxes indicate widely different policy views.

The object of this paper is to examine the structure of current road-user taxes for trucks in Canada, leaving aside the issue of what the structure or level should be. This is a more limited objective than the one raised by Duff (and others). The scope is as follows:

Taxing jurisdictions: Only the taxes of the twelve provinces and territories are considered; municipal taxes, such as cartage fees, and federal taxes, such as the excise tax on fuel, are ignored.

Taxes: Three provincial/territorial taxes are of interest: vehicle registration taxes, for-hire taxes, and fuel taxes.

Trucks: Only "large trucks", those with a registered gross vehicle weight (RGVW) of 5,000 kg or more, are considered.

Current: Taxes as of the summer of 1985 are considered current. In some provinces, there either have been or there will be some changes that have occurred since the summer of 1985.[4]

Finally, the scope of this paper has been limited by the available space. The full results of the research consist of a large number of data files and a model (using spread-sheet software) that calculates taxes per kilometre, per tonne, and per tonne-kilometre under a number of assumptions. For here, only a selection of the results can be shown for a number of truck classes and combination types.

2. Truck Classes and Types

In this paper, all trucks are divided into three classes, even though the real world is considerably more complex than this. In most provinces trucks other than those normally referred to as for-hire can carry freight on a for-hire basis; in some provinces, there is more than one registration class qualifying as for-hire, private, or farm (as these terms are used here); in some cases, registration taxes vary according to districts; and, in many provinces there are registration classes other than the three identified here. The full complexity of the registration system is not analyzed in this paper. Rather, from this maze, certain classes have been selected to represent three types:

For-hire truck: This is used to haul freight on a for-hire basis, generally, but not exclusively on inter-city hauls.

Private truck: This is used to haul the goods of the owner (often "registered owner") of the truck on a "private carriage" basis.

Farm truck: In most cases, this can only be operated under some circumstances (generally where the owner qualifies as a "farmer").

In four provinces, only two of these three classes have been used here as there is no separate treatment of farm trucks. While one registration class has been selected from each province or territory to represent the three (or two) classes, an exception has been made in the case of Saskatchewan (described later). The method used to authorize various registration classes to engage in certain activities varies significantly from one jurisdiction to another in Canada. The most important aspect of these differences here is that in some jurisdictions the registration classes themselves distinguish between for-hire and private commercial trucks, and consequently there is no separate "for-hire tax." Rather, there may or may not be a different registration tax schedule used for for-hire and private trucks.

To keep the analysis manageable, the following truck combination types and RGVW's are considered:

straight trucks	--	15,000 kg or less
tractor-semitrailers	--	15,001 to 44,999 kg
doubles (A- or B-trains)	--	45,000 kg or more

This categorization violates (slightly) the weight regulations in some provinces (the largest tractor-semitrailers in some provinces are not permitted to register as high as 44,999 kg). However, these violations are infrequent and not important to the analysis.

3. Road-user Taxes

In what follows, "vehicle taxes" means the registration tax on the power unit (straight truck or tractor), plus the nominal semitrailer or trailer tax, plus the for-hire tax. In all but one case, the truck registration taxes are based on RGVW (some jurisdictions use different terminology). Further, in all jurisdictions, this RGVW may be assigned for registration purposes to the towing unit of a combination of vehicles (e.g., the tractor in a tractor-semitrailer combination).

Newfoundland: One registration tax schedule for "commercial" vehicles includes all classes of trucks considered here. In addition to these taxes, the following comparison includes (where appropriate) a $25 annual tax for semitrailers. For-hire taxes are $4.50 per 1,000 kg for straight trucks, $170 for combinations up to 15,000 kg, and $200 for combinations with higher RGVW's. (Some minor aspects of for-hire fees are ignored.)

Prince Edward Island: A single registration tax schedule for "trucks" applies to all three classes of trucks. In addition, a $5 semitrailer tax is used where applicable. For-hire taxes are set in terms of straight trucks versus tractors and two versus three axles. In this analysis, the following taxes are used: $35 for trucks with an RGVW of 10,000 kg or less (assuming 2-axles), $45 for trucks with an RGVW of 15,000 kg (assuming 3-axles), and $75 for trucks with higher RGVW's (assuming 3-axle tractors).

Nova Scotia: There are two registration tax schedules relevant for this analysis: "commercial" vehicles (which encompasses for-hire and private trucks), and "farm" trucks. The $25 one-time tax for semi-trailers has been incorporated as a $3 annual charge. There are five levels of motor carrier fees ($100 to $250) that vary with RGVW.

New Brunswick: The two tax schedules relevant for this analysis are for "commercial" vehicles (for-hire and private trucks) and for "farm" trucks. In addition, there is a $5 annual tax for semi-trailers. Motor carrier taxes ($25 to $105) vary with RGVW.

Quebec: There are many registration classes (and tax schedules) in Quebec. For this analysis, for-hire and private trucks have been given registration taxes applicable to "F", "FZ", "L", "LV", "VR", and "Q" plates, and farm trucks have been given taxes applicable for the "N" plate. In addition, the one-time $28 semitrailer tax ("R" plate) has been converted to a $3 annual tax. The applicable for-hire tax ("CTQ" fees) in is $2 plus 10% of the registration tax.

Ontario: Registration taxes have been calculated from the "commercial" motor vehicle fee schedule (for-hire and private), and from the "farm" fee schedule. In addition, the $25 fee for semi-trailers has been converted to a $3 annual tax. For-hire taxes ("PCV" fees) used are for "A", "C", "D", "K", or "T" operating authorities.

Manitoba: The two tax schedules used (there are others) are for farm truck and for "PSV, CT" (for-hire and private). In addition to

these taxes, a $2 annual semitrailer fee has been used where applicable. There are no separate for-hire taxes.

Saskatchewan: The registration system is more complex in Saskatchewan than elsewhere (in particular, the "permitted-use" aspects of the system are more highly developed and the "for-hire authority" system is intimately tied up with the vehicle-registration system). For this analysis, the following classes have been selected:

For-hire (1) - class "A", at 9,100/16,000 kg axle loads.
For-hire (2) - class "AG", at 8,200/14,500 kg axle loads.
Private (1) - class "D", at 9,100/16,000 kg axle loads.
Private (2) - class "C", at 8,200/14,500 axle loads.
Farm - class "R" or "F", registered for 8,200/14,500 axle loads. These trucks may only register up to 38,000 kg.

Strictly speaking, none of these trucks could be registered at 5,000 kg (the first registered weight for these trucks is 5,001 kg); this minor problem is ignored here where a 5,000 RGVW is shown. Where applicable, an annual $22 fee has been included for semitrailers. There are no separate for-hire taxes.

Alberta: For-hire ("public service") and private ("commercial") trucks pay the same registration taxes in Alberta. For farm trucks, there is a flat $45 fee (since raised to $46). For all three truck classes, the $20 semitrailer plate fee (one-time payment) has been converted here to a $2 annual tax. There are no for-hire taxes.

British Columbia: For-hire and private trucks pay the same taxes ("commercial vehicles"). There is a separate schedule for farm trucks, and this is the only instance in this analysis where a tax schedule is expressed in terms of a vehicle's tare weight. To develop the taxes shown in subsequent tables, a relationship between truck tare weight and RGVW has been assumed (discussed later). For all three truck classes, an annual $12 fee for semitrailers has been used where applicable. For-hire ("motor carrier") taxes are $20 for trucks with an RGVW of less than 8,200 kg, and $42 for trucks with higher RGVW's.

Yukon: The two categories of trucks used in this analysis are "commercial" (private and farm in terms of the definitions adopted here), and "public service vehicle - unrestricted" (which is a for-hire truck). In addition, a $10 annual tax for semitrailers is applied where applicable. There are no separate for-hire taxes.

Northwest Territories: The two registration categories used here are "commercial" (private and farm), and "public service vehicle" (for-hire). Further, the registration taxes applicable to the Mackenzie and Dempster Highway systems are used. In addition, a $20 annual tax for (tandem-axle) semitrailers is used where applicable. There are no separate for-hire taxes.

Motive fuel taxes are typically set on an ad valorum basis. For this analysis, the current tax per litre is shown in Table 1. There are several points to note about the fuel taxes used in this analysis.

First, only the diesel tax is used as the main interest here is in comparing taxes on the larger trucks which are almost all diesel-powered. Second, there are some tax rebates (or no-tax situations) affecting the operation of farm trucks. None of these situations has been incorporated into this analysis. Third, in Table 1, no tax is shown for the Northwest Territories. In actual fact, a tax of 4 cents per kilometre is levied on trucks from outside the territory.

4. Comparison of Vehicle Taxes

In Table 2, vehicle taxes are shown for the three classes of trucks. Assumptions and/or procedures are as follows:

Rounding: All figures have been rounded up to the nearest dollar.

Highest tax: The highest tax levied is shown in the right-hand side of Table 2. These are based on the highest RGVW permitted under the ordinary weight regulations (without taking account of such things as seasonal restrictions or allowances, road class, tolerances, exceptions, and special permitting).

Effect of Weight Breaks: The location of a "weight break" in a tax schedule, and the choice of the weights in the following table may have an effect on the comparisons. Taxes from one province may be consistently at the high end of a weight break while those from another may be always at the low end of that province's weight breaks. This possibility has not yet been investigated.

Example: For clarity, consider the following examples: 1) the $1,289 vehicle tax shown for a for-hire double in New Brunswick with an RGVW of 45,000 kg consists of a $1,195 registration tax, a $10 semitrailer tax (2 times $5), and an $84 motor carrier fee (or for-hire tax); 2) the $482 shown for a farm truck in British Columbia with an RGVW of 35,000 kg is based on an assumed tare weight of 10,886 kg (registration tax of $470) plus $12 for a semitrailer plate.

5. Comparison of Vehicle and Fuel Taxes

In order to compare total road-user taxes (or at least those considered in this analysis), a number of cases were developed using a simple model of truck operations. Fuel consumption is assumed to be:[5]

$$km/l = 2.65 - 0.0207 \text{ (1,000 kg of RGVW)}$$

Other assumptions concern the relationship between RGVW and payload. There is a great deal of variability in this relationship depending on the body style (tank versus flat deck, etc.), the type of commodity haul, and a number of other factors. For here, this relationship was assumed using some "typical" values.[6] Further, the simulations assume an annual driving distance, an average trip length, and the existence or non-existence of a backhaul.

Nfld. - 12.5	Que. - 11.25	Alta. - 0.0
P.E.I. - 10.9	Ont. - 9.3	B.C. - 8.47
N.S. - 9.7	Man. - 9.2	Yukon - 5.2
N.B. - 9.8	Sask. - 0.0	N.W.T. - 0.0

Table 1: Motive Fuel (diesel) Taxes (cents per litre)
(Summer, 1985)

		RGVW ('000 kg)						highest tax	
		5	15	25	35	45	55	RGVW	tax
Nfld.	f-h	189	510	1,039	1,471	1,846	--	52.5	2,098
	p	166	442	839	1,271	1,646	--	52.5	1,898
P.E.I.	f-h	115	442	744	1,009	1,280	--	53.5	1,509
	p	80	397	669	934	1,205	--	53.5	1,434
N.S.	f-h	213	585	962	1,319	1,675	--	50.0	1,813
	p	113	465	802	1,119	1,425	--	50.0	1,563
	f	13	60	107	153	198	--	50.0	218
N.B.	f-h	105	425	715	999	1,289	1,573	56.5	1,618
	p	80	397	669	934	1,205	1,471	56.5	1,513
	f	40	199	337	470	608	741	56.5	762
Que.	f-h	198	534	922	1,409	1,900	2,409	57.5	2,520
	p	178	484	836	1,279	1,725	2,188	57.5	2,289
	f	74	265	471	696	930	1,171	57.5	1,225
Ont.	f-h	180	642	1,132	1,639	2,156	2,665	63.5	3,099
	p	136	477	846	1,232	1,626	2,014	63.5	2,345
	f	87	173	266	364	462	560	63.5	644
Man.	f-h	136	499	1,057	1,841	2,630	3,421	56.5	3,529
	p	136	499	1,057	1,841	2,630	3,421	56.5	3,529
	f	42	122	202	283	373	461	56.5	473
Sask. (1)	f-h	141	674	1,258	2,185	2,712	--	53.5	3,218
(2)	f-h	85	151	196	230	814	--	53.5	1,375
(1)	p	141	674	1,258	2,185	2,712	--	53.5	3,218
(2)	p	107	246	408	829	1,412	--	53.5	1,976
	f	60	70	117	218	--	--	38.0	218
Alta.	f-h	93	302	717	1,275	1,703	--	53.5	2,003
	p	93	302	717	1,275	1,703	--	53.5	2,003
	f	45	45	47	47	49	--	53.5	49
B.C.	f-h	141	448	851	1,253	1,787	2,244	63.5	2,618
	p	121	406	809	1,211	1,745	2,202	63.5	2,576
	f	68	186	435	482	590	662	63.5	710
Yukon	f-h	220	400	710	1,010	1,320	1,620	63.5	1,860
	p	75	225	485	735	995	1,245	63.5	1,445
N.W.T.	f-h	80	271	491	691	877	--	54.5	1,037
	p	70	198	345	443	613	--	54.5	724

Table 2: Truck Vehicle Taxes

Some of these simulations result in "unrealistic" situations (e.g., a truck operating intraprovincially at 160,000 kilometres a year in Prince Edward Island, where the trip length is 1,000 km). This lack of "realism" is unimportant here where the objective is to compare the structure of different tax regimes under a number of truck-use scenarios. Although extraprovincial operations can be accommodated, no such simulations are included here, as the results are more difficult to interpret. That is, the simulation can prorate both registration taxes (as they would be under CAVR[7]) and fuel taxes among the different jurisdictions in the same proportion as distance driven. The results, however, are a combination of tax policies in several jurisdictions. For here, the interest is to compare the tax policies separately.

6. Observations

Fuel Taxes: Three of the twelve jurisdictions have no fuel taxes (the qualification regarding the Northwest Territories having been previously noted). The existence or non-existence of a fuel tax can mean as much as $14,000 in total road-user taxes paid by individual trucks (this is the extreme case of a truck with a RGVW of 60,000 kg, operating 160,000 km per year, and paying the highest tax rate).

Level of Fuel Taxes: As shown in Table 1, fuel taxes range from 5.2 to 12.5 cents per litre in the nine jurisdictions which have such taxes. The following figures show the importance of these two tax rates for a small (10,000 kg) and a large (60,000 kg) truck.

RGVW (kg)		10,000	60,000
Annual km		50,000	160,000
Annual fuel tax at:	$0.052	$1,064	$ 5,909
	$0.125	2,558	14,205
Difference		$1,494	$ 8,295

Level of Vehicle Taxes: Annual vehicle taxes range from $45 (a farm truck in Alberta) to $3,529 (for-hire or private truck in Manitoba with an RGVW of 56,500 kg). Even within one of the truck classes, there is a high degree of variability. For example, Saskatchewan has (roughly) both one of the lowest (for-hire(2)) and one of the highest (for-hire(1)) tax schedules in the country: at high RGVWs, the difference in taxes is almost $2,000. (There are important differences in the permitted uses of the two truck classes; for example, the "for-hire (2)" as shown in Table 2 is only permitted to operate intra-provincially at secondary highway axle loads.) Other relatively high taxes are found in Manitoba, and to a less extent in Newfoundland, Quebec and Ontario. Vehicle taxes for private trucks also vary considerably among the provinces/territories. In fact, for high RGVWs there is more variability for private trucks than there is for for-hire trucks: compare the $724 for a truck at 54,500 kg in the Northwest Territories with the $3,529 for a truck at 56,500 kg in Manitoba.

For-Hire Taxes: Nine of the twelve jurisdictions assess for-hire trucks higher vehicle taxes than comparable private trucks. Of these

nine, two (the two territories) do so without explicit for-hire taxes. That is, like the Prairie provinces, the territories have different registration classes to distinguish for-hire from private trucks; unlike the Prairie provinces, though, the territories set the level of the tax schedules higher for for-hire trucks.

Level of For-Hire Taxes: As shown in Table 2, there is a significant difference in the level of for-hire taxes (or registration taxes for for-hire trucks) in the nine jurisdictions which use them. In Table 3, the percentage differences between for-hire and private truck vehicle taxes are shown. At one end of the spectrum, for-hire trucks in the Yukon pay anywhere from 29% to 193% more in vehicle taxes than do private trucks. The Northwest Territories, Ontario, Nova Scotia, and to a less extent Newfoundland also have for-hire taxes that raise vehicle taxes for for-hire trucks significantly above the level for private trucks. At the other end of the scale, for-hire taxes in Prince Edward Island (with an exception for the small trucks at 5,000 kg RGVW), New Brunswick, Quebec, and British Columbia are all relatively modest, at least in comparison with the vehicle taxes for private trucks in these jurisdictions.

RGVW:	5,000	15,000	25,000	35,000	45,000	55,000	highest
Nfld	13.9	15.4	23.8	15.7	12.2	-	10.5
P.E.I.	43.8	11.3	11.2	8.0	6.2	-	5.2
N.S.	88.5	25.8	20.0	17.9	17.5	-	16.0
N.B.	31.2	7.1	6.9	7.0	7.0	6.9	6.9
Que.	11.2	10.3	10.3	10.2	10.1	10.1	10.1
Ont.	32.3	34.6	33.8	33.0	32.6	32.3	32.2
B.C.	16.5	10.3	5.2	3.5	2.4	1.9	1.6
Yukon	193.3	77.8	46.4	37.4	32.7	30.1	28.7
N.W.T.	14.3	36.9	42.3	56.0	43.1	-	43.2

Table 3: Percent Difference Between For-Hire & Private

Farm Trucks: One of the most pronounced differences in tax policies is evident in the treatment of farm trucks. (These policy differences are even greater if the treatment of fuel used by these trucks had been included in this analysis.) Eight provinces have vehicle taxes for these trucks at lower rates than comparable for-hire or private trucks. The particular reduction in vehicle taxes varies considerably from jurisdiction to jurisdiction and from RGVW to RGVW. At one extreme is the $49 for a farm truck of 53,500 kg in Alberta (including $2 for trailer plates), versus the $2,003 for comparable for-hire or private trucks in Alberta. At the other end of the scale, provinces such as New Brunswick and Quebec tax these trucks at roughly half the rate of for-hire and private trucks.

Vehicle Taxes and RGVW: In all but one case (Alberta farm truck), vehicle taxes increase with RGVW. However, the rate of increase varies

markedly. There are a number of ways to show this. In Table 4, vehicle taxes for trucks of 10,000 kg versus 50,000 kg are compared.

Vehicle taxes at 50,000 kg over vehicle taxes at 10,000 kg RGVW							
	f-h	p	f		f-h	p	f
Nfld.	5.79	5.99	-	Sask.(1)	8.80	8.80	-
P.E.I.	5.33	5.81	-	(2)	8.48	10.46	-
N.S.	4.58	5.66	5.74	Alta.	9.34	9.34	1.09
N.B.	5.61	5.81	5.86	B.C.	7.20	8.29	5.27
Que.	6.31	6.35	6.44	Yukon	5.88	11.20	-
Ont.	5.91	6.00	3.92	N.W.T.	5.60	4.86	-
Man.	9.54	9.54	5.09				

Table 4: "Slope" of Vehicle Tax Schedules

Another, and perhaps better, way of showing this is on a graph. Unfortunately, the resulting 13 lines are confusing to interpret. As an alternative, several selected relationships are shown in Figure 1.

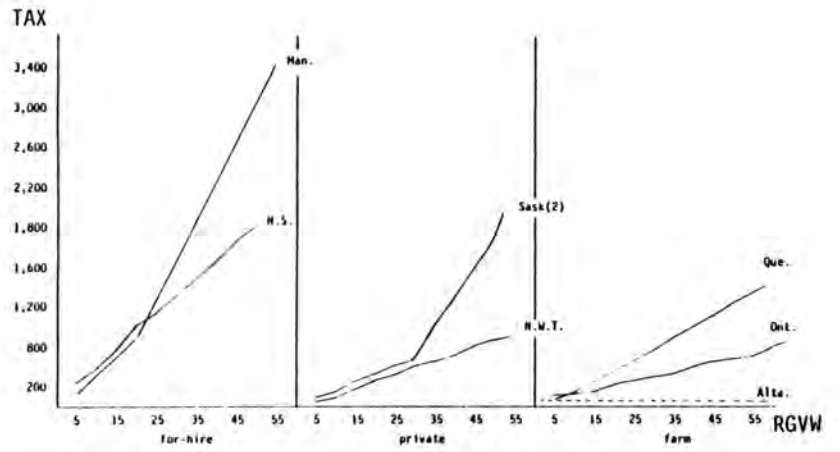


Figure 1: Vehicle Taxes versus RGVW

In Figure 1, considering for-hire trucks, Manitoba has been selected as it has the steepest slopes of any of the tax schedules: at 5,000 kg a truck in Manitoba pays $27.20 per 1,000 kg whereas at 56,500 kg a truck pays $62.46 per 1,000 kg. Other steeply-sloped tax schedules are found in Alberta, Saskatchewan, and British Columbia.

The opposite situation occurs in Nova Scotia (also shown in Figure 1), where taxes per unit of RGVW actually decline slightly for larger trucks: at 5,000 kg a truck in Nova Scotia pays $42.60 per 1,000 kg versus $36.26 at 50,000 kg. In all other provinces and territories, the rate of tax per unit of RGVW gradually increases with RGVW. For example, in Quebec a truck at 5,000 kg pays $39.60 per 1,000 kg versus $43.83 at 57,500 kg.

The pattern is roughly similar for private trucks, in the sense that the provinces with steeply-sloped tax schedules for for-hire trucks also have steeply-sloped schedules for private trucks. (The Yukon, though, is an exception.) In other jurisdictions, except the Northwest Territories, the rate of tax per unit of RGVW increases modestly with larger and larger trucks. In the Northwest Territories it declines slightly.

The pattern for farm trucks is also varied, in the sense that in some jurisdictions (Ontario and quite obviously Alberta) the rate of tax decreases with truck size; in other provinces ((Manitoba) the rate of tax remains relatively constant; and in the remaining provinces, the rate gradually increases with truck size.

Total Road-User Taxes: There are significant differences in the total taxes paid. Consider, by way of example, trucks with a RGVW of 35,000 kg operating intraprovincially, at distances of 100,000 km, no backhaul, and a trip length of 500 km. Road-user taxes for all three classes of trucks are shown in Table 5. As shown, total taxes for for-hire trucks vary from $230 (Saskatchewan (2)) to $7,963 (Newfoundland), or from $0.10 to $3.30 per tonne of freight handled. If the no-fuel-tax jurisdictions are excluded, the simple average for-hire truck tax amounts to $2.61 per tonne. (There is no particular significance to this average, other than as a rough benchmark for a truck operating under the assumptions stated.) Considering private trucks, annual road-user taxes vary from $443 (Northwest Territories) to $7,763 (Newfoundland). Again as a benchmark, the average tax for private trucks (excluding the no-fuel-tax jurisdictions) is $2.55 per tonne.

Road-User Taxes versus Distance: Road-user taxes per unit of distance or per unit of output decline as annual driving distance increases, as shown in Table 6. The jurisdictions without fuel taxes are not shown as, obviously, the change in tax is in inverse proportion to the change in distance driven (a fixed amount is spread over greater output). The figures shown in Table 6 are based on a for-hire truck of 40,000 kg, an average trip length of 1,000 km, and full backhauls. The figures express the total taxes per kilometre, per tonne, or per tonne-kilometre as a ratio of the taxes at an annual distance of 160,000 kilometres. For example, in Quebec, taxes per unit of output increase by 14.3% as annual distance is cut in half (from 160,000 to 80,000 km).

Road-User Taxes and RGVW: Since vehicle taxes increase with RGVW (generally at an increasing rate), total vehicle taxes per kilometre driven are higher for large trucks than for small trucks. However, the fuel tax (in nine jurisdictions), while increasing per kilometre for larger trucks, declines per tonne hauled or per tonne-kilometre. This

is on account of the better payload-handling capabilities of large trucks and the decline in fuel consumption per unit of payload. To show this, two for-hire trucks are compared in Table 7. In both case, annual distance (120,000 km), trip length (1,000 km), and full backhauls are assumed. The only difference is that one truck has an RGVW of 45,000 kg whereas the other truck has an RGVW of 25,000 kg. As shown (excluding the no-fuel-tax jurisdictions), total road-user taxes per unit of output (tonnes or tonne-kilometre) are about two-thirds as high for the large truck in comparison to the small one.

		Vehicle taxes	Fuel taxes	Total taxes	Total tax per		
					km	tonne	tonne-km
Nfld.	f-h	1,471	6,492	7,963	.0796	3.3022	.0066
	p	1,271	6,492	7,763	.0776	3.2192	.0064
P.E.I.	f-h	1,009	5,661	6,670	.0667	2.7660	.0055
	p	934	5,661	6,595	.0659	2.7349	.0055
N.S.	f-h	1,319	5,038	6,357	.0636	2.6361	.0053
	p	1,119	5,038	6,157	.0616	2.5531	.0051
	f	153	5,038	5,191	.0519	2.1525	.0043
N.B.	f-h	999	5,090	6,089	.0609	2.5249	.0050
	p	934	5,090	6,024	.0602	2.4980	.0050
	f	470	5,090	5,559	.0600	2.3053	.0046
Que.	f-h	1,409	5,843	7,252	.0725	3.0072	.0060
	p	1,279	5,843	7,122	.0712	2.9533	.0059
	f	696	5,843	6,539	.0654	2.7116	.0054
Ont.	f-h	1,639	4,830	6,469	.0647	2.6826	.0054
	p	1,232	4,830	6,062	.0606	2.5139	.0050
	f	364	4,830	5,194	.0519	2.1539	.0043
Man.	f-h	1,841	4,778	6,619	.0662	2.7449	.0055
	p	1,841	4,778	6,619	.0662	2.7449	.0055
	f	283	4,778	5,061	.0506	2.0988	.0042
Sask.	(1) f-h	2,185	0	2,185	.0219	0.9061	.0018
	(2) f-h	230	0	230	.0023	0.0954	.0002
	(1) p	2,185	0	2,185	.0219	0.9061	.0018
	(2) p	829	0	829	.0083	0.3438	.0007
	f	218	0	218	.0022	0.0904	.0002
Alta.	f-h	1,275	0	1,275	.0128	0.5287	.0011
	p	1,275	0	1,275	.0128	0.5287	.0011
	f	47	0	47	.0005	0.0195	.00004
B.C.	f-h	1,253	4,399	5,652	.0565	2.3438	.0047
	p	1,211	4,399	5,610	.0561	2.3264	.0047
	f	482	4,399	4,881	.0488	2.0241	.0040
Yukon	f-h	1,010	2,701	3,711	.0371	1.5388	.0031
	p	735	2,701	3,436	.0344	1.4247	.0028
N.W.T.	f-h	691	0	691	.0069	0.2866	.0006
	p	443	0	443	.0044	0.1837	.0004

Table 5: Annual Road-User Taxes
(RGVW = 35,000; km = 100,000; trip = 500; no backhaul)

Kilometres	160,000	140,000	120,000	100,000	80,000	60,000
Nfld.	1.000	1.019	1.044	1.078	1.131	1.218
P.E.I.	1.000	1.015	1.036	1.106	1.107	1.178
N.S.	1.000	1.021	1.049	1.088	1.147	1.245
N.B.	1.000	1.017	1.039	1.070	1.117	1.195
Que.	1.000	1.020	1.048	1.086	1.143	1.239
Ont.	1.000	1.027	1.063	1.113	1.188	1.314
Man.	1.000	1.031	1.072	1.130	1.217	1.361
B.C.	1.000	1.024	1.056	1.100	1.167	1.278
Yukon	1.000	1.029	1.068	1.122	1.203	1.338

Table 6: Road-User Taxes Versus Distance
(Tax per unit output as a ratio of tax at 160,000 km)

	Tax/km	Tax/tonne Tax/t-km		Tax/km	Tax/tonne Tax/t-km
Nfld.	130.9%	60.9%	Sask. (1)	215.2%	100.3%
P.E.I.	129.3	60.1	(2)	425.0	193.2
N.S.	131.6	61.2	Alta.	236.7	110.5
N.B.	130.6	60.7	B.C.	137.2	63.8
Que.	134.6	62.6	Yukon	136.3	63.3
Ont.	136.0	63.2	N.W.T.	178.0	83.1
Man.	145.2	67.5			

Table 7: Road-User Taxes Versus RGVW
(Taxes at 45,000 kg as % of taxes at 25,000 kg)

7. Conclusions

Clearly, there is a wide diversity in provincial and territorial policies concerning the taxation of large commercial trucks in Canada. There is no basis from this research on which to draw any conclusions about which of these policies are preferable to others. Nevertheless, one observation that may be in order is that it is difficult to understand the rational behind these various policies. While there may be good reasons for taxing some trucks at lower or higher rates than other trucks, it is difficult to determine from current provincial policies which trucks should receive separate treatment, or how much the difference in taxation should be (one class of truck versus another, one size of truck versus another). The suspicion is raised that the structure of road-user taxes for trucks is largely a function of political expediency rather than any analysis of the situation. The doubts raised by the Duff Commission remain.

ACKNOWLEDGEMENTS

This research was conducted under a TUP grant received from Transport Canada. T. Graham, a civil engineering student at the University of Toronto, assisted with the analysis.

ENDNOTES

1. Royal Commission to Inquire Into Railways and Transportation in Canada, 1932, Report, King's Printer, Ottawa, p. 102.
2. Workshop on Trucking Issues, hosted by the Railway Association of Canada, Toronto, Feb. 17 - 19, 1986.
3. N. Bryan (More taxes and More Traffic, Canadian Tax Foundation, 1972, pp. 68 - 75) describes all previous research undertaken by the provinces from 1937 to 1965. Other than this research, the most important work done since 1970 has been by Bryan herself (1972), and by Z. Haritos (Rational Road Pricing Policies in Canada, CTC, Ottawa, 1973). More recently, P. Bunting has re-opened the debate about trucks' share of road costs and revenues (Highway Costs and Revenues Attributable to Intercity Trucking, CIGGT, Report No. 82-9 and 82-10, Queen's University, 1983).
4. For example, Ontario is considering the abandonment of its for-hire taxes ("PCV" fees); New Brunswick is introducing a new registration tax schedule (spring of 1986); and, Saskatchewan has collapsed two farm truck registration classes into one.
5. Clayton, A.M., 1984, Heavy Vehicle Fuel Performance in Canada, Transportation Group, Department of Civil Engineering, University of Manitoba, Winnipeg.
6. Some of these assumed relationships are as follows:

RGVW	payload	RGVW	payload	RGVW	payload
5,000	2,337	25,000	15,021	45,000	32,300
10,000	6,112	30,000	19,567	50,000	36,393
15,000	9,886	35,000	24,114	55,000	40,485
20,000	10,475	40,000	28,660	60,000	44,558

7. Canadian Agreement on Vehicle Registration.

A RATIONALE FOR INCREASING TRUCK GROSS AND AXLE WEIGHTS

by

Jon J. Wyatt, Masood U. Hassan and Roger P. Couturier
Saskatchewan Highways and Transportation
Regina, Saskatchewan, Canada

Abstract

This paper describes the analysis and decision making process leading to a more than doubling of the primary highway length in Saskatchewan. For weight regulation purposes Saskatchewan provincial highways are divided into two categories: primary highways comprising inter-city, interprovincial, some U.S. - Canada highways, and a few other highways servicing relatively high traffic volume with 53,500 GVW limit, and secondary highways system comprising relatively low volume intra-regional highways, serving small and medium size communities, with a GVW limit of 49,000 kg.

The first section presents the general characteristics of the highway system, truck transportation, and truck weight regulations in Saskatchewan.

The second section describes the decision-making process. It is pointed out that most decisions regarding transportation are based on a combination of technical/quantifiable factors, and non-technical or policy/economic development objectives. The candidate highway sections for inclusion in the primary highway system were evaluated on technical factors such as benefit/cost ratio, traffic volume and existing pavement type; and on non-technical or policy related factors such as the need to serve all communities of over 2000 population and all designated industrial sites, and to provide interprovincial and international connections to all regions of the province.

As part of the technical evaluation the benefit (reduced truck operating costs)/cost (incremental highway costs) ratio was found to be 2:1.

The main conclusion is that for a land-locked province like Saskatchewan increasing truck weights and thus reducing transportation costs can be an important factor in economic, industrial and regional development.

1. Introduction

Shippers and truck operators view increasing the payload of trucks as the most cost-effective method of enhancing truck productivity and reducing transportation costs. Consequently, highway agencies are under constant pressure to allow heavier trucks on their highway systems, and in the process, bear all or most of the incremental costs of providing heavier pavements and increased maintenance activity. Issues such as how much pavement damage heavy trucks cause, and who should pay for what proportion of the resulting incremental costs, have been the subject of much debate in recent years in the United States and elsewhere (Ref. 1 to 4).

In Canada, individual provinces or groups of provinces have increased allowable truck weights at various times since the 1960's. The objective was to reduce trucking costs and also to bring about uniformity among neighbouring provinces. Complete uniformity among all ten provinces is an ideal yet to be achieved.

Although excellent descriptions of the history and present status of vehicle weight regulations in Canada have been published (5, 6, 7) a need exists in the Canadian transportation literature for reporting the rationale highway agencies use in determining truck weight increases. This paper aims to fulfil this need by describing the rationale leading to the June, 1985 extension of Saskatchewan's primary highway system from 3,180 km to 6,930 km, an increase of 118 percent. Primary highways allow gross vehicle weights of 53,500 kg compared to 49,000 kg on secondary highways. The paper describes the analysis (of costs, benefits and various technical and non-technical factors) and the decision-making process leading to this extension of the primary highway system.

2. Relevant Transportation and Socio-Economic Characteristics of Saskatchewan

This section provides a brief description of the highway system characteristics, truck transportation, and weight regulations in Saskatchewan. Also discussed are the technical, socio-economic and policy factors that prompted a study of the extension to the primary highway system. For a detailed discussion of the development of Saskatchewan's highway system and the weight regulation context, see Ref. 8 and 9.

2.1 Significance of Truck Transportation

Saskatchewan has an area of 648,000 square kilometres, and a 1986 population of over one million people, almost all of whom live in the southern settled half of the province. The existence of 65,000 farms and 1,000 communities makes Saskatchewan's population the most dispersed among Canadian provinces.

The need for personal mobility, combined with the need to move commodities to and from the widely dispersed population, agricultural and industrial centres, has led to the development of a 200,000 km rural road system, and to a vehicle ownership of 720,000 (500,000 automobiles and 220,000 commercial vehicles). Saskatchewan thus has one of the largest road systems in the world, and also one of the highest vehicle ownership rates.

Agriculture was the predominant economic activity in Saskatchewan until the 1950's. Since then, however, mining (oil and gas, potash, uranium, coal, gold, sodium sulphate, bentonite), manufacturing (steel, agricultural machinery), secondary processing, construction, and service activities have greatly diversified the provincial economy. Table 1 shows the present contribution of various sectors to the province's economy.

Two factors make efficient truck transportation vitally significant to Saskatchewan:

1. Since markets for Saskatchewan's export products are at great distances, transportation costs constitute a relatively high proportion of the unit price for many of its products such as grain, potash and forest products. Therefore, any reduction in transportation costs are of immediate benefit to the competitiveness of the local industry.

2. Most intra-and extra-provincial commodities are moved by truck; the major exceptions being grain and 85 percent of potash exports by rail (about 15% of potash exports are by truck (11)).

Therefore, any reductions in truck transportation costs are of immediate benefit to the provincial industry's well being and competitiveness. And, since the highway mode is under provincial control in Canada, provincial governments have used truck weight regulations as an instrument of socio-economic and industrial development.

2.2 Truck Weight Regulations

Of the 200,000 km rural road network in Saskatchewan, 23,200 km are designated as provincial highways managed by the Department of Highways and Transportation (DHT). The remainder are local roads under the jurisdiction of rural municipalities.

For the purpose of regulating truck weights, the provincial highway system has since 1975 been classified into primary and secondary highways. Table 2 shows the history of maximum allowable axle and gross vehicle weights on, and the lengths of primary and secondary highways. The change in length occurring June, 1985 is shown in Figure 1.

FIGURE I

SASKATCHEWAN'S PRIMARY HIGHWAY SYSTEM

LEGEND:

PRIMARY HIGHWAY SYSTEM PRIOR TO JUNE 1985

ADDITIONS TO THE PRIMARY HIGHWAY SYSTEM

CITIES AND TOWNS OVER 2000 POPULATION

INDUSTRIAL SITES

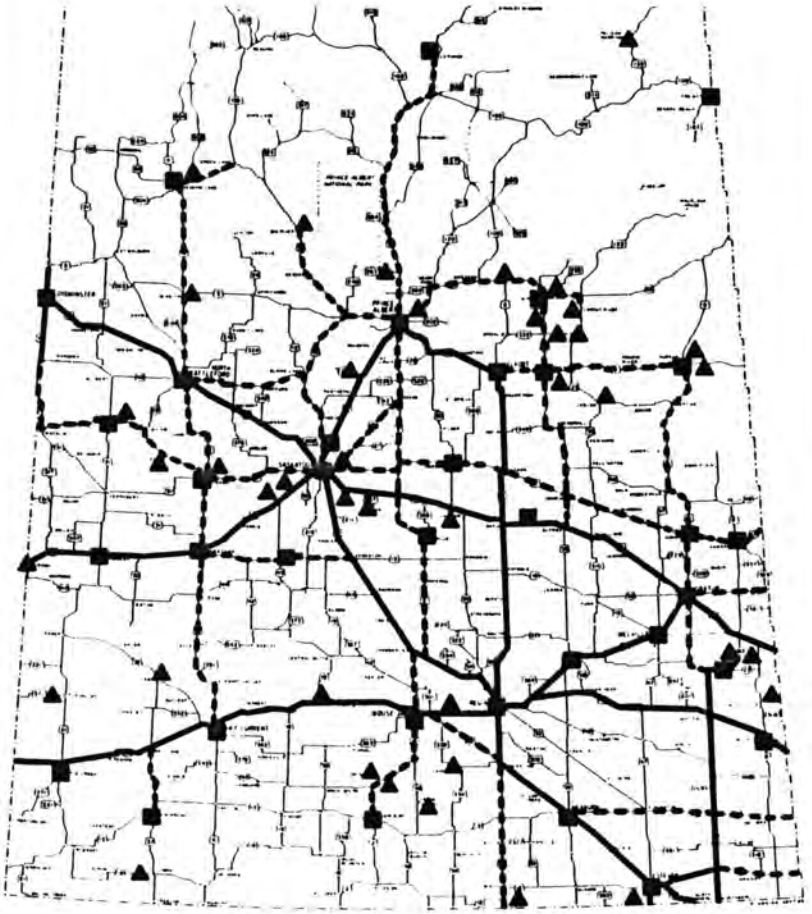


Table 1

Saskatchewan Industrial Output, 1984

Industry	Gross Domestic Product $ million	Gross Domestic Product %	Employment Thousands	Labour Income $ million
Agriculture	1530	9.6	89	248
Forestry	42	0.3	1	37
Mining	2129	13.3	9	437
Construction	761	4.8	23	468
Manufacturing	927	5.8	24	547
Transportation, Communication & Storage	1285	8.1	26	817
Utilities	439	2.8	5	166
Trade	1564	9.8	77	1010
Finance, insurance and real estate	2714	17.0	20	510
Services	2866	18.0	129	2212
Total	15,936	100.0	440	7367

Source: Ref. 10.

The creation of a two-tier weight classification in 1975 was prompted by a drive towards higher allowable weights countrywide and by the provision of financial assistance by the federal government through the Western Canada pavement strengthening Agreement (5). This paper only deals with the June, 1985 extension of the primary highway system length.

Several special provisions or exceptions apply to the weights shown in Table 2(15):

1. Secondary highway axle weights apply to rural-municipal roads with a maximum GVW of 34,500 kg, unless overridden by local bylaws.

2. Primary weights are allowed on the first 10 km of a secondary highway from the intersection with a primary highway.

3. The maximum wheel load allowed is 9 kg/mm tire width; however, during the spring thaw period, it is reduced to 6 kg/mm tire width on gravel and oil treated highways. These surface types do not occur on primary highways, but constitute about 80% of the secondary highway length.

Table 2

History of Maximum Allowable Axle and Gross Vehicle Weights on Primary and Secondary Highways in Saskatchewan

Dates	Highway Classification	Weights				Length
		Steering Axle	Single Axle	Tandem Axle	GVW	
		- thousands of kilograms -				Kilometers
Pre June '75	*	5.5	8.2	14.5	33.0	20,100
June '75 to Nov. '80	Primary	5.5	9.1	16.0	50.0	3,180
	Secondary	5.5	8.2	14.5	33.0	17,720
						20,900
Dec. '80 to May '85	Primary	5.5	9.1	16.0	53.5	3,180
	Secondary	5.5	8.2	14.5	49.0	20,020
						23,200
June '85 Onwards	Primary	5.5	9.1	16.0	53.5	6,930
	Secondary	5.5	8.2	14.5	49.0	16,270
						23,200

*Primary/Secondary distinction did not exist prior to 1975.

Source: Ref. 15 and internal records of Saskatchewan Highways and Transportation.

Several special provisions or exceptions apply to the weights shown in Table 2:

4. During the winter period, December 1 to the last day of February, the allowable axle weights on Saskatchewan highways are increased by 10%. This program was started in 1979.

5. Under the DHT's "bulk commodity policy" special higher vehicle weights and dimensions are allowed for shipments of more than 30,000 tonne per year provided the shipper pay part or all of the incremental road damage costs depending upon economic benefits to the province, presence of rail competition, etc. The current bulk haul agreements cover the following commodities: 1) potash, 2) sodium bentonite, 3) diesel fuel, and, lime and general freight to AMOK mine site, 4) lime, propane, petroleum, sulphur and anhydrous ammonia to Key Lake mine site 6) coal and 6) timber. The bulk commodity policy was instituted in January, 1980. (12)

6. Overweight trucks hauling indivisible loads are allowed on individual permit basis.

3. Rationale for Extending the Primary Highway System

3.1 Decision Making Criteria

In spite of the above mentioned exceptions to the weight regulations, there were many communities and industrial sites that missed access to primary highways by a short distance (see the pre-June 1985 system in Figure 1). Complaints from the affected communities and industries and trucking companies, combined with the government's desire to extend the benefits of reduced transportation costs to a larger segment of the Saskatchewan economy prompted the primary highway extension study in 1984. It is an accepted principle that most public policy decisions regarding transportation have traditionally been based on a combination of technical/quantifiable factors and non-technical/policy/political/regional development factors. The decision to extend Saskatchewan's primary highway system was no exception to this rule.

The general objectives for the 1984 primary highway extension study were:

- to maximize benefits to the trucking industry, shippers and the general economy
- to minimize pavement upgrading and rehabilitation costs to DHT
- to maximize the number of communities and industrial sites served, and
- to preserve system continuity and logic.

After a tentative but exhaustive discussion and study by a committee of DHT officials, these objectives were translated into the following criteria most of which had to be met by the link or a combination of links to be added to the primary highway system:

The technical criteria were:

1) Benefit/cost ratio: the benefits to the trucking industry of increasing allowable weights must exceed the incremental cost of highway maintenance and rehabilitation due to heavier truck loadings.

2) The route must have bridges of sufficient strength to withstand the heavier loads.

3) To minimize upgrading, a substantial portion of the route must have an intermediate pavement or better standard. Thus, no highway with a gravel or oil-treatment surfacing should be considered.

4) The average daily traffic should be greater than 500 vehicles per day.

The non-technical criteria were:

1) All towns with a population of 2,000 or greater are to be provided with access to the existing primary system.

2) The routes must provide all designated industrial sites with access to the primary highway system. The major sites are associated with forestry, agriculture and mining industries that are involved in bulk commodity hauling. Forest industries include raw and manufactured products; agriculture industries include dehydrating, pelletizing, peat moss and malting plants; mining includes salt, bentonite, clay, sodium sulphate and potash.

3) Preference should be given to routes that provide international, interprovincial and intercity connections.

4) Provide system continuity.

Estimation of benefits and costs is presented below. A detailed discussion of other criteria is not presented. Suffice to say that many of the initial candidate links obviously met all of the criteria, while others required a more in-depth examination, and use of engineering and planning judgement. The 3,750 km added to the primary highway system shown in in Figure 1 on the whole satisfied most if not all of the criteria.

3.2 Benefit-Cost Considerations

Estimation of Benefits. Most of the equipment currently used by the trucking industry is designed to operate at primary highway weights. When this equipment is operated on secondary highways, the payloads are reduced by the amount required by the lower allowable gross vehicle weights. As a result, if the allowable weights on the secondary highways were increased to those now applicable on the primary highways, maximum payloads on the secondary system would increase by the amount that the allowable GVW's were increased, thus allowing a payload increase of up to 15 percent (see Table 3).

Quantification of the benefits to Saskatchewan trucking industry of extending the primary highway system was undertaken for DHT by Sparks, Duffee and Associates (13, 14). Their studies indicated the movement at primary weights would result in overall decrease in transport costs of about 10 percent.

Based on a survey of trucking companies in Saskatchewan, the total benefit of extending the length of the primary highway system by 3,750 km was estimated at $2.1 million in 1984 dollars. As shown in Table 4, the potential benefits tend to be associated with a relatively small number of major commodity movement.

Table 3

Payloads at Primary and Secondary Gross Vehicle Weights

Truck Type	GVW		Payload		
	Secondary Hwys.	Primary Hwys.	Secondary Hwys.	Primary Hwys.	Increase
	..... kg				%
5-axle semi	34,500	37,500	20,000	23,000	15
Combination Unit	49,000	53,500	30,000	34,000	13

Table 4

Distribution of Benefits of 3,700 km Extension of the Primary Highway System

Commodity	% of Total
Gasoline and Diesel Fuel	25
Grain	23
Fertilizer	18
Asphalt and Road Oils	10
General Freight	6
Anhydrous Ammonia	4
Lumber	3
Woodchips	3
Cement	3
Plywood and Aspenite	3
Twine	1
Bricks and Blocks	1
Fish	1
Total	100

Estimation of Incremental Highway Costs. The service lives of highway pavements are influenced by axle weights and the number of axle repetitions. Highways are designed to withstand a specific number of load repetitions of a specific magnitude for a selected future time period. This section briefly describes the procedure used to calculate costs incurred by the highway system from higher weight limits.

Due to the increase in GVW and payload per truck with primary highway weights the total number of truck trips and axle repetitions would be reduced assuming that the total tonnes hauled remains the same. However, the damage factor of truck axles would be increased with primary highway weights. The net effect is an increase in the equivalent axle repetitions per year on each kilometre of highway.

Details of the costing method used in this study are discussed elsewhere (9). In summary, only the incremental costs were counted, that is the difference between upgrading, resurfacing and maintenance required at primary weights and those required at secondary weights. The incremental costs, based on a 15 year pavement design life, was estimated at $1.0 million per year in terms of 1984 dollars.

4. Discussion

The benefit-cost ratio of greater than 2:1 provided the economic rationale for extending Saskatchewan's primary highway system from 3,180 km to 6,930 km. Equally if not more important are other socio-economic and regional development benefits. The new primary system provides an additional 13 communities with a population of 2,000 or greater with access to higher weight limit highways as well as numerous small communities and several industries.

The primary extension will have a positive impact on agricultural, trucking and petroleum industries as well as individual communities due to the reduced transportation costs. It is reasonable to assume saving in transportation costs will ultimately be passed onto the public in terms of reduced prices of goods. The higher weight limits create a potential for expansion of market areas leading to increases in business activity and employment. In addition, more uniform weights across the country will reduce transportation costs for interprovincial movements.

Further research to determine impact related to social, environmental and safety concerns, geometric design and bridge costs is required.

6. Acknowledgements

The authors gratefully acknowledge the use of information from the studies conducted by Sparks, Duffee and Associates for Saskatchewan Highways and Transportation and assistance of DHT officials Garry Heiman and Dennis Day. The opinions expressed in the paper are those of the authors and do not necessarily represent policies or opinions of Saskatchewan Highways and Transportation.

References

1. U.S. General Accounting Office, "Excessive Truck Weight: An Expensive Burden We Can no Longer Afford:, Report No. CED-79-94, G.A.L., Washington, D.C., 1979.

2. Organization for Economic Development, "Impacts of Heavy Freight Vehicles", Paris, OECD, 1983.

3. U.S. Department of Transportation, Federal Highway Administration, Report of the Secretary of Transportation to the Congress, "Final Report on the Federal Highway Cost Allocation Study", Washington, D.C., U.S. Government Printing Office, 1982.

4. American Association of State Highway and Transportation Officials, "A Review of Effects of Truck Weights on Pavement Deterioration (Texas Transportation Institute, and Causes of Pavement Damage on Interstate Highways (Counsel Trans)", Washington, D.C., AASHTO, 1982.

5. Nix, F.P., et al, "A Study of Vehicle Weight and Dimension Regulations and Canada's Trucking Industry - Background Papers 1 and 2", Ottawa, Transport Canada; Transportation Development Centre, 1985.

6. Clayton, A.M. and Nix, F.P. "Effects of Weight and Dimension Regulations: Some Evidence from Canada", Paper presented at the 65th Annual Meeting of the Transportation Research Board, Washington, D.C., January 1986.

7. Roads and Transportation Association of Canada, "Vehicle Weights and Dimensions - Bridge Capacity Study", Ottawa, RTAC, 1980.

8. Hassan, M.U. and Said, G.M., "Management of Highway Investment in a Low Population Density Environment: The Saskatchewan Endeavour", RTAC Forum, Vol. 4, No. 2, 1981.

9. Wyatt, J.J. and Hassan, M.U., "Overweight Trucks: Incidence, Costs to the Highway System, Enforcement and Compliance". Transportation Forum, Vol. 1, No. 3, 1984.

10. Government of Saskatchewan, Bureau of Statistics, "Economic Review 1985", Regina, 1986.

11. Saskatchewan Highways and Transportation, Systems Branch, Personal Communication, Regina, 1986.

12. Saskatchewan Highways and Transportation, Systems Branch, "Bulk Commodity Policy", Regina, 1985 (Unpublished).

13. Sparks, G., Couturier, R.P. & Clayton, A., "Increasing Allowable Gross Vehicle Weights on Secondary Highways", Proceedings, CTRF, Regina, June, 1983.

14. Sparks, Duffee and Associates, "Benefits of Extending Primary Weights to Secondary Highways", Regina, Saskatchewan Highways and Transportation, 1984. (Unpublished)

15. Saskatchewan Highways and Transportation, "A Guide to Saskatchewan Vehicle Weight and Dimension Regulations", Regina, December, 1985.

FINANCING TRANSPORTATION INFRASTRUCTURE ISSUES AND FUTURE DIRECTIONS

by

Prof. B.G. Bisson, P.Eng.
UNB Transportation Group
and
Prof. A.M. Stevens, P.Eng.
UNB Transportation Group

1.0 Introduction

Canada, like many developed countries, built much of its transportation infrastructure following World War II and in particular, during the late 1950's and through to the 70's. During much of this time interest rates were low and inflation high. Accordingly, due to the aging of the infrastructure, the burdens associated with ongoing maintenance, rehabilitation, replacement and extension is growing.

The questions of sustaining acceptable levels of transportation infrastructure quality and quantity have become increasingly important public policy issues as governments impose tighter budgetary constraints. Many experts believe that our infrastructure is in a state of disinvestment due to underfunding. Also, some are of the view that the generation of revenues from users of the transportation system through user charges is both inadequate and inequitable. The essential questions are: How much is enough? and who should pay?

This paper begins with the premise that Canada is facing major problems in financing its transportation infrastructure now and in the future. The focus of the paper is on the highway system since it represents a large proportion of total public expenditures on transportation and is the sector which affects nearly all aspects of contemporary society. The paper examines some of the critical choices and issues which must be addressed in the formulation of any future financing strategy. Although the highway system is used to illustrate the points which are discussed, the issues are nonetheless relevant to all publicly financed infrastructure.

The authors believe that it is very timely to explore and debate the question of transportation

finance. We are at another crossroads in the evolution of transport policy in Canada. The recent regulatory reform initiatives proposed by the Minister of Transport have fostered a major re-examination of transport policy from a multi-modal perspective. A strong market force mentality has been introduced into the thinking about how the transportation system should function and finance itself. The federal government is committed to major reform in the area of taxation. Perhaps of greatest importance is the undeniable fact that governments at all levels are struggling to find means to match revenues with expenditures and reduce deficits. It is now not only the time to pay as you go but also to pay for the ride we are enjoying. Taken together, these events and policy thrusts suggest a need to re-examine some of our traditional approaches to financing what is certainly one of the most critical components of our national economy - the transportation system.

2.0 HIGHWAY FINANCE IN CANADA

Canada, owing to its geography, has a very extensive road system, which measures almost 1,000,000 km in length. Almost one-third of the length of all roads is paved.[1] It should always be kept in mind that while there are long trips and goods movements on this system, the bulk of the traffic is composed of trips and movements under 50km in length. Sutherland and Hassan in their paper entitled "An Overview of Canada's Road Transportation Requirements to the Year 2000" estimated the number of kilometers of road under the jurisdiction of each level of government as shown in Table 1.1 below.

Table 1.1

Estimated Public Road Lengths and Administrative Jurisdictions in 1981

Jurisdiction	Kilometers	% of Total Kilometers
Provincial	322,500	33.4
Federal	201,000	2.1
Urban Municipalities	102,100	10.6
Rural Municipalities	520,200	53.9

Source: See Reference 1

In 1981/82 the provinces and territories expended a combined total of almost $4,000,000,000 on highways.[2] The provinces of Ontario, Quebec, Alberta and British Columbia accounted for in excess of 75% of the total expenditure.[2] In the same year the federal

government spent only $211,000,000 of which $152,000,000 was allocated to purely federal highways, whereas $59,000,000 was used in support of provincial highway programs.[2]

Highway-related revenues collected by provincial governments from motive fuel taxes and from vehicle licenses totaled almost $3.9 billion dollars in 1981/82.[2] In that year highway-related revenues exceeded highway expenditures only in the provinces of Quebec and Ontario. All other provinces spent more on highways than they collected in these user charges.

An important feature of highway finance in Canada is that highway user fees are considered general revenue and are not earmarked for highway budgets. The result is that the amount of revenues generated in any year have little bearing on the funding received by a highway agency. In the U.S., dedicated funding is popular. At the federal level, the Highway Trust Fund was established in 1956 primarily to finance the Interstate System.[3]

In certain regions of the U.S. there has been reliance on highway tolls to finance major highway facilities. Road tolls have not been extensively used in Canada other than in the province of Quebec. However even in this province the government recently decided to remove the tolls from its toll roads.

Although numerous highway needs studies have been done and attempts have been made by various organizations to project future funding requirements for highway construction and maintenance in Canada, it is not the purpose of the this paper to attempt to quantify the extent of the financial problem, since any projection would be debatable from a number of perspectives. The objective is to develop a framework which summarizes the major choices and issues which must be addressed in developing a financial strategy for the future of our transportation system.

3.0 Highway Finance - A Conceptual Framework

Highway finance can be expressed in simple terms as outlined below:

(1) What future level of funding is needed for the highway system?
(2) Who should provide the funds and how much should each of the providers of funds contribute?
(3) How should the funds be collected and allocated?

The questions are simple and easy to understand. However the answers are complex and each question raises a myriad of difficult public policy issues. Figure 1 provides an overview of the public policy choices and issues which must be considered in the

FIGURE 1
HIGHWAY FINANCE - A CONCEPTUAL FRAMEWORK

	Future Funding Requirements	Who Pays? How Much?	Funding Mechanisms
Issues:	- Needs assessments - Jurisdictional problems - Changes in the vehicle fleet - Restoration/extension - Political considerations	- Total long-run costs - "winners" and "losers" - Non-users contribution? - Equity considerations - Efficiency considerations - Full cost recovery?	- Cost measurement - Cost assignment - User charge instruments - Institutional structure
Strategies:	- Alter design standards - Demand management - Pavement/maintenance management - Value engineering - Staging of enhancements	- "Pay-as-you-go" pricing - Short-run marginal cost pricing - Long-run marginal cost pricing - Access charges - "Value of service" pricing	- Taxation - Tolls/fees - Credit financing - Public/private partnerships
Impacts: of Strategy	- Transportation Costs - Industry competitiveness - Development patterns - Regional disparities - Economic growth - Standard of living	- Public versus private investment - Competitive equity between modes - Utilization of infrastructure - Composition of vehicle fleet - Mobility - Safety/Environmental - Inflation/Employment	- Equity - Stability of funding - Long-range planning - Political feasibility

formulation of financial strategy.

In the remainder of this paper the conceptual framework provided in Figure 1 will be described in detail. At the conclusion of the paper views of the authors as to the critical requirements for highway finance in Canada in the future will be summarized.

3.1 Future Funding Requirements

3.2.1 Issues

Given the numerous government jurisdictions involved in the construction and operation of streets and highways, it is impossible to obtain future needs assessments which are prepared on a consistent basis. Notwithstanding this problem, the development of a needs assessment is a complex task even for a single jurisdiction. What level of service standards should be used in determining the timing of future capacity improvements? What ride comfort standards should be used in determining the timing of future pavement resurfacing projects? These are only two of a multitude of choices which will necessarily affect both the timing and magnitude of highway investments.

The demand side of the question is also difficult to address. For example, what will be the future composition of the vehicle fleet on the highway system? The future size and performance characteristics of automobiles will clearly have a significant impact on capacity utilization. Furthermore, changes in the provincial vehicle mass and dimension regulations will impact upon the characteristics of the trucking fleet. A major public policy issue in this respect which is currently being debated, is the question of whether large tractor-trailer trains should be permitted on the highways. If these vehicles are indeed allowed to operate in the future, they will have a significant impact on the volume of truck traffic, highway costs and truck-rail competition.

Another crucial consideration in the future level of highway funding will be the degree to which emphasis is placed on restoring and rehabilitating existing infrastructure as opposed to constructing new highways. Some experts believe that Canada's highway system is now relatively mature and that future investments will be focused primarily on restoring the existing system. However, significant portions of the Trans Canada Highway system are still only two lanes. Furthermore, highway expenditures have traditionally been of considerable interest to politicians, who prefer to cut a ribbon at the official opening of a new facility rather than at the unveiling of a recently patched pothole. The essential point here is that, irrespective of the technical basis of any future needs assessment, it is clear that future patterns of expenditures will be

largely dependent upon the degree of political interest in highway improvements. The point is made because of the fact that the kinds of improvements which will increasingly be needed in the future will be less appealing to politicians than the construction of the Trans Canada highway system was in the 1950's and 1960's.

3.1.2 Strategies

Highway administrators can adopt numerous strategies to influence future investment requirements in the highway system. While none of them are new, it is fair to say that they have not yet been widely used, simply because most of the system was built during the economic boom years of the 1960's. However, as funds become increasingly scarce, they are receiving greater attention.

One of the most obvious strategies for reducing highway expenditure requirements is to alter level of service standards. Pursuit of this strategy not only affects the magnitude of investments but also their timing and therefore opportunity costs.

Demand management concepts whereby attempts are made to shift patterns of demand from peak to off-peak periods through various mechanisms such as pricing and staggering of work hours, etc. have been receiving greater attention as a means of rationing capacity.

Highway engineers are finding many ways to make better use of existing resources. Developments in computer hardware and software have fostered the evolution of pavement and maintenance management concepts. The capability of highway engineers to optimize designs, evaluate maintenance strategies, perform life/cycle costing analysis and "what if" sensitivity analysis, has greatly improved with the availability of modern electronic data processing tools.

"Value engineering" has become popular as a means of exploring alternative ways of accomplishing objectives and performing required functions at a lower total life/cycle cost without sacrificing quality.[4]

Staging of highway capacity and strength improvements has become an attractive proposition. Deferring such investments by finding less expensive interim capacity and strength solutions can generate significant savings in capital costs.

The strategies which have been described above are of little value in terms of predicting future funding requirements for the highway system on a national basis. They do serve to illustrate however that decision makers have considerable latitude in influencing highway

expenditures. The question of how much is enough is therefore very much a function of the posture adopted by the various jurisdictions with respect to these potential strategies. The resulting dilemma is how do you develop an appropriate cost-recovery strategy when the magnitude and timing of future costs is so uncertain. This matter is addressed in the next section of the paper.

3.1.3 Impacts

The future allocation of resources to the transport sector and in particular to the highway system will have significant flow-through effects on the Canadian economy. Clearly, transportation costs will be impacted by the quality of the infrastructure. It follows that the competitiveness of industries which are sensitive to transportation costs will in turn, be affected by the level of investment. Development patterns nationally, regionally, and locally may shift depending upon the strategies adopted by the three levels of government in each region of Canada. Accordingly, regional disparities may be either reduced or re-inforced.

The ultimate manifestation of all of the impacts of investment in transportation infrastructure, is the standard of living which can be sustained in this country. While transport investment is not the sole determinant, there is without question a strong dependence of the economy on the transportation system.

3.2 WHO PAYS/HOW MUCH?

3.2.1 Issues

It should be recognized that the future expenditure requirements associated with continued development and operation of the Canadian highway system will be less than the total costs attributable to the system. Economists argue that all real costs should be accounted for within the highway planning and financing framework. These include depreciation of the system, opportunity costs of investment in highway facilities, externalities (eg. noise and air pollution) and tax expenditures (eg. services of the goverment for which the highway sector is exempted from paying).[5]

The double-barrelled question of who pays/how much is certainly the most controversial aspect of highway finance. No matter what approach is taken in the future relative to the status quo, "winners" and "losers" will be created. It will therefore be very difficult to obtain consensus on an appropriate course of action from the numerous interest groups which will be affected. From a public policy perspective, certain critical issues must be addressed in the design of a cost-recovery system.

What proportion of the total costs should be borne by non-users who benefit indirectly from highways? Most economists argue that even though non-users benefit from the consumption of highway services, this is not sufficient justification for asking them to pay for highways. There are many examples in the private sector where consumers benefit indirectly from products/services which they do not purchase. It is argued that there is no justification for dissimilar treatment in the public sector.

Equity considerations tend to dominate public debate of proposed user charges. "Horizontal" equity is maintained when vehicles which are alike in terms of physical and trip characteristics are treated equally. "Vertical" equity suggests that users which create more costs and/or derive more benefits from the use of the highway system should pay more. The concept of vertical equity can be extended to include consideration of the relative "ability to pay."

Two important points need to be emphasized with respect to incorporating equity concepts into the design of a cost-recovery system. First, the technical basis for assigning costs (particulary pavement costs) to classes of users is weak and the development of improved empirical cost relationships is a long-term research problem. Second, given the political sensitivity of public user charges, the "ability to pay" aspect of equity will be a major factor in the acceptability of any user charge scheme.

User charges are also very closely linked to the concept of economic efficiency. Economic theory suggests that efficient utilization of existing highway facilities will result when users pay prices equal to the marginal cost of a trip. Theoretically, efficient prices will also guide future investment decisions.

The key efficiencey issue is, what degree of cost-recovery should be sought through user charges. There are many classical economic arguments which support full cost-recovery. Equal treatment of all modes of transportation, and, neutrality between public versus private sector investment are two such reasons which are receiving heightened attention because of the regulatory reform movement and the federal goverment's stated objective of relying to a greater extent on the private sector as the "engine" of growth in the economy. Clearly, given a market-oriented approach to the provision of transportation services, a user charge system which does not come close to recovering the full costs of the system, has the potential to create severe economic distortions.

It is often argued that some portion of highway costs should be supported by the general tax base because highways provide a public service and create jobs. However, the importance of maximizing efficiency

in the highway system must be recognized in public policy because of its impact on the economy. Road user charges which are too low can lead to significant economic waste. Excessive investment in the highway system to support activities whose costs exceed resultant benefits, will have a negative effect upon such factors as employment and inflation in the longer term.

3.2.2. Strategies

Several strategies can be pursued in the design and implementation of a user charge system. While the "status quo" is an alternative, it will not be discussed, because as stated at the outset, this paper begins with the premise that our traditional approaches to highway finance in Canada are no longer appropriate.

In the United States, the "pay-as-you-go" approach to highway user charges has been widely used. Under this philosophy, an attempt is made to generate sufficient revenues each year to cover the planned expenditures of the year. A conceptual weakness of this approach is that only current expenditures are treated as costs. Accordingly, factors such as negative externalities and opportunity costs of highway investments are not reflected in the user charges. Hence, users do not incurr the full costs associated with their usage of the highways. The "pay-as-you-go" approach is therefore a poor substitute for a full cost recovery system.

A marginal-cost pricing strategy sets prices at the short-run marginal costs associated with usage of the highway. Typical short-run marginal costs are pavement wear, vehicle interference (congestion, accidents) and negative externalities such as noise and air pollution.[5] There are two major problems posed by a marginal-cost pricing scheme. The development of a sound technical basis for estimating and allocating marginal costs to users is an extremely difficult task. Futhermore, devising an effective and feasible method of collecting charges related to these costs is also a major challenge.

It is also possible to set prices on the basis of long-run marginal costs. The notion here is that all costs are variable in the long-run. Prices based soley on short-run marginal costs do not account for future investments which will be needed and therefore are sending misleading signals to the users of the system about the true costs of transportation. Despite its intuitive appeal, most economists agree that there are better means of dealing with long-run marginal costs than by basing a user charge scheme on such costs.[5]

If prices are set at short-run marginal costs, the likelihood is that the revenues generated will not

recover full costs. The difference, normally referred to as "residual" costs can be captured through other mechanisms such as access charges. Access charges are "fees levied as a condition of access to the highway system, but which do not vary directly with actual usage by the individual vehicle."[5] Economists often use so called "Club Theory" when discussing access charges in relation to the highway system. Club Theory suggests that highway users are in effect, members of a club. Registration and license fees are simply membership fees to join the club. The membership fees are designed to cover residual costs and can be set in accordance with supply and demand conditions.

"Value of service" pricing represents yet another possible strategy. It is based on the premise that users should pay in proportion to the benefits they derive from usage of the highway system. The weakness of this approach is that users are unable to weigh the benefits of usage against the marginal costs. However, "value of service" pricing can be useful in the establishment of access charges as well as in pricing schemes designed to reduce congestion. For example, user charges during peak periods might be higher to reflect the increased value of travelling during that time period.

The road user pricing strategies described above are by no means exhaustive and they are not mutually exclusive. However, it is clear that whatever strategies are pursued in the future, the impacts on the transportation system and the economy will be enormous.

3.2.3 Impacts

User charges will affect the relative balance in public versus private investment. They will influence competitive equity between the different modes of transportation and the utilization of highway infrastructure both in terms of traffic volumes and the composition of the vehicle fleet. As a consequence, important social factors such as mobility, safety, energy consumption and environmental impacts will also be sensitive to both the magnitude and structure of user charges. Given the large expenditures which are made on the highway system each year, and the massive investment which is already in place, the flow-through effects of efficiency gains realized by more effective road user pricing are, to say the least, crucial to the economy.

3.3 FUNDING MECHANISMS

3.3.1 Issues

The administrative processes of collecting and allocating funds are an integral component of the design

of a highway finance framework. Three major issues must be addressed in this regard.

Given the need to know both the short-run marginal costs associated with highway usage and the total long-run costs of the system, it is evident that both cost measurement and cost assignment to vehicles and classes of vehicles poses a major challenge. With respect to cost measurement, the point has already been made that considerable research is needed in the area of cost causality for both pavement and capacity related costs especially with respect to large trucks and tractor-trailer combination vehicles.

The state-of-the-art in terms of assignment of costs to classes of users and vehicles within classes is somewhat more advanced. Various measures such as passenger car equivalents and equivalent single axle loads have been developed. Notwithstanding this progress, further reseach into refinement of these measures and development of others would be beneficial. It follows therefore that one of the major tasks in the design of a highway finance framework will be the identification of critical research needs to improve the precision of cost measurement and equity of cost assignments.

Another critical public policy issue is the choice of appropriate user charge instruments to recover costs. The types of user charge instruments which are chosen should be governed by the category of cost that is being recovered. For example, a weight-distance task might be appropriate for the recovery of pavement-related costs whereas some form of highway toll might be better suited to congestion costs. Two other considerations in devising appropriate user charge instruments are: 1) they must be legal and 2) easy to collect and administer.

The introduction of legislation to legalize new user charges will undoubtedly focus public attention on the issue and create considerable resistance to change. Therefore, an effective communciations strategy will be extremely critical to the implementation of a modified approach to highway finance.

The matter of ease of collection and administration places constraints on the range of alternative user charge instruments that can be considered. However, recent technological developments such as the introduction of electronic road pricing in Hong Kong and the use of satellite technology to track vehicles, offer new hope in the area of administration of user charges.

A third critical issue relates to the institutional structure for highway finance. What should the roles and responsibilities of each level of government be with respect to setting and collecting user charges as well as allocating funds which are generated? Should the

funds which are collected from user charges be earmarked for highway expenditures in some form of trust fund or should they be deposited to general revenues?

Delineation of roles and responsibilities for the different levels of government with respect to highway finance is a difficult question in Canada. Although a case can be made for a strong federal role because of the desirability for consistency in user charges across the country, the administration of roads in Canada has for the most part been a provincial responsibility and to a lesser extent, local and municipal governments. The cost-recovery system should undoubtedly allow for some flexibility to build local conditions into user charges. However, the need for a consistent national approach is crucial. Therefore, the federal government should at a minimum play a co-ordinating role in the development of the financial framework.

The concept of a dedicated highway fund financed by road user charges is appealing from a number of perspectives. Such a fund would provide for a stable source of financing and would therefore facilitate long-term planning. Investment decisions could be made within the context of a longer-term fiscal framework. Financial discipline and accountability would be improved.

Despite these advantages, the concept also has some drawbacks. The earmarking of funds reduces the flexibility of government in setting budgets. Furthermore, some of the user charge revenues which would be collected under a marginal cost pricing scheme (eg. charges for noise and air pollution, accidents) should probably be deposited to general revenues as these costs have minimal impacts on highway expenditures. Another major constraint is the highly decentralized approach to highway administration which exists in Canada.

On balance, some version of a national fund warrants consideration. Perhaps portions of certain user charges could be deposited to a national fund to finance transfer payments to the provinces for the Trans Canada Highway system. Some form of national depreciation accounting procedure could be used to determine the amount of funds which should be deposited to a national trust fund each year.

As stated previously, general tax revenues have been the primary source of financing for highways in Canada. Road user charges for the most part have been limited to motive fuel taxes and vehicle license and registration fees. Several alternative financing methods could be considered in the future.

The Gramm-Rudman legislation in the U.S. has stimulated considerable interest in the development of innovative schemes to finance transportation infrastructure. The fiscal policy and tax reform

thrusts of the present federal government in Canada should also spawn activity in this area.

Use of the taxing powers of governments to raise monies for highways has its limitations. New taxes will be strongly opposed particulary if they are regressive with respect to income. The most interesting development in the field of highway use taxes has been the emergence of so-called weight-distance taxes in several states in the U.S. These taxes have proven to be attractive for two major reasons. First, revenues from motive fuel taxes have suffered from improved fuel consumption performance by the vehicle fleet. Second, weight-distance taxes are considered to be equitable because they tax the outputs of a trip rather than the inputs and they more closely approximate the true costs occasioned by the trip. Considerable progress has been made in resolving the problems of collecting these taxes. Given the equity and fund generation weaknesses of motive fuel taxes, it may be timely to carefully examine the potential application of weight-distance taxes in Canada.

As indicated earlier, highway toll financing has been extensively used in the U.S. but not in Canada. Again, some consideration should be given to this alternative in specific applications. Although public attitudes towards tolls are not good because travel on highways is generally taken for granted to be free, one of the most attractive features of tolls is that they could be used to achieve other objectives such as reducing congestion during peak periods. In this application, they not only generate revenues but also ration capacity. Although wide-spread use of tolls cannot be anticipated, they should not be ruled-out as a demand management tool.

Credit financing of highway facilities is not uncommon in the U.S. The usual procedure is to finance construction with revenue bonds backed by the projected revenues from tolls which are also expected to fund operation and maintenance. Some very innovative methods of credit financing have recently emerged in the U.S. For example, some states are providing front-end financial assistance to help revenue-generating projects get off the ground. This "seed money" encourages the supply of debt capital to highway construction projects by overcoming one of the typical problems of highway projects - ie. most of the costs are up front whereas the revenues tend to be downstream. With the front-end problem resolved, the revenue generating capability of a toll way can be harnessed to produce the funding for the remainder of the project.[6] In Canada, the opportunities for tollway facilities are somewhat more constrained due to the relatively low traffic volumes on many of our roads. However, there are undoubtedly some opportunities for effective use of toll financing.

A fourth alternative method of highway financing is to attempt to involve the private sector. In the U.S., numerous examples of public/private partnerships in the finance of highway projects have emerged. In Texas, two new concepts have recently been introduced - ie. transportation corporations and road utility districts.[7] Transportation corporations involve private landowners and developers in the conduct of engineering studies and in donations of right-of-way. Road utility districts are given authority to issue bonds supported by property tax levies for local roads. These are only two of many examples throughout the U.S. of greater private sector participation in the finance of public projects. Again, given the federal government's stated goal to look to the private sector to solve many of our economic problems, it is no doubt opportune for governments at all levels to begin finding ways to pursue strategies of this nature.

3.3.3 Impacts

There are three major impacts of strategies adopted with respect to methods of highway financing. First, to the extent that taxation and toll way financing are pursued, equity impacts will be critical. The challenge is to design mechanisms which are not regressive and which will achieve public policy objectives. Second, both the methods of financing, and, the institutional structure for administering highway finance will affect the stability of funding available for the system. This, in turn, will impact upon the certainty and reliability of assumptions for long-range planning. Third, given the strong public opposition to more taxes and user charges, the political impacts of alternative financing strategies will be considerable.

4.0 CONCLUSIONS

A transport policy which promotes greater reliance on market forces to achieve increased efficiency and lower unit costs in the transportation system has probably outmoded our existing system of highway finance. Significant market distortions may materialize if we continue to rely on a user charge system which does not expose users to the true costs associated with their use of transportation infrastructure.

In designing a new financial framework, a major challenge will be the achievement of an appropriate balance between equity and efficiency considerations. Maximizing efficiency in the highway system is of paramount importance because of its pervasiveness in supporting economic activity. However, equity considerations, particularly ability to pay, will have a major influence in shaping public policy with respect to

highway finance.

The arguments in favour of moving in the direction of a full cost-recovery system are convincing, particularly in view of our market-oriented approach to transport policy. The major challenge in this regard is to improve our ability to measure and assign the costs related to the use of the highway system. To be sure, much research is needed to improve the precision of cost measurement and assignment. However, even if we never achieve full cost-recovery, there is considerable benefit in knowing what the true costs are.

The institutional structure for highway finance warrants investigation. The federal government should assume a leadership role in co-ordinating the development of a new financial framework for the country. Concepts such as a national trust fund, funded by user fees generated by selected instruments, should be considered as a means of financing the Trans Canada Highway system.

The budgetary constraints and battles with deficits which have preoccupied governments in the recent past, have stimulated innovation with respect to the development of new instruments to finance public infrastructure particularly in the U.S. Similar innovation should be encouraged in Canada and should be part of the federal government's overall policy initiatives in the area of tax reform.

The development and implementation of a new framework for highway finance in Canada must begin with agreement on the principles upon which such a framework should be based. Given the many conflicting interests involved, it will be extremely difficult, if not impossible, to forge a consensus on an appropriate set of principles. Ultimately governments will have to decide on a direction, hopefully one which will serve the public interest for many years to come.

LIST OF REFERENCES

1. Sutherland, J.R., and Hassan, M.U., "Road Transportation Requirements to the Year 2000", Proceedings of the 18th Annual Meeting, Canadian Transportation Research Forum, June, 1983, Regina, Saskatchewan, pg. 1-10.

2. "Background Information on Highway Financing", prepared by the Highway Branch, Transport Canada, March, 1985, pg. 2.

3. "The Case for Competitive Equity: Rails, Highways, and Public Policy", Association of American Railroads, November, 1979, pg. 2.

4. "Managing State Highway Finance", National Co-operative Highway Research Program, Transportation Research Board, Washington, D.C., pg. 9.

5. Lee, D.B., "Methods for Allocating Highway Costs", Staff Study, U.S. Department of Transportation, Cambridge, Massachusetts, April, 1981.

6. Miller, C., "Current Issues in State and Federal Tollway Systems Program", The 65th Annual Meeting of the Transportation Research Board, Washington, D.C., January, 1986.

7. Euritt, M.A. and Walton, N.C., "Alternative Roadway Financing Methods: National Examples and Recent Experiences in Texas", The 65th Annual Meeting of the Transportation Research Board, Washington, D.C., January, 1986.

A Measure of Vessel Utilization: Its Implications for Fleet Requirements

G.C. Shaw
Faculty of Administrative Studies
York University, North York, Ontario

1 Introduction

This paper describes a method for estimating the total amount of empty travel time that may be expected for either a vehicle, or a fleet of vehicles, to move any forecasted amount of cargo within a matrix of origin and destination stations. While, we apply the method to Canadian-registered drybulk vessels on the Great Lakes, it is also applicable to other transport modes and geographical regions.

This Canadian drybulk shipping fleet is an important, albeit specialized, part of the Canadian transportation industry. In 1984, these vessels generated almost as many tonne-kilometres of cargo as did CP Rail. However, a only a few commodities are involved with grain, iron ore, coal, salt and stone producing about 90 percent of the total vessel tonne-miles.(1)

As important commodity flows has been that of grain from Thunder Bay or Duluth on Lake Superior, or Chicago or Milwaukee on Lake Michigan, eastward through the Great Lakes to Montreal, Quebec, Baie Comeau or Port Cartier on the St. Lawrence River. While some of this grain moves to Montreal for domestic use, most is transhipped to ocean vessels for export. The empty lake vessel, usually then, sails empty to either Port Cartier or Sept Iles, also on the lower St. Lawrence River, to load iron ore for the Canadian steel plants at Hamilton on Lake Ontario or to American steel mills or ore receiving ports on either Lake Erie or Lake Michigan. Other major commodity flows include that of iron ore from Lake Superior ports to the Canadian steel mills at Sault Ste. Marie, Nanticoke and Hamilton. Coal moves from various United States ports on Lake Erie to the aforementioned Canadian steel mills and to the Ontario Hydro thermal power generating plants at Nanticoke, Port Credit and at Courtright near Sarnia. Canadian, that is Alberta,

coal also moves from Thunder Bay to Nanticoke. Salt is carried from the Canadian ports of Goderich and Windsor to many Canadian and American Great Lakes ports while stone moves from Northern Michigan to the Sarnia/Windsor area, from Colborne to Clarkson on Lake Ontario and from Badgeley Island on Georgian Bay to Midland and to other destinations.

There are two types of Great Lakes drybulk ships: bulkers and self-unloaders. The bulkers consist of a series of cargo holds into which the cargo is poured from above and which are unloaded with shore-side equipment. The self-unloaders are equipped with a series of endless belts which bring the cargo from the ship's holds to an unloading boom on the main deck which, in turn, deposits the cargo ashore. The bulkers are usually used for the longer voyages involving grain to and iron ore from the lower St. Lawrence ports. Grain is unloaded easily with modern elevator equipment and, while the self-unloader's equipment might accelerate the unloading of the return iron ore, it would be only used once in a 20 day two-way voyage. The self-unloaders, therefore, are used mostly on the relatively short voyages involving coal, salt and stone cargoes.

Three sizes of vessels are considered in this study; these are designated as follows:

Large: over 213 metres or 700 feet long,
Intermediate: between 153 and 213 metres, or 500 to 700 feet long,
Small: under 153 metres or 500 feet in length.

The large vessels tend to be the newer ones; most were built since the opening of the St. Lawrence Seaway in 1959. The intermediate vessels tend to be older; most are used in the secondary grain trades such as from Thunder Bay to the Georgian Bay ports. There were some intermediate sized self-unloaders built in the late 1960's for the salt and stone cargoes. The remaining small vessels are all bulkers; most carry salt and various cargoes involving ports in the Gulf of St. Lawrence and Newfoundland.

2 The Definition of the Allocation Ratio

The total time required for a vessel to carry a specified cargo consists of the following four parts:

1. the time required to sail empty from the discharge port of the previous cargo to "A" the loading port of the current cargo;

2. the time spent at "A", both waiting for a berth and loading the cargo;

3. the time required to sail loaded from "A" to "B", the relevant discharge port;

4. the time spent in "B", both waiting for a berth and unloading the cargo.

Parts (2), (3) and (4) are all dependent on how fast the particular cargo can be loaded or unloaded, the availability of loading and unloading berths, the nature of the loading and unloading equipment, the size of the vessel and its required time to sail between the two ports. These variables, for any specific commodity ports and ship, are beyond the operator's control. Part (1), however, depends on the unloading ports of the previous cargo. Therefore, a vessel's total empty sailing time over a navigation season depends both on the cargoes carried and the sequence in which they were loaded.

Under ideal conditions, the vessel operator would know at the beginning of each navigation season all the cargoes to be carried that season; also these cargoes would be available for carriage at the operator's convenience. With these conditions, the operator could determine and then load these cargoes in the one "ideal" sequence which will minimize the total empty seasonal sailing time. In practice these ideal conditions do not exist. A vessel may load iron ore at a lower St. Lawrence port for Hamilton at the beginning of a navigation season, then, in absence of eastward grain cargoes, return empty to the lower St. Lawrence for more iron ore. Later in the season, as a new grain crop is harvested, the same vessel may load grain at Thunder Bay for the lower St. Lawrence and, in absence of any return iron ore cargoes, sail empty westward for five

days to Thunder Bay for more grain. With ideal conditions, these eastward ore cargoes would be coordinated with the westward grain cargoes. In summary, the actual seasonal empty sailing time of one vessel or a fleet of vessels, for a given set of cargoes, will be at least the corresponding ideal empty sailing time.

The ratio of the actual seasonal total sailing time to the corresponding ideal seasonal total sailing time is here defined as an "Allocation Ratio". An Allocation Ratio, for a navigation season or some specific time period, may be calculated either for one ship, for one operator's fleet of ships or, for the industry as a whole. Its use will be illustrated in estimating how much empty sailing time is reasonable for a vessel or a fleet in carrying a specified mix of cargoes, for estimating the potential saving in merging two or more fleets and for estimating total vessel requirements to serve some forecasted future volumes.

3 The Calculation of An Allocation Ratio

The calculation of an allocation ratio is illustrated for one hypothetical Canadian-registered drybulk vessel, for a typical navication season.

The vessel, a bulker denoted as M.V. "Moira", is assumed to have moved ten grain and fifteen iron ore cargoes during this season (Exhibit 1). These cargoes were loaded at four ports and discharged at five. In effect, these five discharge ports were sources and the four loading ports were destinations of empty vessels. Since the number of days required to sail from each discharge to each loading port, were known, the ideal allocation of the empty vessel from its discharge to its loading ports was calculated, using the Transportation Method of Linear Programming, total seasonal empty sailing time (Exhibit 2).

In this example, M.V. "Moira"s actual seasonal empty sailing time was 61.9 days, 12.8 days or 26 percent above the corresponding ideal seasonal empty sailing time of 49.1 days. The vessel, therefore, was defined to have an Allocation Ratio of 1.26 for this navigation season.

The reason for these extra 12.8 non-productive days resulted, largely, from a mismatch of iron ore cargoes into and grain cargoes out of the Chicago area (Exhibit 3). In this season, M.V. "Moira" discharged three cargoes of iron ore and loaded four cargoes of grain at Chicago. To minimize seasonal empty sailing time, she should have loaded grain at Chicago on each of the three sailings when she discharged iron ore and she should have sailed empty from Hamilton to load the fourth grain cargo. In practice, the arrival time of two of the iron ore cargoes at Chicago were not close enough to the required departure time of two of the four grain cargoes. As a result, M.V. "Moira" loaded discharged iron ore and loaded grain only once in Chicago. Her two other iron ore voyages were followed by empty voyages, each of 2.6 days, to Duluth for loading. At other times in the season, she sailed empty for 3.3 days three times rather than once from Hamilton. The vessel also incurred extra empty sailing time in the loading of nine iron ore cargoes at Sept Iles. Five of these should have followed grain unloadings at nearby Baie Comeau and the other four at Quebec City. In fact, due to a mismatch between the arrival time of two of the Quebec grain cargoes and the availability of iron ore at Sept Iles, two of the Quebec unloadings were followed by 5.6 day empty voyages to Duluth while the two of the Sept Iles loadings followed 3.4 day empty voyages from Hamilton.

Since the marginal costs for vessels like M.V. "Moira" approximate $12,000 a day, these 12.8 days of additional sailing time. would cost the ship operator about $150,000. Clearly, even a small reduction in this Allocation Ratio would be of great benefit. Yet Allocation Ratios of 1.26 were found to be typical of individual ships. In most cases, these high ratios resulted from the vessel sailing loaded into Lake Michigan with iron ore then sailing out empty. Later in the season, the same vessel would sail empty into this lake to load grain.

4 Allocation Ratios for Various Vessel Types and Sizes

Allocation ratios were calculated for the vessels of each size and type combination for each vessel operator, based on their voyages in 1979. These calculations were

intended to determine if the allocation ratios differed with each vessel category and/or with the nature of their trades. There were six such vessel categories. While there were no small self-unloaders left in the fleet by 1979, the intermediate self- unloaders were divided into two categories, those of under and over 15 000 tonnes capacity.

4.1 The Bulkers

There were seven operators of large bulkers in 1979; these operated 38 vessels on 913 voyages. These voyages were estimated to require a total of 1617 days of empty sailing time or 16 percent more than the optimum number of 1393 days (Exhibit 4).

As to the individual companies, their Allocation Ratios varied from a high of 1.18 to a low of unity with a median of 1.12. (Only six such company allocation ratios are shown on Exhibit 4; one company with only one vessel was omitted to preserve data confidentiality.

The one operator, with the highest Allocation Ratio of 1.18, suffered from two long empty voyages. The first was from Chicago to Port Cartier in April 1979. This voyage seemed inconsistent with this operator having 83 eastward loads of grain and 70 westward loads of iron ore over the season. Also, a few days later, a sister ship sailed empty into Lake Michigan to local grains. This was the only possible scheduling error noted in the study. The second long empty voyage was from Baie Comeau to Thunder Bay in December, a time of no return iron ore cargoes.

The remaining five operators, with Allocation Ratios between 1.06 and 1.12, suffered from occasional mismatches of cargoes to or from Lake Michigan and from imbalances of grain and ore cargoes to and from the lower St. Lawrence. The operator, with the Allocation Ratio of unity, operated almost exclusively in the grain and ore shuttle to and from the lower St. Lawrence and with loads both ways on every voyage. While this operator loaded grain three times at Chicago, they did not deliver ore to Lake Michigan; hence they avoided imbalanced loads.

The intermediate bulkers had an Allocation Ratio of 1.14 for the 33 vessel fleet. The ratios for the individual six operators varied between 1.03 and 1.14. No obvious reasons were noted for these variations.

By 1979, there were only two operators of small bulkers whose combined fleet of 14 vessels had Allocation Ratios of 1.42. The Allocation Ratios for the individual compaies were 1.24 and 1.36. All these ratios were much higher than experienced with the larger bulkers. While no obvious scheduling errors, or duplications of empty voyages were noted, these large Allocation Ratios seemed to result from the relatively large pairs of origin-destination ports being served. These small bulkers served 1782 port combinations with 311 voyages, or an average of 5.7 per voyage. This average per voyage is in contrast to ones of 0.33 for the large bulkers and 1.39 with the intermediate bulkers.

4.2 Self-Unloaders

There were three operators of large self-unloaders in 1979; these 19 vessels had a combined Allocation Ratio of 1.20 with ratios of 1.08, 1.10 and 1.17 for the individual companies (Exhibit 4). The intermediate self-unloaders had fleet Allocation Ratios of 1.36 with the ratios for the individual companies ranging between 1.05 and 1.41. As with the small bulkers, these Allocation Ratios increased with the numbers of port combinations. That is the operators, with relatively regular runs, carrying coal to the major steel mills and thermal generating stations, had lower Allocation Ratios than did those operators serving the multi-port salt and stone trades. Again, as the numbers of ports increase, it seems more difficult to sequence the loadings to minimize total empty seasonal sailing time.

4.3 Summary

To summarize, the total empty sailing time for the large and intermediate bulkers was, for most operators, less than ten percent above the theoretical minimum. These vessels, for the most part, operated on relatively regular runs. The Allocation Ratios increased, however, for the small bulkers and those self-unloaders which served such a

wide variety of ports that optimal scheduling became more difficult.

5 Possible Results of Mergers

In this section, the use of Allocation Ratios is demonstrated in estimating the potential savings of one operator controlling all the vessels of one vessel category and of the merging of two operators.

As to joint operations, as the numbers of vessels increase, there should be a higher probability of an empty vessel being close to a potential load and, thereby permitting ideal dispatching. That is, were all the vessels to be dispatched centrally to serve everyone's customers, there should be some reduction in total empty sailing time.

To estimate this reduction, the ideal empty sailing time of 1393 days, for the 38 large bulkers, was multiplied by 1.12, the median Allocation Ratio for these vessels, to produce an expected total empty sailing time of 1560 days. This figure, when subtracted from the actual figure of 1617 days, gave a potential reduction of 57 days of 3.5 percent (Exhibit 5). (It was assumed that the dispatching efficiency of one large operator would approximate that of the present median operator.) These calculations were repeated for the other vessel categories. Potential savings of up to four percent were noted with the large and intermediate bulkers, of about eight percent for the small bulkers and of about eleven percent with the self-unloaders.

These potential reductions were, in general, small proportions of the total vessel days. Also, those of the self-unloaders were probably overstated because of the problem of scheduling optionally so many cargoes to so many ports. Also, several cargo contracts specify the exclusive use of certain self-unloaders. However, even with the bulkers alone, there could be potential savings of 155 vessel days or, a seasonal reduction of $1.8 million in direct operating costs.

Since the foregoing section concludes that most of the potential savings could result from a joint operation of the bulkers, an estimate was also made of the potential savings to be expected with the merger of one operator of large bulkers with each of the other five operators. This operator, #2 of Exhibit 4, was selected because of its having the highest Allocation Ratio of 1.18 in 1979. The cargoes of this operator were merged with each of the possible takeover operators and a new expected total empty sailing time was calculated with the Allocation Ratio of the takeover company. The resulting calculations show potential savings of between 12 and 41 vessel days (Exhibit 6). The most realistic saving was deemed to result from a merger of Operators (2) and (4). This merger, with an Allocation Ratio of 1.12, or the median of the large bulker ratios, should permit a reduction of 34 vessel days, or about five percent from the experienced 726 vessel days. This saving should, in turn, mean a reduction of about $400,000 in vessel operating costs. The obvious merger of operators (2) and (7) was rejected because it did not seem reasonable that the combined operation would continue with an allocation ratio of unity.

The use of Allocation Ratios indicates both the potential savings from a merger and the best merger partner.

6 Estimation of Future Vessel Requirements

The purpose of this section is to illustrate the use of the Allocation Ratio in the translation of cargo forecasts into vessel requirements. That is Allocation Ratios are used to estimate the total empty sailing times, to be expected with a specified mix of cargoes. Since the total loaded sailing time and the total port times can be estimated by empirical data, their sum when added to that of the total empty sailing time, will provide the total required vessel days. This sum can be then translated into the total required vessel capacity of each type of vessel and then into numbers of standard vessels (Exhibit 7). This method takes to account the prospective mix of cargoes and, therefore, should be preferable to the industry practice of estimating total vessel capacity, on the basis of the required total loaded sailing time being a certain

proportion of the total vessel time.

The above calculations of future vessel requirements were made for the year 2000 based on there being about 90 000 tonnes of available cargo in that year. This cargo forecast followed from the commodity forecasts made in 1982 for the year 1990 but modified to reflect the changed conditions since that time. (2) On this premise, there should be a total prospective shortage of 445 000 tonnes of vessel capacity (Exhibit 8). Based on past usage patterns, the large bulkers and the intermediate self-unloaders should be in particularly short supply. However, past usage patterns are changing. Iron ore consignees are retiring shore unloading facilities and, therefore, are requiring self-unloader delivery. Also, the need for intermediate bulkers is being reduced as harbours, such as Goderich, are dredged to permit their use by larger vessels. To summarize, these estimated requirements of 445 000 tonnes may be stated as the equivalent of 16.5 large vessels.

This forecast is in contrast to the depressed state of the industry in the early 1980's. However, this projected volume of 90 million tonnes by 1990 is only 12 percent above the experienced 80 million tonnes of 1979. With even such a modest increase over 21 years, there will be 16 new vessels required at a probable cost of $40-50 million each in current dollars. While the industry will not build these vessels unless freight rates and profits warrant, a capacity shortage could reduce Canadian grain and iron ore exports. Therefore, in spite of the current over capacity, care must be taken, particularly in the setting of government policies towards shipyard subventions and ship building tax incentives, to ensure adequate future vessel capacity.

REFERENCES

1. Annual Report, Dominion Marine Association, Ottawa, 1984, p. 48.

2. Gordon C. Shaw and Wade D. Cook A Forecast of the Canadian Drybulk Vessel Requirements on the Great Lakes in 1990) (Toronto: University of Toronto/York University, Joint Program in Transportation; Research Report No. 29, March 1982, p. 129.

Exhibit 1: Summary of Actual Number Load Voyages M. V. "Moira"

To	From Chicago (grain)	Duluth (iron ore)	Sept Iles (iron ore)	Thunder Bay (grain)	Total
Baie Comeau	4	.	.	1	5
Chicago	.	.	3	.	3
Cleveland	.	.	5	.	5
Hamilton	.	6	1	.	7
Quebec	.	.	.	5	5
Total	4	6	9	6	25

Exhibit 2: Travel Times (Days Between Port Pairs

To	From Chicago	Duluth	Sept Iles	Thunder Bay
Baie Comeau	6.1	6.4	0.5	6.0
Chicago	0.2	2.6	6.4	2.3
Cleveland	2.4	2.7	4.2	2.3
Hamilton	3.3	3.6	3.4	3.2
Quebec	5.4	5.6	.1.1	5.3

Exhibit 3: Comparison of Actual and Ideal Numbers of Empty Voyages

From	To Chicago	Duluth	Sept Iles	Thunder Bay	Total
Baie Comeau	. (0)	. (0)	5 (5)	. (0)	5
Chicago	1 (3)	2 (0)	. (0)	. (0)	3
Cleveland	. (0)	. (0)	. (0)	5 (5)	5
Hamilton	3 (1)	1 (5)	2 (0)	1 (1)	7
Quebec	. (0)	3 (1)	2 (4)	. (0)	5
Totals	4	6	9	6	25

Note: Ideal numbers are in *brackets*.

Exhibit 4 Comparison of Allocation Ratios by Size Categories of Bulkers

	Operator	Number of Vessels	Number of Voyages	Port Combinations	Empty Sailing Times Actual	Empty Sailing Times Ideal	Allocation Ratio
Large Bulkers							
	1		30	48	87	(A)	(A)
	2		163	96	196	166	1.18
	3		157	106	236	206	1.12
	4		269	110	581	474	1.13
	5		111	84	184	166	1.11
	6		124	81	214	205	1.06
	7		79	91	116	116	1.00
Combined Fleet		38	913	800	1617	1383	1.16
Ratio: Port Combinations/Voyages				0.88			
Intermediate Bulkers							
	1		131	204	245	216	1.14
	2		70	108	161	146	1.11
	3		135	240	264	230	1.11
	4		156	427	216	199	1.10
	5		163	210	842	827	1.04
	6		91	84	176	170	1.08
Combined Fleet		38	736	1028	1864	1236	1.14
Ratio: Port Combinations/Voyages				1.39			
Small Bulkers							
	1		190	1204	871	274	1.36
	2		121	558	804	246	1.34
Combined Fleet		14	311	1762	676	476	1.42
Ratio: Port Combinations/Voyages				5.72			
Large Self-Unloaders							
	1		186	437	186	158	1.17
	3		292	388	777	706	1.10
	8		594	800	806	288	1.06
Combined Fleet		19	1064	982	1366	1033	1.30
Ratio: Port Combinations/Voyages				0.916			
Intermediate Self-Unloaders A (over 18 000 deadweight tonnes)							
	1		238	858	249	177	1.41
	3		167	160	107	98	1.08
	8		39	77	40	38	1.06
Combined Fleet		8	496	1460	396	291	1.36
Ratio: Port Combinations/Voyages				2.96			
Intermediate Self-Unloaders B (under 18 000 deadweight tonnes)							
	1		76	247	61	39	1.82
	2		374	526	170	184	1.27
Combined Fleet		5	450	826	331	161	1.37
Ratio: Port Combinations/Voyages				1.83			

Note:

(1) The companies are arranged in descending order of allocation ratio so a designated number in one size category does not correspond to the same company in another size category.

(2) The port combinations are the product of the number of loading ports times the number of unloading ports.

Exhibit 5 Estimated Savings With Joint Dispatching of All Vessels of Each Size/Type Category

	Allocation Ratio	Empty Sailing Time				Percent Saving
		Ideal	Expected	Actual	Saving	
	(days)	(days)	(days)	(days)	(days)	
Bulkers						
Large	1.2	1393	1560	1604	44	2.7
Intermediate	1.10	1225	1348	1396	48	3.4
Small	1.30	475	625	675	50	7.5
Self-Unloaders						
Large	1.10	1053	1158	1269	111	8.7
Intermediate A	1.08	291	314	396	82	20.7
Intermediate B	1.30	160	208	221	13	5.9

Exhibit 6 Estimated Reductions in Empty Sailing Times With Selected Mergers of Large Bulker Operations

Merger Partners	Allocation Ratio	Total Empty Sailing Time			
		Ideal	Expected	Actual	Savings
		(days)	(days)	(days)	(days)
2 and 3	1.12	459	514	526	12
2 and 4	1.12	617	691	725	34
2 and 5	1.11	315	350	378	28
2 and 6	1.06	365	387	410	23
2 and 7	1.00	271	271	312	41

Exhibit 7 Summary of Total Vessel Requirements 2000

	Bulkers			Self-Unloaders	
	Large	Intermediate	Small	Large	Intermediate
	(days)	(days)	(days)	(days)	(days)
Ideal Empty Time	2117	937	100	1282	546
Allocation Ratio	1.15	1.14	1.42	1.20	1.37
Total Empty Time	2435	1068	142	1538	748
Total Loaded Time	5171	1230	330	2834	1380
Port Time Loading	2235	581	102	928	632
Port Time Unloading	2219	842	135	632	302
Total Vessel Days	12060	3721	709	5932	3062
No. of Days	265	265	265	265	265
Standard Vessels	45.5	14.0	2.7	22.4	11.6
Standard Capacity (tonnes)	27,000	18,000	6,000	27,000	18,000
Required Tonnage (000's)	1229	253	16	605	209
Surviving Tonnage (000's)	1018.2	89.8	20.0	655.4	85.9
Shortage (000's)	211	163	(4.0)	(50)	123
Vessels Equivalents	7.8	9.1	(0.6)	(1.9)	6.8

Exhibit 8 Summary of Large Vessel Requirements 2000

	Required Tonnage (000's)	Surviving Tonnage (000's)	Deficit (000's)
Bulkers:			
Large	1228.8	1018.2	210.6
Intermediate:	252.7	89.8	162.9
Self-Unloaders:			
Large	604.8	655.4	(50.6)
Intermediate:	208.8	85.9	122.9
	2295.1	1849.3	445.8
Equivalent Large Vessel Requirements:			16.5

THE CANADIAN ROCKIES: A CASE STUDY IN RAIL MODELLING

by

M.L. McLaren, Research Branch
Canadian Transport Commission

E.R. Petersen, School of Business
Queen's University

A.J. (Hamish) Taylor, School of Business
Queen's University

This paper presents the results of a study undertaken to model CN and CP rail operations through the Rocky Mountains.

The purpose of such a study is two-fold. On the one hand, we wished to develop a model which could be used with confidence to address various rail capacity, traffic, and cost issues in this region. On the other hand, we also wished to thoroughly test the applicability of a computer system, the World Bank RAIL model, to real problems in the Canadian context. The RAIL model is a computer system which has been developed by the World Bank to evaluate various rail investment proposals in terms of their expected economic costs and benefits.

The study methodology and assumptions employed, and the various steps in the modelling process are summarized. These include a discussion of the rail issues of concern, the data collection and development phase, scenario development, and final economic analyses. As an example of the application of the process, particular emphasis is placed on the Fraser Canyon capacity issue.

This paper demonstrates that the kind of "broad brush" modelling approach undertaken here, using data which is relatively easy to obtain, can yield many interesting and unexpected results. It also shows that the model building process itself, by simply providing a structure for one's thinking, can be instrumental in highlighting important, previously unnoticed, relationships.

LOSS-COST FUNCTIONS FOR EVALUATING FORECASTS OF DEMAND FOR TRANSPORTATION ROLLING STOCK

by

S.K. Goyal, and C.S. Bayne
Concordia University, Montreal

1.0 Introduction

"Almost every transaction which occurs in the life of the nation involves transportation as one element of cost. Thus, the material well-being of the nation is improved when goods are manufactured and services are rendered under conditions where the real cost of transportation is kept to the minimum necessary to provide fully adequate services," Royal Commission on Transportation, Vol. 11, 1961.

Transportation has always occupied centre stage of Canadian political life and economics. Canada was tied together at Confederation by the offer of railways, and later the Trans-Canada highway with its system of ferries, and national airways. The various provinces were attracted into Confederation through a monopoly rail system to a larger national market for their goods. The early dream of bringing about an equalization of economic opportunities and national unity through the railway system was never fully realized from the perspective of individual provinces. However, rail transportation continues to play a very significant role in the country's economic development and government strategies for management of the economy.

The Transportation Department of Canada spent 1.2 billion dollars on what it calls surface transport during the 1984-5 fiscal year. Of this amount 73.7 per cent was spent on rail transportation services in contrast to 6.5 per cent on highway and road safety. Estimates of expenditures for 1985-6 on these two types of transportation are 73.6 and 7.6 per cent respectively, Estimates 1985-6, Transportation Canada. The percentage share of the transportation sector GDP at 1970 was just under 6 per cent. This is reflected in a growth in the absolute share of the transportation sector in GDP by 78.6 per cent over the 1971 base year value. By

contrast the index for GDP itself only increased by 50 per cent over the same period, Canadian Statistical Review, January 1986. One of the major features of the growth in the trasportation sector is the rapid increase in the importance of trucking at the expense of rail transportation in "feeder" and mainline-haul traffic. The Royal Commission on Transportation 1962 reports that rail freight traffic fell from 73.8 per cent of Canada's total freight ton-miles in 1942 to 53.8 per cent in 1957, while highway traffic rose from 3.2 per cent and highway 10.5 per cent.

Because of the importance of railways and trucking in the Canadian Transportation system and the reorientation of policies to their development along commercial and market lines, it is important to determine which methods are most suitable to forecasting the demand for transportation facilities and rolling stock in the trucking and rail industries. It is also appropriate to explore methods for measuring the accuracy of these forecasting methods and the oportunity costs resulting from having to make decisions regarding capacity requirements based on these forecasts (or under uncertainty) as opposed to decisions based on perfect information. Clearly the economic objective of moving goods and persons and rendering services under conditions that ensure that the real cost over the entire transportation network is minimized depends on the ability to select the best methods to forecast demand for transport facilities. The objective should be to explore approaches and to establish procedures and methods for evaluating them.

2.0 Forecasting the Demand for Transportation Facilities

Most transportation companies provide services in a network system. Some types of transport systems are open and some are closed. Estimating or forecasting the demand for transportation facilities in such network systems is quite different from forecasting the demand for a particular commodity in a single market located within a well defined geographic area. The demand for transportation services derives from the need to move goods, services and persons between points (nodes) in the network. We may divide these facilities into (1) facilities that carry the goods and persons between various points in the network (rolling stock) and (2) fixed facilities in the form of railway yards, runways, airplane hangars, garages, terminals, office buildings and computed and other electronic communication systems, etc., etc. Theoretically, if rolling stock never break down, that is, if trucks, planes,

trains and rail cars are in continuous use then there will be little or no use for garages, hangars, railway yards. In fact this is impossible so that the system must contain these facilities at main throughput points in the network. This requirement is a negligible constraint in the trucking industry; but in the case of railways it is a very important factor in any economic analysis of that carrier. That is, any major expected increase or shifts in the movement of goods, services, and persons would not only have a significant impact on demand for rolling stock but also on that for fixed facilities. However, in the immediate or medium term changes in traffic are reflected mainly in the demand for rolling stock and are usually measured in ton miles hauled and passenger miles. This is true for both rail and road transport carriers.

Our preliminary analysis of methods used in forecasting the demand for transportation facilities and equipment reveals practices which range from judgmental methods based on the knowledge of experts to quite sophisticated techniques combined with varying degrees of expert intervention. In all cases there was an absence of a rigorous methodology for evaluating the accuracy of the forecasts. The common response to this situation is that "the present system works". There is the need for a methodology which takes us beyond the purely descriptive and subjective evaluation of accuracy characterized by such statements.

3.0 Statement of Problem

Armstrong (1978), Makridakis and Wheelwright (1982) and Mahmoud (1984) summarized in their work a number of measures for determining the accuracy of forecasting methods. Examples of some of these measures are: Percentage Error (PE), Mean Percentage Error (MPE), Mean Absolute Percentage Error (MAPE), Adjusted Mean Absolute Percentage (AMAPE), Mean Squared Error (MSE), R-Squared, Coefficient of Variation, Theil's U-Statistic and Gardenfors' "I" Value (1980), the D-W Statistic. Many of these techniques manifest several shortcomings when used as a single indicator of accuracy. Various combinations of these measures such as MSE, combined with D-W Statistic and the Theil U-Statistic provide in many cases an analytic framework for determining the relative accuracy of various forecast models. However none of these methods measured the value of the trade off between the cost of using a forecasting method and the accuracy of that method. The need for such a measure of accuracy has been pointed out by Mahmoud, 1982.

In an organizational system where the capital invested in facilites is very large, and where the financing of excess capacity is very costly relative to the cost of a forecast system, the penalties of using the wrong forecasts system or not using a particular system could be very significant in monetary and socio-political terms. For example, in Canada the early assumptions that railways would continue to be the principal mode of transporting goods and persons over the long-run led to heavy investment in excess capacity. The emergence of fierce competition from trucks in the fifties through to the early seventies caused persistent large positive differences between actual demand and planned capacity in the rail transportation industry. The fact that investment in fixed capacity was so large relative to rolling stock did not make it possible to adapt the system easily to the rapidly changing market conditions. To offset the economic distortions and inequities resulting from the burden of the debt associated with this excess capacity government established a system of direct and indirect subsidies to the industry. These forecast errors have cost the tax payer hundreds of millions of dollars which represent a sort of measure of opportunity cost. Given the size of these expenditures and the need to reduce the national deficit greater attention must be given to choosing more accurate forecasting methods. We suggest therefore that loss-cost functions be used to evaluate the cost benefits of using or not using a given facilities-demand forecast system for rail and truck transportation. This is particularly true of the Rail Transportation industry.

Anticipating the volume and direction of various types of traffic well in advance is very essential to efficiency in the system. Our loss-cost functions will explicitly take into consideration errors in forecasting demand for transportation facilities and rolling stock. Loss-cost functions will be developed under varying assumptions with respect to the relationship between available capacity owned by the carriers, the forecast of demand for rolling stock and actual demand. The merit of these functions rests in the fact that the methods translate the forecasting error into dollars when the forecast results are compared with a perfect forecast. They allow the managers to select the most suitable forecasting method(s) for their organizations in terms of a common measure that can be easily understood.

4.0 Methodology

For the purpose of discussion we limit ourselves to the development of opportunity cost (loss-cost) for trucking services. The assumptions on which the opportunity cost or the loss cost functions are based are as follows:

1. From the past data the trucking company forecasts the demand for its services for the next planning period using some forecasting methods available to it.

2. Based on the forecasts the company plans to meet the demand for the services, if possible, from its own fleet.

3. The company is able to subcontract if the forecast for the demand for the services exceeds the available capacity. If the forecasted demand is less than available capacity, the company cannot subcontract the idle (unused) capacity.

4. Any potential revenue reflecting effective demand for capacity which is not planned either by the company's vehicles or the leased vehicles is lost.

5. The company has two types of costs due to errors in forecasting:

   a. Error due to under estimation, and
   b. Error due to over estimation.

4.1 Notations

A = Actual cost with available forecast;
P = Cost with perfect forecast;
A-P = LCF = Loss cost function;
C = Cost per unit capacity of company vehicle;
L = Cost per unit capacity of leased vehicle;
R = Revenue per unit of capacity subcontracted out;
S = Loss of revenue per unit capacity not planned for;

During period "t" let

X_t = Available capacity owned by the company.
F_t = Forecast of demand.
D_t = Actual demand.

5.0 Loss Cost Functions

Normally the company may face any of the following six cases where the forecast error in terms of dollar value will be estimated.

5.1 Case 1: ($D_t \leq F_t \leq X_t$)

The Actual Demand is less than or equal to the forecasted demand which in turn is less than or equal to the available capacity owned by the company. In this case the company is not going to lease extra trucks because both the actual demand and the forecasted demand are less than the capacity owned by the company. In this case, we have

$$A = CD_t - R(X_t - F_t)$$

$$P = CD_t - R(X_t - D_t)$$

$$LCF = A - P = R(F_t - D_t) \qquad (1)$$

5.2 Case 2: ($F_t \leq D_t \leq X_t$)

The forecast is less than the actual demand and the actual demand is less than the capacity owned by the company. Thus, leasing from outside is not required. The loss cost function is determined by the difference between A and P. Note that revenue is lost due to shortfall in capacity equal to $(D_t - F_t)$.

$$A = CF_t + S(D_t - F_t) - R(X_t - F_t)$$

$$P = CD_t - R(X_t - D_t)$$

Loss Cost Function = A - P.

$$LCF = (D_t - F_t)(S - C - R) \qquad (2)$$

5.3 Case 3: ($F_t \leq X_t \leq D_t$)

The forecast is less than the capacity owned by the company and the capacity is less than the actual demand. In this case there is a shortage of capacity equal to $(D_t - F_t)$. Thus the loss cost function is determined as follows:

$$A = CF_t + S(D_t - F_t) - R(X_t - F_t)$$

$$P = CX_t + L(D_t - X_t)$$

$$LCF = A - P = S(D_t - F_t) - (R+C)(X_t - F_t) \qquad (3)$$

5.4 Case 4: ($F_t \geq X_t \geq D_t$)

The forecast is greater than the capacity owned by the company and the capacity is greater than demand. The company faces the extra cost of leasing trucks to meet the demand., The loss cost function is determined by:

$$A = CX_t + L(F_t - X_t)$$

$$P = CD_t - R(X_t - D_t)$$

$$LCF = A - P = (C+R)(X_t - D_t) + L(F_t - X_t) \qquad (4)$$

5.5 Case 5: ($F_t \geq D_t \geq X_t$)

The forecast is greater than the actual demand and the actual demand is greater than the capacity owned by the company. In determining the actual cost of forecast in this case, the cost of leasing from other companies must be considered: Hence we get

$$A = CX_t + L(F_t - X_t)$$

$$P = CX_t + L(D_t - X_t)$$

$$LCF = A - P = L(F_t - D_t) \qquad (5)$$

5.6 Case 6: ($D_t \geq F_t \geq C_t$)

The actual demand is greater than the forecast and the forecast is greater than the capacity owned by the company. Hence $(F_t - X_t)$ will be the capacity obtained from the outside and $(D_t - F_t)$ will not be met. In this case we get:

$$A = CX_t + L(F_t - X_t) + S(D_t - F_t)$$

$$P = CX_t + L(D_t - X_t)$$

$$\text{Lost Cost Function} = A - P = (S-L)(D_t - F_t) \qquad (6)$$

It should be noted that the six cases were derived on the basis of different assumptions which were stated with respect to each case. There may however be special circumstances which necessitate a slight modification of the loss-cost function to match the special case (see for example, Mahmoud 1982, Mahmoud and Goyal, 1984).

6.0 Conclusion

There is a managerial need for a meaningful accuracy measure to evaluate different forecasting techniques utilized by the transportation industry. In order that accuracy measure be used effectively it should be expressed in terms of monitary units. The loss-cost functions presented above measure the opportunity cost of an inaccurate prediction and meet these requirements. In delineating the approach above we have developed six different loss-cost functions applicable to the rail and trucking industries. Empirical testing to investigate the use of these functions by managers is desirable. These functions do not replace the accuracy measures presented by Makridakis et al., 1983. In the initial stages one needs to have a method to select the best possible model from among many possible others. The residual analysis procedures of Makridakis et al. as well as Box and Jenkins methods are still needed in the initial model selection stages. Once a model has been selected and implemented accuracy analysis can be conducted by using our loss-cost functions to compare the selected forecast system with alternative forecasts. The intention is to examine forecasting practices in the rail, trucking, and air transportation industries in detail in order to test these loss-cost functions empirically. In the process we hope to be able to improve the models suggested above and perhaps develop more relevant models. We believe that this research will take us a long way to meeting the needs for loss-cost functions that can measure the accuracy of forecasts used by the different sectors of the transportation industry.

7.0 References

Aeronautical Research, 1957, "Avoidable Costs of Passenger Train Service," Cambridge, Massachusetts.

Armstrong, J.S., 1978 "Long Range Forecasting: From Crystal Ball to Computer," 1978, John Wiley.

Babcock, Michael W., 1981, "National and Regional Forecast of Rail Demand to 1985", Annual Proceedings of the Transportation Research Forum, pp. 394-402.

Bayne, C. Attribute Demand Analyses of the Transportation Market, 1980, AIDS Proceedings.

Box, George P. and Jenkins, Gwilym M., 1976, Time Series Analysis (Forecasting and Control), Holden-Day.

Cleary, James and Levenbach, Haas., 1982, "The Professional Forecaster," Lefebvre Learning Publications.

Estimates, 1985-86, Transport Canada, Part II, pp. 5-13.

Firth, Michael, 1977, "Forecasting Methods in Business and Management," Edward Arnold (Publishers) Ltd.

MacPherson, M.A. (Chairman)., 1963, "Royal Commission on Transportation, Vols I, II, III, pp. 153-365 Vol. III.

Mahmoud, E.H., 1982 "Short-term Forecasting: Matching Techniques to Tasks, and Integrated Framework and Impirical Investigation", Ph.D. thesis, The State University of New York at Buffalo, New York.

Mahmoud, E.G., 1984a, "Accuracy in Forecasting: A Survey", Journal of Forecasting, 3, No. 2, pp. 139-159.

Mahmoud, E.G., 1984b, "Gardenfors' "I" Value: A Comment on the Measurement of the Relative Accuracy of Sales Forecasting Models", Technological Forecasting and Social Change, Forthcoming.

Mahmoud, E.H. and Goyal, S.K., 1984, "Loss-Cost Functions for Measuring the Accuracy of Sales Forecasting Models", Technological Forecasting and Social Change, Forthcoming.

Makridakis, S. and Wheelwright, S.C., 1982, "The Handbook of Forecast g_0: A Manager's Guide," John Wiley.

Makridakis, S., Wheelwright, S.C. and McGee, V., 1983, "Forecasting Methods and Applications," 2nd edition, John Wiley.

Market Facts of Canada Ltd., 1977, "A Method of Quantifying Travellers' Values for Design of Optimal Intercity Transportation Systems (prepared for Transportation Development Agency)

Rosenblatt, Murray (Ed.), 1962, "Proceedings of the Symposium on Time Series Analysis".

Theil, H., 1969, "Economic Forecasts and Policy", North-Holland Publishing Company, Amsterdam.

Thomopoulos, Nick T., 1980, "Applied Forecasting Methods," Prentice-Hall.

Turgeon, W.F.A. (Chairman), 1951, "Report of Royal Commission on Transportation".

Wood, D.F. and Johnson, J.C., 1983, "Contemporary Transportation," Second Edition, Penn Well Publishing Co.

ON-DOCK TRANSFER: FACING THE ISSUES

by

Daniel S. Smith
Manalytics, Inc.

1.0 Introduction

The quest for ever more efficient intermodal transportation is bringing together two recent innovations: double-stack container trains, and on-dock container transfer. On-dock transfer is not new, but it is receiving earnest attention as the means of extending the line-haul advantages of double-stack trains to the whole intermodal movement.

Can we pull double-stack trains into the container yard, and load and unload to and from the container stacks using yard lift equipment? Both containerships and double-stack trains are highly specialized systems for container transportation. In trying to serve both in the same container yard, we must confront complex tradeoffs between marine, rail, and transfer costs and service. Ocean carriers, ports, and railroads each bring different goals and perspectives to the discussion of on-dock transfer.

2.0 Defining On-Dock Transfer

As with so many emerging issues, a discussion of on-dock transfer must begin with definitions and clarifications. In this case, the subject is transfer of ocean-going ISO containers between ships and rail cars. Where and how that might best take place is a subject of vigorous debate among ocean carriers, ports, and railroads. The premise of on-dock transfer is that the transfer should take place within the confines of the marine terminal, rather than draying the container over public roads to another facility. As it happens, this simple premise becomes complex when we examine the numerous ways in which it can be implemented. The issues to be faced in implementing on-dock transfer go to the heart of intermodalism itself: reconciling the incentives and characteristics of the participants to realize the full potential of intermodal transportation.

On-dock transfer is not as ambitious or demanding as direct transfer between ship and rail. Some European terminals can load railcars at shipside, using the container crane to move containers to

or from the ship without an intermediate vehicle or point of rest.[1] Many North American marine terminals have railroad tracks within reach of the container cranes for transfer of non-standard cargo, so direct ship-to-rail container transfer is possible and has probably been done from time to time. But no North American port has maintained a direct ship-to-rail transfer of significant volume or duration, and none do so now. The on-dock transfer systems in North America use either a vehicle or ground storage as an intermediary between the ship and the railroad cars.

The phrase "on-dock" is amenable to a variety of interpretations, the literal meaning being physically impossible. Since the dock is the expanse of water occupied by the ship[2], the actual transfer must take place elsewhere. "On-dock" usually means "inside the marine terminal," and the boundary is defined by the entry and exit gate, where the formalities of interchange, inspection, and paperwork take place. Upon examining the North American "on-dock" facilities now operating or planned, we find large variations in the distance between ship and rail transfer site. Most on-dock transfers are separated from the ship by at least the width of the marine terminal, and do not correspond at all to a mental image of shipside transfer.

It is function that defines on-dock transfer, not proximity to the ship. The objective of on-dock transfer is to reduce the cost, time, and administrative effort required to shift containers between the ship and the railroad. The major cost elements in container transfer are: terminal space and facilities; container lifting and moving equipment; the number of container lifts; and the number of drayage hookups and drops. The time taken for each operation affects both cost and service quality. There are two aspects of time that bear separating: the minimum time required to complete a given function efficiently, and the delays imposed on containers, ships, railcars, and draymen by inefficiencies. The administrative effort required (in terms of overhead cost, delays, potential for error, etc.) depends on the number of functions to be performed and on the number of jurisdictional interchanges that take place.

None of the factors above depend very much on distance. Where rail transfer sites are 20-30 miles from the marine terminal, as in the older arrangements at Los Angeles/Long Beach, distance may matter. But within the immediate vicinity of the port (usually less than ten miles away), the actual distance is relatively unimportant. Analysis of drayage operations consistently reveals that the majority of the drayman's time is spent within the marine and rail terminals and at their gates, not on the road. An efficient one-hour drayage operation might typically involve 25 minutes at the marine terminal, 15 minutes at the rail terminal, and only 10 minutes each way on the road. There is obviously a difference between a 30-mile dray and a half-mile dray, but within the port area the difference in distance between on-dock and off-dock transfers is insignificant.

There is no single dominant design for on-dock transfer facilities. A review of Canadian and U.S. West Coast facilities reveals a variety of means to the same end.

3.0 Canadian Practice

On-dock terminals are the norm at major Canadian ports. Halifax (Halterm), Vancouver (Vanterm), and Saint John (Brunterm) all have rail transfer facilities within large, multi-user marine terminals. While U.S. ports may agonize over the difficulties of adding on-dock transfers to existing marine terminals, the Canadian terminals were designed to include rail transfer from the beginning. But they have yet to handle double-stack trains on a regular basis.

The Halterm complex covers 24 hectares, with a four-track rail transfer site roughly 1,700 feet long with a 68-car total capacity. The tracks are on the opposite side of the container stacks from the berths, and run parallel to the primary direction of chassis and truck flow. In operation, there is little need for vehicles to cross the transfer tracks, although the area is fully paved and rail cars can be spaced to allow cross traffic. There is a single truck gate beyond the rail transfer area, although switching movements would briefly block the traffic flow. Both the container stacks and the rail transfer are served with rubber-tired gantries, a total of six for the whole terminal. Containers are moved from ship to stack, and from stack to rail, with yard tractors and chassis.

Halterm has handled conventional rail movements for several years. In late 1985, CN began a six-month test movement of a five-platform articulated double-stack car on its "Clipper" trains between Halifax and Montreal. The test is intended to determine what cost savings can be expected from double-stack trains and what operational problems might be encountered. CN serves Halifax exclusively, so there is no issue of access by multiple railroads.

Vanterm, at Vancouver, has a different arrangement. The rail facility is on the side margin of the marine terminal, perpendicular to the berths and the container stacks. Vanterm is served by both Canadian Pacific and Canadian National, who alternate switching responsibility every six months. The rail transfer site can accommodate 17 standard cars on each of three loading/unloading tracks. There is a railyard about one mile from Vanterm, allowing the railroads to do sorting off-site. The main Vanterm container yard is operated with straddle carriers, but containers are moved to the rail transfer with yard tractors and chassis. The railcars are served with rubber-tired gantries.

At Saint John, N.B., Brunterm, LTD. operates a multi-user container terminal with a unique arrangement for rail transfer. CP trackage extends into the midst of the marine terminal itself, adjacent to the container stacks. The six tracks can accommodate 11 conventional flatcars each. Although CP switches the terminal, CN can

serve customers there. Import containers, whenever they can be immediately identified as rail-bound, are placed on a chassis and moved by a yard tractor to the rail transfer. The railcars are worked with front-end loaders. The arrangement has marked advantages for export containers, which can be moved by the front-end loaders directly from the railcars to the container stacks, where they await ship arrival. This is one of the few instances where a chassis movement is completely eliminated.

An important feature of the major Canadian on-dock rail transfers is that they serve large, multi-user marine terminals. Terminals on this scale can, if properly designed, accommodate an efficiently sized rail transfer in a configuration that reduces or eliminates interference with container yard activity. It is difficult to add on-dock rail transfer to existing marine terminals, especially single-user terminals which may not have sufficient overall length.

4.0 U.S. West Coast

The development of on-dock transfer on the U.S. West Coast has proceeded quite differently than in Canada. The ports of the Pacific Northwest, Northern California, and Southern California serve the burgeoning transpacific trade, and originate a fleet of eastbound double-stack trains. Under pressure to handle those trains efficiently and in tight competition with one another, U.S. West Coast ports have turned to on-dock transfer as a selling point. Ports that have it advance claims for its efficiency. Ports that do not yet have on-dock transfer are studying it, or looking for other ways to provide the same benefits.

At the Port of Tacoma, an on-dock container transfer facility serving Terminals 4 and 7 has been in operation since 1981. The six-track North Intermodal Yard is served with three 11', 6" wide straddle carriers, a practice unique in North America. Their width enables them to straddle the rail cars, and their height enables them to travel the length of the cars, raising the container over double-stacked boxes to reach an empty slot. The ability of two container terminals to share an adjacent transfer facility is a benefit of Tacoma's geography: Terminals 4 and 7 are on opposite sides of a peninsula, with the transfer facility between them. Since the whole peninsula is within port jurisdiction, the straddle carriers and yard tractors can make the short trips involved without venturing onto public streets or facing highway weight restrictions. The first double-stack cars were loaded with Star Shipping containers in 1985. A few weeks later, Maersk began using the North Intermodal Yard for their double-stack train to Chicago. The transfer facility is switched by the Tacoma Municipal Belt Line, and has connections to both Burlington Northern and Union Pacific. The Port of Tacoma has awarded a design contract for an ambitious expansion program to be completed in July of 1986. Trackage will be doubled to handle 42 five-unit double-stack cars, and six new 12-foot wide Valmet straddle carriers will serve the expanded yard.

Portland's on-dock transfer at Terminal 6 has also been operating since 1981. In 1985, 500-1,000 containers per month were shuttled between the ship and the railcars on chassis, using PortPackers for the actual transfer. The Port acts as its own stevedore for the gantry-served container yard, charging the railroads on a per-box basis for loading. Being entirely within the marine terminal, the rail transfer is not affected by highway weight limits. The on-dock transfer is reached by a rail line owned by Union Pacific and Burlington Northern in common, with actual switching performed by BN. Although double-stacks have not yet moved through Terminal 6, there is no obstacle to their use. Behind Terminal 6 are two 3,000-foot railroad tracks suitable for double-stack trains. With paving, these will be directly accessible to Terminal 6 using yard equipment, and Portland expects to complete this expansion within a year.

At Seattle, Burlington Northern's new Seattle International Gateway container yard is within two miles of four major container terminals, but requires a dray over public roads. The new Seattle yard is suited to Burlington Northern's approach to double-stack trains, as it allows BN to combine the container volumes of several steamship lines and shippers' agents into a six-day-per-week double-stack train. Nevertheless, the Port of Seattle looked at on-dock transfer as far back as 1981.

In response to requests from shipping lines, the Port of Oakland is studying possible locations for a port-owned, rail transfer facility to serve the Outer Harbor terminals. These new facilities would be contiguous with multi-user marine terminals, and accessible without using public roads. The transfer could be served by yard tractors and would not be subject to highway weight limits. If the port rail facility is built, ocean carriers calling at Oakland will be able to choose between drayage to nearby railyards, existing rail service to their terminals for overweight containers, and the multi-user, port-owned rail transfer.

Current operations at the Port of San Francisco are inside the marine terminal--on Pier 96, to be precise. Existing trackage in San Francisco's South Container Terminal (Piers 94-96) is being used to load and unload conventional container flatcars. Switching movements are handled by the San Francisco Port Railway. The whole operation is inside the terminal gate and within yards of the ship. San Francisco's planned permanent ICTF on Cargo Way will be contiguous with the South Container Terminal. The Port has proclaimed the advantages of on-dock transfer for containers that exceed highway weight; with internal access between the South Container Terminal and the ICTF, the Port can continue to handle such containers.

In Southern California, the new Intermodal Container Transfer Facility (ICTF), intended to serve the Ports of Los Angeles and Long Beach, is nearing completion. But K Line has plans to by-pass the new LA/LB ICTF and begin on-dock transfer to coincide with the start up of double-stack service. If residential objections over additional

traffic on the UP route can be resolved, the UP will serve the ITS terminal (berths 232-234) via L.A. Harbor Belt trackage. New trackwork will bring trains to the marine terminal, where ITS's own switch engine will position cars. At 25-ton capacity Freightlifter will transfer containers between the gantry-served stacks and the railcars using stevedore labor throughout. K Line expects to save up to $70 per container by transferring on-dock rather than draying to the LA/LB ICTF now under construction. Rail contract terms are expected to include a credit to K Line for the transfer, which would otherwise have been performed by the railroad.

5.0 The Issues

The theoretical advantages of on-dock transfer lie in the complete elimination of one or more operations from the chain of lifts and moves required between ship and rail.[3] The dray is usually the target, but most on-dock transfers internalize the transport function of the dray rather than avoiding it. The cost advantages of well-conceived on-dock transfer have been documented[4], but it remains to discuss where and how the theory might be applied, and whether other means to the same ends might be more suitable in some circumstances.

Despite the theoretical advantages of on-dock transfer and its apparent successful implementation in Canadian and U.S. ports, it may not be the best course of development for every port. Certainly, ports which have new, off-dock facilities (such as Los Angeles/Long Beach or Seattle), or ports that would have to fit on-dock facilities into fully developed terminals (such as Oakland), may want to consider other means of obtaining the same benefits. While ports typically encourage ocean carrier and railroad arrangements from a neutral stance, they typically bear the capital cost of on-dock transfer facilities. A recent article commented that double-stack trains were becoming to ports what television antennas were to 1950s homeowners--you have not "arrived" if you do not have one yet.[5] Must every port provide on-dock transfer as well?

If on-dock transfer eliminates drayage, its attraction depends on which party is paying for the drayage. In most locations, the ocean carrier pays for drayage on MLB and IPI traffic. Where drayage costs are high, as in Los Angeles/Long Beach, ocean carriers with substantial volumes of MLB and IPI traffic would benefit from on-dock transfer. Accordingly, K Line is planning to begin on-dock transfer at Long Beach, bypassing the new ICTF. Railroads pay drayage costs in some areas, and would benefit from on-dock transfer if the drayage savings were greater than the switching and other costs incurred by the railroads.

A reduction in overall cost does not necessarily mean a reduction in the charges paid by the carriers involved. How can the port or terminal owner recover the capital costs of an on-dock facility if every other party expects to save money? Some on-dock transfers (and

new ICTFs as well) assess facility charges on each container. If containers are drayed to railroad-operated intermodal yards, the actual transfer between chassis and railcar is included in the rail rate. Will the railroad be willing to rebate the transfer cost if it must incur switching costs at an on-dock transfer? Some railroad contract rates include drayage at the port, making the ocean carrier largely indifferent to the transfer cost. Who, then, has any incentive to pursue on-dock transfer? Moreover, small differences in intermodal transfer costs may not signify much to railroads and ocean carriers who have traditionally equalized tariff rates over large geographic areas.

For the ocean carriers, the blessings of on-dock transfer may be mixed. The savings may be substantial if the ocean carrier can muster enough containers to fill large blocks of cars or, more often, a full trainload to a single destination. Maersk in Tacoma, Sea-Land in Tacoma, and K Line in Long Beach will be filling dedicated trains for Chicago at their single-user marine terminals. For steamship lines not using dedicated trains, single-user on-dock transfer may reduce flexibility. The common-user intermodal train with daily departures, such as BN in Seattle and Santa Fe in Los Angeles/Long Beach, allows the ocean carrier to tender containers as they are available, without organizing 10 FEU lots to each destination. In that case, the ocean carrier can effectively benefit from delivery of OCP traffic to the railroad since the overall port volume makes common-user double-stack economies possible.

For any ocean carrier, multi-railroad access to an on-dock transfer is critical. Where large contract volumes are at stake, effective competition between railroads can result in substantial rate reductions. If only one railroad can serve an on-dock transfer, the ocean carrier may not reap the benefits. Competing access can be provided by switching agreements (as in Vancouver, Saint John, or Portland) or through a neutral switching railroad (as in Tacoma or Long Beach).

In the U.S., double-stack service is provided either in dedicated trains for single customers (such as the APL Linertrains), or in "common user" trains that combine the volumes of several ocean carriers or OCP customers to achieve the line-haul economies of double-stacks. On-dock container terminals may run counter to the railroads' preference for using high-volume Intermodal Container Transfer Facilities (ICTFs) to achieve economies of scale. The advent of dedicated double-stack trains has encouraged railroads to expand off-dock ICTFs to avoid separating the mile-long trains. If container business is withdrawn from the rail hub, can the remaining trailer or domestic container business support an efficient rail facility? The railroads want to minimize switching and sorting, and so might be amenable to handling a full train on-dock, if it would fit. At the other extreme, serving all ocean carriers at a port in a single large, on-dock multi-user facility obviates the need for separate rail switching and sorting facilities. A hybrid may be in the offing:

blocks of perhaps 6-10 double-stack cars dedicated to specific customers, rather than the 15-20 cars of a full train. The dedicated blocks of cars may allow railroads to serve less-than-trainload, single-user terminals while keeping switching and sorting costs to a minimum.

Railroads are reluctant to handle mixed lots of containers and cars at single-user terminals. Double-stack cars each hold 10 FEU. If the railroad must accept partially-filled double-stack cars and top them off elsewhere, the benefits of both on-dock transfer and double-stack cars would be dissipated. Overall railroad switching costs are much the same whether a single car has 2 FEU or 10 FEU on board, so the switching cost per box rises rapidly if small volumes are handled at on-dock transfers. Small volume on-dock facilities would also force railroads to split their car supply and reduce car utilization. At Seattle, BN can fill double-stack cars with a mix of container traffic bound for a single destination, offering the line-haul cost savings to customers who could not support dedicated trains or cars by themselves, and carry any overflow on conventional flatcars. Santa Fe is using a similar approach to its Southern California "common user" trains.

The Canadian and European on-dock transfers follow a different pattern. By attaching an on-dock transfer to a very large multi-user terminal, these arrangements allow all port traffic, MLB, IPI, and OCP, to be handled at the on-dock terminal. To the extent that the railroad can combine traffic from several customers to achieve trainload economies, it can do so at the on-dock facility. It remains to be seen how these terminals will handle double-stack cars. This is one reason for the experimental CN service to Halifax.

Space is at a premium in modern container terminals, and a rail transfer facility takes up space. Worse yet, efficient rail facilities tend to be long and narrow, and do not fit well with the boxier, oblong shape of marine terminals. The problem is exacerbated by double-stack cars, which come in 265-foot units, or about one quarter to one third the length of a typical berth. Even a small number of such cars could seriously disrupt traffic flow in a single-user terminal. Here again the multi-berth, multi-user marine terminal can more easily accommodate a rail facility. Brunterm, at Saint John, handles railcars in the midst of a multi-user marine terminal, enabling front-end loaders to move export containers direct to the stack. Halterm, in Halifax, has a 1,750-foot (537 meter) total berth length, permitting construction of a substantial rail facility along the back side of the terminal. Although smaller overall, Portland's Terminal 6 has a similar concept. Sea-Land and Maersk both load their Tacoma trains on-dock, in the functional sense, but neither transfer takes place within the marine terminal proper. Maersk, at Terminal 7, uses Tacoma's North Intermodal Yard, which runs between Terminals 4 and 7 and serves both. Sea-Land uses Tacoma's South Intermodal Yard, which is a small, conventional rail container yard accessible to Sea-Land's yard tractors and chassis via a short

connection and an elevated public road. The K Line Long Beach train will be loaded on the periphery of the ITS terminal there, again outside the working marine terminal.

If adjacent or nearby marine terminals are too small to accommodate on-dock transfer individually, then some sort of joint-access arrangement would seem promising, with a rail terminal shared by two or more marine terminals as in Tacoma. Yet this would entail a major reconfiguration of developed ports. Highly developed ports may find it difficult to provide rail access through existing terminals. Ports and railroads that have just invested in new ICTFs will be reluctant to abandon or rebuild them.

Staging and buffering are important functions, although often overlooked in transportation studies. Back-of-the envelope calculations tend to ignore the staggered arrival of export containers for a given ship call; the need for customs clearance or OCP and local containers; the limited number of chassis and lift vehicles available at peak periods; the need for free circulation in the marine terminal while a ship is in port; and the random delays of lost or incomplete paperwork, and damaged or mis-directed containers. "Just-in-time" manufacturing systems demand precise scheduling and extremely high quality control--the equivalent for container handling may not be available.

Organization and coordination are of prime importance in attaining high productivity through on-dock transfer. To minimize handling costs and delays rail, yard, and ship operations have to be closely coordinated. This requirement may place demands on ship stowage with the binding constraint that ship delays cost up to $30,000 per day. The arrival of double-stack container cars on the intermodal scene makes rail stowage an issue as well: 20-foot containers must go on the bottom platforms of end cars, 45-foot containers go on the top, and so forth. If containers have to be organized differently for rail stowage, the need for a container yard buffer may be greater than the advantages of direct chassis transfer to the ship. Not infrequently, the delays and thus costs of conventional drayage can be attributed to inefficient organization and coordination in the marine terminal. Moving the transfer to the terminal may not solve the organizational problem; it may even make it worse.

The labor cost per transfer is a function of organization and productivity. In Seattle, the cost of a drayman with a highway tractor is $35 per hour, $39 per hour overtime. The hourly cost of a longshoreman to drive a yard tractor is roughly $27, to which can be added $10-15 per hour for the tractor, for a comparable total of $37-42 per hour. Thus, there is little inherent advantage to either longshore or Teamster labor. The cost per box depends on how many moves can be made per hour under the prevailing work rules and institutional arrangements. The same firm, Intermodal Management Services, Inc., operates both BN's Seattle International Gateway and

the South Intermodal Yard at Tacoma. The first uses railroad union labor for loading, the second uses longshore labor, but a single job classification and simplified work rules yield very similar labor costs at the two facilities. The marine terminal gate usually divides longshore labor jurisdiction from Teamster, railway, or non-union territory, and the advantages of on-dock transfer may be tempered by the local labor situation. But the apparent cost difference between yard chassis movements and street drayage has more to do with the delay cost of administrative chores than the hourly cost of labor.

6.0 To Dray or Not to Dray

If our goal is to avoid drayage costs, but reducing distance is not the solution, what is it that determines drayage costs? It is time that determines the cost of moving a container between the marine terminal and the rail yard: time to find and mount the container, time to hook up the chassis and inspect the container, time to complete and check paperwork, and more time for delays at any point. The whole process must be reversed at the rail end. It is the gate, and the functions it symbolizes, that raises drayage prices far above the cost of merely transporting the container. At the marine terminal gate, the container passes from the jurisdiction of the ocean carrier to the jurisdiction of the drayman. At the rail yard gate, the container passes from the jurisdiction of the drayman to the jurisdiction of the railroad.

Since North American on-dock transfers have not yet brought the rail cars to shipside, the container must still be transported between ship and rail. At Tacoma's North Intermodal Yard, this whole trip is sometimes made by straddle carriers. Everywhere else in North America, a yard tractor moves the container on a chassis between the marine terminal proper and the rail transfer. Thus, the transportation function of drayage has been retained in on-dock transfer. Literally speaking, the container is still drayed.

Exactly what is it that on-dock transfer avoids? First, on-dock transfer reduces two interchange processes to one simplified procedure. Second, on-dock transfer avoids the use of highway licensed and equipped drayage equipment. Third, on-dock transfer avoids highway weight limits, which prevent 40-foot containers from being loaded to their ISO weight capacities.

Since MLB and IPI containers usually travel in multiples to inland hubs, one railroad bill of lading (or its deregulated equivalent) can be used for the lot. If each container must be interchanged to a drayman, separate ocean/truck interchange paperwork must be created for each container. On-dock transfer obviates the need for the second set of paperwork, but so does the system in use at Burlington Northern's Seattle International Gateway, which uses the same paperwork for both interchanges. As a result, the time spent by draymen at the Seattle Intermodal Gateway is roughly half of what those same draymen spend in marine terminals. The use of computer

links rather than documents in triplicate has encouraged such developments, and the Port of Seattle has been a leader in that regard. Draymen must still deal with individual containers, however, while an on-dock rail transfer can consolidate the documentation for multiple boxes.

The use of public roads for drayage requires the use of truck tractors and chassis that meet highway safety standards, and pay highway license fees and taxes. Where drayage includes freeway travel, as in Los Angeles/Long Beach, it is hard to envision anything but highway tractors doing the job. But at many ports, containers are drayed entirely over surface streets in the vicinity of the Port. In movements between the APL and USL terminals in Oakland and the adjacent UP and SP rail yards, containers travel farther within the terminals than on the public streets. Easments or dedicated traffic lanes could enable yard tractors with suitable lights and braking capability to make these short forays onto city streets and perform the transportation function of drayage while avoiding the cost of highway equipment.

Although neutral chassis pools do not eliminate drayage, they may substantially reduce its cost by eliminating base chassis movements. The neutral chassis pool was introduced by Burlington Northern to expedite the handling of double-stack trains in Chicago. Ocean carriers with containers on BN trains need not provide chassis for delivery from Chicago: chassis move to and from BN's Cicero yard as needed. Santa Fe has started a neutral chassis pool for its Chicago operation, and now has a neutral pool at the ports of Los Angeles/Long Beach. Chassis for the Los Angeles/Long Beach pool are maintained at a central yard and dispatched as needed to either marine terminals (for imports) or the Santa Fe yard (for exports). If this arrangement succeeds in reducing bare chassis movements, the use of neutral chassis pools can be expected to spread.

The on-dock transfers at Vanterm, Halterm, and Brunterm enable those ports to handle containers loaded at or near their ISO limits. These typically exceed highway weight limits when combined with a chassis and tractor, and are commonly referred to as "overweight" containers. Overweight containers are of greater significance in Canada where international traffic, especially export traffic, tends to be heavier. U.S. westbound export traffic also tends to be heavy, and the greater proportion of 40-foot containers in the U.S. trade creates a potential problem below the border as well. The ability to handle overweight containers is thus far a side benefit of on-dock transfer rather than a central objective. Yet the benefit can be substantial, allowing ocean carriers to solicit overweight shipments without special handling that cuts into profits. The Port of San Francisco has made its ability to handle overweight cargo a major marketing point. Where drays are short and confined to an industrial area surrounding the port, however, agreements with city officials can permit overweight drayage on public roads. San Francisco used such an

arrangement temporarily, and the Port of Oakland is presently pursuing similar agreements with the Oakland municipal government.

7.0 Conclusions

It would appear, then, that most of the benefits of on-dock transfer could be achieved through institutional and organizational arrangements without building actual on-dock facilities. Tacoma's South Intermodal Yard may be a model for that kind of development. The critical feature which gives that yard the functional capability of on-dock transfer is the private road connection to the Sea-Land terminal. The Port of Oakland is considering a similar approach.

Yet the on-dock facilities in use appear to be successful, and more are in planning or under consideration. What, after all the doubts have been aired, is the attraction of on-dock transfer over the other means of reducing transfer cost?

If only one point emerges from this discussion, it is that on-dock transfer is not a technological or operational innovation, but an organizational and institutional one. The accomplishment is not bringing the railcar close to the ship, but bringing it inside the gate. There are other ways in which most or all of the benefits of on-dock transfer can be obtained: public highway easements, streamlined paperwork and administration, simplified work rules, neutral chassis pools, etc. But each of these measures requires difficult re-negotiation of existing institutional and regulatory arrangements. For one port or carrier to undertake all these efforts would be a Herculean task. The capital requirements of on-dock transfer facilities may be small in comparison.

The greatest barrier that ports face in achieving on-dock transfer is geographic. Vancouver, Saint John, Halifax, and Portland built new multi-user terminals with built-in rail transfer. In Tacoma, rail tracks that served a former grain facility occupied a corridor between terminals that was later converted to the North Intermodal Yard. In San Francisco, vacant port land is available next to the developing container terminals. Not all ports have these options.

Are double-stack trains and on-dock transfers compatible? They can be, and this review of the issues suggests that the key factor is volume. Double-stack trains, or sets of dedicated double-stack cars, can be efficiently handled at on-dock transfers where sufficient volume is available to outweigh the rail switching costs and minimize any re-sorting or topping-off requirements. This means the large multi-user terminals where the railroad can consolidate boxes from several steamship lines and third parties, or the single-user terminals of trainload customers. From the railroad viewpoint an on-dock transfer is a satellite operation, and it must be big enough to support itself.

The advantages of on-dock transfer depend on the alternatives available as well as on the characteristics of ports and ocean carriers. In Seattle, where a very close and very efficient off-dock intermodal yard has recently opened, the advantages may be very small. APL, the one Seattle carrier operating a dedicated double-stack train, has opted for continued drayage to UP's Argo Yard. In Long Beach, the new ICTF was not sufficient improvement for K Line, who is moving to on-dock transfer.

On-dock transfer, like double-stack trains or intermodalism itself, is not a cure-all. Under existing practices, some ocean carriers and terminals are not candidates for on-dock transfer. Other situations that seem to clamor for on-dock transfer should be examined more closely to ensure that on-dock transfer will solve the problem. As with so many attractive innovations, we can expect to see on-dock transfer mis-applied in some places.

In essence, on-dock transfer is a way of circumventing long-standing organizational and institutional inefficiencies. The key to efficient intermodalism is not the distance between ship and rail, but what takes place there.

NOTES

[1] The Unitcentre terminal in Rotterdam can load directly from ship to rail using container cranes with extended backreach.

[2] I am indebted to James Putz, of the Port of Oakland, for pointing out this ironic truth.

[3] See, for example, Ashar, A., "The Case for On-Terminal Operations," WWS/World Ports, February/March 1984, page 78, or Hardwicke, R., "The Final Gap," American Shipper, November 1985, page 66.

[4] "Stack to Rail Handling Costs Analysed," Cargo Systems, June 1982, page 58.

[5] Hardwicke, R., "Baltimore Cuts a Deal with Chessie System," American Shipper, September 1985, page 27.

UNDERSTANDING THE ROLE OF INTERMODAL TRAILER ON FLAT CAR (T.O.F.C.) SERVICE IN CANADA

by (co-authors) Lloyd L. Ash, Trimac Consulting; Charles Schwier, Canadian Institute of Guided Ground Transport; and Barry Gardiner, Transport Canada

Background

For goods movement, rail technology claims a fuel efficiency advantage in comparison with trucking expressed in BTU's per Ton-mile or Joules per Tonne-km. Over the longer term, rail has a greater potential than truck to tap "non-fossil" energy sources such as hydro and nuclear in the form of route electrification. These factors have led several researchers to propose greater use be made of inter modal technologies to combine the service flexibility of truck with the line haul efficiency of rail (1,2,3,4,5,6).

Ignoring conservation of energy, from a "total cost" standpoint, economic efficiency has led to introduction of inter modal "rail-truck" services in the form of T.O.F.C. (Trailer on Flat Car) and C.O.F.C. (Container on Flat Car) as alternatives to "over the highway" (O.T.H.) trucking.

These technologies combine the pick up and delivery flexibility of trucking with line haul efficiency of rail. This minimizes freight transfer costs and damage in the transfer process.

To date in Canada, T.O.F.C. has been widely used for North American domestic shipments, while C.O.F.C. has captured the tidewater directed market.

These technologies, yet, are not universally accepted. Even on very long distance corridors that are more demonstrably railway cost effective, significant trucking occurs.

To meet a need to better understand Canada's intermodal systems options, Transport Canada recently commissioned a study of Canadian T.O.F.C. activity. This paper highlights the findings of that effort.

Project objectives were as follows:

-To identify the T.O.F.C. market in Canada, quantify historical movements, and develop a ten year activity forecast.

-To analyse "typical" case study corridors in terms of

comparative economics and energy use of T.O.F.C. vs O.T.H.

-To review tariff structures for each corridor to verify the economic evaluations and to understand T.O.F.C. pricing.

The Present and Historic T.O.F.C. Market in Canada

In most parts of Canada, the surface freight transportation market started out as a virtual rail monopoly. Rail's market share was eroded by creation of a good highway network and the evolution of trucking technology as a viable competitor, for all except high volume bulk tonnage movements.

Firstly, motor carriers took the short haul freight away from rail. Then truck competition became reality for all distances, as highway systems improved and truck payloads increased--with considerations of speed, reliability, and ability to pay influencing mode choice.

At the same time, more long distance trucking of non-bulk items resulted from increased labor costs for transferring freight from the gathering modes (truck and wagon) to rail. For bulk materials, by contrast, it is still usually economical to transfer from an optimally engineered (payload) truck to an optimally engineered railcar.

Post World War II Canadian industrial land use reflects these changes. Direct rail spur access is less important to the finished goods manufacturing industry than it used to be.

In the 1950's, the railways--recognizing traffic loss to trucks--looked for an approach to recover at least part of the lost revenues associated with the longer distance trucking market and set about creating the technology for T.O.F.C.

An examination of the cost patterns reconfirmed that at certain distances rail had an inherent cost advantage over the motor carrier. This advantage was not useful in direct price competition because the shippers were using trucks, at almost any price, to satisfy other perceptions of service needs. eg. speed, reliability.

The first T.O.F.C. service was introduced in the Toronto-Montreal market and involved railway owned truck trailers (Plan 2, see later Figure 1). Then, a market very quickly developed to carry trailers for the "for-hire" truckers in this corridor (Plan 1). In this "plan", marketing and customer contact was the trucker's responsibility, with a private arrangement between trucker and

railway for the line haul movement.

This service has spread, over the years, to other--particularly long distance--corridors within what are now five T.O.F.C. plans. Figure 1 highlights the particular characteristics of each "plan". In general, "ownership of equipment" and "contractual relationships" are what determines the T.O.F.C. plan.

Growth of T.O.F.C. was aided by price incentives to motor carriers and private fleets as well as freight "migration" from boxcars to trailers.

Figure 2 attempts to stratify the freight market by type and mode of carriage. Ideal T.O.F.C. movements consist of "non-bulk trailerable goods", preferably in truckload shipments. An example of a "non-trailerable" good is machinery of outsize dimensions. Many "trailerable" products move via third parties such as freight forwarders, pool car operators, and the "speed freight" carriers, both on the road and in the air.

T.O.F.C. has most successfully served trailerable finished goods in full truckloads over long distance corridors. Time sensitive less than truckload (L.T.L.) movements have been less susceptible to T.O.F.C. than non express truck movements.

Despite a "recessionary" economic climate for freight in the 80's Canadian T.O.F.C. has seen continued growth. Figure 3 illustrates the total growth of T.O.F.C. and as a percent of rail traffic from 1976 through 1983. This growth has been limited, however, by increases in allowable highway vehicle weights and dimensions.

T.O.F.C. Forecast to 1995

As noted previously, T.O.F.C. activity has increased continuously despite economic recession from 1976 to 1983. For this reason, development of an econometric demand forecast was not successful. Instead, a base linear growth forecast was estimated, with selective adjustments to account for possible impacts of available improved T.O.F.C. technology.

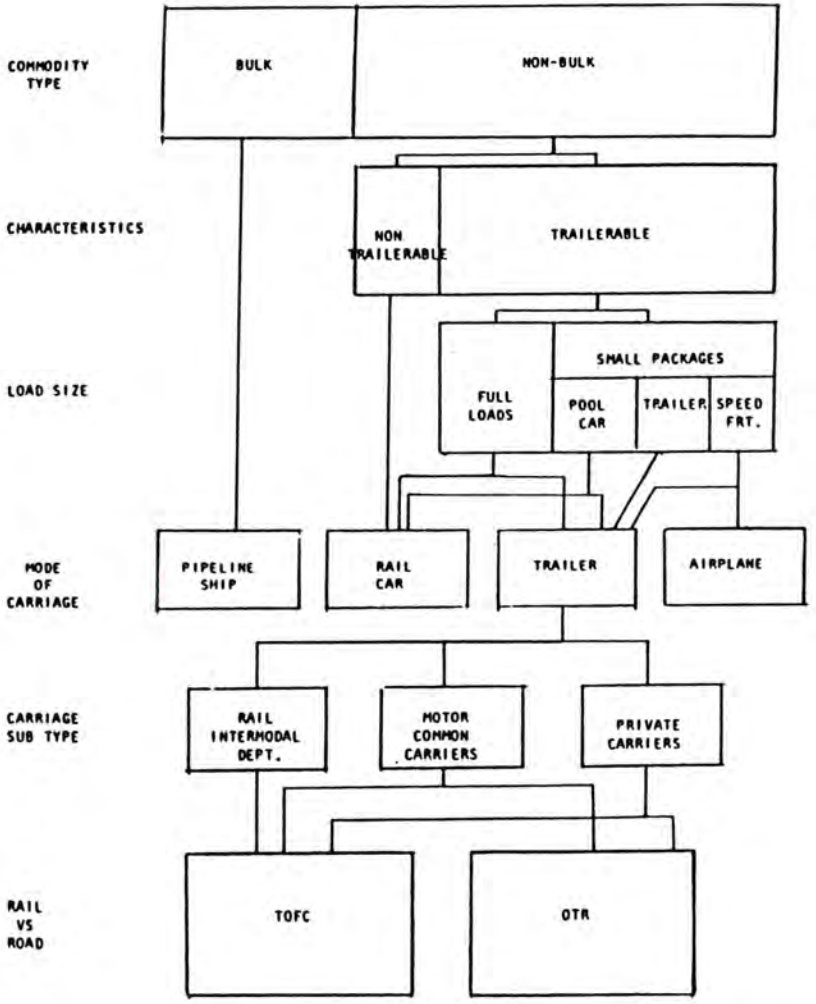
Figure 4 illustrates the base forecast developed by linear extrapolation of "provincial originated" T.O.F.C. trends by province of origin and destination. U.S. sourced and destined movements were included in the analysis. The base scenario saw T.O.F.C. increasing from a present 5.4 million annual tons to 7.5 million tons by 1995.

Disadvantages of using "trend" to forecast include a lack of "causality", ignoring of market saturation

FIGURE 1: T.O.F.C. PLANS OUTLINED

Plan	Trailer Owner Is	Railway Contracts With	Trucking Is By	Shipper Contracts With
1	For-Hire Trucker	For-Hire Trucker	For-Hire Trucker	For-Hire Trucker
2	Railway Intermodal Department	Shipper	Railway	Railway
3	Shipper or lease trailer	Shipper	Shipper or Subcontractor	Railway
4	Shipper or lease trailers AND FLATCARS.	Shipper	Shipper or Subcontract	Railway
5	For-Hire Trucker	Shipper	For-Hire Trucker	Railway and For-Hire Trucker Jointly

FIGURE 2: THE FREIGHT MARKET IN CANADA



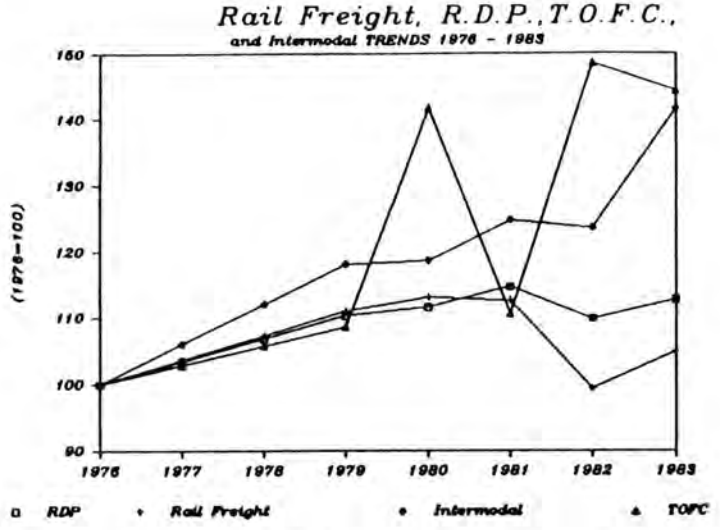


FIGURE 3: GROWTH OF T.O.F.C. FROM 1976 THROUGH 1983

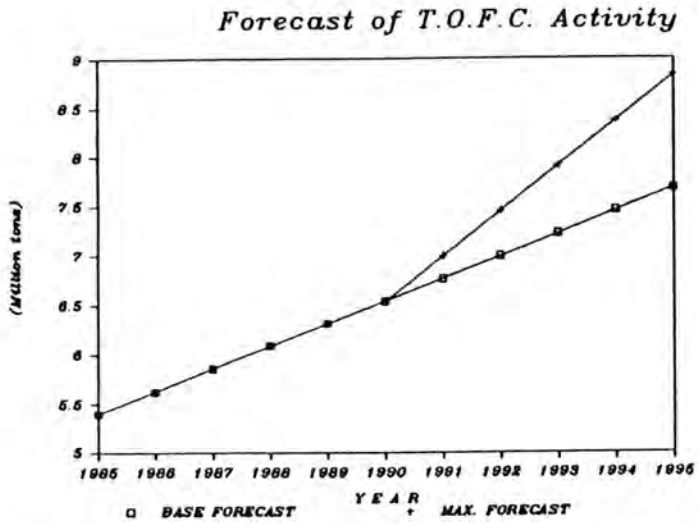


FIGURE 4: ESTIMATED T.O.F.C. GROWTH FROM 1985 THROUGH 1995

constraints (if present), and failure to explicitely recognize changes in economic/social factors or technology.

The principal advantage of the linear model was that it fit the historic data well. Because T.O.F.C. is a small proportion of the total transportation market, it is not likely to be "saturated". By taking a "scenario" approach, it was hoped to appropriately recognize technological opportunities.

Potential Technological Developments Related to T.O.F.C.

Proponents of T.O.F.C. "blame" increases in highway limits for eroding potential T.O.F.C. markets in Canada and this is likely true in the short term. However, in the longer term it is important to remember that technology is seldom "static" or "frozen". Thus, rail technology has, and is continuing to improve.

System improvements currently being implemented include the use of "well cars" to reduce aerodynamic losses, "double stacked containers on well cars" to increase payload efficiency, and consideration of new "side transfer" technology to improve rail short haul efficiency.

An optimistic forecast is shown in Figure 4, based on an assumed market share increase for T.O.F.C. using these technologies. In this scenario, T.O.F.C. is expected to grow to 8.9 million annual tons by 1995.

Little technological impact was foreseen until 1990. This reflects current freight market competitive factors (evidenced by availability of inexpensive trucking and lease operator tractors) which tend to result in deferral of capital investment for new technology. In addition, there is a lead time to establish and market innovative services. Unfortunately, shippers' perceptions of T.O.F.C. tend to be negative and time will be required to change them.

Some likely T.O.F.C. strategies that may result in an increased activity from 1985 through 1995 include:

-More Efficient Transfer Capability. Side transfer has been proposed to replace conventional loading ramp intermodal yard technology. Such operations might enable trains to "peddle" trailer movements over shorter distance movements.

-Opportunity For High Productivity Integral Train. Railroad researchers have suggested that present technology has not been optimized using traditional flatcars for T.O.F.C. Opportunities exist for reducing tare weight and rolling resistance, improving aerodynamics, reduced maintenance technology, and alternate diesel fuel use. Up to 50 % operating cost savings are

predicted. In this context, there are designs for new light weight skeleton cars and low centre of gravity well cars. In 1985, CN Rail announced the purchase of 260 "well cars" for piggyback service. These cars are particularly suitable for moving the newer 48 foot van highway trailer.

Working to reduce the amount of T.O.F.C. activity, container technology is a competitive alternative.

Considering the history of intermodal truck and rail activity in Canada, it is easy to see why T.O.F.C. has dominated the market. Growth of T.O.F.C. has required the cooperation and assistance of motor carriers--which has been easier to achieve with Plan 1. This service option particularly appeals to the general freight trucker operating van, stake and tarp, and flatdeck equipment. C.O.F.C., on the other hand, appeals primarily to flatdeck carriers who have the equipment to pick up and deliver containers--but little of the total trailerable finished goods market. Other problems related to standardizing container sizes have limited the C.O.F.C. share of the domestic North American market.

Results of Corridor Case Studies

Case studies were analysed based on a one-way trailer movement using the Trimac Truck Costing Model and the C.I.G.G.T. Railway Costing Model. The four corridors included Toronto-Vancouver (apprx. 2800 miles), Toronto-Winnipeg (apprx. 1300 miles), Toronto-Montreal (apprx. 350 miles), and Calgary-Edmonton (200 miles).

Figure 5 summarizes the case study energy and economic comparisons for a 40 foot long highway van unit. In these comparisons, the T.O.F.C. value shown includes provision for urban truck pick up and delivery (trailer spotting) based on a 25 mile round-trip.

In viewing these generalizations, care must be exercised for the following reasons:

-Service generalizations were used for analysis purposes which assumed reasonably productive utilization of rail schedules and trailer sport positions in the train.

-Both the rail and truck cost analyses used "long term cost" approaches rather than "market based" approaches that reflect current recessionary conditions. Thus, shippers presently pay less for both services than estimated because a surplus of capacity has depressed rates to only slightly above variable costs. This results in a low rate of return on (sunk) capital that is better than "idle resources", but is unlikely

FIGURE 5: T.O.F.C. AND O.T.H. ENERGY AND ECONOMIC COMPARISONS 40 FOOT VAN HIGHWAY TRAILER

CORRIDOR	DISTANCE (miles)	FUEL USE (litres) TOFC	FUEL USE (litres) OTH	TOTAL TRIP COST ($/movement) TOFC	TOTAL TRIP COST ($/movement) OTH
Toronto to Vancouver	2800	952	2292	$2398	$5458
Toronto to Winnipeg	1300	450	1072	$1373	$2605
Toronto to Montreal	350	184	288	$ 760	$ 717
Calgary to Edmonton	200	112	155	$ 658	$ 345

T.O.F.C. Trailer on Flat Car
O.T.H. Over the highway trucking

FIGURE 6: T.O.F.C. AND O.T.H. ENERGY AND ECONOMIC COMPARISONS 48 FOOT VAN HIGHWAY TRAILER

CORRIDOR	DISTANCE (miles)	FUEL USE (litres) TOFC	FUEL USE (litres) OTH	TOTAL TRIP COST ($/movement) TOFC	TOTAL TRIP COST ($/movement) OTH
Toronto to Vancouver	2800	857	2336	$2534	$5512
Toronto to Winnipeg	1300	406	1092	$1455	$2633
Toronto to Montreal	350	166	292	$ 806	$ 728
Calgary to Edmonton	200	106	157	$ 700	$ 352

T.O.F.C. Trailer on Flat Car
O.T.H. Over the Highway Trucking

to result in significant new capital investment. Use of a longer term horizon was a conscious aspect of the study design, hence the need for a more satisfactory "rate of return" on capital investment.

Figure 5 shows the clear economic cost advantage of T.O.F.C. for the two longest distance corridors. This analysis neglects any service comparisons between trucking and T.O.F.C.. For the 350 mile Toronto-Montreal corridor, there is a slight cost advantage to trucking, but cost levels still permit T.O.F.C. to compete for a share of this market. For the shorter Edmonton-Calgary corridor, T.O.F.C. is generally cost prohibitive. This finding compares with U.S. researchers' findings that T.O.F.C. best serves trips over 500 miles.

In relation to energy use, T.O.F.C. demonstrated fuel savings between 30 and 60 percent compared to trucking for all corridors. This analysis illustrates an interesting conflict between the objective of energy (sub) optimization and total cost optimization for the short distance corridors.

For technological comparison, the case studies were also analysed for 48 foot van trailers and for "well cars" similar to the car sets recently acquired by CN Rail. Note that the use of 48 foot vans on standard (60 foot and 89 foot) flatcars would not be as efficient as the well car configuration. Figure 6 illustrates the analysis which was performed.

In general, the corridor comparisons are similar to those cited for the 40 foot van trailers. In comparing technologies, articulated "well cars" are noted to be more fuel efficient in an absolute sense (see Figs 5,6) reflecting the reduced aerodynamic drag and rolling resistance of these units. Per trailer transportation costs are higher for a 48 foot than a 40 foot van. However, as costs are not 20 % higher and the larger unit has a 20 percent larger cubic capacity, the enhanced efficiency of these units is demonstrated.

Conclusions and Recommendations For Further Research

The case studies and forecasts presented provide a reasonable first understanding of T.O.F.C. in Canada. In particular, the service is well suited to trailerable van freight movements where economic cost minimization is important and service times are not a major factor.

For short distance corridors under 500 miles, the cost factors tend to favor truck, although fuel use is still somewhat higher than for T.O.F.C.

Similar corridor comparisons would be useful for C.O.F.C. (Container on Flat Car) in Canada. C.O.F.C., in particular, has potentially enhanced energy conservation and overall economic benefits if containers are "double stacked" on "well cars". Such a research effort could also usefully address the factors which have constrained C.O.F.C. in the North American domestic market and examine the potential for overcoming these areas of objection.

REFERENCES

1 Hueur and Eshelman, HOW SHORT HAUL PIGGYBACK CAN BE MADE ECONOMIC, IPC Transport Press Limited, AT Kearney and Company Inc., Railway Gazette Intl., Vol 135, No 8, Aug 1979

2 Flott, EFFECT OF PIGGYBACK OPERATION ON VOLUME OF HIGHWAY TRUCK TRAFFIC, Highway Research Record, 1967, No 153, pp43-53.

3 Samuelson and Roberts, C.O.F.C. vs T.O.F.C.: A COMPARISON OF TECHNOLOGIES, M.I.T. Centre For Transportation Studies, June 1977, REport Number CTS-77-10.

4 Randall, RAIL INTER_MODAL OPERATION AND FUEL EFFICIENCY, Energy Research and Development Administration, 20 Massachussets Ave N.W., Washington D.C., 20402 May 1977

5. Rice, TOWARD MORE TRANSPORTATION WITH LESS ENERGY, MIT Technology Review, Vol 76, No 4, February 1974.

6. Welty, TOFC?COFC GROWTH: THE END IS NOWHERE IN SIGHT, Railway Age, Vol 174, No 10 , May 1973.

7. Samuelson and Roberts, PRICING TOFC SHUTTLE TRAINS: AN EQUILIBRIUM ANALYSIS, Transportation Research Record, N721, 1979.

8 Leilich, ECONOMICS OF IMPROVED TOFC/COFC SYSTEMS, Transportation Research Record N721, 1979

9 Reebie Associates, AN IMPROVED TRUCK/RAIL OPERATION: EVALUATION OF SELECTED CORRIDOR, NTIS Report No. FWHA/TE-76/02-S, Dec 1975

ECONOMIC ANALYSIS OF LINER SHIPPING INTERMODAL SERVICES AND RATESETTING PRACTICES

by

Michel Archambault
Canadian Transport Commission
Research Branch

1 - Introduction

Recent studies on trade flows have confirmed that the concept of "natural hinterlands" for seaports no longer applies to containerized shipments and that the trend is towards "load centering ports". These findings are directly linked to the technological advances of containerization and intermodalism which have given birth to new patterns and practices in international cargo distribution. One striking result of these developments is the advent of sea-rail intermodal services involving co-ordinated strategies and efforts between ocean and rail carriers in order to enhance their efficiency in container movements and enter into new markets. It is becoming evident, during the past ten years, that some new economic realities in the internatioanl liner shipping industry have been the driving forces behind the growth and innovation in intermodal services.

Shipping companies strive for cost advantages through further economies of scale, leading them to order ever larger fully cellular container ships. A direct side effect of the load capacity of these new container vessels has been the need for a rationalization of the maritime ports of call to ensure high traffic density, which is a vital prerequisite for achieving the economies of scale. However, expected economies in containership operations and the rationalization of ports of call depend upon efficient intermodal access and connections, in order to extend the reach of liner companies into distant inland markets and provide a rapid overland turnaround of containers. Due to these new conditions of efficiency in container movements, liner companies are increasingly playing a greater role in the total distribution of cargo by providing a complete transportation service to shippers, usually under a single rate assessed for the transport of cargo over the entire route.

Relatively little information has been published concerning intermodal ratesetting practices of liner companies and the structure of their intermodal rates. This paper will examine these issues by using the results of an economic analysis of outbound intermodal rates quoted by three major Conferences serving Canadian North Atlantic trades. Two of these Conferences operate from the Canadian east coast ports, while the other operates from the west coast of Canada.

2 - Liner Intermodal Rate Practices

One of the major effects of the integration of intermodalism into liner shipping activities has been a significant reform of the conventional weight or measurement based liner tariffs. The new system has adopted a lump-sum commodity box rate system, itself extended with comprehensive intermodal rates which include conditions for inland transportation.

The conversion to commodity box rates has not resulted in a reduction in the number of commodity classifications. In fact the commodity nomenclature has remained as extensive as it was under the conventional system. However, all intermodal services are rated strictly accordingly to the commodity box rate system and intermodal tariffs apply to unitized cargo in containers provided by the carrier.

As shown in Table 1, there is a diversity of products covered by the outbound intermodal rates quoted in the tariffs by the three major conferences linking Canada with the United Kingdom and Continental Europe. Although individual cargo moving in containers is assessed a freight rate in accordance with the commodity entries, it does not preclude the shipment of a container stuffed with mixed commodities. In such a case, each component cargo will have to be rated on a pro rata basis determinated by the weight of the cargo making up the full container load. Furthermore, as the containers are usually provided by the lines, they are made available to the shippers for container (de-) stuffing and positionning tasks subject to free time conditions. Once the free time period - which varies by container type and the number involved - has expired, demurrage charges will be applied. In order to take into account the various transportation and stuffing requirements related to the movements of cargo in containers and the economics of moving goods intermodally, two sets of service conditions have been implemented by liner companies.

The first set of conditions is the (de-) stuffing terms of any containerized shipments which apply to

TABLE 1

LINER INTERMODAL RATE COMMODITY CHARACTERISTICS*

	COMMODITY GROUP					
	BULK CARGO	CRUDE MATERIALS	FABRICATED MATERIALS	END PRODUCTS	OTHER	TOTAL
NBER OF COMMODITIES	7	18	26	30	7	88
Percentage	(8,0)	(20,5)	(29,5)	(34,1)	(8,0)	(100,0)
NBER OF RATES	83	132	119	87	34	455
Percentage	(18,2)	(29,0)	(26,2)	(19,1)	(7,5)	(100,0)
UNIT VALUE (per kg)						
mean ($)	0,45	2,56	1,78	8,10	°°	3,01
minimum ($)	0,15	0,14	0,10	1,04	°°	0,10
maximum ($)	0,70	5,09	6,53	26,00	°°	26,00

* Effective as of November 1984, outbound intermodal rates between Canada and United Kingdom, and Continental Europe.

°° Not intended to be calculated.

each end of an intermodal service. Two terms, "House"(H) and "Pier"(P), determine whether the shipper or the liner company has to arrange for the proper(un-) packing of the container(s). The term House means that the shipper has to load (or unload) cargo into (out of) the container(s) at his own expense, usually at a facility other than the terminal of the carrier involved, and to present at (or remove from) the terminal designated by the carrier the loaded container(s). The other (de-) stuffing term - Pier- signifies that the carrier arranges at shipper's request, for the container (de-) stuffing but at the carrier's designated location. The assignment of the two terms (H/H, H/P and P/H) defines the conditions applicable to the origin and destination of the shipment.

The second set of conditions refers specifically to the type of intermodal services available to the shipper and to the scope of rates. Four types of intermodal service can be supplied: Door-to-Door (D/D), Door-to-Terminal(D/T), Terminal-to-Door(T/D) and Terminal-to-Terminal(T/T). Various intermodal rates, inclusive of all transportation charges incurred for the movement of the container(s) between two specified locations, can be assessed in accordance with the commodity entries in the tariffs. The "Door" and "Terminal" terms are indicative of the service pattern. The term Door is used to indicate that the inland point explicitly refers to the shipper's designated place of stuffing or destuffing while the term Terminal specifically refers to one of the liner company inland container depots (also referred as container freight stations).

As a typical example, let us take a "Door-to-Terminal" movement from Brampton, Ont. to a U.K. container depot, under "House-to-House" stuffing terms. The intermodal rate quoted by a liner company will include the charges for: (1) truck delivery of empty container for loading and pick-up of loaded container between Brampton, Ont. and the Toronto railway container terminal, (2) the truck-rail container transshipment, (3) the container identification and inter-carriers telex reports on container(s) moved, (4) the transport by rail, (5) the railway and steamship terminal services, (6) the ocean transport and finally, (7) the overseas terminal services where the loaded container is placed at the disposal of the consignee. However, as stuffing terms are governed by "House-to-House" conditions, all expenses incurred for the proper packing and unpacking of the cargo will not be included in the liner intermodal rate, being under shipper's responsibility.

Based on the 1984 liner intermodal rates, Table 2 reveals two leading liner intermodal service practices.

TABLE 2

MAIN CHARACTERISTICS OF LINER INTERMODAL RATES (EFFECTIVE AS OF NOVEMBER 1984)*

	TERMINAL/ TERMINAL	DOOR/ TERMINAL	TERMINAL/ DOOR	DOOR/ DOOR	TOTAL
HOUSE/HOUSE	94	76	65	155	390
PIER/HOUSE	51	8	-	-	59
HOUSE/PIER	6	-	-	-	6
TOTAL	151	84	65	155	455
	20' CONTAINERS				
MEAN RATES ($)	1,285	2,274	1,395	1,786	
MEDIAN ($)	1,315	1,800	1,330	1,816	
STD. DEV.	167	1,067	218	324	
MIN. RATES ($)	925	1,260	1,130	1,298	
MAX. RATES ($)	1,975	5,750	2,218	2,542	
MEAN INLAND DISTANCE (MILES)	-----	607	162	413	
UNIT VALUE ($/TONNE)	1,128	4,423	1,901	1,869	

* Outbound intermodal rates between Canada and United Kingdom, and Continental Europe.

First, 86 per cent of intermodal rates were quoted on "House-to-House" terms, indicating that the costs incurred for container stuffing were not generally covered by the intermodal rates assessed by liner companies and reflecting, that those latter tend to put the responsibility on shippers to arrange for proper stuffing of their cargo. Second, inland container depots (ICD) seem to play a major role in the patterns of liner intermodal services: one third of their intermodal rates correspond to intermodal service performed between two ICDs and another third to intermodal services either starting from or terminating at an ICD. The identification of ICDs in Canada shows that they are all located either close to or at a railway-head switching yard or a railway-head terminal (i.e. Halifax, N.S., Saint John, N.B., Québec City and Montréal in Qc, Toronto, Hamilton, Sarnia and Windsor in Ont., Winnipeg, Man, Regina and Saskatoon in Sask. Calgary and Edmonton in Alta, and Vancouver in B.C.).

From the latter observations, it is reasonnable to infer that the tendency of liner companies to locate their ICDs close to railway container terminals reflects their drive toward obtaining cost and operational advantages, by developing patterns of intermodal services which generally concentrate on full container loads to be moved on unit trains. In other words, the liner strategies are based on the potential of railways for expanding the hinterland container markets and on opportunities to take advantage of railway time-volume rates for point-to-point services.

Two transportation economic premises support these liner intermodal practices. The first is that greater efficiencies in intermodal operations can be realized when relative long distance line-hauls can be performed, before containers are broken down into their component packages. The second is that railways have economic advantages for long distance and high density volume shipments, where economies of scale can be achieved from block movements of containers on unit trains. Furthermore, there are opportunities for liner companies to take advantage of the concentration of transportation services at most of railway container terminal areas. In addition to available local truck operations for the remaining part of an intermodal transport, cargo consolidation and distribution activities usually already exist around these railway facilities - two key operational aspects which make intermodalism possible.

Table 3, Line (1), attests to the fact that railway time-volume rates may lead to a high discount per container, depending on the shipper's ability and capacity

TABLE 3

COST BREAKDOWN OF A 20' CONTAINER D/T SERVICE FROM KITCHENER (ONT) TO A WESTERN EUROPE BASE PORT (NOVEMBER 1984)

TRANSPORT COST COMPONENTS	$	REGULAR RATE	TIME-VOLUME FREIGHT RATE min. nber of containers			
			2	20 p.w.	50 p.w.	12,000 p.y.
Del. and pick-up of cont.	X	219	145	145	145	145
Container identification	8					
Truck-rail transshipment	69					
(1) Rail freight rate*	X	509	339	263	247	219
Telex reports on cont. (min)	5					
Rail Terminal Service at port	69					
Liner Terminal Service (Canada)	54					
Ocean Freigh rate**	910					
Liner Terminal Service (W.E.)	100					
(2) Total transport cost ($)		1,943	1,699	1,623	1,607	1,579
(3) Liner intermodal rate quoted ($)		1,650	1,650	1,650	1,650	1,650
(4) Difference of (2) - (3) ($)		293	49	(27)	(43)	(71)

* Kitchener has been linked to the Toronto railway container terminal; p.w.=per week, p.y.=per year.

** The commodity involved is "Video monitors and parts".

to commit himself to large volume of containers over a given period of time. Line (2) indicates what might be the total transport cost to the shipper if he elects to arrange his own transportation by comparaison to Line (3), where the liner intermodal rate quoted for this particular "Door-to-Terminal" service is shown. This example, although limited, illustrates how the railway time-volume rates can, to a large extent, allow liner companies to supply intermodal services at a competitive price relative to other transport operators, such as some freight forwarders.

To summarize, in the context of container transport, the operations of larger liner containerships and of railway unit trains entail very similar conditions of efficiency: traffic density and both steady and balanced cargo flows. This situation has led liner companies and rail carriers, on a purely commercial basis, to co-operate and co-ordinate their efforts to improve the efficiency of their container activities. Three main organizational devices of uniting liner and rail activities are:

(1) the synchronization of containership's and unit trains' schedules allowing more efficient and further flows of containers to and from ports, through direct transshipments of boxes from (to) vessels to from) unit train cars,
(2) the provision by liner companies of point-to-point rates and intermodal services, in order to control the costs and quality of services offered to inland shippers and, with the advent of mini and micro land-bridges, to enhance the competitiveness of their maritime services relative to their competitors and finally,
(3) the implementation by railways of flexible high discount time-volume box rates, largely set by competitive forces and negotiations, for both import and export sea-container traffic between specified Canadian ports and major railway container terminals.

3 - Regression Analysis of Liner Intermodal Rates

A recent CTC study, based on 1983 liner conference tariffs, has empirically shown that the commodity box rates system is positively and significantly related to the conventional weight-measurement tariff system. From this result, it is reasonable to expect that the determinants of the intermodal commodity box rates will also include some factors that past studies have identified as influencing the level of port-to-port liner freight rates. Using, as a case study, the 1984 intermodal rates quoted by the Canada-United Kingdom

Freight Conference Canadian - Continental Eastbound Freight Conference and Western Canada - Europe Conference for Canadian exports, this section aims to identify statistically the determinants of the liner intermodal rates.

The analysis which follows is based on the premise that liner intermodal tariffs reflect the cost and value of services provided as well as the market supply conditions on the routes. Accordingly, the intermodal rates are related by multiple regression analysis to cost and value of service factors, where the straight linear estimated form is:

$$CIR = B_0 + B_1\ UVAL + B_2\ Inld + B_3\ TIS = B_4\ COST + B_5\ MSC + u$$

where

- CIR = the commodity intermodal rate
- Bo = the constant term
- UVAL = the unit value of commodity per kg
- INLD = the total inland distance in Canada and in Europe
- TIS = the type of intermodal service
- COST = a group of dummy variables used to represent various cost determinants, which could be
  - FEU: 40' container size
  - OST: overseas service terminal charges
  - STUFF: stuffing conditions
  - WC: Vancouver as port of export
  - TCC: temperature controlled cargo
  - EMR: Special conditions of inland carriage
- MSC = a group of variables used to represent various market supply conditions which could be
  - TONS: total tonnes of containerized commodity carried by each conference
  - COMP: proportion of containerized commodity carried by non-conference lines on the route
  - DIVR: commodity rate of diversion through American ports.

The major sources of data include conference tariffs and rules filed with the Canadian Transport Commission, data on cargo shipping records obtained from Statistics Canada, special tabulations on commodity unit value and commodity trade diverted through American ports produced by Statistic Canada and various Canadian and foreigh inland distance matrixes.

The results of the regressions are shown in Table 4. The high coefficients of determination ($\bar{R}^2$)

TABLE 4

REGRESSION ANALYSIS OF LINER INTERMODAL RATES**

VARIABLES	T/T & D/T	T/D & D/D	EAST COAST	ALL RATES
CONSTANT	1 142,5 (13,1)	1 318,2 (19,7)	1 328,2 (16,3)	1 137,9 (18,1)
FEU (d)	728,7 (11,4)	641,1 (10,8)	675,1 (16,6)	695,2 (19,3)
WC (d)	240,0 (1,9)	--	--	292,0 (3,2)
STUFF (d)	-145,3 (2,1)	--	-89,7 (1,7)*	-15,9 (0,3)*
OST (d)	126,7 (1,7)*	--	165,0 (4,0)	144,9 (3,6)
INLD	0,44 (5,9)	0,30 (4,1)	0,58 (9,8)	0,69 (14,3)
UVAL	0,025 (4,5)	0,009 (1,4)*	0,014 (4,2)	0,014 (3,8)
TIS (d)	395,0 (3,9)	726,9 (19,7)	--	--
TCC (d)	1 930,0 (10,9)	--	--	1 870,4 (14,6)
EMR (d)	1 611,8) (11,8)	--	--	1 053,9 (9,6)
COMP	--	-368,7 (6,2)	-238,4 (3,2)	--
TONS	--	--	-0,003 (2,0)	--
DIVR	--	-2,4 (2,1)	--	--
$\bar{R}^2$:	0,85	0,82	0,76	0,85
N :	204	87	188	289

d = Dummy variable * = Insignificant variable at 5% level if T<1,9

** By November 1984, between Canada and the U.K. and the Continental Europe.

indicate that the four regression equations explain a large portion of the variations in intermodal rates. Several important points can be highlighted from the Table 4. Considering determinants linked to demand characteristics, two independant variables have been found significant: the commodity unit value (UVAL) and the commodity-by-commodity tonnage of containerized cargo carried (TONS). The significant positive coefficient of the unit value in three of the four equations suggests that liner companies still practice price discrimination, by setting generally higher rates for high-value commodities than for low-value ones. However, the insignificant UVAL coefficient, observed in the second equation which applies only to the conferences operating from the Canadian east coast ports, might be an indication that the pressure of market competition may negatively affect the traditional approach to tariffs: "the higher the value of an item the better it is able to bear a high cost". Market competition emerges from both other Canadian based liner companies serving the same markets (COMP) and foreign intermodal services offered by American based liner companies (approximated by the commodity rate of diversion DIVR).

The other demand-related variable, TONS, enables us to test the hypothesis that liner companies tend to quote lower rates for commodities moved in large quantities. Due to the unavailability of data on commodities carried intermodally, the containerized tonnage by commodity for each of the two East Coast conferences has been used as a proxy-variable. The significant negative sign of the TONS' coefficients (equation (3)) can be attributed to a possible barginning position of shippers in two ways. First, it may correspond to a partial transfer, from the liner company to the shippers, of lower railway time-volume rates available to liners as a result of their capacity to commit large volumes of traffic to railways. Second, a more global reason, large quantities imply security of revenues and ensure economies of scale in overall liner container operations, benefits which could be reflected in the pricing decisions of some lines.

Seven different cost and value related independant variables have been identified as potential sources of variation in intermodal rates. Two necessary variables taken into account are the specific cost factors associated with inland and maritime distances involved. The inland distance variable (INLD) refers to the total Canadian and European distance overland, considered for each intermodal rate. The longer maritime distance associated to Vancouver relative to Montréal, as port of exit, has been represented by the dummy variable WC. As expected, in all equations (where applicable)

the INLD and WC coefficients were positive and statistically significant.

The five other specific cost factors, represented by dummy variables, refer explicitly to particular service conditions that could be included in some intermodal services offered by liner companies. Two of them, which relate to distinctive cargo characteristics, are the temperature controlled cargo (TCC) and other special requirements for cargo handling or inland carriage (EMR), such as the case of some western grains moved via Vancouver. Both, when applicable, were found positive and significant variables influencing the level of liner intermodal rates. Two other explanatory variables, statistically significant, are the inclusion or exclusion of the overseas terminal service charges in the intermodal rates (OST) and the (de-)stuffing terms linked to each individual intermodal service (STUFF). The expected negative coefficient of the variable STUFF, in equation (1), is consistant with the fact that, under "H-to-H" terms, the liner company is not making any arrangements for container stuffing activities, which is reflected in lower intermodal rates. The last cost factor identified is the 40' versus 20' container size to which rates apply, represented by the dummy variable FEU. In all equations, the coefficient of the FEU variable is significantly positive and always smaller than the constant term. This can be attributed, on the one hand, to the higher handling and transportation cost of a 40' container relative to a 20' container and, on the other hand, the usually lower cost to move a single 40' container rather than two 20' containers.

In addition, the economic premise that a competitive market environment usually leads to lower prices or reduces the sustainability of price discrimination in a given industry has been confirmed. In equation (2), the commodity-by-commodity proportion of containerized cargo tonnage carried by other liner shipping companies serving Canada (COMP) and rate of cargo diversion through American ports (DIVR) are negatively related to the intermodal rates. This may also indicate that, as a result of development of efficient intermodal networks, the competition in the liner market has been enhanced, not only on a national level but also, between liner companies calling at ports located in two adjacent countries (Canada and the U.S.A. in the present case).

Finally, in equations (1) and (2), the significant positive sign of the coefficients of the dummy variable TIS (type of intermodal services) can be interpreted in two ways. In one instance, this gives support to the hypothesis that liner companies would practice

a value-of-service pricing based on the relative overall quality-value that could be associated to each of the four type of intermodal services. In the other instance, this may also indicate the omission of other explanatory variables influencing the level of intermodal rates, either related to the demand side or the supply side, however. This latter would suggest a need for further research.

In conclusion, the results of this regression analysis confirm the hypothesis that some determinants - commodity unit value, the requirement for temperature controlled containers, the maritime distance and the quantity of the commodity moved - already identified in previous studies as factors for variations in the level of ocean freight rates, can also be significant variables to account for intermodal rate variations. However, the most striking result is the importance of COST and MARKET SUPPLY determinants to explain differences between liner intermodal rates. The level of intermodal rates appears to vary more in response to cost characteristics of the services and to liner shipping supply conditions than to demand-related factors.

References

Canadian Transport Commission, Research Branch, "La tarification intermodale pratiquée par les compagnies maritimes de ligne régulière", Discussion Working Paper No. WP 20-85-24.

Canadian Transport Commission, Research Branch, 'Economic Analysis of the Liner Market and Freight Rates in Canadian International Trades", Research Report No. 1985/05E.

Bryan, I., 1974, "Regression Analysis of Ecean Liner Freight Rates on some Canadian Export Routes", Journal of Transports Economics and Policy, May 1974, pp 161-173.

Heaver, T.D., 1972, "Trans-Pacific Trade, Liner Shipping and Conference Rates", The Logistics and Transportation Review, Vol. 8, No. 2 1972 pp 3-28.

Endnote

The author wants to thank J. Diamond, H. Kurasawa and A. Ray from the Research Branch for their invaluable comments on earlier versions of this paper. However, I alone am responsable for the views expressed in this paper and they do not necessarily reflect those of the Canadian Transport Commission.

THE CANADIAN LANDBRIGDE

by

REJEAN LECLERC
ST.LAWRENCE DEVELOPMENT SECRETARIAT.

1.0 Introduction

In recent years, the most significant progress noted in the transportation field, particularly in water transportation, has been the development of containerization. This method took hold gradually in Canada about the middle of the 1960s. It was thought then than 90% of all general cargo shipped could be containerized. Now, twenty years later, about 70% of general cargo moved by ship is containerized.

Compared with the other sectors of international water-borne trade, the maritime container transport industry accounts for only a small volume of world trade (about 200 million tons out of a total traffic volume of 3 600 million tons)[1]. Container traffic does of course hold first place in terms of value of goods moved.

According to Cargo System Research Consultants Ltd., containerized traffic throughout the world grew at an average annual rate of 18½% between 1970 and 1980. As the beginning of the 1980s, the average annual rate of growth was 12½%. Cargo Systems Research Consultants Ltd. concludes in its report that the average annual rate of growth up to 1990 will be 5%[2]. These forecasts are confirmed by the Bremen Institute of Shipping Economics and by the Japanese maritime transport company, Nippon Yusen Koiska (NYK).

In 1970, two regions dominated world container traffic. Western Europe accounted for almost half the traffic and North America for almost a third. Ten years later, their share had fallen to one-third and one-fifth respectively. During this same period, the Far East outstripped the American market while South and Southeast Asia, Africa, the Middle East and South America began to generate not inconsiderable volumes of traffic (about 5% each).

The Far East/Europe route is therefore a most thriving one, ranking third in the world, and it is with penetration of this large market in mind that the idea of establishing a Canadian Landbridge service came about.

2.0 Commerce between Asia and Europe

In 1982, exports from the Far East to Europe totalled more than $37 billion while imports from Europe to Asia amounted to $24.3 billion. The Asia/Europe traffic is concentrated mainly among the EEC countries, Japan, the People's Republic of China, Hong Kong, South Korea, Malaysia and Singapore, with Japan showing a clear predominance in trade at both the import and export levels.

Annual traffic between Asia and Europe is estimated at one million T.E.U., all of which is moved by water transportation, about 650 000 T.E.U. being shipped from Asia to Europe and 350 000 from Europe to Asia [3].

The USSR, meanwhile, operates a landbridge whose traffic has been increasing since 1970 and now totals between 90 000 and 120 000 T.E.U. annually.

The volume of traffic from Asia to European markets by way of the United States, Mexico and Canada is negligible but could increase in the future.

2.1 Maritime services

Two groups of maritime carriers provide services through the Suez Canal: Conference carriers (Far East Freight Conference: FEFC) who hold between 60% and 70% of the market, and carriers who are not members of the Conference and who share the rest of the market.

It is these outsiders who determine the competitiveness of the market and it is they who can cause the Conference to increase its rates. Among the principal outsiders are Evergreen and Yang Ming. These tolerated outsiders operate at tariffs lower than those of the Conference (5% to 10% lower as agreed by the Conference).

2.2 The Soviet landbridge

The trans-Siberian landbridge (TSR) is a transportation service from the Far East to Europe by sea (Japan-USSR), then by land route (rail and road) USSR-Europe.

In northern Europe, a feeder service which begins at Leningrad serves the ports of Hamburg, Rotterdam, Tilbury, Antwerp and

Le Havre. In southern Europe, another feeder service starts from the Russian port of Zhdanov on the Sea of Azov and serves the Mediterranean countries including those of North Africa.

In the Far East, feeders ply between Nakhodka/Vostochny, Japan, Korea, Hong Kong, Malaysia, Singapore, Taiwan and the Philippines. The feeder services are operated exclusively by Fesco, Baltic Steamship Co., and Black Sea Steamship Co., except for those between Japan and the USSR which are provided by the Japanese carriers, Y-S Line, K. Line and Jino Lines.

The Russian trains are dispatched to Chop on the Czechoslovakian/Austrian border en route for southern Europe, and Ungheney on the Hungarian border to serve southeastern Europe.

At present, the Soviet operation holds 10% of the Far East/Europe market, and the traffic imbalance is between 2 and 3 to 1 for the traffic going West[4].

Russian landbridge traffic is divided up as follows: one-third is destined for northwest Europe and 4% for countries on the Mediterranean. Just over one-third of the traffic goes to Scandinavia (17./%), Central Europe (10.9%) and the Comecon countries (7.7%). The remaining 30% of the containers go to the Middle East, mostly to Iran.

In short, there are at present two alternatives by means of which the market between Asia and Europe is served. Let us now consider the potential of a Canadian landbridge and what is needed to make it a reality.

2.3 Canadian landbridge

All the elements needed to create a Canadian landbridge, using the country's rail system to link the Trans-Pacific and Trans-Atlantic maritime services in order to serve the Far East and European markets, are in place. The ports of Vancouver and Montreal (perhaps Halifax and Saint John) could then be the container transit points for the North American continent.

It should be noted that only a very small volume of traffic from the Far East en route to Europe uses the Canadian landbridge.

In the early 1980s, before increased rates on the Pacific made costs prohibitive, a substantial traffic volume of 3 600 forty-foot containers of textiles from South Korea was routed to Europe by the Canadian landbridge. Now, with the higher rates, fifteen containers per month are shipped by the landbridge which is now used mostly to transport high value products which can support the higher rates in return for faster service than water transportation alone can provide 5.

2.3.1 The port of Montreal

The port of Montreal has six container terminals with a total area of more than 40 hectares. Montreal's ideal geographic location, coupled with an excellent port linked to a first-class intermodal land transportation system, make it a major distribution centre for a number of European shipping lines which serve both the Canadian and American Midwest.

Since the introduction of container traffic at the port of Montreal in 1967, the number of units shipped has been constantly growing and in 1985, with a total of 481 525 T.E.U., Montreal became the third-ranking port on the eastern seaboard of North America, surpassed only by the ports of New York and Baltimore which recorded greater activity in this sector of maritime transport.

The port of Montreal is served by two major transcontinental rail systems: Canadian National and Canadian Pacific.

Numerous maritime container lines put in at Montreal en route to the main European ports. Among the services provided on a more regular basis are the coordinated St.Lawrence services offered by Canada Maritime, and those of Cast North America (1983) Inc. and of Manchester Liners.

It therefore seems that if a Canadian landbridge system were to be established, the arrival of additional container traffic would not pose any major technical or infrastructure problems for the port of Montreal.

2.3.2 The port of Vancouver

Vancouver is Canada's front door on to the Pacific, facing as it does the Far East's fast-growing market.

Vancouver has three container handling terminals covering almost 70 hectares: Vanterm (19.4 hectares), Lynnterm (28 hectares) and Centennial (22.3 hectares). In 1985, Vancouver's container traffic totalled 142 368 T.E.U., a figure which is surpassed in many American ports on the west coast. Unlike Montreal whose container traffic comes in large part from the U.S. Midwest (40% to 50%) Vancouver has seen its containerized traffic diverted to the U.S. ports of Seattle, Portland and Oakland [6].

The port of Vancouver is also served by the two transcontinental railway systems (CN and CP) and by the American Burlington Northern Railway.

As with Montreal, the arrival in Vancouver of additional container traffic would not pose any technical or infrastructure problems.

Moreover, the two transcontinental rail companies, CN and CP, have the equipment that would be needed to adequately handle any additional volume of container traffic generated by the landbridge.

Since June 1985, the Maersk Line shipping company has been serving the Far East market and the west coast of Canada from Vancouver, thereby providing the link needed to develop the Canadian landbridge [7].

3.0 Traffic System and Transit Time

Tariffs for container transportation change constantly (see Table 1 for comparative rates for 1985).

3.1 Tariff system for maritime services

The Far East Freight Conference tariff system is based on a number of CBR (Commodity Box Rate) groups. It should be noted that products from Europe to the Far East are grouped into fifteen categories while those shipped in the opposite direction are grouped into eighteen categories. Moreover, the tariff system used is flexible and so costs can be changed depending on the main destination of the container flows.

3.2 TSR tariff system

First, it should be pointed out that the Trans-Siberian landbridge (TSR) operates under the umbrella of SOYUZ TRANSIT which is owned by the Soviet government. Forwarders pay for the movement of containers inside Japan and for the loading of containers onto vessels in Japanese ports. The Russians use a port-to-port tariff system (from a Japanese port to a European port).

Non-vessel operating common carriers (NVOCCs) must pay for the unloading of vessels in Europe. NVOCCs provide through bills of lading from the port of departure in Japan to the destination in Europe.

Soyusuneshtrans, the Soviet company which handles transportation to other countries, awards licences to forwarders in Europe and the Far East (who number about 15), and it is they who use the Soviet landbridge. TSR rates are set at annual meetings held with each individual forwarder. The system is for the most part coordinated by 17 NVOCCs in Europe and by members of their Trans-Siberian Intermodal Operation Association of Japan. They have a very simple tariff structure. There are seven Commodity Box Rate (CBR) groups.

But now, the TSR must compete in terms of rates. Its low rates vary from one commodity to another as to those of the FEFC members. As a rule, TSR rates are 10% to 20%, and in some cases 30% to 40%, lower than the Conference rates. To combat this, the members of the Conference grant reductions of between 10% and 30% to shippers of certain commodities who guarantee them a regular volume of traffic.

A comparison of the maritime services tariff system with that of the TSR reveals that when goods are destined for a European port, the maritime tariff system seems to be more advantageous. If, on the other hand, the goods are headed for an inland destination on the continent, the TSR rates are the least costly.

3.3 Canadian tariff system

The tariff system in effect for container transportation in Canada is based on FAK (Freight All Kinds) which means that it is a unitary system. If a landbridge is established, the tariff system will have to take into account the fact that, as indicated earlier,

there is an imbalance in Asia/Europe traffic which stands at between 2 and 3 to 1 in favour of traffic to Europe. The tariff variance, which at present is between $100 and $200 for the transport of one container in either direction, seems too narrow. It is clear to us that this tariff structure is too narrow. It is clear to us that this tariff structure is too rigid for the operation of a competitive Canadian landbridge.

One striking fact with regard to the tariff system is the rigidity of the rates charged for goods shipped by the Canadian landbridge. The other two competitors (the FEFC and the TSR) have very flexible rates based on the goods shipped and on the direction of the traffic.

3.4 Transit time

The Canadian landbridge system could stand up well to competition from the point of view of transit times (Table 1).

At present, the Soviet landbridge cannot compete with the other systems when it comes to transit time and reliability of service. Maritime services make the Far East/Europe crossing in 33 days compared with the more than 40-day journey by the Russian landbridge. It is this aspect of the Canadian landbridge which could prove attractive since it offers the shortest transit time, i.e. 32 days [7].

By crossing the Pacific direct to Vancouver, the transit time could be reduced by three days and this would certainly influence the rivalry in rate setting.

As far back as a century ago, a cargo of tea leaving Yokohama, Japan, crossed the ocean direct to Vancouver and from there was shipped by the Canadian railway system, reaching London 29 days after its departure from the Far East [8], a journey four days shorter than the transit time offered by today's maritime services. Postal service along this same route took only 26 days [9].

With railway tunnels rebuilt [10] to accommodate double-stack trains, the advantages of the Canadian landbridge could be enhanced in terms of time-saving and lower transportation costs [11] in order to make the system more attractive.

It should never be forgotten that transit time is the key factor in the landbridge system. In fact, "at 18 percent simple interest,

TABLE: 1 COMPARATIVE TABLE OF LANDBRIDGES VS ALL WATER CONTAINER SYSTEMS 1985.
EUROPE / FAR EAST / EUROPE.

OPTIONS	ALL WATER	TRANS SIBERIAN	CANADIAN LANDBRIDGE
Traffic/year (T.E.U.) Average	1 000 000	100 000	1 000
Tariff Range/T.E.U.	$1 250 - $3 400 US	$1 250 - $3 000 US	$2 500 US[1]
Tariff Range/F.E.U.	$2 600 - $7 000 US	$2 600 - $6 000 US	$4 100 US[1]

OPTIONS	DEEPSEA ROUTES	MILEAGE	TRANSIT TIME	LOADING/ DISCHARGE	TOTAL TRANSIT
ALL WATER	Japan (Kobe) - Rotterdam	11 121	29 days	4 days	33 days[2]
CANADIAN LANDBRIDGE	Japan (Kobe) - Vancouver	4 541	11.8	4	15.8
	Montreal - Rotterdam	3 343	8.0	4	12.0
	Rail - Landbridge Vancouver Montreal		4.4		4.4
	Japan (Kobe) - Rotterdam (Via CLB)				32.2 [3]
TRANS SIBERIAN LANDBRIDGE	Nakhodka - Western Europe	-	40-50	-	40-50
	Kobe - Nakhodka & Vostochny	805	2.0	4	6.0
	Japan (Kobe) - Rotterdam (Via SLB)				45-55

1) With sizeable container volume on a regular basis, more competitive rates would be possible.
2) With an average of 36 days.
3) With possibility of a 3-day reduction if there is a direct Far/East/Vancouver service.

a container with $150 000 worth of merchandise costs $74 (sic) a day in inventory carrying costs" [12].

One thing is certain: there is no lack of competition in international maritime trade.

3.5 Competition

The winds of deregulation now sweeping across the United States (U.S. Staggers Act 1980, U.S. Shipping Act 1984, U.S. Motor Carrier Act 1980) will result in the rationalization of transportation systems. Canada will be indirectly affected by the liberalizing of transport regulations. Already, we are seeing a concentration and consolidation of transportation companies which enables some of them to provide services without hindrance over wide areas of the United States and even across the entire country. The coming of minibridge and microbridge services between the west coast of the U.S. and the Gulf of Mexico are striking examples of this [13], not to mention the introduction a few years ago of rail services for double-stack trains which enable containers to cross the country rapidly at very competitive costs [11].

The advent of round-the-world services, particularly those offered by U.S. Lines Inc., and by Evergreen, whose vessels have a capacity of 4 218 T.E.U. and 2 728 T.E.U. respectively, will maximize economies of scale and rationalize port operations by reducing unit costs (creation of load centres).

It should be noted that the TSR creates problems for FEFC members since it concentrates its efforts on the Japan/Europe routes where its share of the market increased from 7% in 1970 to 19% in 1977 [14]. In fact, of the 100 000 T.E.U. which move along the Trans-Siberian, more than three-quarters is exclusively between Japan and Europe [15].

The laying of a double track along the Trans-Siberian rail system is under way. When the 3 146 km B.A.M. (Baikal, Amour, Magistrale) is completed, the Trans-Siberian landbridge will have a greater transportation capacity (250 000 T.E.U. per year) for Far East/Europe traffic, and it will be able to improve its transit times since the average speed of the trains will rise from 45 km per hour to 60 km per hour.

On the other hand, the maritime services developed at a relatively low cost will provide an alternative to the costlier but faster landbridge intermodal services.

4.0 Conclusion

But, in the final analysis, it is on grounds of economic feasibility that the battle for the Far East/Europe market should be waged so that Canada can obtain a greater share of this market (which could amount to some 100 000 T.E.U. per year) for its two rail systems via the ports of Vancouver and Montreal. This additional traffic would almost double the number of T.E.U. shipped to Vancouver (142 368 in 1985) and increase T.E.U. container traffic to the port of Montreal by one-quarter (481 525 in 1985).

One way of competing on the Asia/Europe market would be:

a) to reduce the rates for internal rail shipments;

b) to promote diversion of export traffic shipped from eastern Canada to the Far East via Vancouver;

c) to establish a tariff system by group of CBR goods (Commodity Box Rate) and create four or five product groups so as to keep up with competitors using this system.

One way of competing effectively with the Siberian landbridge would be to use the NVOCC concept [16]. Of course, it would then be necessary to use the services of maritime transport companies which operate on both the Pacific and Atlantic oceans but which are not involved in Asia/Europe maritime services.

The door-to-door tariff concept used by NVOCC would perhaps be an efficient way of solving the problem of rates that future users of the Canadian landbridge will have to pay. This umbrella could cover rail tariffs (should a Canadian landbridge be established) and the rates charged by maritime transport companies which work the Atlantic and Pacific oceans and which complete the servicing of the European and Far East markets. This would allow for greater operating flexibility.

There is no question here of applying an "on-the-spot" tariff system but rather of introducing a well-planned system whose scope

must be envisaged in the long term. The introduction of an efficient and competitive landbridge service could initially serve trade between the Far East and Europe. At the same time, it could place Canadian and even American products (with the possible advent of free trade) on the doorstep of the major markets of the other two components of Triad power [17].

Thus Canada, by its special goegraphic position coupled with its port and rail intermodal system, could, in serving as a link between the continents, play its most important role ever.

BIBLIOGRAPHY

1. PEARSON, Roy and John FOSSEY, "World Deep Sea Container Shipping", The University of Liverppol, Marine Transport Center, 1983, p. 10 and Containerization International Yearbook 1984.

2. Cargo Systems Research Consultants Ltd., "Container Port/Terminal Facilitates & Trade Growth", Cargo Systems, Worcester Park, 1982.

3. Commodities originating in the Far East are in 60% of cases shipped by 40-foot containers while those travelling in the opposite direction are shipped in 20-foot containers.

4. Containters shipped along the Soviet landbridge are rented while those shipped by sea alone belong to the maritime transport companies.

5. WILSON, Mark, "Landbridge to depend on tolls". The Province, Vancouver, Wednesday Aug. 8, 1984, p. 19.

6. ARCHAMBAULT, Michel, "North American Trade Diversion: A New Perspective", Canadian Transportation Research Forum, 20th annual meeting. Proceedings, Toronto 1985, pp. 836-858.

7. The Maersk Line service takes 12 days between Tokyo and Vancouver, passing by Tacoma/Seattle. If the vessels could stop first at Vancouver, transit time could be reduced by three days.

8. JOHNSON, Ron, "Les ports du Canada: Vancouver la porte du Pacifique", Commerce Canada, April 1985, p. 27.

9. KACKING, Norman R., "History of the Port of Vancouver", Documentation from Port of Vancouver 1985, p. 7.

10. "Tow up north of the border": Canada's railways are experimenting with double-stack technology". Cargo Systems, January 1986, pp. 16-19.

11. KNEE, Richard, "Burgeoning Double-Stacks", American Shipper, August 1985, pp. 6-9 and HARDWICKE, Robert, "Double-Stack Savings May Equal 20-25%", American Shipper, August 1985, pp. 10-16.

12. "Rail Intermodalism", Container News, February 1982, p. 24. At 12% interest, the daily inventory carrying cost is $50, which could affect the competitiveness of the other options.

13. Mc INTYRE, Geoffrey R., "Minibridge Traffic: impact port development", World Wide Shipping, July/August 1984, pp. 17 and 19.

14. PEARSON, Roy "Containerline Performance and Service Quality" University of Liverpool, Marine Transport Center, Liverpool, 1978, p. 114.

15. Ibid., p. 17.

16. "NVOCC 's Brokers, Forwarders: integral part of shipping", Container News, November 1983, pp. 12-13.

17. KENECHI OHMAE, and McKinsey and Company Inc., "Triad power: The coming shape of global competition", The Free Press, 1985.

OPERATIONS PLANNING FOR AN EXCLUSIVE BUS LANE

Gülgün Pöğün
Industrial Engineering Department
Middle East Technical University
Ankara, Turkey

Ahmet Şatır
Quantitative Methods Department
Concordia University
Montreal, Quebec, H3G 1M8,
Canada

1. INTRODUCTION

The enormous growth of the population in Ankara, the capital of Turkey, in the last fifty years brought about an irregular expansion of the city in all directions. As a result of this growth, the metropolitan transportation system became insufficient in certain regions in meeting the passenger demand. Thus, municipal authorities felt strongly the need for establishing mass transportation systems. The first exclusive bus lane constructed in 1978 on the east-west axis of the city was part of a mass transportation system designed for the capital. Although the exclusive bus lane operated efficiently during the first years, some operational problems were observed during the recent years. The system became incapable in satisfying the passenger demand especially during the peak hours. Convoying of buses and long passenger waiting times were observed frequently.

This paper presents alternative operating policies for the exclusive bus lane and compares the performance of each alternative with respect to predefined criteria based on the findings of a simulation model developed. The literature is voluminous in the field of transportation and bus scheduling. Among the studies done on planning the route system, Silman et al. (1974) found the optimal frequency of buses by using the gradient projection method with the objective of minimizing the journey time of passengers. The basic problems and the principles of route control were discussed by Akcelik and Maher (1977) by setting up a series of route control experiments using the simulation technique.

Gavish (1978) prepared time tables for the problem of scheduling buses to trips by formulating the problem as a zero-one integer programming and then converting the problem into a large scale assignment problem. On the subject of operation of urban bus routes, Chapman et al. (1977a,c) studied the operation of a route in terms of the times spent by buses and passengers in different parts of the journeys and the factors which affect these time. The same study (1977b) also dealt with the sources of irregularity in the operation of urban bus routes. Newell (1971) and Edwards (1979) developed analytical models for bus dispatching policies. Anderson et al. (1979) worked on the time dependent model by simulating an urban bus route. Simulation models were also developed by Bly and Jackson (1974) and Jenkins (1976) to study the effects of various dispatching policies.

2. DESCRIPTION OF THE CURRENT OPERATING SYSTEM

The exclusive bus lane operates on a traffic corridor that has the highest traffic density on the east-west axis of Ankara. Fifteen bus lines use the exclusive bus lane, some lines using the entire lane whereas some using part of it. No other vehicles are allowed to use the lane. Three bus lines use the entire lane, namely: i) Line R (Gaziler dispatching center (GDC)-Besevler ring), ii) Line 17 (GDC--Bahcelievler-GDC service) and iii) Line 21 (GDC-Emek--GDC service). A total of 62 buses are assigned to Lines R, 17 and 21. These buses make around 450 trips in a day. This paper focuses on these three lines in developing and evaluating the alternative bus scheduling policies.

The layout of the exclusive bus lane is given on Map 1. There are fourteen bus stops throughout the lane which is 5.3 km long and seven meters wide. The reference point for the lane is the "Kizilay" bus stop which is located almost in the middle of the lane and having the highest passenger demand in both directions. Passenger movements from east and west ends to Kizilay bus stop during morning and evening peak hours are given in Figure 1.

MAP 1

FIGURE 1

During the first months of the lane operation, the average velocity of a bus operating in the lane was 18 km/hr. However, this average velocity has dropped to 13.5 km/hr. in recent years mainly due to the convoying of buses in the lane. Convoying occurs as a result of a number of factors. For regularly scheduled and dense bus lanes, the delay of a bus may affect the operating performance of other buses and thus the lane as a whole, causing a decrease in the level of service and comfort. As a bus travels along the route, its trip time between successive bus stops is subject to random fluctuations. If the bus falls behind schedule, the headway increases. This results in an accumulation of passengers in bus stops which the delayed bus is supposed to serve. Then, the boarding time for a bus in question at these bus stop increases. As the bus becomes full satisfying the entire demand at few bus stops, its average velocity decreases significantly. In this mode of operation, also known as the "bunching" phenomenon, the succeeding bus serves few passengers in those bus stops where the demand is almost fully satisfied by the previous bus. Although the average velocity of the succeeding bus is supposed to increase in this case, in practice this does not happen. The restriction regarding the overtaking of buses operating in the lane due to traffic safety precautions results in convoying of buses with the first one being full and the other(s) following the full bus with an underutilized capacity and at a slower velocity.

The situation described is observed frequently in the exclusive bus lane especially during the peak hours, decreasing the velocity of buses and the efficiency of the operations at large. The reasons behind the convoying of buses in the exclusive bus lane can be argued as follows:

i) Despite the fact that Line R, Line 17 and Line 21 buses that use the entire lane are dispatched on a regular schedule from the dispatching center, the other twelve bus lines that use different parts of the lane do not have a regular schedule. There are 86 buses involved in this non-scheduled, demand responsive utilization mode which provides a significant amount of uncertainty in controlling the density of the traffic flowing in the lane.

ii) The fact that the buses currently operating in the lane are not sufficient in capacity to meet the largely increased peak hour demand in recent years remains to be the dominant factor behind high boarding times which in turn facilitates convoying.

iii) Another reason for convoying is the capacity of the bus stops most of which can accommodate on the average two buses at a time for boarding and alighting. This increases the average waiting time of buses at bus stops before boarding and alighting of passengers, thus contributing to the convoying effect.

3. PROBLEM STATEMENT

This study deals with the bus scheduling problem for the operations of the exclusive bus lane constructed in the east-west axis of Ankara. The scheduling period considered is the morning peak hours of 7-9 a.m. Alternative dispatching and route policies are developed to tackle the scheduling problem. A simulation model is used to evaluate the alternative policies with respect to the performance measures defined. Among the bus lines using the lane, three lines that use the entire lane are considered, namely Line R, Line 17 and Line 21. The bus and passenger movements regarding the twelve bus lines using different parts of the lane are not considered in this study. There are basically two reasons behind this omission. The size of the problem almost doubles when these services are included in the simulation model in which case some of the software capacity limits of the simulation package used would have been exceeded. Secondly, due to the largely non-scheduled nature of these lines, the operational data on bus and passenger movements is not available. However, the effect of these services on the operation of the lane is implicitly included in the model through reduced average velocities of buses and thus increased trip times between bus stops.

4. ELEMENTS AND FEATURES OF THE SIMULATION MODEL DEVELOPED

The simulation model developed to evaluate alternative bus scheduling policies for the exclusive bus lane is written in General Purpose Simulation System (GPSS) language. The initial conditions are taken as zero in the model. This is realistic since the buses start to run shortly before 7 a.m. and therefore the system can be considered as empty prior to 7-9 a.m. peak period operations.

The data used in the model is obtained from the records of the Transportation Planning Department of Ankara Municipality. The assumptions, variables and constraints used in the simulation model developed are as follows.

4.1 Assumptions

Two groups of assumptions are made regarding the buses and the passengers. The assumptions regarding the buses are:

i) No overtaking of buses occurs in the lane.

ii) There is no signalization effect. (In fact, the delays caused by signilization are incorporated in bus trip times as a percentage of total trip time.)

iii) A bus does not stop at a bus stop if its capacity is fully utilized and there is no alighting passenger.

iv) Repair time of a bus and trip time between bus stops are assumed to be uniformly distributed.

v) Bus breakdowns are assumed to occur at bus stops and the probability of breakdown at any arrival at a bus stop is assumed to be 0.001. All passengers in a breakdown bus are alighted at the bus stop where the breakdown occurs. The bus is assumed to be repaired at the bus stop. After the repair, the bus continues its trip with a fully available capacity.

The assumptions regarding the passengers are given as:

i) Boarding and alighting times per passenger are assumed to be uniformly distributed.

ii) The number of alighting passengers at each bus stop is also assumed to follow the uniform distribution where the mean of the distribution varies for each bus stop.

iii) If the passengers could not board on the bus because it is full, they are considered as lost passengers for that bus and they are added to the demand of the next bus. No single one probability distribution is assumed for the number of boarded passengers at each bus stop, however different probability distributions having the same mean are used in the experimentation phase of the study. All other probability distributions are verified using the previous three years data.

4.2 Variables

The variables used in the model are classified as: i) exogenous variables, ii) status variables and iii)

endogenous variables. Following is a list of the variables used in the simulation model.

i) Exogenous variables

- number of buses operating in the lane
- dispatching frequency of buses from the dispatching center
- number of bus stops in the lane
- routing configurations that may be followed
- parameters defining the distributions of

  i) boarding and alighting passengers at each bus stop
  ii) boarding and alighting times per passenger
  iii) bus trip times between bus stops
  iv) bus breakdowns
  v) repair times

ii) Status variables

status of a bus as either:

- travelling in the lane
- waiting for passengers to board and/or alight
- being broken down

iii) Endogenous variables

a) random variables

- number of boarding and alighting passengers at each bus stop
- boarding and alighting times per passenger
- bus trip times between bus stops
- bus breakdowns
- repair times

b) response variables

- total number of boarded and alighted passengers
- unsatisfied demand of passengers
- capacity utilization of buses
- average time spent by a bus at a bus stop
- total bus trip time

4.3 Constraints

The constraints used in the model are:

- bus capacity
- capacity of each bus stop
- amount of working and investment funds allocated to the operation of the exclusive bus lane

5. ALTERNATIVE BUS SCHEDULING POLICIES

Alternative bus scheduling policies developed for the operation of the exclusive bus lane are grouped under: i) dispatching policies and ii) route policies. Time between successive dispatching, bus stops that are passed by and number of buses used for each policy during the morning peak operations are summarized in Table 1.

TABLE 1

5.1 Dispatching policies

Four dispatching policies are tested where the dispatching frequencies from the Gaziler Dispatching Center (GDC) are varied for each policy. Under these policies, the buses serve every bus stop in the lane, and thus there are no bus stops that are passed by.

i) FRQ6 dispatching policy: This is the dispatching policy currently employed. The buses are dispatched from GDC at a frequency of every ten, six and six minutes to Line R, Line 17 and Line 21, respectively.

ii) FRQ5 dispatching policy: The dispatching frequency to Line R remains the same. However, more buses are dispatched to Line 17 and Line 21 in this policy. The time between successive dispatching decreases to five minutes for both lines.

iii) FRQ4 dispatching policy: One bus is dispatched to Line 17 and Line 21 every four minutes. Dispatching frequency for Line R is not changed.

iv) F6R5 dispatching policy: Under this policy, the dispatching frequency for Line 17 and Line 21 is identical to the current dispatching frequency (FRQ6). However, more buses are dispatched to Line R at a frequency of every five minutes.

The last three dispatching policies developed place more buses into the lane additional to the 62 buses currently operating without making any modifications on the route structure. Thus, the performance of the dispatching policies will indicate whether the overall efficiency of the lane can be improved by simply operating with more buses or modifications to route structures should also be considered.

5.2 Route policies

Three alternative routes are developed to be served by buses operating in the exclusive bus lane. Each route is a combination of a number of sub-routes, as indicated in Table 1.

i) P6EX route: This route policy combines the current policy (FRQ6) with a policy that creates two new starting points for bus trips at the east end of the exclusive lane. These points are the bus stops #2 and #3. During the morning peak hours, one bus for Line 17 and one bus for Line 21 are to be dispatched from both #2 bus stop and #3 bus stop every six minutes. The dispatching frequency from GDC is assumed to remain at its current level. However, the buses starting their trips at bus stops #1, #2 and #3 will only avoid stopping at two successive bus stops that follow the starting bus stop in the west direction, otherwise stopping at all other bus stops. This policy is geared towards increasing the average velocity of buses starting their trips at the east end by meeting the high demand that occurs at the first three bus stops without forcing each bus to stop at all bus stops to fill the remaining (tiny) available space.

ii) RING route: Ring services are designed for the second route policy developed, namely GDC-Kizilay-GDC Ring (GDC-K), Bahcelievler-Kizilay-Bahcelievler Ring (17-K), Emek-Kizilay-Emek Ring (21-K) and the currently operating GDC-Besevler-GDC Ring (GDC-R). The schematic diagram of the ring services is given in Figure 2. Kizilay bus stop becomes the major starting terminal and point in the lane under this policy. Since there is no direct trip that covers the entire route between starting points in the east end (GDC) and the west end (Bachcelievler and Emek), it will be necessary for some passengers to change bus at the Kizilay bus stop in order to continue their trips. One bus is dispatched every five minutes from Bahcelievler and Emek dispatching points. The dispatching frequency for GDC-Kizilay-GDC Ring is one bus for every three

minutes, whereas the dispatching frequency for GDC-Besevler-GDC ring stays at its current level of one bus for every ten minutes. However, the buses operating on this route do not stop at the Kizilay bus stop since it is served by three other ring services. The inspiration for this operating route policy comes from the "bowl phenomenon" concept of assembly line operations which suggests that the most critical section of the assembly line from a scheduling point of view is the middle station(s). Kizilay bus stop, being located almost in the middle of the exclusive bus lane with the highest passenger density, resembles the middle station on an assembly line (in this case, the exclusive bus lane). More flexibility in bus scheduling is aimed at by converting the Kizilay bus stop into a source (and sink) point in the lane.

FIGURE 2

iii) SERI route: The last route policy proposed is the combination of the previous RING route policy and the (modified) current policy FRQ6. The current dispatching frequency from GDC to the three lines is not altered in this policy, however all three lines now pass by the Kizilay bus stop since this bus stop is served by three ring services. Buses are dispatched every five minutes for each ring service. The schematic diagram of this route policy is given in Figure 3. This policy allows direct trips between the end points in the lane, an option which is not available under RING route policy. The average velocity for those buses covering the entire lane shall increase since they will not be stopping at the Kizilay bus stop where the demand for boarding and alighting of passengers reaches the highest point. On the other hand, this policy also allows ring services to and from Kizilay bus stop, thus making it possible to evaluate the possible merits of combining the current route structure with the ring routes.

FIGURE 3

6. EVALUATION OF ALTERNATIVE BUS SCHEDULING POLICIES

6.1 Performance measures

In order to compare the performance of the alternative bus scheduling policies, four measures are

defined. The first performance measure takes into consideration the effect of using different number of buses (as given in Table 1) for each scheduling policy. This performance measure is defined as the "difference between the percent increase in the number of total passengers that are boarded during the morning peak hours (relative to the amount currently being served) and the percent increase in the number of buses operating (relative to the 62 buses currently used during the morning peak)."

The second performance measure used for a given policy is the "average number of passengers boarded at a unit bus stop", formulated as:

$$Z = \sum_{i=1}^{k} \left(\frac{d_i}{D} \times \frac{B_i}{n_i} \right)$$

where Z : average number of passengers boarded per bus at a unit bus stop

d_i: passenger demand at bus stop (including the unsatisfied demand)

D : total passenger demand for the route

B_i: total number of boarded passengers at bus stop i

n_i: number of buses that served bus stop i

k : number of bus stops on the route

(The unit of time used for the above notation is two hours, i.e. morning peak between 7-9 a.m.).

Since the number of buses used for each scheduling policy varies, each bus stop is served by different number of buses during the two hour morning peak. Estimating the mean number of boarded passengers per bus per bus stop by dividing B_i by n_i only provides a measure for an individual bus stop. However, an aggregate performance measure is required in order to compare alternative bus scheduling policies developed. The above formulation defines such a measure by taking the weighted average of boarded passengers on a given route. Since each bus stop is weighted according to the demand satisfied, the aggregate performance measure gives average number of passengers boarded per bus on a "unit bus stop" basis.

The last two performance measures considered are the "average time spent by a bus at a bus stop" and

"average bus capacity utilization rate". These measures are especially indicative on the performance of alternative policies since the number of buses utilized for each policy is different.

6.2 Evaluation of alternative policies

In comparing the performance of alternative bus scheduling policies, one factor to be considered is the different number of buses utilized for each policy. The percent increases in the number of total passengers that are boarded and in the number of buses used (relative to the levels of current operational policy (FRQ6)) are illustrated in Figure 4. The largest positive difference in percentage terms occurs in RING route policy. This policy uses the same number of buses as the current policy, however there is a 22.5 percent increase in the number of boarded passengers. This finding is a strong indication that the operational efficiency of the lane can be significantly improved by route modifications rather than increasing the number of buses operating. The other two route policies, namely F6EX policy and SERI policy, also result in positive differences of 1.5 percent and 3.4 percent, respectively. On the other hand, F6R5 policy is the only dispatching policy that results in a positive difference of 4.8 percent between the percent increases in the number of boarded passengers and in the number of buses. Both of FRQ5 and FRQ4 dispatching policies perform poorly with 1.9 percent and 10.5 percent negative differences, respectively. These findings indicate that dispatching more buses into the exclusive bus lane will actually decrease the efficiency of the operating system unless route modifications are made.

FIGURE 4

Table 2 illustrates the results obtained for the performance measures defined during the morning peak operation of the exclusive bus lane. The responses obtained for the alternative dispatching policies are given in the first four columns of Table 2, whereas the last three columns give the values of the performance measures for the alternative route policies.

TABLE 2

Regarding the performance measure of average number of boarded passengers per bus at a unit bus stop, the proposed dispatching policies of FRQ5, FRQ4 and F6R5 result in lower responses compared to the current dispatching policy of FRQ6. This is in line with the previous finding which states that dispatching more buses into the exclusive bus lane without modifying the current operating route policy will decrease the efficiency of the operating system. Among the route policies developed, F6EX policy (i.e., the current dispatching policy combined with new express services) results in the largest average number of boarded passengers per bus at a unit bus stop. RING and SERI policies also perform well on this measure.

When the performance measure of average time spent by a bus at a bus stop is considered, the alternative route policies generally result in higher waiting times compared to the alternative dispatching policies. This is attributed to the relatively high level of boarded passengers per bus at a unit bus stop for the route policies developed. However, it should be noted that the first two performance measures in Table 2 are negatively correlated for the three operating route policies. This may be explained by the specific route structures. Although F6EX policy has the highest value for the average number of boarded passengers per bus at a unit bus stop, the service time by a bus at a bus stop is minimum within the three route policies. This is due to the four bus stops that are passed by under this policy. The zero service times assigned to these bus stops facilitate a lower average time spent by a bus at a bus stop. The higher average service time observed for SERI policy compared to RING policy is due to the additional two lines in the former policy that serves the entire lane. The highest service time among the dispatching policies belongs to the FRQ4 policy. This policy also has the lowest average number of boarded passengers. Both of the poor performance measures can be attributed to the inefficiency of operations that results from dispatching the highest number of buses into the lane without modifying the current route structure and thus augmenting the convoying effect.

The average bus capacity utilization rate is generally higher for route policies. This result is consistent with the responses obtained for the second performance measure where higher figures for average number of boarded passengers are associated with route policies. As seen in Table 2, the lowest utilization rate among the route policies belongs to the SERI policy which is almost 2 percent lower compared to the utilization rates of F6EX and RING policies. This low

rate is the consequence of the relatively low average number of boarded passengers and high service times occurring for the SERI route policy. The lowest utilization rate among the dispatching frequencies is that of the FRQ4 policy for which the reasons are discussed previously.

The ranking of alternative bus scheduling policies with respect to the performance measures defined is given in Table 3. A scale from one to seven is used where a ranking of one indicates the most desirable policy for a given performance measure. The route policies of F6EX and RING rank as the most favorable policies in the overall evaluation. Among the proposed dispatching policies, F6R5 policy ranks favorably. It should be noted that the current operating policy (FRQ6) is, in fact, the best one among the dispatching policies under the first three performance measures. The performance measure on the difference between the percent increases is not shown for the current policy, since it is the base policy against which the percent increases are estimated, therefore resulting in a zero difference.

TABLE 3

6.3 Analysis of variance

In order to understand the interaction between the performance measures (i.e., response variables) and the controllable factors used, analysis of variance is carried out on the results obtained from the simulation runs. The response variables are taken to be the performance measures given in Table 2. The controllable factors used in the analysis of variance are grouped as:

i) Dispatching frequency: This is the quantitative factor used in the experiments. The four levels associated with this factor are the frequencies for each dispatching policy as given in Table 1.

ii) Route: The route followed by buses for alternative route policies is a qualitative factor used in the analysis of variance. Four levels are considered for this factor, namely the current route and the three routes followed in F6EX, RING and SERI policies.

iii) Distribution of passenger demand: As a second qualitative factor, the distribution of the passenger

demand during the morning peak hours are taken at three levels, following either the Poisson, normal or uniform distributions.

iv) Number of replications: Three replications are run for each combination of data set. The number of replications is used as a factor in the analysis of variance in order to see whether or not the response obtained for a replication differs significantly from those responses obtained for the other two replications.

The factors which are found to be significant at 0.01 significance level are given in Table 4. The analysis of variance shows that the "dispatching frequency" factor has a significant effect on all three performance measures. The "route" factor, on the other hand, is significant for the first two measures, but not for the "bus utilization" performance measure. Findings of the analysis of variance reveal that the distribution of passenger demand does not have a significant effect on the values of the performance measures defined. The "replication" factor has an impact only on the average time spent by a bus at a bus stop. The explanations of variations in the performance measures (in the order given in Table 4) by the additive effect of factors are 66.2 percent, 62.8 percent and 5.5 percent, respectively. The reason behind the low level of explanation given for the "average bus capacity utilization rate" performance measure is the saturated utilization rates that show only a small degree of variation between the alternative policies.

TABLE 4

7. CONCLUDING REMARKS

Alternative bus scheduling policies for an exclu-sive bus lane are developed and evaluated in this paper. The major two findings within the framework of the problem studied can be summarized as follows:

i) Dispatching more buses into the lane without making route modifications will decrease the efficiency of operations through more convoying. Thus, the dominant factor in setting a bus scheduling policy is the route(s) to be followed. Among the route policies developed, RING policy achieves a 22.5 percent increase in the number of boarded passengers using the same number of buses as the current scheduling policy.

Thus, this policy is desirable to implement if the Transportation Department of Ankara Municipality is not willing to allocate more buses to the exclusive bus lane. If, however, the objective is to maximize the number of passengers carried during the morning peak hours within the bus allocation constraints of the Transportation Department, then SERI route policy provides a 24.4 percent increase in the number of passengers served at the expense of increasing the number of buses operating by 21 percent. Thus, the changes in the current operating policy largely depends on the priorities of the Transportation Department. However, it is evident that any modification on the current policy should incorporate new ring and express services.

ii) The variance of passenger demand during the morning peak hours has no significant effect on the performance of the scheduling policies developed as long as the same mean demand value is used for various statistical distributions. This is an indication for the degree of saturation of the passenger movements in the lane. Thus, the construction of a metro on the east-west axis of Ankara remains to be the only viable alternative in absorbing the ever growing passenger demand.

LIST OF FIGURES

Figure 1. Passenger movements from east and west ends to Kizilay bus stop during morning and evening peak hours.

Figure 2. Schematic diagram of ring services.

Figure 3. Schematic diagram of SERI (semi express and ring services) route policy.

Figure 4. Percent increases in the number of boarded passengers and in the number of buses.

LIST OF MAPS

Map 1. Map of the exclusive bus lane.

LIST OF TABLES

Table 1. Time between successive dispatching, bus stops that are passed by and number of buses used for alternative bus scheduling policies during the morning peak operations.

Table 2. Values of performance measures for alternative bus scheduling policies.

Table 3. Ranking of alternative bus scheduling policies.

Table 4. Significance of the factors on the value of the performance measure (S - significant, NS - not significant).

REFERENCES

Akcelik R. and Maher J.R. (1977) Route control of traffic in urban road networks. Transpn Res. 11, 15-24.

Andersson P., Hermansson A., Tengvald E. and Scalia-Tomba G. (1979) Analysis and simulation of an urban bus route. Transpn Res. 13A, 439-466.

Bly P.H. and Jackson R.L. (1974) Evaluation of bus control strategies by simulation. TRRL Lab. Report No. 637. Department of the Environment, Crowthorne.

Chapman A.R., Gault, H.E. and Jenkins I.A. (1977a) The operation of urban bus routes: 1. Background and preliminary analysis. Traffic Engng Control 18(6), 294-298.

Chapman A.R., Gault, H.E. and Jenkins I.A. (1977b) The operation of urban bus routes: 2. Sources of irregularity. Traffic Engng Control 18(7-8), 364-367.

Chapman A.R., Gault, H.E. and Jenkins I.A. (1977c) The operation of urban bus routes: 3. Wider aspects of operation. Traffic Engng Control 18(9), 416-419.

Edwards J.L. (1979) Determining transit vehicle requirements on local city bus routes: A different approach. Traffic Engng Control 20(4), 167-171.

Gavish B. and Schweitzer P. (1978) Assigning buses to schedules in a metropolitan area. Computers and Oper. Res. 5, 129-138.

Jenkins I.A. (1976) Comparison of several techniques for simulating bus routes. Research Paper No. 14, University of Newcastle-Upon-Tyne.

Newell G.F. (1971) Dispatching policies for a transportation route. Transpn Sci. 5(1), 91-105.

Silman L.A., Barzily Z. and Pasay U. (1974) Planning the route system for urban buses. Computers and Oper. Res. 1(2), 201-211.

TABLE 1

Time between successive dispatching (minutes)

Policy	Subpolicy	Besevler(R)	Bahcelievler(17)	Emek(21)	Kizilay(K)	Bus stops passed by	Number of buses
FREQ6		10	6	6		none	62
FREQ5		10	5	5		none	71
FREQ4		10	4	4		none	81
F6R5		5	6	6		none	65
F6EX	F6	10	6	6		none	74
	EX		6	6		#'s 2,3,4,5	
RING	GDC-K				3	none	62
	17-K				5	none	
	21-K				5	none	
	GDC-R	10				#8	
SERI	SE	10	6	6		#8	75
	GDC-K				5	none	
	17-K				5	none	
	21-K				5	none	

TABLE 2

	FRQ6	FRQ5	FRQ4	F6R5	F6EX	RING	SERI
Average number of boarded passengers per bus at a unit bus stop	25.5	23.0	20.3	23.7	32.0	30.2	28.0
Average time spent by a bus at a bus stop (seconds)	89.2	90.8	105.8	89.4	102.0	111.1	120.3
Average bus capacity utilization rate (0/0)	96.6	96.0	91.7	96.5	97.7	97.5	95.8

TABLE 3

	FRQ6	FRQ5	FRQ4	F6R5	F6EX	RING	SERI
Average number of boarded passengers per bus at a unit bus stop	4	6	7	5	1	2	3
Average time spent by a bus at a bus stop	1	3	5	2	4	6	7
Average bus capacity utilization rate	3	5	7	4	1	2	6
Difference between the percent increases	-	5	6	2	4	1	3

TABLE 4

	Factors			
	Frequency	Route	Distribution	Replication
Average number of boarded passengers per bus at a unit bus stop	S	S	NS	NS
Average time spent by a bus at a bus stop	S	S	NS	S
Average bus capacity utilization rate	S	NS	NS	NS

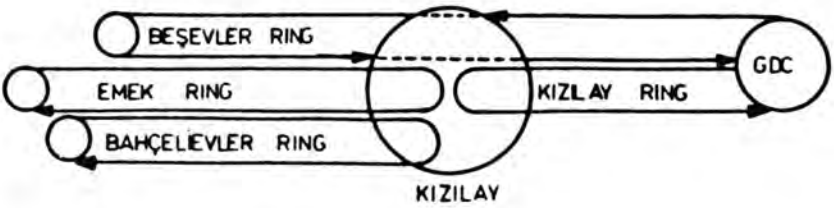


Fig.2. Schematic diagram of ring services.



Fig.3. Schematic diagram of SERI (semi-express & ring services) route policy.

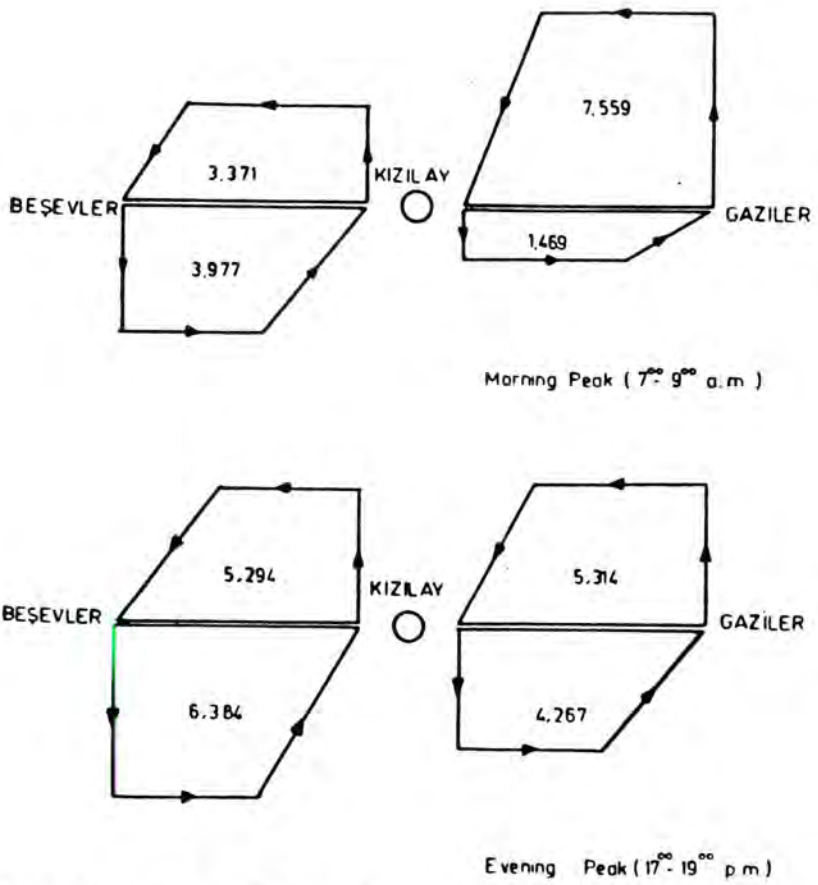


Fig.1. Passenger movements from east and west ends to Kizilay bus stop during morning and evening peak hours.

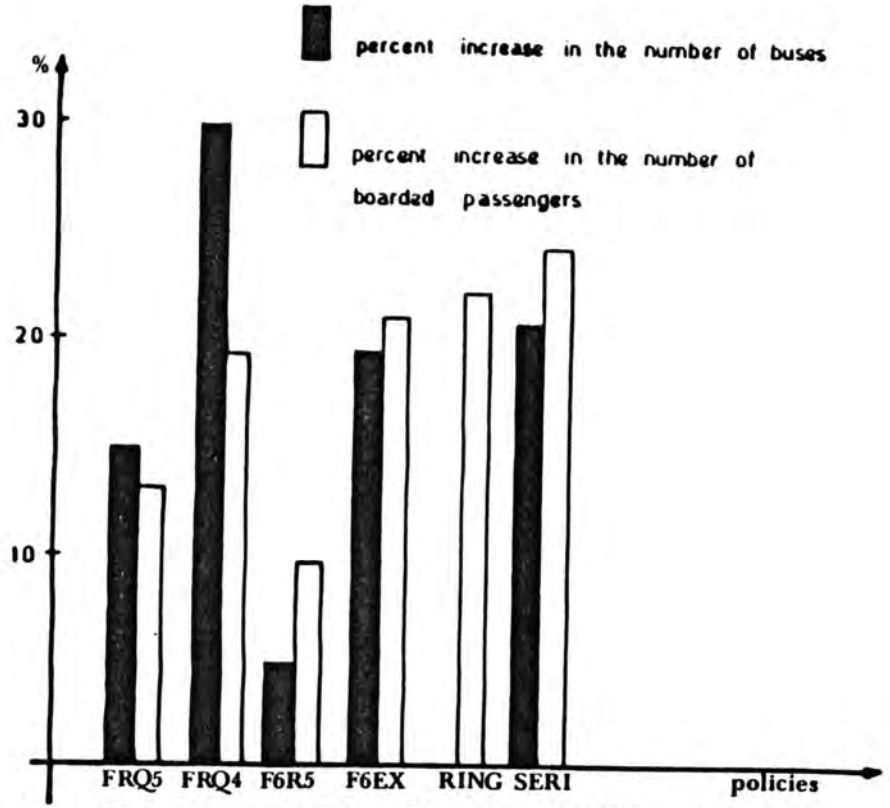
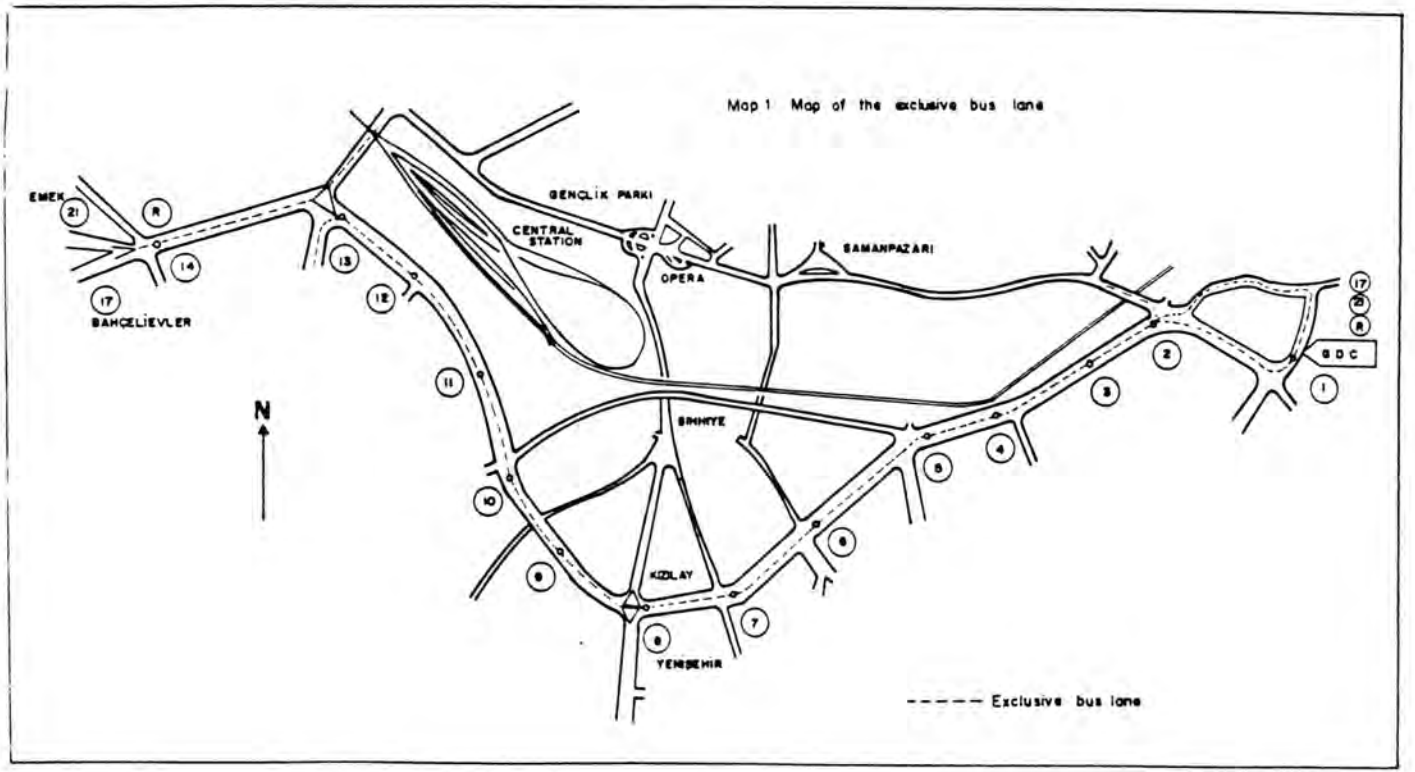


Fig.4. Percent increases in the number of boarded passengers and in the number of buses.



Map 1 Map of the exclusive bus lane

DEVELOPMENT OF AN INFORMATION SYSTEM ON THE TAXI INDUSTRY

by

Jean David
Government of Quebec

In 1984, The Research departement of the Ministry of Transport received a mandate to develop an information system on the taxi industry in Quebec.

We, therefore, set our objective, on the one hand, to obtain the most comprehensive picture of the industry, and on the other hand, to request only the strict minimum of information from the industry.

To meet this double objective, we decided to do two things: first, to undertake a complete survey of calls to taxi companies and second, to make a sample survey among taxi drivers.

The greatest problem we encountered in the survey was the non-availability of the most important data: the number of calls. In fact, many companies keep no statistics on this point. This being the case, it was impossible to obtain a complete picture, nor even a partial one that was large enough to be worthwhile. At this point we were obliged to intervene.

We decided to adapt our request to the industry, convincing them to give us statistics that would be analyzed and suited to their needs. With this approach it was later possible to organize a complete survey of calls to the taxi companies.

Then, we had to organize a sample survey among taxi drivers to discover other necessary data in order to obtain a complete picture of supply and demand. For this survey we used a one-of-a-kind method developed by the BSQ (Bureau de la statistique du Québec) in 1979. This method permits us to contact the driver directly in his taxi while he is working and without disturbing him at his work. The driver gives a brief description of the trips he makes over a two-hour period, the period following his meeting with the observer.

The combination of the call survey and the taxi driver survey provides us with an exhaustive knowledge of taxi supply and demand. As a result, it is now possible to estimate the overall taxi service and supply demand at any given moment during an average week.

METHODS OF ALLOCATING PUBLIC TRANSIT OPERATING SUBSIDIES IN CANADA: CURRENT PRACTICE AND SUGGESTED APPROACH

by

Attahiru Sule Alfa
Transport Institute and Department of Civil Engineering, University of Manitoba

and

Jonathan Heads
Transport Institute

1.0 Abstract

Public transit authorities receive subsidies from their provincial governments to assist them towards providing efficient and effective public transport systems for the members of the community. These subsidies can be split into two categories: (i) those that go toward capital projects, and (ii) those that go toward operations. This paper addresses the issue relating to the operating subsidies.

One of the main purposes of public transit operating subsidies (PTOS) is to assist the transit authorities, in operating public transit systems to meet a wide range of the users' goals. It is thus imperative that methods used for allocation of subsidies should take into account and reflect these aims. The interest of this paper is on how a given amount of funds assigned to PTOS by a province should be allocated among all of its transit authorities.

PTOS is allocated in most provinces on a per capita basis, on a cost recovery basis, or on other bases such as revenue passengers or deficit. Two provinces, Saskatchewan and Ontario, base their allocation on combinations of two of these factors. There is no standard method adopted by all provinces at the moment. In principle, PTOS to a transit authority should be based on the adequacy of the service it provides community-wide, on the efficiency of its system in terms of cost and community-wide service, and on a per-capita basis to insure minimum subsidy. The aim of this paper is to propose a framework to be used for developing a standard approach for allocating PTOS, which should reflect the goals for which PTOS is intended.

2.0 Introduction

The responsibility of providing and operating public transit system sin urban areas in Canada has mainly rested with the respective municipal governments. Provincial governments in the past two decades started providing subsidies to municipal governments to assist them towards providing adequate transit service in their municipalities. Seven provinces and one territory in Canada have instituted direct transit assistance programs. Two other provinces (New Brunswick and Newfoundland) provide financial assistance indirectly through their consolidated payments to municipalities. The federal government has in the past contributed towards the capital costs of transit through the UTAP program, and maintains a fund for handicapped transit. This paper is concerned with the subsidies provided by the provinces toward urban public transit systems.

The amount of total transit subsidy allocated by a provincial government each year is dependent on the total funds available to the government, other projects, and the level of demands for other types of subsidies, such as the roadway subsidy, the educational subsidy, etc. Exactly how the allocation of the amount of subsidies is carried out among different sectors depends on many factors. These are not the subject of this paper. The subject in this paper is how the total transit subsidy is distributed among the municipal governments with transit systems in the province.

One of the main purposes for providing transit subsidies to transit authorities is to assist these authorities in providing public transit systems to meet a wide range of the users' needs. Additional reasons for the subsidies vary from province to province. Some of these include improvement of transit's effective contribution towards meeting social and economic needs of all members of the public, assistance to municipalities in meeting some of their financial commitments, and aiding municipalities in the development and operation of public transit services, in consideration of local conditions and the achievement of specific objectives. The main objective of this paper is to assess how each province attempts to achieve these aims by the method it employs in allocating transit subsidies and to propose a framework to be used for developing an improved approach for carrying out this allocation.

It is important to distinguish at this point between public transit operating subsidy (PTOS) and public transit capital subsidy (PTCS). PTCS is mainly to assist in development, implementation, and capital improvement

of public transit systems. PTOS, on the other hand, is to assist in the cost of operating public transit services. The interest in this paper is limited to the PTOS. Nevertheless, the allocation of PTOS and PTCS should not be treated as independent issues. It is well known that a high capital investment in a system often demands a lower operating cost for the system and vice versa. Hence, a municipal government that receives a large share of PTCS from the provincial government in a particular year should be earmarked for lower PTOS in comparison to other municipalities. While the authors are aware of this necessary interrelation between PTCS and PTOS, the interest in this paper is focussed on PTOS allocation. The interrelationship to be considered between PTCS and PTOS will be studied in a future work. Meanwhile, PTOS allocation will be studied with the assumption that there is equity in the allocation of PTCS and no municipality in a province receives undue advantage over another. For completeness, both PTCS and PTOS are included in the review of current practice.

3.0 Review of Present Practice

3.1 General

Even though most provinces seem to have about the same goals and objectives with regard to allocation of PTOS, the criteria on which allocations are based still differ from province to province. In most provinces, allocation is based on a single criterion (e.g., allocation on a per capita basis, on a cost recovery basis, or on other bases such as revenue passengers or deficit). Some provinces use two criteria which are a combination of two of these.

On the basis of the purpose behind providing PTOS, if the amount of allocation is to reflect how well these purposes have been achieved and provide incentive for further improvement, multiple criteria must be used for basing allocation. The use of only one criterion might encourage a transit authority to concentrate on one objective which helps them to obtain a higher level of subsidy, while ignoring another objective which may be important, but will not assist them in gaining more subsidy money.

3.2 Summary of Criteria Used by Each Province

Alberta. Alberta presently funds transit operation by means of a per capita allocation. Municipalities with conventional public transit receive funding at $8 per capita plus $3 per capita for transportation of the elderly and the disabled (1).

From 1982-1984, Alberta funded most eligible public transit capital projects at 100%. A new three-year program has been implemented in 1985 which calls for the cost-sharing of transit capital projects at 75% provincial funds and 25% city funds.

British Columbia. British Columbia employs a funding formula which is based on a fixed level of cost recovery by the individual transit operator, with remaining costs split between the municipality and the province. The cost recovery portion for Greater Vancouver and Greater Victoria has been approximately 40% since 1979. Small community transit systems are expected to recover 30% of their costs from operations. The municipality must make up for any revenue shortfall below the cost-recovery target and may retain any revenue in excess of the cost-recovery target for use in transit (2). British Columbia owns all vehicles and leases them to individual transit operators. Thus, capital cost subsidy cannot be clearly distinguished from operating cost subsidy.

Manitoba. Manitoba provides operating assistance for public transit at the rate of 50% of the operating deficit for Winnipeg, Brandon, Thompson, and Flin Flon. This operating assistance is subject to a ceiling which is determined each year. The province provides transit capital assistance equal to 50% of the net cost of bus purchases in the municipally-run systems in Winnipeg and Brandon (3). These buses must be purchased from provincially-owned Flyer Industries. Some uncertainty exists as to the future of Flyer Industries at the time of writing. The privately-run systems in Thompson and Flin Flon are not eligible for capital assistance.

Nova Scotia. Nova Scotia employs a per capita basis to determine its level of public transit operating assistance. The operating assistance was $4.60 per capita in 1985 (4). Dartmouth receives an additional per capita subsidy for the provision of a commuter ferry service between Dartmouth and downtown Halifax. Halifax receives an indexed grant to compensate for the increased deadhead costs resulting from the location of a regional transit maintenance facility in Dartmouth (5).

New transit bus purchases qualify for 50% provincial capital assistance. The provincial share for other capital purchases is negotiated on an individual basis.

Ontario. Ontario uses a system of public transit funding which employs three subsidy groups. These are the Basic, Additional, and Special Subsidies. The Basic Subsidy is equal to 50% of theoretical net cost. Each municipality, depending on its class as determined by population, has

been assigned a target revenue to operating cost ratio. This target is the theoretical percentage of operating cost that is expected to be recovered from revenues. Using the target ratio, the Basic Subsidies for systems as a percentage of operating cost range from 13.75% - 25%.

If a system's net operating cost exceeds it theoretical net cost, a municipality is eligible to receive an Additional Subsidy. The actual net cost minus the theoretical net cost, up to a ceiling of 25% of theoretical net cost, is eligible for an Additional Subsidy of 25%.

Municipalities with an annual population increase greater than 4% are eligible for a Special Subsidy. The Special Subsidy is equal to 1.5% of the operating cost for each 1% increase in population in excess of 4%.

Municipalities with a new major transit facility are eligible to receive a Special Subsidy for its initial years of operation. A major transit facility is one operating on an exclusive right-of-way. Such projects have their subsidies determined on an individual basis as part of their agreements with municipalities.

The total of the Basic Subsidy, Additional Subsidies, and Special Subsidies must not be in excess of 75% of actual net operating costs for a public transit system (6).

The provincial subsidy for capital items is 75%. The need for additional transit vehicles must be demonstrated by the municipality and approved by the Province of Ontario prior to purchase. Terminal buildings, garages, shelters, and terminal parking facilities for transit users are eligible for capital subsidy. Other capital items, such as transit infrastructure and service vehicles, also qualify for this 75% capital subsidy. Rapid transit construction is subsidized at this rate as well (5).

Quebec. Quebec provides public transit operating assistance equal to 40% of regular service revenues. Reduced fares receive the same level of subsidy as regular fares.

Monthly passes that are sold at a discount are eligible for provincial assistance. The monthly pass grant is 100% of the discount up to 30% of equivalent full fares. Thirty percent of equivalent full fares means 30% of the price of 50 trips at regular fare. From 1984 to 1986, the refunded percent of equivalent full fares is being gradually reduced from 30% to 24% for the

transit operations in Montreal, Quebec City and Hull (7).

In 1985, the maximum provincial funding level for the five public transit commissions was 95% of the municipal contribution for the operating grant and 130% of the municipal contribution for the total of the operating grant and the monthly bus pass grant. These provincial proportions are scheduled to lower each year until 1988. The provincial funding ceiling policy for the four public transit corporations and any eligible municipalities is that the total of the operating and monthly pass grants must not exceed 75% of the deficit of operation.

Provincial transit capital assistance is 75% of the costs for buses, passenger shelters, garages and terminals, and 100% of the costs of rapid transit systems for the public transit commissions and corporations. Eligible municipalities qualify for 75% funding assistance for passenger shelters (5).

Saskatchewan. In 1985, Saskatchewan provided operating transit assistance at $4 per capita for Regina, Saskatoon, Moose Jaw, and Prince Albert, and at $3 per capita for Yorkton, Swift Current, North Battleford/Battleford, and Creighton (8). The four largest centres also receive an incentive grant which is computed as the number of revenue passengers, divided by the adjusted transit operating deficit, and multiplied by a factor. Thus, more provincial assistance accrues when a transit system is able to reduce its deficit or increase it ridership.

Capital funding assistance from Saskatchewan covers 50% of the cost of purchasing new vehicles or refurbishing older buses in the four largest cities. The province provides 75% of this amount for other cities and towns. Other approved transit capital expenditures receive 75% provincial assistance, with the exception of transit storage and maintenance facilities (5).

Yukon Territories. The Yukon provides public transit funding to Whitehorse at the rate of 60% of the operating deficit, with the remainder of the deficit shouldered by the City of Whitehorse. Whitehorse is the only Yukon municipality currently operating a public transit system (4).

Others. Although Newfoundland and New Brunswick do not financially assist public transit directly, municipalities may use their municipal grant monies to defray transit operating costs. Newfoundland has public transit

systems in St. John's and Corner Brook (10). New Brunswick has public transit systems in Saint John, Moncton/-Riverview/Dieppe, and Fredericton (11).

Prince Edward Island and the Northwest Territories each have one bus in operation. The City of Charlottetown, P.E.I., provides funding for one bus, which is operated by a service club. A private operator funds and operates one bus in the Northwest Territories (5).

3.3 Advantages and Disadvantages of Present Approaches

Each of the criteria used by most provinces has advantages and disadvantages when applied on an individual basis. For example, the use of a per capita allocation ensures that a municipal transit authority receives a "fixed" amount of subsidy in proportion to its size. The disadvantage with this approach is that the transit authority does not have to provide good or efficient service to qualify for this amount. With this sort of approach, the provincial government does not necessarily achieve one of its purposes of providing PTOS, which is to provide adequate and efficient transit service to the community.

Both the cost recovery basis for allocation, and criteria such as revenue passengers do reflect the need for the transit authority to perform well financially and penetrate the market reasonably, respectively. These can be classified as incentive based. However, a transit authority may improve its cost recovery level without necessarily improving its performance, but simply by eliminating routes that have poor financial performance or concentrating more on high demand density routes that will prove financially more efficient. The need for the transit system to reach and be accessible to most people in the community will thus not be achieved - i.e., one of the purposes of PTOS suffers. Similarly, revenue passengers may be increased at a lower cost on high demand routes than on sparse demand routes. This is a more effective and efficient way for a transit authority to obtain higher PTOS, but not necessarily achieving one of the goals of PTOS.

Allocations based on deficits seem to have an element of lack of incentive attached to them. A transit authority does not necessarily have to improve its revenue/cost ratio if it knows that a portion of its deficit will be subsidized.

A combination of per capita grant and incentive grant by Saskatchewan ensures that the municipal transit

authority receives a minimum level of subsidy plus an increase if it attracts more revenue passengers. The increase in cost for attracting more revenue passengers is considered by the adjustment based on operating deficit. It however does not include subsidy based on more areal coverage of service. Nevertheless, it is an improvement over the single criterion techniques.

Ontario's system of transit operating subsidies first recognizes that larger transit systems can be expected to earn a greater proportion of their operating costs through their operations. The province's Special Subsidy takes into account the increased transit cost associated with population increases greater than 4% until the transit system properly adjusts its level of service to meet the additional requirements. As is reflected in the Basic Subsidy, transit authorities are expected to improve their revenue-cost ratios with higher populations in the longer term. Another part of the Special Subsidy relates to provincial assistance for the initial years of operation of major new transit facilities. This subsidy assumes that front-end costs need to be defrayed until the new facility is able to be effectively marketed and accepted by riders as a draw to increased utilization of the transit system.

The Ontario system of funding could be summarized as being a revenue-cost ratio incentive approach, modified by the impact of population. It encourages transit systems to maximize their revenues and minimize their costs at levels commensurate with the size of the population served. The problem with this method is that a transit operator has an incentive to concentrate its service on the more profitable routes and times, and reduce the level of service on the less profitable routes and at the less profitable times. However, Ontario's work in relating revenue-cost ratios to population size represents an important step in the progression of transit funding theory in North America.

4.0 Framework for a More Comprehensive and Objective Approach

Four possible variables that might be considered for inclusion in the public transit operating assistance formula are revenue-cost ratio, ridership, revenue-km, and travel and wait time per rider. The issue to be examined is how the introduction of these components as criteria for a province to decide its level of support to individual transit operators will affect the achievement of the goals of transit subsidies. As was previously stated, some of the aims of transit subsidies are to assist in meeting riders' needs, to allow transit to make

an effective contribution towards meeting the social and economic requirements of all citizens, to aid municipalities in meeting some of their financial commitments, and to let municipalities develop and operate their desired level of public transit services in consideration of local conditions and the attainment of specified objectives.

Some jurisdictions in Canada currently use revenue-cost ratios in their deliberations on public transit operating grants. These ratios provide an overall indication of how much revenue is collected as compared to costs disbursed for a transit system. However, this variable alone, as was pointed out earlier, could act as an incentive for the transit operator to reduce the level of service provided, especially on unprofitable routes and at unprofitable times. Revenue-km and/or travel and wait time per rider could be used in conjunction with revenue-cost ratios to ensure a reasonable level of areal coverage and vehicle frequency, respectively, are maintained. Taken alone, revenue-cost ratios can act as an incentive to operate a transit system in the manner of a profitable enterprise. This can be beneficial to a transit system when major inefficiencies are present, or ridership is very low. After the point when the transit system is being run in an efficient manner, further attempts to reduce costs will be at the expense of the level of service. Thus, in an effort to gain increased grant money from the province, a transit operator may be tempted not to pursue the riders' goal of a useable system with a high level of service.

It is thus appropriate to set up two thresholds for revenue-cost ratios. One would be the minimum standard, and the second would be the practical maximum achievable. Maximum subsidy is provided when a transit system operates between the two thresholds. Less subsidy would be received if more than the upper threshold was reached, because this would reflect a drop in the level of service through dropping less profitable parts of the system. Less subsidy would also be received if a transit system recorded a revenue-cost ratio below the lower threshold. Figure 1 provides a graphical representation of these two threshold levels. The bars show three levels of subsidies which are achieved below the first threshold, between the two thresholds, and above the second threshold. Alternatively, a continuous function may be used with the level of subsidy continuously varying with revenue-cost ratio (as shown in dashed curve).

Ridership is a key performance variable, in that it provides an indication as to how well a transit operator's service has been accepted by the people in the

community. A substantial ridership is necessary for a transit system to defray a part of its costs. Without the moderating influence of other variables in the formula, the use of ridership can suffer from the same drawback as the use of revenue-cost ratios for PTOS allocation. This problem can be alleviated by considering additional variables such as revenue-km or travel and wait time in allocating PTOS. For example, if a transit authority decides not to provide service after 7:00 p.m. to a suburban area because there is low ridership at that time, a lower revenue-km amount would result, and would counteract the increased relative funding per cost generated by concentrating service in high ridership periods. The exact mathematical linkage that would facilitate the arrival at this equilibrium is a subject for further research. Travel and wait time could also be employed as a moderating influence in the funding formula. Since transit authorities have an incentive to reduce service on less heavily used routes when ridership is a funding component, vehicle headways could tend to be lengthened on such routes. In this case, the travel and wait time for users would be increased. The benefit to the transit system of ignoring the less travelled routes could be countered if the additional subsidy was weakened through the travel and wait time mechanism.

The two threshold system outlined for revenue-cost ratios could also be employed with ridership per capita. Subsidy would be greatest within the range between the two thresholds. It would decline if a minimum level of ridership per capita was not achieved. It would also decline if too much emphasis was placed on the attainment of high ridership per capita levels to the detriment of a balanced overall level of service.

Revenue-km was deemed of importance in transit operations funding because it measures the total in-service distance logged by a transit system. Whereas high ridership to some extent may be unattainable even with well-directed and considerable effort on the part of transit systems as it is only indirectly controllable by their policies, revenue-km is directly under the control of transit operators. As opposed to ridership, which is a demand-realized variable, revenue-km represents a quantity-supplied variable. Revenue-km is one measure of the level of service provided.

To ensure that suburban areas are not ignored by transit operators reluctant to service low-volume routes, a sectoral approach to revenue-km is suggested. That is, a revenue-km figure would be tabulated by the transit operator for a number of sectors in the service area.

Thus, the concentration of transit service in more profitable regions of the service area would not be masked by the summation of total revenue-km. Service in all of the sectors would need to be kept up to acceptable levels to avoid losing subsidy money. For example, if the vehicle headways were increased to one hour in a suburban sector after 7:00 p.m., the revenue-km for that sector would reveal it and reduce the subsidy from the province. This sectoral approach is also appropriate for the tabulation of ridership per capita and all other variables.

Travel and wait time per capita is of great importance in assessing a transit system's performance. From the standpoint of the rider, it is one of the most crucial factors in determining usage patterns. Although travel time by urban transit will often exceed that by private auto, good performance in comparison with similar transit systems should be encouraged. Wait times are governed by vehicle headways on various routes. These wait times are especially important as they relate to flexibility of departure and exposure to adverse weather conditions for those types of transit where enclosed terminals are not provided.

In setting desired levels of performance for all of the variables, the size of the municipality under consideration should be taken into account. Ontario has included in its funding method a provision for larger cities to recover a greater portion of their costs from revenues received. Larger cities tend to attract both a larger per capita and total ridership to transit than do smaller cities. Higher levels of service can also be expected of transit systems in larger cities.

The two level-of-service variables which have been suggested for possible inclusion in the funding formula are revenue-km and travel and wait time per capita. The ideal service level for the transit system would be achieved when it fell within the thresholds set. Below the lower threshold level, a poor level of service would occur. Only marginal improvements in service would take place above the upper threshold level. For example, a point is reached at which additional routes are duplicative and add very little additional service for a transit system. It is also clear that when not enough service is being provided to serve the whole municipality, additional routes or route extensions are necessary to move beyond this poor level of service. Another variable that has not been considered here which could be included in the funding formula is daily hours of service.

Each of these variables can be achieved in several different ways by transit authorities. Some of the approaches will be in direct response to the provincial objectives. Other approaches, on the other hand, tend to serve the interests of transit authorities in obtaining higher subsidies. Table 1 summarizes the policy options available to transit operators and their effects on the four variables proposed for possible inclusion into a funding formula. It also assesses whether these effects contribute positively or negatively to the attainment of the objectives for the variable.

5.0 Conclusions

A need exists to develop a formalized general approach to transit funding for use by the provinces. The techniques of funding public transit outlined in this paper offer the provinces a way of better meeting their own objectives for providing funding assistance to municipalities. The objectives for public transit are often conflicting. For example, cost reduction must be traded off against improvements in the level of service provided. Multiple criteria methods of funding public transit offer advantages over single criterion methods. The provinces will set the standards to be used for determining the upper and lower thresholds. The exact procedures that would be employed to construct the threshold levels need to be developed in further research.

References

1. Personal communication, Sandra Lawson, Urban Transportation Engineer, Alberta Department of Transportation.

2. Personal communication, Steve New, Transportation Planner, B.C. Transit.

3. Personal communication, Kent Smith, Senior Urban Planner, Manitoba Department of Urban Affairs.

4. Personal Communication, L.R. Keddy, Assistant Director - Transportation, Nova Scotia Department of Municipal Affairs.

5. Canadian Urban Transit Association, Government Funding Policies for Urban Transit in Canada, 1983-84.

6. Ministry of Transportation and Communication, Transit Subsidy for Operating Expenditures, Section 2, Ontario Municipal Transit Manual, Transit Office.

7. Personal communication, Robert Menard, Ministere des Transports du Quebec.

8. Personal communication, B. Singh, Transit Program Manager, Saskatchewan Department of Urban Affairs.

9. Personal communication, Roger Graham, Director - Community Services, Yukon Department of Community and Transportation Services.

10. Personal communication, R.E. Corbett, Assistant Deputy Minister - Local Government Services, Newfoundland Department of Municipal Affairs.

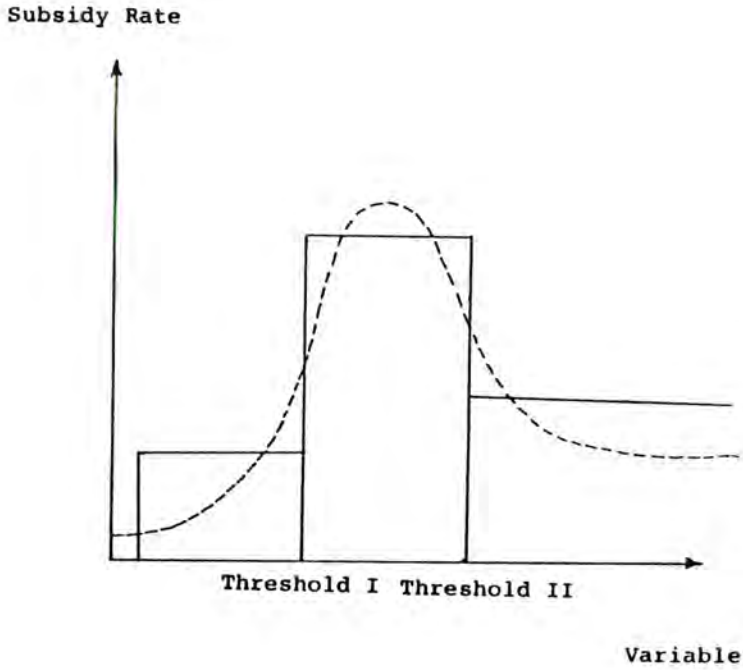
11. Personal communication, D.L. Johnson, Transportation Policy Officer, New Brunswick Department of Transportation.

Table 1.
Effects and Assessment of Transit Policy Options on Funding Formula Variables

	Rev-cost ratio	Rider-ship	Rev-km	Travel & wait time
Extend daily hrs of service	+/-(?)	+(*)	+(*)	
Decrease vehicle headways	+/-(?)	+(*)	+(*)	-(*)
More effective routing	+/-(?)	+(*)	+/-(?)	-(*)
Expand area of of service	+/-(?)	+(*)	+(*)	
Increase fares	+/-(?)	-(Ø)		
Reduce fares	+/-(?)	+(*)		
Market transit	+/-(?)	+(*)		
Sell advertising space in system	+/-(?)			
Reduce daily hrs of service	+/-(?)	-(Ø)	-(Ø)	
Increase vehicle headways	+/-(?)	-(Ø)	-(Ø)	+(Ø)
Combine shorter routes into longer routes	+/-(?)	-(Ø)	-(Ø)	+(Ø)
Reduce area of service	+/-(?)	-(Ø)	-(Ø)	
Improve maintenance program	+/-(?)			
Improve transit communications to riders	+/-(?)	+(*)		

\+ Increases the value of the variable
\- Decreases the value of the variable
+/- Could increase or decrease the value of the variable
* Positive contribution in relation to the objectives for the variable
Ø Negative contribution in relation to the objectives for the variable
? No assessment can be made as the direction of change is not clear

Figure 1. Relationship Between Threshold Levels of Subsidy Rates



STRUCTURE OF LINER MARKETS AND EFFECT OF CONFERENCE RATES IN CANADIAN OVERSEAS TRADE

by

V.H. Wei
Research Branch, Canadian Transport Commission

1.0 INTRODUCTION

In recent years, the liner industry has experienced a series of important market and regulatory changes. Firstly, there were rate wars between conference and non-conference carriers, the dissolution of some traditional liner conferences and the merger of a number of conferences into super conferences in some trade areas etc... Secondly, in conference regulation, the United Nations Code of Conduct for Liner Conference came into force in 1983, and the regulatory reform in the United States resulted in the passage of the Shipping Act of 1984. Moreover, in Canada, the Shipping Conference Exemption Act (SCEA) of 1979 which was to expire in April 1984, has been extended twice and is still under review.

This paper has two objectives. The first is to analyze the changes in the structure of the Canadian liner market as well as in the liner conference system, and the second is to assess the impact of liner conference rates on the prices of major export and import commodities in the Canadian overseas trades.

The conclusions of this paper are largely supported by empirical analyses which include: an analysis of the demand for liner services to and from Canada; empirical analyses of the level and structure of conference rates; and comparisons of the levels of inbound and outbound rates on the Canadian North Atlantic routes.

2.0 LINER MARKET STRUCTURE AND CONFERENCE RATES

2.1 Evolution in the Liner Market

In the 1970's, major world liner markets were dominated by traditional shipping conferences whose main

functions included setting freight rates, rationalizing capacity and controlling competition. As such, the monopoly power of conferences was a controversial issue among economists and legislators.

However, in the early 1980's, the dominant position of the conference in liner shipping was greatly challenged due to changing market conditions, such as, recession in world shipping markets, severe overcapacity, and competition from non-conference lines. Most importantly, conference rules were found by many as inflexible and restrictive in response to competition from outsiders. As a consequence, many member carriers withdrew from conferences and took independent rate actions. The following is an analysis of the Canadian liner market during this period.

Table 1 shows the demand for liner services in Canadian import and export trades with a break-down by conference and non-conference lines for the period from 1977 to 1982. As shown in the Table, a total of about 12 million tonnes of liner cargos were handled in 1977. Between 1977 and 1979, total liner cargo tonnage increased by 26.5%, with an annual growth rate of 13.8% and 11.2% in 1978 and 1979 respectively. The growth, however, slowed down and even became negative in the early 1980's as a result of the worldwide recession. The liner cargo loaded and unloaded in Canada in 1982 was 3% less than in 1979.

This period was also marked by the fast growth of non-conference lines. In inbound traffic, the conferences' share of liner cargo tonnage declined drastically from 77% in 1977 to 55% in 1982. Conference lines faced even more competition from the non-conference lines in the outbound market; the share of conference lines in total outbound liner trade declined from 62% to 39%. In total Canadian trades, the conferences' market share decreased from 69% to 43% between 1977 and 1982.

However, the growth in market shares of the non-conference lines lasted only a short period of time. As the shipping conferences weakened, rate wars soon took place in major liner markets such as the North Atlantic and the Transpacific trade routes. On the North Atlantic route, for example, liner rates were depressed to a point that liner shipping was unprofitable, causing the bankruptcy of Cast, the major non-conference line on the route. On the Pacific coast, a massive membership withdrawal resulted in the dissolution of the Pacific Westbound Conference (PWC). Subsequently, the need for a co-operative arrangement, the conference system, was reaffirmed.

Table 1

THE DEMAND FOR LINER SERVICES IN CANADIAN OVERSEAS TRADE 1977-1982 (Thousand Metric Tons)

	1977	1978	1979	1980	1982
INBOUND					
Conference	2,556	2,504	2,489	1,832	1,800
Non-Conference	765	1,395	1,124	1,964	1,502
Total Liner	3,321	3,899	3,613	3,796	3,302
OUTBOUND					
Conference	5,495	5,465	5,133	4,344	4,337
Non-Conference	3,369	3,946	6,048	6,366	6,748
Total Liner	8,864	9,411	11,181	10,710	11,085
TOTAL TRADE					
Conference	8,051	7,969	7,622	6,175	6,137
Non-Conference	3,644	5,341	7,172	8,331	8,250
Total Liner	11,695	13,310	14,794	14,506	14,387

Note: (1) Figures exclude Canada-U.S. Trades
(2) 1981 data was not processed, therefore not included.

Source: Based on shipping data on computer tapes provided by Statistics Canada.

By and large, shipping conferences regained control of liner markets by 1984. For instance, on the Canadian North Atlantic routes, Cast (1983) and Sea-Land joined the four conferences serving inbound and outbound trades between Canada and United Kingdom, and between Canada and Europe respectively. As a result, conference vessels represented 85% of total TEU capacity supplied by all participants on these route in 1984. Moreover, these North Atlantic conferences undertook a rate reform in 1983 but they still maintain traditional conference rules and regulations, such as the closed conference system, loyalty contracts and centrally negotiated rates.

However, all Canada-U.S. joint conferences are now regulated by the new U.S. Shipping Act of 1984 which requires that conferences be open to all common carriers willing to serve the particular trade or route, and that conferences allow members the right of independent action. These include the two recently formed super conferences, namely, the Transpacific Westbound Rate Agreement (TWRA) and the Asia North America Rate Agreement (ANERA). These two conferences cover not only cargo moving through the Pacific ports of U.S. and Canada to and from Asia but also the Asian trade routes to and from the U.S. Atlantic and Gulf coasts. By consolidating a number of conferences and widening intermodal operations, the super conferences were supposed to have a greater market power on the Transpacific routes. However, recent developments indicate that their ability to maintain rate stability could be greatly weakened by the members' right to take independent rate action.

In summary, the conference system and the structure of liner markets continue to evolve. The competition from non-conference lines has forced the conferences to undertake a series of rate and regulatory reforms; the efficiency of the super conferences is still under test; and finally, the effect of the upcoming revision of the SCEA on Canadian and European-based closed conferences is yet to be seen.

2.2 Effects of Competition on Conference Rates

This section examines separately the effects of competition on the level and the structure of conference rates:

The Level of Conference Rates

In order to measure the behavior of conference freight rates, a set of price indices has been calculated based on the chain Laspeyres method.[1] Figure 1 shows the aggregated conference rate index which represents average

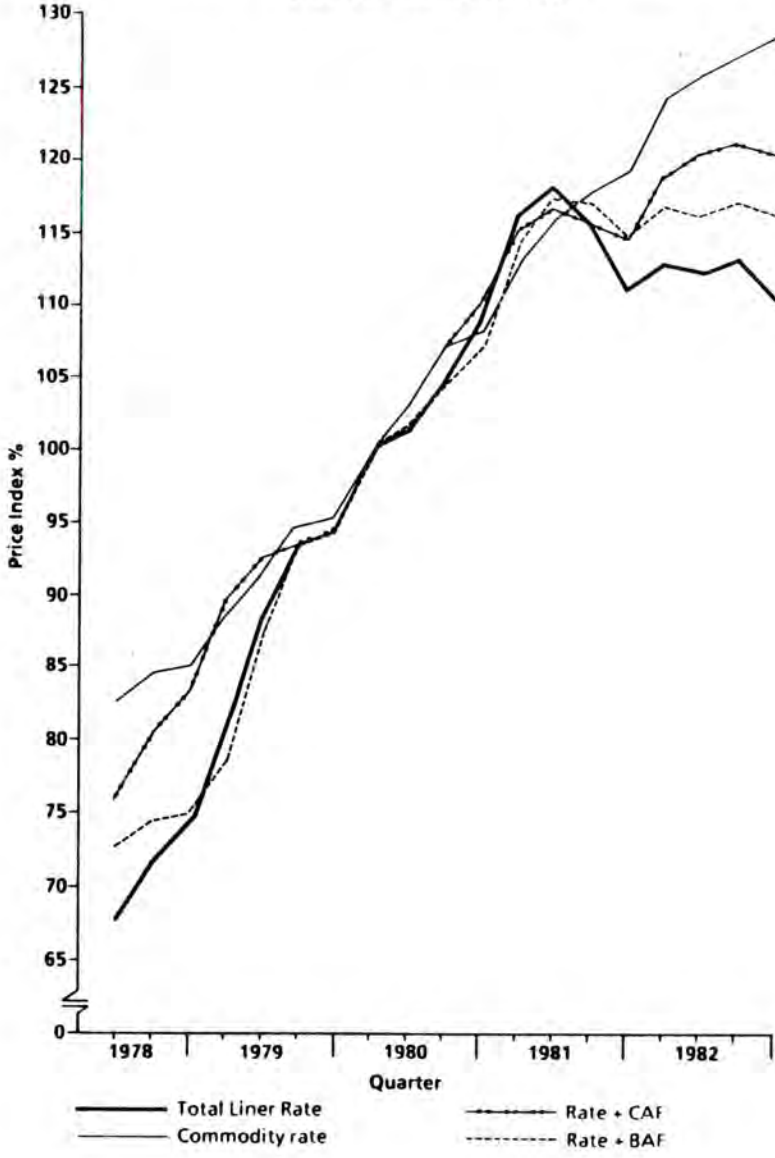
quarterly percentage changes in rates of 17 outbound shipping conferences serving Canadian trades over the five-year period from 1978 to 1982. This Figure includes four separate time series of rate indices: base commodity rates, including bunker adjustment factors (BAF), including currency adjustment factors (CAF), and including both BAF and CAF.

As shown in the Figure, a strong and persistent upward trend of liner conference rates appeared during the three-year period from the second quarter of 1978 to the second quarter of 1981, due to both increases in base commodity rates and in bunker and currency surcharges. The surcharges had a drastic impact on total liner costs. However, from a turning point in the middle of 1981, overall liner rates declined through 1982, which can be attributed to two major factors. First, bunker prices levelled off and declined, and the conferences gradually rolled part of the surcharges into commodity rates. As shown in the Figure, there were continuous quarterly increases in the commodity rate index during 1981 and 1982. However, the price index constructed on the basis of the combination of commodity rates and bunker surcharges shows little increase during these two years. Secondly, conferences faced strong competition from non-conference lines on major trade routes. As a consequence, several affected conferences not only cancelled their annual general rate increase (GRI), but also reduced rates for certain highly competitive liner cargos in 1982. Unfortunately, for Canadian shippers the benefit of depressed liner rates was offset somewhat by the weakened Canadian dollar which was reflected in the CAF. Overall, the rate level in 1982 was about 3% lower than in 1981.

The Structure of Liner Rates

A number of earlier studies on the structure of conference rates have revealed that conferences practice value-of-service pricing,[2] that is, high value commodities tend to be charged higher freight rates than low value commodities for similar transportation services. In theory, this type of price discrimination is not sustainable in a highly competitive market. Recently, the CTC Research Branch has carried out an empirical analysis of the structure of conference rates[3] in order to determine if there were changes in major explanatory variables of liner rates during the recent rate war period, notably in 1982 and 1983. The analysis covered the freight rates of four conferences serving Canada-UK and Canada-Europe trades.

Figure 1
QUARTERLY LINER CONFERENCE PRICE INDEX
FOR CANADIAN EXPORT TRADES 1978-1982
(1ST Quarter 1980 = 100)



As a rate reform was implemented by the North Atlantic conferences in 1983 when the weight/measurement (W/M) rate units were replaced by the commodity box rates (CBRs), the empirical rate structure analysis also aimed at the effect of the rate reform on the structure of liner rates on these routes.

The methodology adopted was multiple regression analysis. Both simple and log-linear rate models were constructed and tested. In the model specification, the dependent variable of the 1982 rate models was commodity rates per tonne. A set of independent variables included were: volume carried by conference lines, number of shipments, average weight per shipment, stowage factors, unit value of commodity, volume carried by non-conference lines, frequency of appearance of a commodity in annual vessel voyages, and the dummy variable for temperature controlled cargos. In the 1983 rate models, the dependent variable was commodity box rates for 20' and 40' containers. The same independent variables listed above for 1982 were used except the stowage factor, which was replaced by the density factor. In addition, the rate of 1982 was included as an independent variable.

As a result of multicollinearity, a number of alternative reduced models were constructed and tested. However, due to the lack of space, only a selected set of the linear models of outbound conferences is included in Table 2. Nevertheless, the main points summarized below are based on the overall empirical results.

First of all, the results do not support the hypothesis that the value of a commodity is a significant factor in conference pricing. Rate wars on the North Atlantic might have significantly affected the conference's value-of-service pricing. In fact, the freight all kinds (FAK) rates generally offered by non-conference lines were very competitive in the liner market for high-value cargos. During the fierce competition, the conference lines had complained that the non-conference lines "creamed-off" their high revenue cargos, and the conference had later retaliated. Consequently, the results support the economic theory that price discrimination is not sustainable in a highly competitive market.

However, the fact that the unit value still has a positive relation with the rate, although not significant, indicates that the pressure of competition may have reduced but not totally eliminated the price discrimination which existed in the traditional "what the traffic will bear" tariff. And it is possible that the conferences may re-introduce the value of service pricing

Table 2

REGRESSION COEFFICIENTS OF RATE STRUCTURE MODELS OF OUTBOUND CONFERENCES ON CANADIAN NORTH ATLANTIC ROUTES

	1982 Rates (per tonne)		1983 CBRs	
Indep. Variables	United Kingdom	Europe	United Kingdom	Europe
Constant term	58.86* (4.75)	76.18* (6.86)	969.1* (4.84)	810.1* (2.71)
Rates '82			7.86* (5.48)	9.24* (4.12)
Volume	.0001 (1.862)	-.002* (-2.01)		-.002 (-.102)
Avg. Weight			-13.93* (-2.03)	
Stowage	.568* (3.098)	.332 (1.758)		
Density				.55 (.29)
Unit Value	.004* (2.299)	.001 (.92)	.003 (.143)	-.0143 (-.867)
Vol. Non-conf.	-.001 (-1.771)			
Voyages		-.217 (-.671)	2.014 (.581)	-6.094 (-1.298)
Dummy	139.94* (7.99)	128.48* (9.28)	1093.67* (3.68)	1014.74* (2.86)
N	59	54	59	54
R^2	.67	.75	.78	.76

* significant explanatory variables based on $t \geq 2$.

in future rate adjustments after they regain their controlling power in a given market.

Secondly, the results suggest that the freight rates per tonne are approximately equal to the average costs of liner transport on each leg or route of the North Atlantic trades. This is concluded from the fact that the constant term is significant in all rate models.

Thirdly, the dummy variable is the only other variable (aside from the constant term) significant in all rate models. It reflects differences in average costs between dry and refrigerated or hazardous cargos.

Fourthly, other explanatory variables, such as stowage factor, volume etc. are found significant only in certain rate models. However, generally speaking, the rate models show that the stowage factor has a positive relationship with the rate while volume, the degree of non-conference competition and the frequency of shipment (voyages) have a negative effect on the level of conference rates.

Finally, the new commodity box rates are found positively and significantly related to the weight-based commodity rates. Therefore, the rate reform has changed the rate units but has not significantly altered the structure of conference rates on the North Atlantic routes.

3.0 EFFECT OF CONFERENCE RATES ON CANADIAN OVERSEAS TRADES

3.1 Comparison Between Inbound and Outbound Rates

The disparity in the level of liner freight rates between inbound and outbound cargos has been a common concern among shippers and governments, especially where a nation relies on the liner services of foreign-dominated conferences. Questions are often raised regarding liner rate discrimination against the importers or exporters in a particular country, and ocean carriers' pricing adversely affecting a nation's foreign trade and the balance of payments. For instance, the U.S. government has conducted a series of congressional hearings and investigations on the issue of the higher liner rates charged on U.S. exports relative to rates on their imports on the North Atlantic routes.[4]

Canada relies heavily on foreign-flag liner operators. Therefore, a statistical comparison between the inbound and outbound rate levels on the Canadian North Atlantic routes was undertaken. For each group of cargos identified in the ship manifest records, freight

rates for outbound and inbound traffic were obtained from the tariffs of four conferences serving Canada to and from the United Kingdom and Continental Europe respectively. The rate differential analysis was performed separately for the years 1982 and 1983 in order to reflect relative rate levels before and after the North Atlantic tariff reform.

Since import and export commodity items were quite different, we adopted a statistical test to compare the relative levels of inbound and outbound rates and to determine if the rate differentials were indeed significant: assume that the outbound rates (X) and the inbound rates (Y) are independent and normally distributed, and that the distributions of X and Y are $N(\mu_x, \sigma^2)$ and $N(\mu_y, \sigma^2)$ respectively. The hypothesis $H_0 : \mu_x - \mu_y = 0$ is tested against the alternative hypothesis $H_1 : \mu_x - \mu_y < 0$. Specifically, the first hypothesis assumes that the inbound and outbound rates are at the same level; the second, or the alternative assumption is that outbound rates are lower than inbound rates.

If the random samples of sizes n and m are taken, the test can be based on the statistic,

$$T = \frac{\bar{X} - \bar{Y}}{\frac{(n-1)Sx^2+(m-1)Sy^2}{(n+m-2)} \left(\frac{1}{n} + \frac{1}{m}\right)}$$

which has a t distribution with r=n+m-2 degrees of freedom when H_0 is true. The hypothesis H_0 will be rejected in favour of H_1 if the observed value of T is less than $-t\,\alpha(n+m-2)$ where α represents the critical level.

The results of the rate comparisons are presented in Table 3. In 1982 tariffs, liner freight rates for inbound commodities are found to be higher than those for outbound commodities on the Canadian North Atlantic routes. In Canada-United Kingdom trades, this conclusion is drawn at the 99% significance level (i.e. H_0 is rejected at an $\alpha=0.01$ confidence level); in the Canada-Europe trade route, it can be said at 99.5% significance level. Moreover, it is noted that the variance of inbound rates is much greater than that of outbound rates.

In the analysis of 1983 commodity box rates, it is found again that rates for inbound traffic are higher than outbound traffic. Moreover, in Canada-UK trades, the rate differentials between inbound and outbound containers is more significant for 20' than 40'

Table 3

COMPARISONS BETWEEN OUTBOUND AND INBOUND LINER RATES ON CANADIAN NORTH ATLANTIC ROUTES

Trades	Outbound $\bar{X}$	Outbound Sx^2	Outbound n	Inbound $\bar{Y}$	Inbound Sy^2	Inbound m	t
I. 1982 Commodity Rates							
Canada - U.K.	118	3253	78	146	6895	78	-2.449
Canada - Europe	109	1065	82	144	6648	82	-3.497
II. 1983 CBRs							
Canada - U.K.							
20' containers	1693	290K	69	2759	3361K	66	-4.623
40' containers	1856	342K	73	2128	4691K	69	-1.035
Canada - Europe							
20' containers	3349	1781K	21	3632	1255K	21	-.743
40' containers	3323	2599K	28	4854	2563K	28	-1.523

K = Thousand

containers; however, the reverse is true in Canada-Europe trades.

In conclusion, the results show that on the Canadian North Atlantic trade routes, the disparity in inbound and outbound rates is statistically significant, and that the inbound rates are higher than outbound rates. However, because the unit values of Canadian exports to Europe are generally lower than those of imports from Europe, there is reason to believe that in terms of relative freight-value ratios, the impact of liner freight rates on the prices of Canadian exports may be more significant than the impact on imports. Therefore, in the following section, the freight incidence of selected inbound and outbound commodities on the North Atlantic routes will be examined.

3.2 Incidence of Liner Freight Rates

The incidence of a freight rate is defined as the percentage of the price of a commodity at the destination point that is accounted for by freight charges incurred by shippers. In this study, the price of a commodity at delivery is assumed to be the sum of the liner freight rate and the F.O.B. value of the commodity. Due to the lack of data, insurance costs, custom duties and transport costs beyond the port of destination are excluded from the delivered price of a commodity.

Liner freight incidences of the commodities included in the above inbound and outbound rate comparisons were calculated based on 1982 commodity unit values and freight rates. It was found that, in the majority of commodity groups, the incidence of freight rates on Canadian exports was higher than that on imports. For example, in the Canada-UK trade, about two-thirds of outbound commodity groups in the sample were found to have higher incidences than inbound commodities; on average, the incidence of liner freight rates on imports and exports were 7.6% and 11.2% respectively. In the Canada-Europe trade, the freight incidences were 8.3% for inbound and 8.4% for outbound commodities.

4.0 SUMMARY AND CONCLUSIONS

The empirical analysis shows that the market shares of shipping conferences were seriously threatened by independent lines in the early 1980's. In response to changing market conditions, shipping conferences started to reform their traditional approaches. As a result, super conferences were established; they cover larger trade areas and regulate both ocean and intermodal rates.

However, the market power of these super conferences is weakened by the development of less-restrictive rate agreements. The rate wars in the liner market also affected the level and structure of conference rates, causing depressed rates and a reduction in the practice of value-of-service pricing. Finally, in trades between Canada and Europe, liner rates were found to be higher for inbound than outbound traffic. However, in terms of freight rate incidence on final prices of commodities, the reverse held true.

REFERENCES

1. WEI, V.H., "Shipping Conference Freight Indices for Canadian Export trade - Quarterly Time Series", Canadian Transport Commission, Research report no. 1984/01.

2. BRYAN, I.A., "Regression Analysis of Ocean Liner Freight Rates on Some Canadian Export Routes", Journal of Transport Economies and Policy, May, 1974.

3. WEI, V.H. "Economic Analysis of the Liner Market and Freight Rates in Canadian International Trades", Canadian Transport Commission, Research Report No. 1985/05E.

4. Federal Maritime Commission, "Impact of the Pricing Policy of North Atlantic Carriers on U.S. Exporters", Washington, D.C., 1981.

Note: The views expressed in this paper are those of the author and do not necessarily reflect the views of the Commission.

IMPACTS OF CHANGES IN VEHICLE MASS AND DIMENSIONS ON TRUCKING ACTIVITY IN THE ATLANTIC PROVINCES

by
Don Good
Fiander-Good Associates Ltd., Fredericton
and
Prof. Barry G. Bisson
Transportation Group, University of New Brunswick
and

1.0 Introduction

In 1976 vehicle mass and dimensions in the Atlantic Provinces varied considerably on the provincial primary highway network. At that time, the Province of New Brunswick permitted 56 700 kg gross vehicle mass (GVM) on parts of its primary highway system while Newfoundland permitted 45 400 kg GVM and a 10 percent overload without penalty. On specific routes in Prince Edward Island 50 000 kg GVM was permitted while Nova Scotia's regulations only permitted 36 300 kg. In addition to the GVM limits, inconsistencies were prevalent with respect to axle loadings. Both New Brunswick and Nova Scotia permitted axle loads of 9 000 kg while Prince Edward Island and Newfoundland only allowed 8 000 kg.

The above inconsistencies often forced the trucking industry to conform to the lowest mass limitations en route or change truck loads at the respective provincial borders. Either requirement resulted in significant increases in overall truck operating costs. Provincial and Federal officials responsible for long range highway planning in the Atlantic Region believed that overall operating costs could be substantially reduced if the GVM limits were increased uniformly in the Atlantic Region, to permit larger average payloads.

To provide the necessary data to validate the above statement, a comprehensive truck origin-destination roadside survey was simultaneously completed throughout the Atlantic Provinces in August, 1976. Detailed analyses of the data identified potential benefits (cost savings) to the trucking industry with payload increases. As a result of these potential benefits, as well as potential highway geometric and surface benefits to all highway users, Transport Canada and the Governments of the four Atlantic Provinces entered into Phase I of a

program in 1978 "to jointly finance the strengthening/improvement of certain primary highway links with a view to permitting the adoption, in the Atlantic Provinces, of specified uniform truck load operations". These truck load operations were defined as a GVM of 50 000 kg and maximum axle loads of 9 000 kg per axle.

The agreement between Transport Canada and the four Atlantic Provinces required an evaluation to be completed to identify benefits attributable to the trucking industry. These benefits were evaluated and documented in a report entitled The Atlantic Provinces Primary Highway Strengthening/Improvement Program Motor Carrier Benefit Study.[1] The truck analyses were based on the 1976 origin - destination survey data and truck origin-destination data collected in the Atlantic Provinces throughout 1984.

This paper focuses on the impacts uniform vehicle mass and dimension regulations have had on trucking activity in the Atlantic Region. The paper reviews the impact of recent changes in the regulations and also provides some insights into the sensitivity of trucking operations to the existing regulations.

2.0 TRUCK FLEET IMPACTS

The collection of a truck data base in 1976 prior to the regulation changes in trucking regulations, followed by collection of a new and comprehensive truck data base in 1984, provided a unique opportunity to identify impacts the regulation changes have had to date on the truck fleet operating to, from and within the Atlantic Provinces. The discussion below provides an insight into these changes. However, it should be remembered these changes have occurred between 1978 and 1984, and it is quite probably additional changes are forthcoming.

Table 1 summarizes the percentage changes which have taken place with respect to vehicle types between 1976 and 1984. Vehicle type changes in both the total number of trips and the total tonnes hauled are illustrated.

TABLE 1

CHANGES IN THE ATLANTIC PROVINCES
TRUCK FLEET CHARACTERISTICS

Vehicle Type	% of Total Truck Trips 1976	% of Total Truck Trips 1984	% of Total Tonnes Hauled 1976	% of Total Tonnes Hauled 1984
Single Unit Trucks	54.8	52.5	23.6	24.6
3-axle Tractor Trailers	1.5	0.4	1.1	0.3
4-axle Tractor Trailers	2.0	1.4	1.6	1.2
5-axle Tractor Trailers	37.7	30.0	64.1	44.4
6-axle Tractor Trailers	2.9	13.2	7.8	26.7
Other	1.1	2.5	1.8	2.8

Source: The 1976 and 1984 Atlantic Provinces Truck Origin-Destination Data Bases

Table 1 reveals a number of interesting impacts which have occurred in trucking operations since 1976. The actual number of single unit trucks as a percentage of total trips has dropped in the 8 year period, yet the percentage of tonnes hauled (which is a better indicator of GVM impacts) has increased 4.2 percent. As discussed later in the paper, increases in axle loadings have resulted in larger average payloads for single unit trucks. There has also been a substantial increase in three axle single unit trucks. These 3-axle vehicles represent 35 percent of all single unit trucks operating in 1984.

The greatest impact of mass and dimension regulation changes has occurred in the utilization of 5 and 6-axle tractor-trailers in the Atlantic Provinces. Table 1 reveals that 5-axle tractor trailers have decreased from 37.7 percent of total trips in 1976 to 30.0 percent in 1984, a 20.4 percent decrease. In terms of total tonnes

hauled, the change is even more dramatic dropping from 64.1 percent to 44.4 percent, a decrease over the eight year period of 30.7 percent. In 1976 the 5-axle tractor-trailer was the work horse for the trucking industry. The data in Table 1, together with the vehicle utilization profiles presented later in this paper, indicate this is changing.

In 1976, 6-axle tractor-trailers represented only 2.9 percent of all trucking activity (trips). However, in 1984 these vehicles accounted for 13.2 percent of the trips, a 355 percent increase. Expressed in terms of percentage of total tonnes hauled, there was an overall increase of 242 percent.

It is in the utilization of the 5 and 6-axle tractor-trailers that changes in the regulations have had the greatest impact. Where once the 5-axle tractor-trailer was used extensively throughout the Atlantic Region to conform to the lowest GVM in place (36 300 kg), it is now being replaced to some extent by the 6-axle tractor trailer, a vehicle well suited for operating at the 50 000 kg GVM limits that are presently in place on the provincial primary highway system in all four Atlantic Provinces. Although the changes illustrated in Table 1 are substantial, it may be questioned that if the 6-axle tractor-trailer is well suited to take advantage of the 50 000 kg GVM, why has there not been a greater change in the 8 year period.

However, there are three important factors which must be taken into consideration. Firstly, the changes in GVM and axle loadings throughout the provinces did not occur until 1978. Secondly, there was a downturn in the economy in the early 1980's which influenced the trucking industry's ability to raise capital for new equipment. Finally, it was not financially feasible for trucking companies to replace their tandem axle trailers with triaxle-trailers immediately. What has occurred is that many companies have increased their triaxle trailer fleet as their tandem trailers became candidate for replacement. Many trailers have 10 year life spans, consequently, there is still a number of years to go before the 1978 fleet has outlived its useful life. It should also be noted that some trucking firms transport commodities which are not suited to 6-axle tractor-trailer operations.

The significance of a change from 5 to 6-axle tractor-trailers in terms of operational and operating cost impacts is discussed in more detail later. But at this time it is worth noting one particular advantage a 6-axle has over a 5-axle. For a 20 percent increase in payload capability, there is only approximately a 5 percent increase in operating costs. Thus substantially fewer trips are required with 6-axle than 5-axle tractor-trailers.

To further illustrate the dramatic impact the increase in GVM limits and axle loadings has had on trucking activity in the Atlantic Region, Figures 1 and 2 have been prepared. Each figure represents a distribution of vehicle type utilization by distance, expressed in terms of percent tonnes moved, for truck traffic with an origin or destination in New Brunswick. Figure 1 was developed from the 1976 truck data, while Figure 2 was prepared from the 1984 truck data. Similar graphs have been produced for the other three Atlantic Provinces but have not been included in this paper.

Figure 1 clearly reveals that the 5-axle tractor-trailer was the work horse of the Atlantic Provinces trucking industry in 1976, moving between 55 and 95 percent of all tonnes to or from New Brunswick. Although the 6-axle tractor-trailer operated on highways in New Brunswick permitting 56 750 kg GVM, their overall usage was low, below 10 percent of all tonnes moved. As shown by Figure 2, a major shift to the 6-axle tractor-trailer has occurred, thus taking advantage of the higher mass limits on the primary highway network and the inherent larger payloads.

Because some New Brunswick highways permitted GVM limits of 56 700 kg, there were more 6-axle tractor-trailers operating in 1976 than in the other three provinces. Thus the shift from 5-axle to 6-axle was even more dramatic in the other provinces, especially in Prince Edward Island and Newfoundland, where there was also a significant reduction in the utilization of single unit trucks to transport goods. Nova Scotia showed the least change to 6-axle tractor-trailers of any of the Provinces.

Depending on distance and the type of trip (ie. extra-regional, intra-regional or inter-regional), the 6-axle tractor-trailer is handling between 10 and 60 percent of the total tonnes. In comparison, this vehicle type handled between 0 and 20 percent of the tonnes in 1976. This is a significant shift in vehicle utilization and reflects the impact the increase in GVM limits has had on trucking activity in the Region. This impact is further illustrated if average payloads are reviewed.

Table 2 summarizes the 1976 and 1984 average truck payloads (expressed in kilograms) by vehicle type.

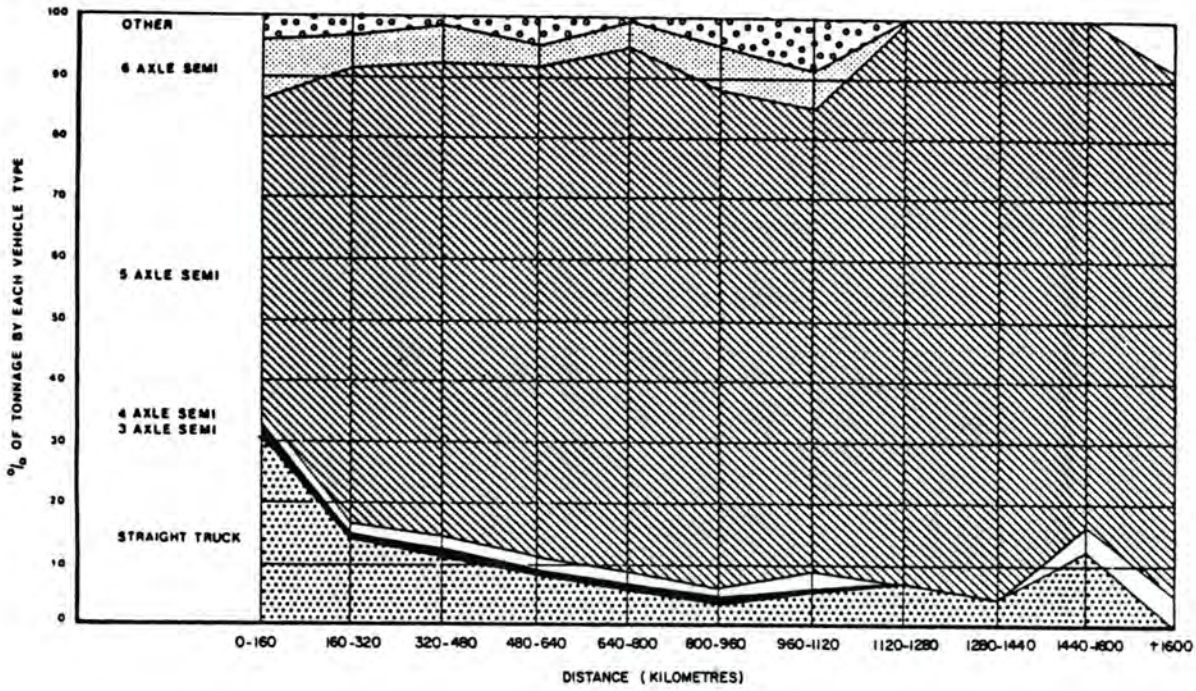


FIGURE 1: TRUCK TYPE UTILIZATION FOR TRAFFIC WITH AN ORIGIN OR DESTINATION IN NEW BRUNSWICK - 1976

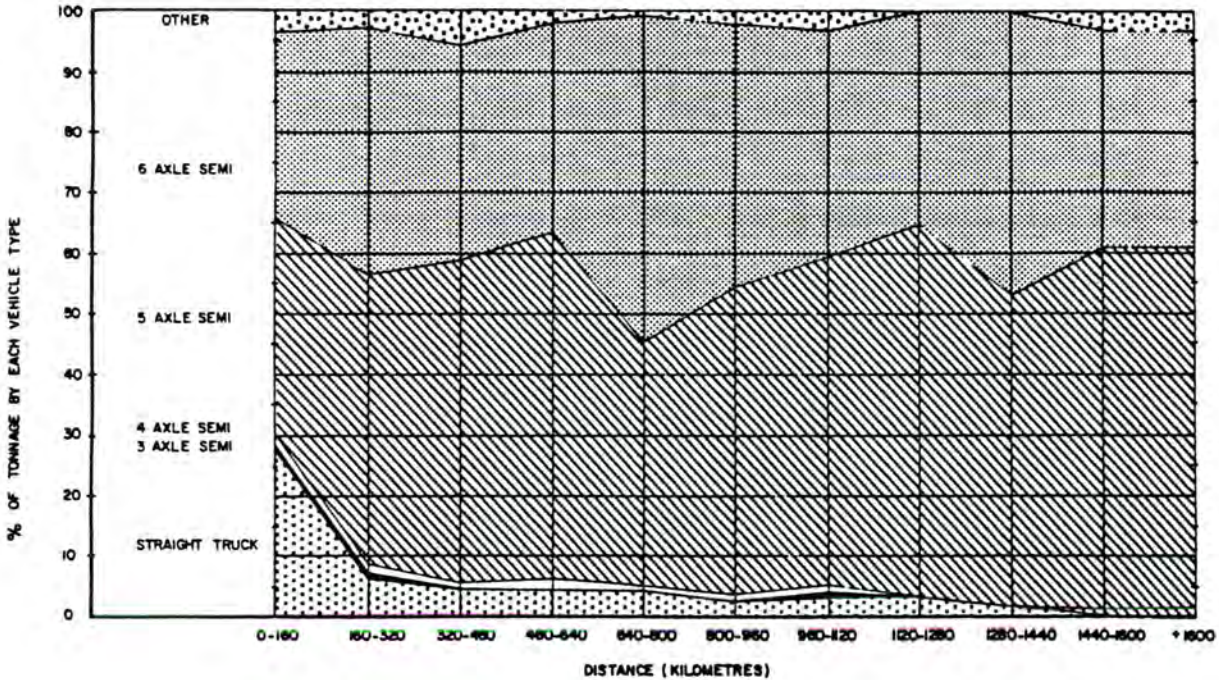


FIGURE 2: TRUCK TYPE UTILIZATION FOR TRAFFIC WITH AN ORIGIN OR DESTINATION IN NEW BRUNSWICK - 1984

TABLE 2

A COMPARISON OF AVERAGE PAYLOADS
BY TRUCK TYPE FOR 1976 AND 1984

Truck Type	Average Payload (kg) 1976	1984
Single Unit Trucks	2 860	3 370
3-Axle Tractor Trailers	4 640	4 640
4-Axle Tractor Trailers	5 270	6 290
5-Axle Tractor Trailers	11 320	10 640
6-Axle Tractor Trailers	17 690	14 480
Other	12 890	8 130

Source: The 1976 and 1984 Atlantic Provinces Truck Origin-Destination Data Bases

A number of comments are worth making with respect to the values shown above. With the increase in GVM, and an increase in the single axle loadings in some provinces, it can be observed the smaller truck types have shown an increase in the average payload. Single unit trucks show a 17.8 percent increase, 3-axle tractor-trailers have remained constant while 4-axle tractor-trailers increased by 19.4 percent.

However, the 5 and 6-axle tractor-trailer average payloads are different than what might be expected. The 5-axle tractor-trailers show a small decline in average payload (6 percent). This occurrence can be explained by realizing that there has been a significant increase in 6-axle tractor-trailers in terms of the percent of total tonnes hauled. More 6-axle tractor-trailers have been purchased and the 5-axle tractor-trailers are now being used more extensively to handle commodities with "bulk out" rather than "weigh out" characteristics. This would explain the small drop in the average payload, rather than an expected increase. However, there are indications this average payload value will increase in the future because many trucking firms are spreading the tandem axles on their trailers to increase their allowable GVM.

When comparing the 6-axle average payload between 1976 and 1984, it can be seen that there has been a significant decrease (18 percent). However, there are a number of reasons for this occurrence. In 1976 the

6-axle tractor-trailers represented 2.9 percent of the total trips while in 1984 the 6-axle tractor-trailers account for 13.5 percent. When comparing shares of total tonnes hauled, the difference is even more dramatic as can be observed from the vehicle utilization profiles shown in Figures 1 and 2. It is obvious the 1984 value represents a much higher sample and consequently, a more accurate estimate of average payload.

However, it should also be noted that in 1976 most 6-axle tractor-trailers were operating in New Brunswick on Routes 1, 2 and 7 where GVM limits were 56.7 tonnes. The forest industry in New Brunswick at that time was utilizing the 6-axles because of the larger permissible payloads. In 1984, the use of the 6-axle tractor-trailers is much more extensive, and it appears reasonable to expect the average payload to have decreased somewhat, although it can be expected to increase in the future as more primary highways become available for use by the trucking industry.

When reviewing Table 2 it can be seen that the "other" truck type shows a large decrease in average payload. This "other" classification represents a very small part of the total truck traffic stream (less than 3 percent). However, it should be noted that this difference in average payload can be attributed to small changes between the 1976 and 1984 truck classification system utilized in the origin-destination surveys. The average payload for 1976 is a weighted average of full trailers, double semis, trailer trains and mobile homes. Under the 1984 column the average payload is comprised of a weighted average of single unit trucks with trailer, tractor-trailers with trailers and mobile homes.

To this point the discussion on the impact of vehicle mass and dimensions on Atlantic Region trucking activity has been based on the 1976 and 1984 truck origin-destination data bases. However, in the spring of 1984, 40 common and 28 private carriers operating to, from and in the in the Atlantic Provinces were interviewed, along with 33 users (shippers), to determine changes which have taken place to date and possible changes which might be expected in the future as a result of the Highway Strengthening/Improvement Program.[2] Attempts were directed at identifying changes in fleet configuration, reductions in rehandling of goods, improved competition between modes, increased regional development, contributions towards company operating costs, new markets served, reduced product prices and general service improvements.

Interviews with the 68 trucking firms provided detailed information with respect to changes in truck fleet characteristics between 1976 and 1983. Based on data gathered from these firms, Table 3 has been prepared.

TABLE 3

COMPARISON OF TRUCK FLEET CHARACTERISTICS
BETWEEN 1976 and 1983

Equipment	1976 No. of Units	1976 Average/ Firm	1983 No. of Units	1983 Average/ Firm	Percent Increase
Tractors	635	9.9	1 152	17.5	81
Tandem Trailers	1 088	16.5	1 854	28.1	70
Triaxle Trailers	45	0.7	360	5.5	700

Perhaps the most interesting aspect of the data summarized in Table 3 relates to the triaxle trailers. There has been a 700 percent increase in the number of triaxle units between 1976 and 1983, or a change in the average number of units per firm from 0.7 to 5.5.

The survey of the 68 trucking firms also provided insight into changes in the axle spacings of tractors, tandem trailers and triaxle trailers as a result of increases in the GVM limits and the maximum allowable axle loadings. Figure 3 illustrates the distribution of tractor axle spacings for 1976 and 1983. It is quite apparent that there has been a major shift from 48 inch to 60 inch spacing on the tandem axles between 1976 and 1983. Although greater spacings are permitted they are not being widely used.

Figure 3 illustrates similar data for the tandem trailer fleet operated by interviewed firms. In 1976, over 50 percent of all tandem trailers had an axle spacing of 48 inches while 30 percent were at 72 inch spacings and 15 percent at 96 inches. By 1983 59 percent of all tandem trailers had 72 inch spacings while the 48 inch spacings had dropped to approximately 5 percent. Over 14 percent had axle spacings in 1983 of 108 or more inches. These larger spacings are prone to tire scrubbings as well.

The distribution of triaxle trailer axle spacings is also illustrated in Figure 3. The amount of change in triaxle trailers is not as extensive as was evident for the tandem trailer units and the tractor units. This is not surprising because triaxle-trailers which were being purchased even in 1976 were acquired to provide the maximum loads available at the time or anticipated during

the lifespan of the equipment.

The most common axle spacings for triaxle trailers are a 6 and 10-foot arrangement with the second most common spacing being an 8 and 8-foot axle spacing arrangement. These two axle arrangements represent about 93 percent of the triaxle units being operated in 1983 and are intended to take advantage of maximum axle loadings permitted under the regulations.

3.0 THE FUTURE

The trend towards a greater portion of trucking activity by 6-axle tractor-trailers should continue. Many trucking firms have equipped their trailers with a lift axle as the third axle in the triple axle assembly. This gives the operator the flexibility to operate in either a 5 or 6-axle configuration, depending upon load conditions. The ready availability of the 6th-axle provides an opportunity to significantly increase payloads as required, and therefore substantially reduce tonne-mile costs.

The straight truck will continue to play a prominent role in trucking activity in Atlantic Canada. Data from the 1984 O-D Survey indicate that a large percentage of truck trips are less than 150km in length. Furthermore, because of the nature of the economy of the region, many trucking movements consist of small loads which are ideally suited to the straight truck. Because of the incremental payload benefits of a 3-axle straight truck relative to a 2-axle, the trend towards an increasing proportion of 3-axle trucks again can be expected to continue as the 2-axle trucks come due for replacement.

With respect to future changes in regulations in the region, it would appear that care will be taken on the part of both the industry and the provincial governments to ensure that revisions will not render the 5 and particulary 6-axle tractor-trailers obsolete. Most operators claim that the economic life of these trailers is in the order of 10 years. Since many of them have only recently been purchased, and since they represent the bulk of the trucking fleet, it seems reasonable to conclude that there will be some stability in the vehicle mass and dimension regulations for some time to come.

Notwithstanding the above observations, some pressures for certain changes can be anticipated. The approach to spring weight restrictions is significantly different in each of the four Atlantic provinces. Although spring weight restrictions do not apply to the major arterial highways, a large significant number of trucking movements involve the use of secondary roads. Accordingly, some degree of interest in greater uniformity of spring weight restriction regulations may materialize.

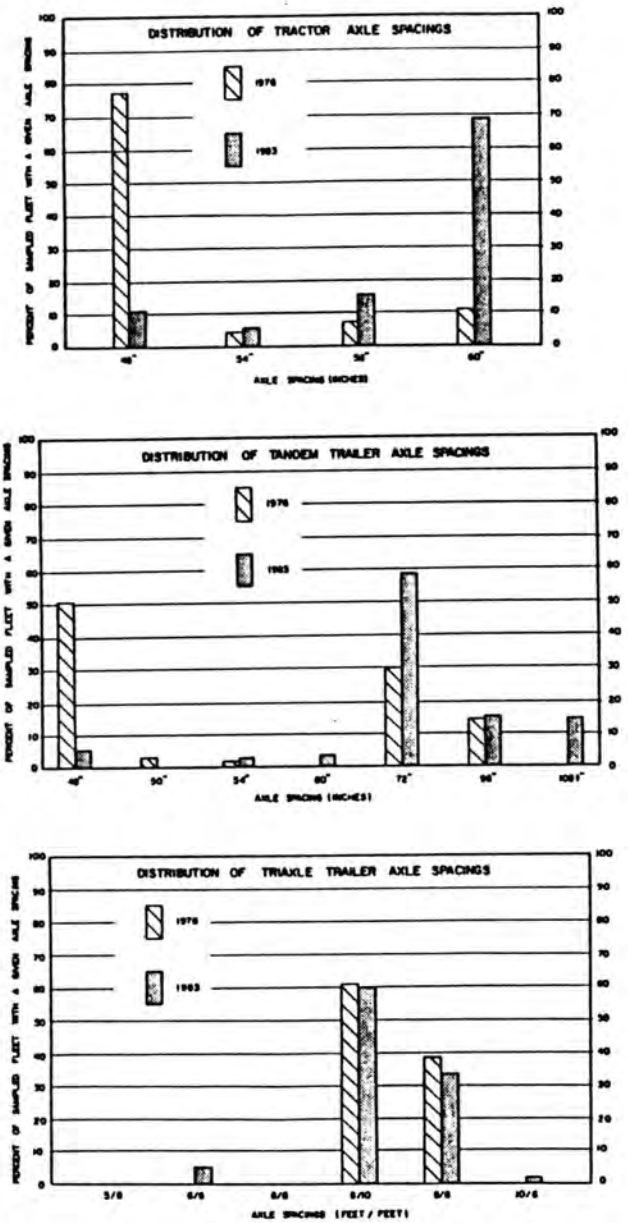


FIGURE 3: AXLE DISTRIBUTIONS

With respect to extra-regional trucking much of the attention will focus on the relativity between Quebec/Ontario regulations and the four Atlantic provinces, since a large proportion of trucking activity to/from the region has its origin/destination in central Canada. Some significant differences presently exist in the regulations of Quebec/Ontario relative to this region. Most of these differences favour the former. Hence, some pressure can be anticipated to achieve a greater degree of uniformity in order to improve the productivity of the inter-provincial trucking fleet.

One of the most sensitive issues with respect to future changes in GVM regulations in Atlantic Canada will be the impact of such changes on the rail mode. The unique problems posed by the railways in Newfoundland and Prince Edward Island, and, the general market conditions for rail transportation to/from the region, have fostered a move towards a greater degree of intermodal rail operations. Much of the traffic which is moving by rail is clearly very sensitive to truck competition. It may be therefore, that a critical point has been reached with respect to GVM regulations, such that further changes could have a major impact on the future viability of the rail mode in the region. This is not to suggest that a shift from the rail mode to the truck mode is inappropriate. However it must be recognized that policy makers will be extremely sensitive to the multi-modal impacts of any future changes in the GVM regulations.

In conclusion, this paper provides a lucid illustration of the enormous impact that changes in government regulations can have on an industry. The trucking industry has made some very significant adjustments in the configuration of its fleet in response to the regulatory changes in Atlantic Canada. A recent study has estimated the discounted benefits to the trucking industry of the changes in regulations to be in the order of one billion dollars in 1984 dollars over a twenty year study period.[1] While the precise magnitude of the benefits can be debated, it is clear that GVM regulations represent one of the last frontiers for the trucking industry in terms of realizing large scale improvements in the productivity of the fleet.

REFERENCES

1. The Atlantic Provinces Primary Highway Strengthening/Improvement Program Motor Carrier Benefit Study, Fiander-Good Associates Ltd., September, 1985.

2. Atlantic Provinces Motor Carrier and Shipper Industry Surveys, Fiander-Good Associates Ltd., May, 1984.

THE BROKER IN THE FOR-HIRE TRUCKING INDUSTRY

by

Frank R. Wilson
Transportation Group, University of New Brunswick
and
Karen Buchanan
Marketing Management Information, Canadian National

1.0 Introduction

In the last decade, established for-hire carriers have significantly increased their use of brokers. The reasons are basically twofold. First, the brokers are willing to work under more flexible rules and conditions and in some cass for lower hourly wages than unionized drivers. Second, brokers offer the firm an alternate source of capital for fleet purchases. With this increased use of brokers and with comparatively limited knowledge in Canada about the nature and use of these operators, it became evident that a better understanding was necessary concerning this component of the trucking industry.

The increased use and anticipated sweeping regulatory changes in the trucking industry expected in the near future makes it vital that a better understanding of broker operations be attained. This lack of data on the extent of broker usage also affects key operating ratios reported by the for-hire trucking industry in general. For example while revenue from broker hiring is included in company accounts, quite often the distances travelled are not. This distorts any distance-related cost calculations or statistics.

A limited amount of reliable data exists (Statistics Canada) appears to be the major source) describing the broker segment of the trucking industry in Canada. The study by the UNB Transportation Group was undertaken to obtain a better understanding of broker operations. Part of the study involved personal interviews with individuals in the trucking sector. Those sample included 21 for-hire carriers and 44 brokers, domiciled in New Brunswick. The study year was 1982. A broker in the context of this study, is a person who owns one or

more highway tractor units and operates under the authority of a for-hire carrier.

Financial data collected in these surveys provided the basis for much of the material presented in this paper. The general health of the broker segment of the for-hire trucking industry was evaluated. Additional truck cost data from Transport Canada allowed cost comparisons vis-a-vis broker/non-broker operation.

2.0 THE EXTENT OF BROKER UTILIZATION

The lack of data made it difficult to obtain an accurate measure of broker utilization in the for-hire trucking industry. However, a reasonable proxy for utilization is the ratio of broker payments to the total operating expenses of for-hire firms. As shown in Table I, the New Brunswick-domiciled Class I, II, and III for-hire carriers have been increasing their payments to brokers to the point where in 1983 these payments accounted for 36% of total operating expenses. The national average is about half this figure, reflecting the relatively high degree of broker utilization in New Brunswick.

This extensive use of brokers suggests that they are a common component of for-hire trucking companies. However, a recent survey indicated that only 6% of New Brunswick-domiciled for-hire carriers were using brokers. This may reflect the large number of small for-hire firms not included in the Class I, II or III carrier designations, but included in the survey of the industry.

Those carriers which made use of brokers tended to use them extensively. Typically, broker tractors comprised over 50% of the tractor fleet of those New Brunswick-domiciled firms employing brokers; in several cases this figure was 100%. The percentage of broker/total trailers was much lower. A summary of the fleet characteristics of firms using brokers is shown in Table 2. Aggregation of the data was required to ensure confidentiality.

TABLE 1

BROKER ACTIVITY SUMMARY

($,000)

NEW BRUNSWICK

Year	Operating Expenses	Payments to Lessors	Percent of Total
1979	118,331	34,712	29.3%
1980	131,776	43,050	32.7%
1981	154,380	53,070	34.4%
1982	173,856	62,560	36.0%
1983	197,259	71,115	36.0%

CANADA

Year	Operating Expenses	Payments to Lessors	Percent of Total
1979	4,470,039	688,705	15.4%
1980	5,060,137	801,554	15.8%
1981	5,497,950	872,422	15.9%
1982	5,448,736	891,266	16.4%
1983	5,526,630	949,266	17.2%

From Statistics Canada Catalogue 53-222, Table 7, 1979-1982

Figures include Class I, II, III For-Hire Carriers, excluding Household Goods Movers

TABLE 2

FLEET CHARACTERISTICS OF SAMPLED FIRMS

Characteristic	Number Brokers Employed Per Firm			Total
	<12	12-50	>50	
Total Firms	13	5	3	21
Total Company Tractor Units	51	23	110	184
Total Broker Tractor Units	107	152	583	842
Total Tractor Units	158	175	693	1026
Total Company Owned Trailers	340	122	1127	1589
Total Broker Trailers	25	84	109	218
Total Trailers	365	206	1236	1807

It is evident from the figures above that the broker is a significant element in the for-hire trucking industry in New Brunswick. In particular, for those carriers employing brokers, they represent the majority of the fleet. As such, the cost-effectiveness of the decision to hire brokers could spell success or failure for the firm.

3.0 THE BROKER AND THE FOR-HIRE FIRM

To better understand the nature of broker utilization in the for-hire firm, it is useful to examine the relationship which exists between the broker and the hiring firm. A brief summary of some details of this relationship were extracted from the study results.

Various mechanisms exist which are used by owner-operators (in this context, brokers) to operate

their tractor units under another firm's authority.

The three mechanisms are:

1. "Re-registration" mechanism - whereby an owner-operator transfers the vehicle registration to the licensed authority.

2. "Vehicle-lease" mechanism - whereby the owner-operator formally leases his vehicle (this may also involve the transfer of vehicle registration), and

3. "Authority" mechanism - whereby the owner-operator obtains a form of his own authority, and then works under the authority of another carrier.

Any lease agreement must be filed with the Province of New Brunswick's Motor Carrier Board. A deregulated environment could change these relationships.

Vehicle leasing, usually in conjunction with re-registration, is the standard practice in New Brunswick. In general, a full-time broker's registration would be in the company's name, while the part-time broker's registration remained in his/her own name.

Several forms of compensation to the broker by the firm were encountered in the survey. They included payment as:

- percentage of gross revenue,
- rate per mile,
- rate per loaded mile,
- rate per ton, or
- rate per 100 pounds.

For each of the above, both flat and variable rates were observed. The variable rate depended on the direction of travel, the type of commodity to be transported, the equipment used, provinces or states travelled, distances travelled, and the weight of commodity hauled. In terms of equipment used, the rate varied with respect to the type of trailer used (tandem, triaxle or twin). For example, a tandem operation earned a lower rate than that for hauling a twin trailer. The broker obtained a higher rate if hauling his own trailer.

In addition to the agreed-upon rate, a number of special provisions are often supplied to the broker by the for-hire carriers. These provisions include, inter alia, fueling facilities, maintenance services, insurance and financial assistance. More than 50 percent of the firms provided fueling facilities, insurance policies, workmen's compensation payments and vehicle registration.

The firms interviewed experienced relatively low broker turnover rates. This could be due to the major costs incurred by the broker in transferring from one for-hire firm to another. These costs include such items as truck painting and costs associated with switching permits and licenses. An initial minimum cash outlay of $3000 to $5000 is required to transfer. For example, some firms required the brokers to paint their tractor(s) the company's colour, at the broker's expense. However, other firms were willing to pay a portion of the broker's tractor painting costs if they remained with the company for a specified period of time.

It was stated, by those for-hire firms employing brokers of varying fleet size, that the larger operators did not receive preferential treatment vis-a-vis the single unit operators. When a special run was to be made, the broker was selected on a seniority basis, and not by the number of units he had with the company. Also, the broker operating a larger fleet received the same hauling rate as the smaller operators.

4.0 OPERATING CHARACTERISTICS OF BROKERS

In addition to examining the broker in relation to the for-hire firm, it is important to understand the nature of the broker operation itself. The following comments summarize the findings of a recent survey of brokers domiciled in New Brunswick, mentioned earlier in this report.

Eighty-two percent of the total tractor units owned by the brokers sampled were used specifically for broker operations. The remaining fleet was composed of part-time broker units and units used full-time in another segment of the trucking industry. The larger broker-operators tended to utilize their entire fleet for broker operations. The number of tractor units per broker operation ranged from 1 to 68.

Approximately 50 percent of the broker respondents had other employment while operating as a broker. Most of these part-time jobs were in some way related to the trucking industry. A few brokers operated two full-time businesses.

The nature of operations of those brokers interviewed can be categorized as follows:

- local,
- line haul, or
- manufacturer to customer.

The local service operators shunt goods to and from nearby terminals. The line haul operators transport goods from one terminal to another. The remaining brokers provide a direct service from the manufacturer to the customer. The largest percentage of brokers were used for intercity movements.

The major commodities hauled by the brokers were food- and wood-related products and general freight. The major provinces of operation, by volume, for the brokers sampled were New Brunswick and Nova Scotia. The United States was also a major area of operation.

The number of hours worked per week by each broker (full-time) ranged from 60 to 100. The 100 hour figure usually included some time spent on routine maintenance. Most full-time brokers averaged between 100,000 and 150,000 miles per year (160,000-240,000 km/yr).

In general, equipment maintenance was performed by the brokers themselves. Mechanics were employed only by the larger broker fleet operators. For any major repairs, a local mechanic or a fleet maintenance depot would often be consulted.

Two and one-half years is considered by some experts to be the optimum economic life of a tractor, taking into account repair costs and Canadian tax laws. However, none of the brokers sampled replaced their tractor units in this time frame. Approximately 50 percent of brokers operated their units for 5 years.

5.0 FINANCIAL ASPECTS OF BROKER OPERATIONS

While the majority of brokers interviewed in the study were willing to provide detailed expenditure information, detailed revenue data was less frequently reported. The majority of respondents indicated a revenue range. Most of the brokers surveyed earned revenues between $50,000 and $100,000 in 1982. The most frequent profit response range was reported as being between zero to $15,000. This is considered reasonable since in many cases the brokers were in essence "working for wages". This lack of adequate revenue data limits the degree of detail of any financial analysis.

An appendix was included in the 1982 broker questionnaire to record the expense items incurred. These included:

- vehicle insurance and registration
- motor carrier license
- fuel
- tires
- other operating supplies
- parts
- maintenance and repair
- wages of drivers
- other wages
- unemployment insurance payments
- pension funds
- administration.

The total broker operating costs per unit ranged from .43¢ to $1.40 per mile (.27 to .88 ¢/km). In general, the single unit operators not employing any drivers had the lower operating costs. A significant variation was observed in the operating costs of the brokers.

Operating ratios (total operating cost divided by total revenue) for each broker were calculated. Maximum and minimum operating ratios were specified for the revenue range as stated by the broker. In some cases broker operations are represented by a single operating ratio calculated using a single revenue value stated by the broker. A number of brokers were found to have operating ratios slightly below or above 1.00. A few were found to have very good ratios and a further examination indicated two major reasons for these conditions. First many brokers did not include profit in the expense category since they operate on basis of earning an annual salary. Secondly, and perhaps more important in the context of operating ratios, is the lack of consideration of vehicle depreciation. No broker reported depreciation as an expense; this omission has the effect of seriously understating total operating expenses. An examination of the operating costs of trucks in the Maritime provinces indicates that depreciation accounts for approximately 15% of the total cost of tractor operation.

It was found in the study that brokers operating one or a few units on a well defined lane with regular loadings did develop sound operating ratios. When one cosiders the absence of a profit item in the expense column together with little or no depreciation allowances these results are as expected.

The implications of a higher-than-unity operating ratio may vary, according to the nature of the broker operation. Accounting practices for tax purposes may indicate higher ratios than actually exist. A full-time, single unit broker may, effectively, be receiving a lower salary for his work and the part-time broker may be cross-subsidizing his/her broker operation through income from other sources (or a lower effective salary, as above).

In evaluating the viability of an operation, the following observation is of interest. Of the 40 respondents to a question regarding their reasons for being a broker, 25% mentioned their enjoyment of trucking, 25% cited the lack of license requirements, and a further 10% indicated that they liked being their own boss. Such factors are intangible benefits of being a broker, and must be included in any consideration of company viability.

There are several steps which may be taken to improve the observed operating ratios of brokers. Of primary importance is improved record-keeping, so that accurate expenditure data is available when rates are being discussed. Furthermore, calculation of current expenditure rates related to trucking industry averages may indicate areas where improvement is possible, or where revenue increases may be justifiable. Several examples of this kind of analysis are shown below.

Figure 1 illustrates the frequency distribution of distance-based driver costs for a number of broker firms. As can be seen, the most common charges are in the 12-14¢/km range. These figures, for the most part, include U.I.C. and pension contributions. There is little apparent difference between brokers operating tractors, and those operating tractors and trailers.

This driver cost data may be compared to the data regarding operating costs of trucks in the Maritime Provinces. The lowest reported cost/km for a driver was 15.7¢; the average figure was nearly 20¢. The broker as a driver is probably working for approximately 20% lower wages than his/her unionized counterpart.

In the same manner, the cost of fuel may be compared. The for-hire industry average is reportedly between 21 and 24 ¢/km for the truck types in question. The brokers included in the survey reported fuel costs within a much broader range as shown on figure 2.

The cost of the driver and fuel accounts for approximately 65% of the total costs of brokering as

reported in the survey. (These totals, since they do not include depreciation, may be considered the "over-the-road" variable costs of brokering). As such, if the broker is to operate a competitive business with an operating ratio of less than unity, it is important that driver and fuel costs be comparable to current for-hire industry standards.

With some simplification it is possible to examine the cost of a broker to the for-hire firm. The 1982 operating costs of trucks in the Maritime Provinces provides the benchmark, or base case for cost comparison. The data reported here is for a 5-axle dry freight configuration; travelling 160 or 240 thousand kilometers.

In the case of hiring a broker with a tractor only, the tractor variable cost figure will change. Since reported broker expense data does not include fixed costs, the default (for-hire) fixed costs are assumed. Estimated tractor variable costs were calculated from the broker survey data. Unit-weighted averages of the total reported broker expenses disaggregated by the distance ranges of (80-160) and (160+) thousand kilometers, were computed. New total cost figures are thus produced.

In the same manner, an estimate of the total costs to the for-hire firm employing a broker with tractor and trailer are calculated. Total broker expenses are assumed to include both tractor and trailer variable costs. Again, fixed costs are assumed to be similar to those in the for-hire industry.

A summary of the results of these calculations is shown in Table 3. As can be seen, there appear to be significant cost advantages in hiring brokers, particularly in the case of long-distance operations. This is primarily due to the lower driver wage. While in the case of hiring a broker with a tractor/trailer for 160,000 km/yr the total cost is marginally lower than the base case 96.3¢/km vs. 97.8¢/km or about 1%. It must be remembered however that the profit to the firm was made without significant capital investment (e.g. tractor/trailer unit). This implies a slight overstating of total operating costs, as the assigned profit margin in the base case is 10% of revenues. A lower rate would likely be acceptable if a broker was hired.

The analysis above provides only a preliminary indication of the costs of utilizing brokers. A detailed analysis would require more specific data from brokers, and the for-hire industry. However, it appears that in addition to any other considerations, there are financial advantages to the firm making use of brokers.

TABLE 3

COMPARISON OF ESTIMATED OPERATING COSTS

OF TRUCKS IN MARITIME PROVINCES

5 Axle Dry Freight Movement[1]

	Reference Data[2] Base Case		Broker Tractor Only		Broker Tractor & Trailer	
	160×10^3 km	240×10^3 km	160×10^3 km	240×10^3 km	160×10^3 km	240×10^3 km
Tractor Variable	54.8	54.4	41.9	39.0	59.2	44.6
Tractor Fixed	8.8	5.8	8.8	5.8	8.8	5.8
Tractor Variable	5.9	5.7	5.9[4]	5.7[4]	included above	
Trailer Fixed	1.9	1.3	1.9[4]	1.3[4]	1.9	1.3
Other[3]	26.4	24.9	26.4	24.9	26.4	24.9
TOTAL	97.8[2]	92.1	84.9	76.7	96.3	76.6

1. Source: Operating Costs of Trucks in Canada.
2. All figures in ¢/km and
3. Includes Insurance, Administration, Interest and Profit.
4. These included as The For-Hire firms costs for "Total" comparison purposes.

6.0 THE BROKER IN A DEREGULATED ENVIRONMENT

Given the major role brokers play in many for-hire trucking firms, it is important to identify potential changes which may occur as a result of the impending deregulation of the transportation industry. For example, as regulations are relaxed it is expected that brokers will have significantly more freedom of operation. This may lead to a stronger bargaining position than they enjoy at present, and perhaps higher revenue.

As mentioned earlier, 25% of brokers surveyed in New Brunswick cited the lack of licensing requirements as a major reason for operating as a broker. With the possible elimination of licensing requirements, it is likely that many of these brokers may enter the for-hire market. Administrative ease was also mentioned frequently in the survey, suggesting that the broker is not likely to disappear in a deregulated environment.

In this more competitive situation, the control of operating costs will be vital to the success of a trucking firm. Based on the analysis presented earlier, it appears that there are some operating cost savings associated with broker usage. If this is indeed the case, brokers may become more attractive to the for-hire firm. This increased attractiveness may allow the broker to charge higher rates, depending on the cost margins involved.

The above examples are indicative of the manner in which broker operations may be affected by deregulation; they are by no means exhaustive. As a significant segment of the trucking industry, uniquely affected by deregulation, it will be important to monitor broker operations in this changing environment.

Acknowledgment

The authors wish to acknowledge assistance of R.J. Potvin, UNB Transportation Group in preparation of study results.

REFERENCES

Operating Costs of Trucks in Canada - Motor Carrier Branch, Surface Transport Administrator. Transport Canada, Ottawa, July 1982.

Transport Canada, Strategic Policy Branch, Private Vs For-Hire Trucking, April, 1978, pp. 1-37.

University of Toronto-York University, Regulatory and Technological Change in the Trucking Industry: An Assessment of Impacts on Operating Costs, February, 1984, pp.1-121.

University of New Brunswick, "The Trucking Industry in the Province of New Brunswick - An Assessment of the Economic and Regulatory Environment", The For-Hire Trucking Industry in the Atlantic Provinces - Provincial Case Studies, (Ottawa, Ontario: Canadian Transport Commission, 1983), pp. 1-136.

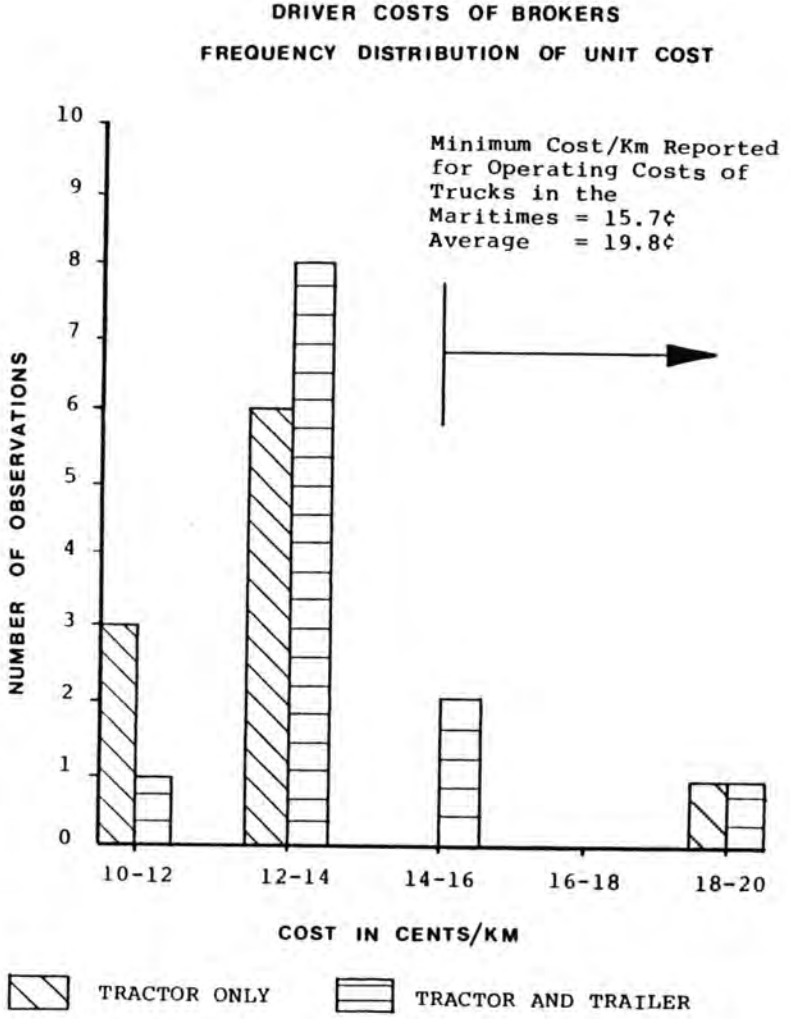

DRIVER COSTS OF BROKERS
FREQUENCY DISTRIBUTION OF UNIT COST
Minimum Cost/Km Reported for Operating Costs of Trucks in the Maritimes = 15.7¢
Average = 19.8¢
NUMBER OF OBSERVATIONS
0
1
2
3
4
5
6
7
8
9
10
10-12
12-14
14-16
16-18
18-20
COST IN CENTS/KM
TRACTOR ONLY
TRACTOR AND TRAILER

FIGURE 1

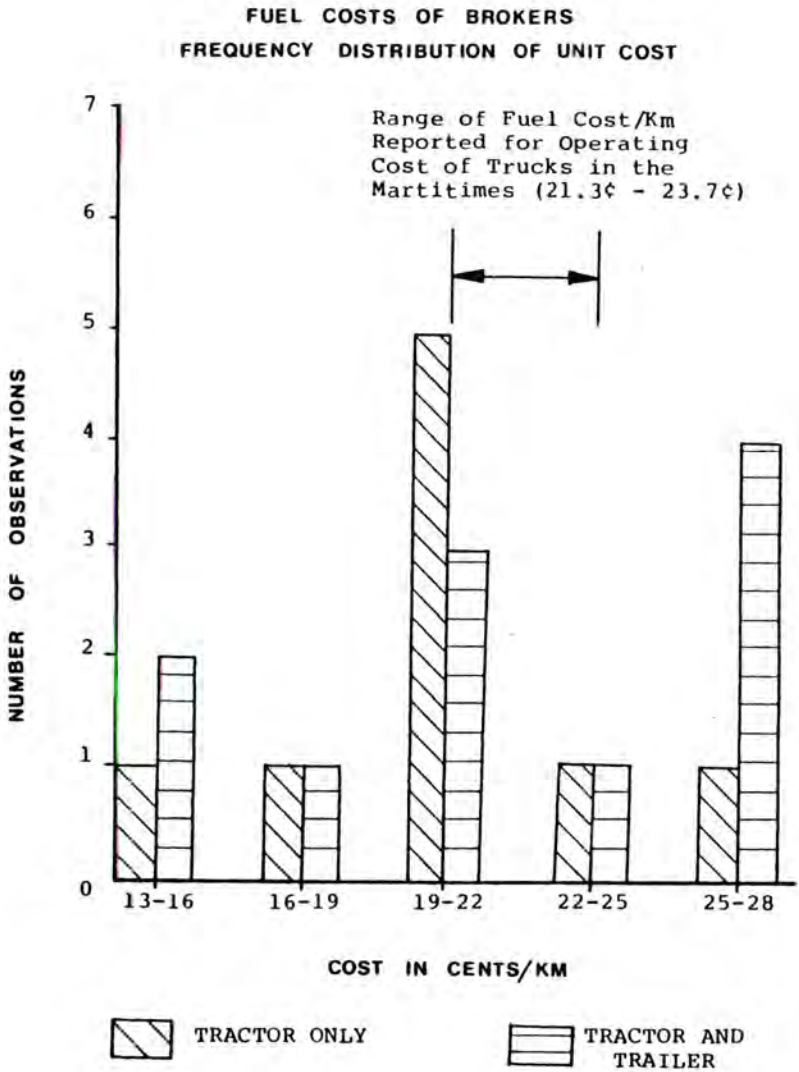

FUEL COSTS OF BROKERS
FREQUENCY DISTRIBUTION OF UNIT COST
Range of Fuel Cost/Km
Reported for Operating
Cost of Trucks in the
Martitimes (21.3¢ - 23.7¢)
NUMBER OF OBSERVATIONS
0
1
2
3
4
5
6
7
13-16
16-19
19-22
22-25
25-28
COST IN CENTS/KM
TRACTOR ONLY
TRACTOR AND TRAILER

FIGURE 2

A NATIONAL TRANSPORTATION RESEARCH ORGANIZATION ALTERNATIVES AND FACTORS

by

Richard W. Lake and Yves Dubé
Research Branch, Canadian Transport Commission

1.0 General

The MacPherson Commission brought a new approach to the appraisal of Canada's transportation problems. Although it had been appointed to inquire into the problem of horizontal freight rate increases, it chose to deal with it in a novel way by addressing the underlying circumstances that led the railways to apply for those increases. To do this, it had to consider all the competitive aspects of transportation that had developed over 2 or 3 decades and that had to be taken into account in setting freight rates. This was probably the first Canadian application of a research or structured approach to policy analysis in transportation.

MacPherson found competition pervasive in Canadian transportation, that competition was, by itself, the best type of regulation against unfair rate setting, and that it led to the most efficient transportation system. It concluded that overall rate regulation should be abandoned. It found that some services, particularly grain and railway passenger, were probably non-compensatory, and that carriers should be reimbursed for providing services declared to be in the public interest. Rail line redundancy was identified as a problem, and it was recommended that appropriate disposition of uneconomic branch lines should be undertaken after careful study within a larger transport context. It was considered essential that Canada's regulatory apparatus be overhauled to encourage multimodality, integration and coordination of transport. Finally, it was found that the nation needed a coherent stated national transportation policy, and that this policy should be subjected to a continuous examination through an on-going long range program.

Although the MacPherson recommendations were supported by a great number of studies, much more so than those of previous Royal Commissions, no recommendation for the establishment of a transportation research unit in government was included. It may be that this was not in line

with its thinking as far as the government role in transport was concerned. As a matter of fact, recommendations did not even include the creation of a multimodal regulatory agency. Instead, the creation of a national consultative transportation council was proposed.

The government, in 1967, introduced the **National Transportation Act** creating the Canadian Transport Commission as a multimodal regulatory agency and assigning a research function to this Commission.

The attitude of government towards transportation research in government is very much dependent on the role that it sees for itself in transport. In a pure laissez-faire capitalism, government sees very little requirement for research. The research function will be left to the individual firm which, in turn, will likely limit itself to research that serves management needs. The government is satisfied that this approach leads to the best overall performance of the economy and of the transportation sector. In any event, data are unavailable. At the other extreme, in a pure socialist economy, governments see themselves as managers of the economy in total, with the transportation sector only one part of this economy. Research will be undertaken at the top, so to speak, but not much will be done at the individual sector level. In a mixed economy like Canada the problem is a great deal more complex. In such a system the government lets the market make the decisions but is prepared to intervene when and if the market does not function properly or tends toward a state that is inconsistent with the national interest. In our estimation, it is in this kind of system that transportation research is the most relevant and the most useful, and where it should be the most diversified, dealing with economic and social issues as well as with technological ones. It will also involve the interplay of various actors, that is, government, shippers, carriers, public interest groups and universities, and will not be directed only at serving management needs.

2.0 The NTA and Research in a Regulatory Agency

The first Canadian multimodal economic research unit for transportation policy was set up jointly by the Board of Transport Commissioners and the Air Transport Board in the early nineteen fifties.[1] In 1954 it was transferred to the Department of Transport where it remained the principal source of policy research until the advent of the CTC Research Branch. By the end of 1969 the Transportation Development Agency had been created in Montreal and policy research in transportation "declared" to be the preserve of the Department of Transport.[2]

A marriage of regulation and research has caused the industry and legislators concern. In 1966, before the Standing Committee when it was debating the **NTA**,[3] Messrs. Gordon, MacMillan and Bandeen of CN and Crump and Sinclair of CP tempered their support for an ongoing research organization with concern lest its separation from the regulatory function not be maintained. For example, Mr. Bandeen testified "We fail to see the advantage of having these two combined but, ...if they are... let us hope that they keep their two arms separate...", and "...the research portion...should be separate from the regulatory section. If it is not separated, the functions should be kept very carefully separate...".

Similarly, the CP brief stated "There is a need in Canada for a body to make continuing studies and conduct research into matters relating to all forms of transportation. With developments in transportation thus under constant study and review, it is our hope that this country can have an economic and efficient transportation system without resort to periodic Royal Commissions. It is important that care be taken that the study and research function of the Commission does not become confused with its regulatory function, nor that it results in the Commission assuming some of the functions of management." and Mr. Crump testified "I have believed that transportation as a whole - not railways but transportation as a whole - is going to require a great deal more research than has been given to it in this country. Some other countries are doing far, far more than we are. Now, this function is being given to the new commission and at the same time they have a regulatory function. The research will, of course, be of aid to them but I do not think the two mix. Research is a separate science that...would be dealt with by a separate section of the new commission and will not impinge on the regulatory section" and "(results of the research would be used)...not only by the regulatory section of the commission but I would hope by the transportation industry as a whole in Canada."

The Standing Committee members showed considerable sympathy for this perspective, to the extent that amendment of the bill to provide for an independent transportation economic research council was suggested. Mr. Pickersgill, however, seems to have carried the day with his interpretation of the "two vice presidents" structure when he stated "One of the vice presidents will deal broadly with research and will have nothing whatever to do with the regulatory function."

2.1 Research in the CTC, Advantages and Disadvantages

As was said above, Canada has a mixed economy. The role of research at the public level in such an economy

is to try to identify problem areas and to find ways to deal with these problems. Transportation policy in Canada is made up of a mixture of legislation, regulations, direct government responsibilities and interventions of a financial nature. The MacPherson Commission made a clear distinction between national policy and national transportation policy. Its philosophy, on the whole, was that there was to be as little intervention of government in the transportation system; whatever intervention there was to be would have to be justified by the national interest. This in itself would limit to a significant extent those interventions that it had been the practice to make in the name of national transportation policy, and would also limit the role of public research.

The rationale for giving the CTC the research role has been much debated since the passage of the **National Transportation Act**. Without pretending to read the minds of the people who made the decision, it seems that it was a compromise and that this compromise was a reasonable one given the conditions existing then. There were perceived advantages. One was that a research unit housed in a regulatory body would participate in the independence of that body from political interference. This, in turn, would allow the research reports to be published irrespective of so-called bad political consequences. Another was that contact with the day-to-day transportation problems faced by the Commission would help to make the research more relevant. Finally, the availability of expertise of various kinds and particularly of data, sometimes of a confidential nature, within the regulatory body would enable better documented research and higher quality results.

As a disadvantage independence can reduce sensitivity to the overall political scene and the research concerns of government as a whole. Being part of a regulatory body also imposes constraints of an operational and financial nature. It is difficult to resist pressure for providing expertise on certain regulatory matters, especially when the expertise available is limited. Efforts to maintain the separation that Mr. Pickersgill intended between the research and the regulatory functions of the Commission yielded to compromise in the short run. This has led to some confusion between research and **de facto** policy formulation through regulatory decision.

2.2 **A Recent Review**

The situation after nineteen years is reflected in the "Nielsen" report[4] which states "Much of the CTC's research is in support of the regulatory activities of the Commission...," "Despite the original support and

enthusiasm...there has been a continual erosion of the real importance..." and "...the CTC research budget has been reduced to the point...". The fears expressed in 1966 were valid; research may be important, but regulatory decisions are invariably more urgent, and thus command first call on limited financial and personnel resources. The research process builds expertise; it was reasonable to expect commissioners to make the maximum use of the resources available.

3.0 Research in the Department

Concerns regarding the housing of a research organization in a government department have been focussed on a perception of loss of independence due to bureaucratic and political interference. In that respect, the "Nielsen" Task Force reports "There is a large body of opinion which supports the view that research carried out within the strict confines of a bureaucratic structure is of limited value..." and "Experience shows that research organizations within TC eventually become part of the bureaucratic structure and cannot retain long-term independence and objectivity." The words are rather strong, "most particularly" the reference to "objectivity", and do not recognize that the principal client of such organizations is internal, and independence is not intended.

Many of the flaws inherent in a regulatory commission domicile also apply to an operating department. The scale of the research element within the department would, however, be quite different. Even at less than 10% of the CTC, the Research Branch is represented at the senior management decision level; within Transport Canada it would be of less consequence. There are advantages and disadvantages to this. On one hand, it could never speak for itself; on the other, a powerful champion could more easily protect its resources.

4.0 A National Research Organization -- Other Options

If neither the regulatory agency nor the department constitute appropriate venues for research, what are the alternatives? There have been a variety of suggestions, most of which presumed co-existence with the CTC Research Branch. Some, from the perspective of the authors, were impossible inasmuch as they presumed government funding without the requisite financial accountability. (There have been occasions when the TUP have teetered on the edge of this abyss.) The organizational objective is, in our opinion, to protect researcher independence and objectivity while ensuring performance and financial accountability. Feasible structures (under the above

criteria) can be categorized under the **National Transportation Institute**, the **Transportation Research Council**, or the **Bureau of Transport Economics** models.

4.1 Transportation Institute

The National Institute is essentially a European model, particularly suited to the centrally focussed nations of Europe, South America and Africa. The national role is entrusted to a university or parapublic institution and funding may be provided by a number of interested parties (but directly and indirectly mostly by the central government). An example Canadian proposal for such a structure is that prepared by Tillo Kuhn of York University in 1968.[5] Of this concept N.R. Crump of Canadian Pacific commented[6] "Perhaps the Research Institute concept, used so widely in Europe, may have practical value in Canada. The institute is the forum where industry and government can co-operate with universities in interdisciplinary research programs. In this area, I understand York University is doing valuable work in arousing widespread interest in a university-based national transport institute."

In general, the National Institute model is based on research by a substantial permanent professional (non-public servant) staff.

4.2 Transportation Research Council

A National Transportation Research Council was proposed by E.W. Tyrchniewicz in 1968,[7] and such a structure was approached by the TUP in its latter years. More importantly, the establishment of a federally funded National Transportation Research Advisory Council with a $10 million annual budget was recommended by the "Nielsen" Task Force. "The council would be comprised of private sector (including labour), provincial and research community representatives appointed by the Minister with a small permanent staff (about 15) of highly qualified individuals to provide professional support in the form of a secretariat to the council.

"The council would rely on the established research community, including consultants and universities for input to guide its endeavours.

"Research priorities would be established by the council in accordance with broad national interests and requests by the Minister, independently of departmental influence or control...".

Such a Council structure would differ significantly from an Institute in that it represents dispersed employ-

ment of funds from a single central source while the Institute constitutes central concentration of effort utilizing funding from dispersed sources.

4.3 Bureau of Transport Economics

Among examples of Bureaux of Transport Economics (BTE), the Australian model[8] is perhaps the most appropriate to Canada. A Bureau is an element of the government; the staff are public servants. However, the reporting relationship is such as to ensure a considerable degree of professional and administrative autonomy. In Australia the Bureau reports directly to the Minister of Transport. There may well be a guiding council with representation from industry and other levels of government, but its role is advisory. In the Australian case work undertaken by the BTE falls into four categories: projects referred by the Minister of Transport, projects developed in consultation with the Department of Transport, Federal-State councils and industry advisory bodies, ongoing information collection and dissemination, and internally generated background studies. A BTE would devote about half its budget to work by its full time staff; the other half would support university research, provide research fellowships, fund consultant studies and joint ventures, etc.

5.0 Factors Governing Success

Hybrids between the above three models are, of course, possible, and confusion of terminology is widespread (in particular, BTE type organizations are often called institutes). This leads to an appearance of consensus when none exists. G.H. Cooper interviewed 51 persons, the majority senior government and industry transportation executives,[9] with 85% of those responding to the question favouring "an independent transportation systems research institute" with a professional staff of at least 35 carrying out "long range more speculative transportation system or policy research." Why then, with such support in influential circles, has such an organization never materialized? The reaction to specific proposals suggests that supporters of the concept may envisage quite different organizations. In particular, there are differences as to the form of organization that is most likely to succeed.

It is suggested that certain factors would govern the long term success of a Canadian transportation research organization:

5.1 **A Godfather** - No matter how hard management and individual researchers may try, research integrity and the commitment to publish will sometimes offend certain interests. The shelter of a strongly research-minded protector is essential.

5.2 **Access to Data** - Logical speculation is interesting; it may even reveal important concepts. However, one cannot justify spending public money on research where less than the best data available are used. Frequently, such data are confidential.

5.3 **Broad User Base** - Effective research requires stability. A good research organization is still developing after ten years; one can't hope for excellence in less than five. The focus of an individual user of research output frequently changes more rapidly than the research organization can afford to. Only a broad user base can give the stability necessary.

5.4 **Funding** - Access to sufficient funding is obvious. There is a "critical mass" below which one cannot maintain both the range of expertise and a reasonable mix of experienced and developing staff. Also quite obvious is the need for funding stability. Less obvious is the damage excess funding, particularly short term, can do; research organizations can rarely efficiently absorb large funding increments. Very large projects, involving large sums, should remain separate from the ongoing research program.

5.5 **Staff Situation** - In research, a single excellent performer can out-produce several good ones. Top research personnel are attracted by salary, security and especially the quality of the work environment and the notice paid to their work. There is also the acute problem of providing career promise while maintaining satisfactory research staff turnover. Researchers usually start as such on graduation; there must be attractive midcareer opportunities for them if they and research tire of each other.

5.6 **Collaborators and Variety** - Effective transportation researchers must work with and consult a wide range of practitioners and other researchers. They must also gain experience both nationally and overseas, and have access to what is done elsewhere, so that they can bring new approaches and analytical tools into play on behalf of their primary clientelle.

5.7 **Independence** - Quality researchers will accept considerable, but not total, direction as to what they should study. Suggestions as to methodology and approach are welcome. Queries with respect to substantiation of findings are addressed seriously. However, the professional researcher considers the formulation and presentation of his/her conclusions as personal prerogative. The degree of research independence that an institution provides affects both its ability to attract the best personnel and the credibility of its output.

6.0 Alternatives Evaluation

The table below shows a subjective ranking of the five organizational alternatives discussed in this paper for each of the seven "factors for success". Others are encouraged to rank according to their perception. No conclusion is drawn; it is not the authors' intention to promote any of the alternatives, and the ranking gives no indication of clear superiority. In fact, each of the five alternatives ranks first in at least one factor.

Tentative Ranking of Research Institutional Alternatives

	Godfather	Data Access	Broad Base	Funding	Staff Situation	Collaborators & Variety	Independence
Regulatory Agency	5*	1	4	5	2	4	2
Operating Dept.	4	3	5	3	1	5	5
Council	2	5	1	2	5	1	3
Institute	3	4	2	4	4	2	1
Bureau	1	2	3	1	3	3	4

*As of 1985 this factor is low. Of course, in 1967 it was high.

7.0 Concluding Perspective

This paper discussed alternatives for a national transportation research organization that would succeed CTC Research as the principal such organization. Yet,

it should not be interpreted as implying that any single organization would be sufficient. There must be a blend of research -- industry from its perspective, different levels of government and different arms of the federal government from their perspectives, and a healthy and dispersed level of academic activity. There must also be communication between researchers with different perspectives, a role CTRF strives to satisfy. But the above cannot replace a national organization that would both perform and coordinate research.

The consensus alluded to earlier - that Canada requires a national transportation research organization -is paramount. The organizational form of such an entity is secondary. If the CTC is eliminated, CTC Research will go too, or become an orphan. Yet, its function should be continued, hopefully with substantial improvement. The choice between an appendage of Transport Canada, a council, an institute or a bureau, should be the result of careful analysis.

Endnote

The authors wish to thank Richard Fosbrooke, Andrew Gemmell, Hiroshi Kurasawa, Andrew Mozes and Roger Roy for their valuable comments on the first draft of this paper. However, the views expressed are the responsibility of the authors alone and do not necessarily reflect those of the Canadian Transport Commission.

FOOTNOTES

1. Baldwin, J.R., "The Evolution of Transportation Policy in Canada", Research Seminar Paper, Canadian Transport Commission, January 1977.

2. Cooper, G.H., "The Early Days of an Experiment: Transportation Policy Research in a Regulatory Agency under the **National Transportation Act** of 1967", unpublished draft, September 1985.

3. Minutes of the Standing Committee on Transport and Communications, No. 24, October 13 and No. 28, October 20, 1966.

4. The Task Force on Program Review, "Economic Growth: Transportation", Minister of Supply and Services Canada, 1986, pp. 315-324.

5. Kuhn, T.E., "Proposals for Canadian Transport Institute", Vice-Presidents Committee on Canadian Transportation Studies: Third Progress Report, York University, Appendix C-2, October 1968.

6. Crump, N.R., address to Transportation Day Luncheon, Canadian National Exhibition Association, August 29, 1968, from Vice-Presidents Committee on Canadian Transportation Studies: Third Progress Report, York University, October 1968.

7. Tyrchniewicz, E.W., "Proposal for Establishing a National Transportation Research Council", Vice-Presidents Committee on Canadian Transportation Studies: Third Progress Report, York University, Appendix C-1, October 1968.

8. With an establishment of 100 persons the BTE is slightly larger but similar to the CTC Research Branch with less involvement in regulatory support, a more highly developed relationship with the states, and a different reporting relationship.

9. Cooper op.cit. Appendix E.

TRANSPORT RESEARCH: REALITY OR RHETORIC

by

Richard M. Soberman
University of Toronto - York University
Joint Program in Transportation

1.0 Introduction

In Canada, much of the original impetus for transportation research is attributed to the McPherson Royal Commission on Transportation of 1961 which eventually formed the basis of the National Transportation Act of 1967.

Subsequent to the 1967 Act, two important research initiatives were taken by the federal government. The first involved establishment of the Research Division of the Canadian Transport Commission, the second, creation of the Transportation Development Agency as an independent administration within Transport Canada.

Initially, the activities of both these groups were characterized by generous funding and staffing plans, a broad scope of research interests ranging from social and economic policy research to technological research and development, wide coverage of all modes in both the urban and intercity context, and a high degree of independence from the day to day operating responsibilities of the CTC and Transport Canada. Both the CTC and TDA also encouraged increased involvement of industry, consultants, and universities in transportation research through various funding mechanisms. In 1970, for example, the CTC established a special university research program involving a long-term commitment to graduate student support and independent research.

Today, these research agencies portray a very different picture. In real terms, funding has been reduced substantially and research independence has all but disappeared. The TDA has been restructured as an internal directorate within Transport Canada and CTC Research (along with the CTC) is about to disappear. Transport Canada's research interests are limited almost entirely to those areas in which they have direct operating responsibilities. Support for independent transportation research

that may be in the broad national interest has also been eliminated by cancellation of the university research program.

2.0 Evolution of Government Support For Transportation Research

In a general sense, the need for research and development is a concept that has been widely embraced in Canada largely as a means of improving the competitiveness of Canadian products in world markets. Because so much of Canadian production is influenced by transportation considerations, there has also been a longstanding interest in transportation research.

Recently, it has become fashionable to attribute this fundamental interest in transportation research to the McPherson Royal Commission on Transportation of 1961, which states in the preface to its first volume that,

> unless the underlying anomalies in our transportation system are adequately understood and properly treated, lasting solutions to particular transportation problems cannot be expected. [1]

The McPherson Royal Commission, of course, was concerned with a much broader range of transport policies than research alone. Nevertheless, the National Transportation Act of 1967 did attach special importance to the role of the Canadian Transport Commission with respect to the encouragement of independent research to advise the Minister on policy development.

Following enactment of the 1967 legislation, there was considerable controversy over the role that a regulatory agency should play with respect to independent research. Although, that role was questioned both by industry representatives as well as senior administrators of the then Department of Transport, the Canadian Transport Commission embarked upon an active program of research development in accordance with its own perception of the responsibilities of the Vice-President, Research, as defined in the 1967 Act.

During the late 1960s and early 1970s, the CTC assembled a large staff of professionals encompassing a wide range of disciplines within its Research Division. While this division engaged in many of the activities usually characteristic of a government administration, two factors are noteworthy. First, a large proportion of the staff assembled were both qualified and capable of carrying out in-house research and, in fact, did so. In other words, rather than relying solely on external consultants,

the CTC became the direct source of research product and continued to perform this function (albeit on a reduced scale) until this time.

Second, at the initiative of the Honourable J.W. Pickersgill (the CTC's first president and former Minister of Transport who was responsible for introducing the National Transportation Act of 1967 to parliament), a great deal of emphasis was place on mobilizing the resources of Canadian universities to participate more actively in transportation research. Under the aegis of the Canadian Transport Commission, a number of regional university transport research centres were established, funds were made available for the support of research proposals generated by university faculty members (as opposed to research in response to specific government requests for proposals), and a program of fellowships was established to encourage post-graduate studies and research at Canadian universities.

It is also interesting to note that although responsibility for management of the CTC's research program rested with the Vice-President, Research, an Advisory Council on Research consisting of non-governmental representatives was appointed by the President, to advise the CTC on research priorities and needs.

The controversy over the CTC's role with respect to research, however, continued, and ultimately, following the recommendations of an independent task force on the organization of the Department of Transport, a new transportation research unit was established in Montreal, known as the Transportation Development Agency. That agency was provided with authority and budget to undertake independent research and development (with more of an emphasis on development) in support of the canadian transportation industry.

In the early years of the joint existence of the Research Division of the CTC and the Transportation Development Agency of the Ministry of Transport, the usual bureaucratic discussions took place with respect to the division of responsibility and budgetary allocations between the two research entities. As one example, the university research program initiated by the CTC was eventually transferred to the Transportation Development Agency. By and large, however, the relationship between the two groups was harmonious, with the Research Division of the CTC concentrating more on social and economic research and the Transportation Development Agency concentrating more on technological research and systems analysis. Both maintained a considerable degree of independence from the day-to-day operational responsibilities

of the CTC and the Ministry, and both reported to their respective parent agencies at a high administrative level.

Different individuals will have different interpretations of how this picture of transport research organization which prevailed in the early 1970s evolved into the picture which many observe today. Suffice it to say, the preeminence which the CTC enjoyed with respect to transport research declined, probably in direct relation to budgetary allocations made to the Research Division over this period, when compared to the relatively larger budgets allocated for research within the modal agencies of the Ministry and the Transportation Development Agency.

Moreover, through numerous reorganizations within Transport Canada, the independence of the Transportation Development Agency was reduced as its chief administrator gradually began reporting to successively lower levels within Transport Canada. Whereas TDA was originally established under the direction of an administrator with impeccable transport research qualifications who reported directly to the deputy minister and participated in periodic meetings of senior administrators, it has become more of an internal arm of a division of Transport Canada.

In addition, when compared to the early 1970s, it is clear that the role of research has been redefined to concern only the operational responsibilities of the department. As a result, legislation is pending to eliminate the research function of the CTC (as well as the CTC itself) and the Minister of Transport has already cancelled the university research program in its entirety.

In simple terms, the environment for transport research that emerged following passage of the National Transportation Act of 1967, could be characterized as healthy and supportive. In both the CTC and Transport Canada, senior administrators were receptive to increasing the level of research activity, and indeed, took many of the initiatives. Today, attitudes might best be characterized by the conclusions of the Education and Research Study Team of the Nielson Task Force which, at least with respect to university involvement, finds research to be "a luxury that Transport Canada can no longer afford."[2]

In this background, nothing has been said of industry-sponsored research simply because there is very little to say. Most industry research (excluding product development activities of individual companies) has involved considerable government support, through industrial development programs, through contract research with government agencies, through direct ownership (as in the case of the

Urban Transportation Development Corporation), or through joint ventures with the Transportation Development Centre of Transport Canada. Industry-based calls for more transportation research have always appeared somewhat hollow in relation to the commitment of real private sector support for other than proprietary product improvements.

3.0 A Recent Appraisal of Transport Research

By and large, those involved in transportation research are likely to argue that the picture described in the preceding section understates the significant contribution that research has made to improvements in the Canadian transportation system. Government managers of research, whether within the modal administrations of Transport Canada, the Transportation Development Centre, or the Research Division of the Canadian Transport Commission, can admittedly point to a wide variety of successful projects ranging from joint ventures between government and industry concerning technological innovation, to the development of data and methodologies that permit better social and economic evaluation of policy development. University-based researchers can also point to a range of research studies that have directly or indirectly affected national and regional transportation policy. Universities can also take credit for improving the quality and training of professionals who eventually find their way into government agencies or private firms concerned with transportation.

As a proxy for the divergence of views that can be expected from various sources, it might be useful to summarize the findings of the recently published Task Force on Program Review, prepared for the Federal Government under the auspices of the Deputy Prime Minister, The Honourable Erik Nielsen. From the Task Force report dealing with transportation, some of the findings related to research are summarized in the following paragraphs.[3]

1. Compared to the national governments of other industrialized nations, the Government of Canada has devoted relatively limited resources to transportation research.

2. Despite the original support and enthusiasm that characterized the development of research programs sponsored by the federal government, there has been a continual erosion of the real importance place on these activities by senior administrators and elected officials.

3. The product of the CTC Research Program is highly regarded and considered by some to be an essential

element of national transportation policy development.

4. The Transportation Development Centre is often seen as an agency that disperses funds in accordance with internally perceived priorities as opposed to real market-driven needs. To some extent, it is also seen as a self-perpetuating organization producing solutions in search of problems for which there are no real clients. Others believe that the activities of the Transportation Development Centre are essential to stimulate research and development that would not otherwise be undertaken by private industry.

5. The Transport University Program is highly regarded by both the private and public sector in terms of both research and the training of transportation professionals, particularly in view of the relatively small budget attached to this program.

6. There is a large body of opinion which supports the view that research carried out within the strict confines of a bureaucratic structure is of limited value and that, as a result, internal government research programs should be discontinued except in direct support of the operating responsibilities of specific departments. Moreover, experience shows that independent research organizations within government eventually become part of the bureaucratic structure and cannot retain long-term independence and objectivity.

7. There is substantial agreement that technological research development is best handled by the private sector.

8. There is also substantial agreement on a basic need to undertake truly objective social and economic research on matters of national and regional significance, independently of the internal structure and short-term perspective of the federal government.

To place these points in their proper perspective, it is useful to note that the transportation study team's assessment was based on the review of CTC and Transport Canada research programs totalling some $27 million, something less than 0.5% of all expenditures budgeted for these two agencies during the 1985-86 fiscal year. That figure tells a great deal about the importance which

elected officials and senior administrators attach to research.

These views on the need for research are, of course, not universally shared by everyone. Transport research has both its advocates and its critics. For almost every example that advocates may use to illustrate the benefits of research, critics can point to examples of research that lack either relevance or intellectual integrity. Moreover, even where research produces meaningful findings, critics argue that most tranportation policy decisions are so politically sensitive as to preclude any possible influence of rational analysis.

Such viewpoints are difficult to either prove or disprove. Therefore, a rather simplistic argument is adopted, namely, that decisions related to investment or control of the nation's transportation system, whether taken in the private sector or in the public sector, are likely to be better and more effective if they are taken on an informed basis as opposed to an uninformed basis. Even on strictly political grounds, better decisions are likely to be taken when politicians are aware of the full range of consequences of alternative choices of action.

To be fair, even the critics of transportation research would probably not disagree with the view that better knowledge ultimately leads to better decisions. What may be in dispute is the mechanism and the auspices under which research is sponsored. Thus, to some extent, the controversy over transportation research concerns whether it should be undertaken in response to private as opposed to public initiatives.

The argument in favour of publicly supported research relates to the need to ultimately place within the public domain, data and information about transportation which transcends the boundaries of any one transportation company's interests. Here, the argument may be analogous to the argument that "war is too important to leave to the generals".

On the other hand, arguments can also be made that it is not really possible to undertake objective and independent research under the aegis of government departments that have operating responsibilities and which must respond to the parochial interests of individual members of parliament or cabinet members. Moreover, independent research that produces results which are contrary to the stated policies of a particular department or agency are often perceived to create more problems than they solve, at least for senior administrators.

Although there are a number of questions related to who should do the research and how it should be funded, the basic argument put forward in this paper is that transportation is too important an issue on a national scale to be deprived of independent and objective research that transcends the often parochial interests of individual transportation companies or individul government bureaucrats.

4.0 Barriers to Effective Research

Canadians, unlike Americans, are more prone to "let government do it", whether one considers medical care, higher education, or research. Thus, while various well-known leaders of the transportation industry have sometimes been heard to discuss the need for an industry-based research entity that could represent its views to government on policy development, they have always stopped short of committing their own funding in any significant way. For this reason, transport research in Canada has been largely dependent on federal and provincial government funding. Despite the current rhetoric about privatization of a number of government programs, this situation is likely to continue for the foreseeable future.

Without denigrating the contributions which past governments and certain individuals have made in the development of the conducive environment for independent and objective research, it should be noted that this reliance on government support is characterized by a number of basic weaknesses.

First, in times of economic austerity and government concern with budget-cutting and deficit reduction, expenditures on research of any type are extremely vulnerable. On a day-to-day basis, for example, many senior administrators simply do not see a reduction in research programs as affecting their ability to perform their functions over the short term. Moreover, at the political level, expenditure reductions for transportation research do not directly affect a visible constituency of sufficient size to generate vociferous opposition (compared, for example, to de-indexization of old-age pensions).

Second, as noted in the summary report of the Nielsen Task Force, career advancement in the public service is enhanced, if not dictated by "a direct relationship between position level and the size of the organization being managed".[4] The task force report goes on to state:

> There appear to be few incentives for public sector managers to accomplish new or difficult tasks, to try innovative approaches to provide better

service to the public, or to try to do more with less.

Thus, in preparing their shopping lists for cutbacks, senior administrators will often prefer to select programs that reduce expenditures rather than the number of person-years directly under their control. In general, larger dollar amounts can be saved without proportional reductions in person-years, by cancelling or reducing research programs, than by reductions in operating programs. In addition, of course, career advancement can be enhanced by demonstrations of ability to reduce expenditures.

Third, as noted previously, many of the initiatives for increased research that emerged following passage of the National Transportation Act of 1967, were, in fact, taken by senior government officials who, because of their individual backgrounds and experience, believed in both the importance and relevance of research. Many of these individuals, were extremely knowledgeable in the field of transportation, from the standpoint of government, industry, and politics.

Increasingly, however, particularly at the federal level, senior administrators in transport organizations come from other backgrounds, and are appointed largely because of their skills as administrators rather than because of their transport experience. Being less knowledgeable of the field, they can hardly be expected to be as supportive of research as were their predecessors.

Finally, it is perhaps a sad commentary on the real state of freedom of information, that while governments sponsor most research in Canada, governments are also the major source of data and information, most of which is considered to be highly confidential. Even at this time, independent research is seriously hindered by inadequate access to information necessary for research, and by limitations imposed on placing the results of government sponsored research in the public domain.

5.0 Conclusions

The views presented in this paper can be summarized in terms of three basic points. First, it is argued that there is a need for truly objective and independent research on transportation matters of national and regional significance, that extends beyond those needs perceived by either government operating departments or individual transportation companies.

Second, at least until this time, the primary support for transportation research which is of general public

interest, has come from the federal government and, to a lesser extent, provincial governments. Private sector support for transportation research of broad national interest has been relatively insignificant.

Third, the high degree of dependence on government support makes independent research extremely vulnerable to budgetary cycles and the frequent changes in key government personnel responsible for the administration of research programs.

Thus, having argued about the need for research, but having suggested that their are some serious barriers to effective research supported primarily by governments alone, the real issue is how best to ensure that the needed research is, in fact, undertaken in a manner that puts more of the right information into the hands of elected officials, senior policy makers, and the public.

If a more conducive and less fickle environment is to be created for transportation research, it may be time to act upon the often repeated recommendation for the establishment of a reasonably independent national body for transportation research. Examples of the Transportation Research Board in the U.S. and of the Transportation and Road Research Laboratory in the U.K. illustrate the potential payoffs from the creation of such a body. Both are national research organizations that employ professionals, many of whom have established credentials in the international research community, to undertake their own research to varying degrees. Both are more than institutions through which funds merely flow between government and third parties.[5]

The concept of a national research entity is, of course, not new. The McPherson Royal Commission recognized the lack of any organization in Canada "sufficiently broadly based to undertake the task of continually developing goals for national transportation policy."[6] and went on to recommend the creation of a National Transportation Advisory Council. In 1983, in private correspondence, a senior government official proposed the formation of a Transportation Research Board to provide independent transportation economic research and policy advice to the Minister, either at his request or on the Board's own initiative. Very recently, once again the concept of a national research organization was proposed by the transportation team of the Task Force on Program Review.

In its report, the transportation team, which was concerned with the delivery and efficiency of a broad range of federal government transportation programs, recommended the establishment of "an independent

federally-funded national transportation research advisory council to be concerned primarily with social and economic research related to transportation matters of national and regional importance." As envisaged by the study team, the council would consist of private sector, provincial and research community representatives selected by the Minister. It would also retain a small permanent staff of highly qualified professionals capable of conducting research as well as managing research. In addition, the study team recommended that research priorities be established "in accordance with broad national interests and requests by the Minister, independently of departmental influence or control."[7]

Thus, there is a stream of thought that has remained fairly consistent, with respect to a national transportation research body, at least since the time of the McPherson Royal Commission, characterized by two major features: a mandate that is broader than the responsibilities of any individual operating department, and a level of reporting to the government that is sufficiently high to maintain independence from the established bureaucracy. It remains to be seen just how many times proposals of this nature must be made by different groups or individuals before the gap that separates the rhetoric and reality of transportation research can be bridged.

FOOTNOTES

1 Royal Commission on Transportation (Ottawa: Queen's Printer, 1961).

2 Task Force on Program Review, Education and Research (Ottawa: Canadian Government Publishing Centre, 1986) p.144.

3 Task Force on Program Review, Transportation (Ottawa: Canadian Government Publishing Centre, 1986) pp. 315-324.

4 Task Force on Program Review, An Introduction to the Process of Program Review (Ottawa: Canadian Government Publishing Centre, 1986), p. 25.

5 See, for example, A. Cubukgil, Z.J. Haritos and R.M. Soberman, A World Transport Research Centre: An Assessment of Need (Toronto: University of Toronto-York University, Joint Program in Transportation, 1985).

6 As cited by G.H. Cooper, The Early Days of An Experiment: Transportation Policy Research in a Regulatory Agency Under the National Transportation Act of 1967 (Ottawa: Canadian Transport Commission, 1985) p. 25.

7 Transportation, op. cit.,p.324

SHIPPERS' RESEARCH AGENDA

W. H. Sheffield*

ABSTRACT

The question of what research should be done is largely decided within government or by those active in research. This paper tries to focus on those issues identified as vital, and in need of research, by shippers. It also advances the understanding of the shipper's perception of Canadian transportation research. Highlighting the gulf between shippers and researchers, the analysis proves the need to forge a better union between these two communities.

INTRODUCTION

At the 1981 PEI, CTRF conference, the writer was upset over the emphasis on public policy research and limited shipper/carrier participation in the research process. To determine whether this was an isolated uninformed reaction a questionnaire was distributed to Canadian Manufacturers' Association transportation committee members and all principal members of the Canadian Industrial Transportation League. The responses demonstrated a lack of shipper participation in, and awareness of, ongoing research, but a desire for greater input.

Last spring when it became clear Transport Canada was terminating grants to University Transportation Centres, an alternate source of funding should have been the private sector. Given the recession of the early 80's and the lack of meaningful dialogue between researchers and actual users of transportation it is not surprising this is not naturally occurring. With a reduced Canadian transportation research budget and the present unwillingness of the private sector to fill the void left by Transport Canada, how then do we ensure that the research undertaken gives Canada the best return on investment?

To the writer it appears the initial objective should be to identify what research shippers want done. This could (a) provide support for research already underway, (b) help direct researchers into areas of benefit to shippers, and (c) possibly squeeze a little extra funding from the government on particular topics. A second phase should be improved relations between shipping associations and those engaged in research. Over time this might evolve into financial support.

*General Transportation Manager, Stelco Inc.

With these lofty objectives in mind á letter was sent to most major shipping associations in Canada and to the full membership list of the Canadian Manufacturers' Association national transportation committee. The letter is attached as **Appendix I.** **Appendix II** is the list of recipient associations.

RESPONSE

Of the 161 letters distributed, 40 responded (25%). Some of these responses did not come until a follow-up letter was circulated. Of the 40 responses, 14 or 35% declared they had no input. A number went on to emphasize a lack of interest and/or a low opinion of transportation research. To highlight the severity of some of this disinterest below are a few selected quotes:

> *"I did not initially reply to your questionnaire because I did not really believe that any meaningful result would be forthcoming....."*
>
> *"Your concern as it relates to research is coming much too late..."*
>
> *"We do not require research at the present time."*

In our earlier paper[1] we discounted the notion that a low response rate from shippers was evidence of an unwillingness to recognize research. That assertion is obviously in question.

On the positive side the other 65% identified some 75 separate ideas for research topics.

AGENDA

Appendix III is the list of research ideas submitted. They are classified by the writer. Some input took the form of very specific questions to be answered but some only identified a topic needing analysis. Liberty was taken to combine responses and cut down on duplication. Although the ideas were many and varied, five broad areas deserve highlighting due to the frequency with which they surfaced.

1. **DEREGULATION**

Everyone in Canada is sensitized to deregulation, or economic regulatory reform as Mr. Mazankowski's office like to call it. "Freedom to Move" has awakened those slumbering in the status quo. By far the most oft mentioned topics for research revolve around the change in policy framework for Canadian transportation. Specific items on the reform agenda such as confidential contracts, interswitching/mandated joint line rates, the new regulatory agency and dispute resolving mechanisms all showed up. In addition more general research topics such as the effect

of deregulation on the consumer and institutions, the opportunities for entrepreneurs, the standard questions on small shippers and remote communities, plus a desire for a post mortem on activities were listed.

Although this emphasis on deregulation is not surprising, it demonstrates a change in attitude from the 1982 survey.[1] At that time the shipping community identified public policy as the main topic of Canadian transportation research but felt public policy research should be secondary to operations research.

2. **TRUCKING UNIFORMITY/PRODUCTIVITY**

The second most frequent area suggested by shippers relates to highway equipment configuration, highway weight and dimension laws, and highway construction related to the above; with the ultimate goal of increased payloads. Obviously RTAC and TRANSPO are on the same wavelength as the shipping community. It should be noted, however, that none of the responses mentioned those present research efforts. Are shippers aware of them?

3. **TRANSBORDER TRUCKING**

The entry of U.S. carriers into the Canadian market has become a public topic of debate largely due to the Canadian and Ontario Trucking Associations' activities to prevent it. Shippers line up on the opposite side of the argument and therefore are very interested in whatever research can predict the results of freer entry. To this basic question, research into the success of Canadian carriers operating in American markets since the U.S. Motor Carrier Act of 1980 is added. Another question that naturally flows from this is how transborder trucking fits into free trade discussions with the United States.

As with the highway uniformity question there was no indication by any shipper of knowledge of existing research results. Our own limited knowledge includes some work on the B.C. and Ontario motor carrier markets by UBC and some recent research done on the Quebec Motor Carrier market sponsored by Consumer and Corporate Affairs. On this issue there seems to be more rhetoric than research.

4. **INSURANCE**

Not surpringly the interest in trucking insurance increased with the demise of United Canada. Transportation risk analysis, as it pertains to insurability, kept coming up in various forms through the responses. How much insurance is really necessary? Are present premiums cross-subsidizing bad risks still on the books? Are shippers paying too much in insurance surcharges? There is no question shippers need to know more about the reality of liability and its cost.

5. HAZARDOUS GOODS

With the advent of the Transportation of Dangerous Goods Act and Ontario's recent introduction of the Spills' Bill shippers sending or receiving hazardous goods feel uncomfortable. There is a need for better statistics on hazardous shipments based on class, volume and mode with a particular call for improved data on highway movements. There is a requirement for research into hazardous goods routes in various urban areas. An analysis was requested on the impact of treating empty tank cars as loads. The ultimate question is: When does the cost of regulation deter the use of beneficial hazardous goods?

In addition to these five major areas, many other topics were promoted. One general proposal supported by a number of shippers is a study into the modal share of freight traffic on a mileage basis and by population centre, i.e. to identify where infrastructure meets demand. It would indeed be interesting to identify where we overservice and underservice regional shipping requirements. Forecasting Canada's transportation requirements in the future could follow very nicely from this understanding of the present infrastructure status. Another topic of particular interest to all of you is the Canadian Industrial Transportation League's effort to establish a shipper data base. Although you may not participate in the actual establishment of the data base it would seem obvious that all of you would want access to it. The CITL promotes this data base as a requirement and has arranged some government seed funding.

There were a number of references to electronic data interchange; its potential in transportation and its effects. Also some legal concerns including EDI, multimodal liability, and the legal basis of the courier industry versus traditional railway express surfaced. On rates there is a perception that freight prices outpace the consumer price index and that geographical differential pricing should be better understood. Tariff filing was initially conceived to protect shippers. The question of whether it ever did so, or still does, remains on the minds of some.

The issues of subsidies and public duties also deserve attention. Perhaps this interest is also related to "Freedom to Move" which recommends that subsidies be visible and justifiable. Suggested research topics were Newfoundland railcar discontinuance and its impact; imposed public duties, are they fully compensated? Cross subsidization in government subsidized rail services; as well as the history of subsidies in Atlantic Canada.

Suggestions, grouped by mode but excluding the "big five", expand the agenda. The issue of cost deregulation on the rail side is paramount with the priority being a rational approach to branch line and station abandonments. Also for rail there is a call for a better understanding of private car compensation, the economics of double stack trains, and the future possibilities of electrification.

On the highway side in addition to uniformity and the transborder trucking issues there is a need for a trucking cost index kept current. The Trimac[2] and Kearney[3] efforts are either unknown or insufficient. Other highway suggestions included intercorporate private trucking interprovincially and a better definition of highways required. The marine/export side includes the Shipping Conferences Exemption Act, the flag waiver system and whether it works for shippers; a better understanding of the needs of Canadian exporters; Lakes' vessel costing; and the need for competitive marine freight systems in the North.

The only references to air were with regard to the impact of the airline ticket tax on remote communities and bilateral negotiations for international air routes.

As with everything there are a number of issues which are difficult to cataloque. They included such items as multi-modal services, commodity pipelines, and the effect of interest rates on time sensitive shipments. There was even some concern regarding transportation education.

FURTHER COMPARISON WITH EARLIER STUDY

In 1982 the questionnaire responses highlighted a lack of shipper awareness with respect to Canadian transportation research.[1] For example, CTRF was recognized by only 23% of the sample. Of the universities engaged in transportation resarch only U.B.C. and the Toronto York Joint Program attained 50% recognition levels. The responses for our shippers' research agenda support the earlier conclusion of low shipper research knowledge.

As mentioned earlier in the paper no respondents mentioned past or current research, although some of the topics proposed have already been addressed by researchers. In our earlier questionnaire shippers indicated a preference for operations research including computer costing and scheduling models. In the present shippers' research agenda no such ideas surfaced. Earlier rail and highway were perceived as #1, and #2 as research topics. It would appear from the agenda collected, for shippers this priority remains.

In 1982 on the question of who funds research vs. who should fund research shippers identified the Federal Government as being the major source of funds and agreed with its primacy. Some, however, indicated a willingness to get involved in funding. It would be surprising under recent economic conditions for this to be actually happening. On the issue of who selects research vs. who should, Transport Canada ranked first in both cases in 1982. Shippers thought their influence was meagre but ranked themselves as the second most important group for research selection. Given that shippers feel this strongly (a resounding 95% of the 1982 respondents declared shippers should have input on what research is done) you would think that given the opportunity of a shippers' research agenda, the response rate would have been much higher. I have no

explanation for this lesser level of interest than declared, but I'd like to insert one more anonymous quote:

> *"I was reluctant to respond to your initial letter because of a deep-seated fear of fostering more committees, studying more subjects, and spending more tax dollars. However, I am reminded that the government already has a multitude of people studying useless projects and I hope your efforts in steering these wool-gatherers toward worthwhile pursuits is effective."*

COMMUNICATIONS/MARKETING

In the 1982 survey, 92% of the respondents identified trade magazines as their major source of learning about transportation research. Research journals were identified as a source by 43% but I would hypothesize that the definition of research journal from a shipper's perspective is not the same as yours. It is imperative that researchers try and communicate with the shipping community in addition to each other. Again I am going to take the easy way out and quote a compelling response:

> *"The most important thing I would like to see as a shipper is readable published articles which could be read by average shippers and politicians (and newspaper reporters), which would result in better informed thinking about transportation markets and economics.....The main problem is to get good research read and understood by ordinary people. This requires readable topical studies and distribution of the end product."*

Obviously you must address your research efforts to two audiences, the existing research community through journals, conferences, etc. but also the shipping community. If this paper does nothing more than shame you into sending readable synopses of your research to a number of trade publications, it will have been worthwhile. **Appendix IV** includes a suggested list of such publications. It is not exhaustive but it would be a good start.

WHERE DO WE GO FROM HERE?

Obviously of the items on the research agenda, a number have been the subject of excellent research so far. I would encourage all authors of that research to make sure their results are distributed both to the list of associations in **Appendix II** and the list of Canadian transportation trade magazines in **Appendix IV.** Secondly I would suggest new research ideas whether they are included in this Shippers' Research Agenda or not should be run past the associations you believe have the most interest. It is unlikely in the short term any association would offer funding. In fact many may not even bother to acknowledge your approach, but potential benefits justify that risk. If you have the moral support of a major association or two for your research, your opportunities for government funding are enhanced.

Lastly I would suggest that you improve your relationship with both shippers' associations and trade publications. This should include encouraging these parties to pay attention to the journals you believe to be of value. Who knows some day you may sell your product to an alternate source of funding.

REFERENCES

1. Sheffield, W. H., "Canadian Transportation Research: A Shipper's Perspective" Transportation Forum Vol. 2-1, June 1985.

2. Trimac Consulting Services Ltd. "Operating Costs of Trucks in Canada"

3. Kearney: Management Consultants, "Canadian Private Fleet Cost Index".

APPENDIX I

(Copy of original letter)

"As shippers, we have a long term stake in quality Canadian transportation research. Unfortunately, the link between the shipping and research communities is poor. In fact, I would describe it as two-way "elitism". The research community, largely made up of academics, doesn't accentuate communication with the practitioner (shipper and carrier). Similarly the users and providers of transportation feel the academics are out of touch and of little value.

When you consider academics do the research and governments fund it, it is not surprising that we don't determine what research is given priority. However, I suggest to you that to have quality transportation research in Canada, shippers must have input. The only way to really ensure input is to provide funding. Obviously, no individual shipper is going to foot the bill for major research projects that benefit many, but it is unnatural for major shipping associations to have no research budgets or ongoing liaison with the research community.

A few years ago, I agreed to be a Board Member of the Canadian Transportation Research Forum, (a group largely consisting of academics, consultants, and government representatives). This experience has reinforced the opinion expressed. We need to forge a more effective union between the user and the research community. That opportunity is now. Transport Canada has eliminated the TUP program which was a major source of funding for university transportation centres across the country. Although shippers' associations are not an available alternate source of funds perhaps we can help redirect remaining funding or encourage additional funding for research we support. In this vain, I ask you to help us create a Shippers' Research Agenda. Please write and tell me the research projects you feel are required. Your input is vital.

Yours truly,
STELCO INC.

W. H. Sheffield
General Transportation Manager

WHS:lc "

APPENDIX II

(List of Associations)

CANADIAN MEAT COUNCIL
5233 Dundas St. W.
Islington, Ont. M9B 1A6

GROCERY PRODUCTS MFG. OF CANADA
101 - 1185 Elington Ave. E.
Don Mills, Ontario M3C 3C6

CANADIAN PAPER BOX MFG. ASSOC.
185 Bay Street
Toronto, Ontario M5J 1K5

MINING ASSOCIATION OF CANADA
705 - 350 Sparks Street
Ottawa, Ontario K1R 7S8

CANADIAN FERTILIZER INSTITUTE
280 Albert St.
Suite 301
Ottawa, Ontario K1P 5G8

MOTOR VEHICLE MFG. ASSOC.
25 Adelaide St. E.
Toronto, Ontario M5C 1Y7

HEARST LUMBERMAN'S ASSOCIATION
P.O. Box 1210
Hearst, Ontario P0L 1N0

SHIPPING FEDERATION OF CANADA
300 St. Sacrement Street
Montreal, Quebec H2Y 1X4

ONTARIO GRAIN & FEED DEALERS ASSOC.
106 - 1400 Bishop Street
Cambridge (Galt) Ontario N1R 6W8

AUTOMOBILE IMPORTERS OF CANADA
60 Harbour St.
World Trade Center
Toronto, Ontario M5J 1B7

COUNTRY ELEVATORS' ASSOC.
720 - 360 Main Street
Winnipeg, Manitoba R3C 3Z3

PROPANE GAS ASSOC. OF CANADA INC.
1202 Sun Oil Building
500 - 4th Avenue S. W.
Calgary, Alberta T2P 2V6

PETROLEUM TRAFFIC COMMITTEE
c/o Gulf Oil Limited
800 Bay Street
Toronto, Ontario M5W 1E2

CANADIAN POOL CAR OPERATORS' ASSOC.
111 - 1117 Ste. Catharine St. W.
Montreal, Que. H3B 1H9

QUEBEC ASBESTOS MINING ASSOC.
P.O. Box 608
Black Lake, Que. G0N 1A0

THE CANADIAN CHEMICAL PRODUCERS ASSOC.
350 Sparks Street, Suite 805
Ottawa, Ontario K1R 7S8

CANADIAN CATTLEMEN'S ASSOCIATION
325 - 590 Keele St.
Toronto, Ontario M6N 3E3

THE CANADIAN MANUFACTURERS' ASSOC.
One Yonge Street
Toronto, Ontario M5E 1J9

CANADIAN FARM & INDUSTRIAL EQUIPMENT INSTITUTE
307 - 720 Guelph Line
Burlington, Ontario L7R 4E2

ONTARIO CATTLEMEN'S ASSOCIATION
590 Keele Street
Toronto, Ontario M6N 3E3

CANADIAN WAREHOUSING ASSOCIATION
517 Wellington St. West, Suite 209
Toronto, Ontario M5V 2X5

CANADIAN INDUSTRIAL TRANSP. LEAGUE
242 - 2360 Dundas St. W.
Toronto, Ontario M6P 4B2

BOARD OF TRADE OF METROPOLITAN TORONTO
Grain and Grain Products Branch
P.O. Box 60
Toronto, Ontario M5X 1C1

CANADIAN NATIONAL MILLERS' ASSOC.
205 - 151 Slater Street
Ottawa, Ontario K1P 5H3

CANADIAN FEED INDUSTRY ASSOCIATION
P.O. Box 2080, Station D
Ottawa, Ontario K1P 5W3

ONTARIO LUMBER MANUFACTURER'S ASSOC.
414 - 159 Bay Street
Toronto, Ontario M5J 1J7

CANADIAN EXPORT ASSOCIATION
250 - 99 Bark Street
Ottawa, Ontario K1P 6B9

CANADIAN PAINT & COATING ASSOC.
825 - 515 Ste. Catherine St. W.
Montreal, Que. H3B 1B4

CANADIAN PULP & PAPER ASSOCIATION
2300 Sun Life Bldg.
Montreal, Quebec H3B 2X9

CANADIAN ASSOCIATION OF RECYCLING IND.
602 - 8 Colborne St.
Toronto, Ontario M5E 1E1

ONTARIO GRAIN CORN COUNCIL
801 - Bay St. 7th Floor
Toronto, Ontario M7A 2B2

PHARMACEUTICAL & TOILET PREPARATION
TRAFFIC ASSOC.
c/o Hoechst Canada Inc.
4045 Cote Vertu
Montreal, Que. H4R 1R6

MANITOBA FOREST PRODUCTS ASSOC.
P.O. Box 343
Hudson Bay, Saskatchewan S0E 0Y0

MARITIME LUMBER BUREAU
P.O. Box 459
Amherst, Nova Scotia B4H 6H4

ALBERTA FOREST PRODUCTS ASSOC.
204 at 11710 Kingsway Avenue
Edmonton, Alberta T5G 2Y5

INTERIOR LUMBER MANUFACTURERS' ASSOC.
203 - 2350 Hunter Road
Kelowna, B.C. V1X 6G1

CARIBOO LUMBER MANUFACTURERS' ASSOC.
301 - 197 NORTH SECOND AVENUE
Williams Lake, B.C. V2G 1Z5

CANADIAN FRUIT WHOLESALERS' ASSOC.
333 Ontario Food Terminal
165 The Queensway
Toronto, Ontario M8Y 1H8

ELECTRIC & ELECTRONIC MANUFACTURERS'
ASSOCIATION
1608 - One Yonge Street
Toronto, Ontario M5E 1R1

CANADIAN LUMBERMEN'S ASSOCIATION
27 Goulburn Avenue
Ottawa, Ontario K1N 8C7

EDMONTON CHAMBER OF COMMERCE
TRANSPORTATION COMMITTEE
P.O. Box 2356
Edmonton, Alta. T5J 2R5

WESTERN TRANSPORTATION ADVISORY COUNCIL
885 Dunsmurr Street
Vancouver, B.C. V6C 1N5

ATLANTIC PROVINCES TRANSPORT COMMISSION
P.O. Box 577
Moncton, N.B. E1C 8L9

APPENDIX III

SHIPPER RESEARCH IDEAS

DEREGULATION

1. How can we get rid of government regulations in transportation?
2. What benefits would accrue to Ontario based manufacturers (shippers/receivers) with the event of deregulation of the trucking industry? What benefits would appear that are not currently available, and what, if any negatives would be experienced by the Ontario economy?
3. Public necessity and convenience vs. fit, willing and able.
4. Collective ratemaking and confidential contracts.
5. Inter-switching and mandated joint line rates.
6. Development of a responsive, independent regulatory agency.
7. Dispute resolving mechanisms.
8. The true effects of deregulation when and if it occurs.
9. The relationship between deregulation and trucking bankruptcies; the level of costs to protect the transport industry under our present regulatory system and justification for that cost.
10. Economic regulation as a method of improved safety--is it real? Could resources be better used on enforcement and safety regulation?
11. Prospective role of third parties (e.g. brokers, consultants) in a deregulated era of competitive, non-published rates.
12. Economic benefits to the consumer under transportation deregulation.
13. An analysis of institutional change under deregulation.
14. Opportunities for the entrepreneur.

TRUCKING UNIFORMITY/PRODUCTIVITY

15. The effects of introducing tandem trailer (45 ft.) operation into Canada. The effect on carrier and shipper costs, safety and the motoring public.
16. Road building materials for construction to get heavier payloads.
17. Provincial uniformity on highway weight and dimension laws plus trailer configuration.

TRANSBORDER TRUCKING

18. The impact of U.S. carriers entering the Canadian market in the event of deregulation of the trucking industry.

19. The experience of Canadian trucking companies who have entered the U.S. market in terms of success, return on investment, impact on their Canadian operations and benefits if any to the Canadian economy.

20. The effects of "free trade" in trucking .... Ontario/U.S.A.

INSURANCE

21. Insurance surcharges--are we paying too much?

22. Transportation risk analysis as it pertains to insurability.

23. How much insurance is necessary?

24. Are present insurance premiums cross-subsidizing bad risks still on the books?

HAZARDOUS GOODS

25. Data on the movement of dangerous goods in Canada by class, volume and mode. Existing statistics are incomplete particularly for the highway mode.

26. Impact analysis on shippers and railways of empty tank cars are treated as loads.

27. Hazardous goods transportation in urban areas.

28. Where does the cost of regulated safety become a deterrent to the use of the beneficial hazardous good?

RAIL

29. A rational approach to branch line and station abandonment.

30. Double stack trains.

31. Private car compensation in Canada, historical and legal background.

32. Average rail revenue per ton mile vs. CPI. Railways are prone to use this comparison to support need for rate increases. Is it valid?

33. Further electrification of CAnada's rail system; regional impact of such development and affects of energy costs and taxation.

HIGHWAY

34. A comprehensive means of measuring by index trucking transportation cost fluctuations; sensitivity to labour, fuel and maintenance, etc.

35. Inter-corporate private trucking inter-provincially.

36. Instant access to updated information on carrier licenses and insurance coverage.

MARINE/EXPORT

37. Lakes vessel costing study.

38. Duty drawback problems.

39. Compilation and analysis of volumes (tonnage) shipped from Canada to various offshore markets by (a) port of shipment, (b) commodity, (c) conference/nonOconference, (d) month and year.

40. Steamship conference loyalty agreements, bunker surcharges, currency adjustment factors and the conference exemption act.

41. Availability of a cost competitive marine transportation mode for marine freight transportation in the north.

42. The waiver system and related import duties; does it work for shippers?

43. Compedium of international conventions affecting Canadian exporters.

44. The needs of the Canadian shipper in an internationally competitive export market; an analysis of institutional, technological, financial and commercial requirements.

45. Deep sea fleet.

46. UNCTAD liner code of conduct.

AIR

47. Bi-lateral international air negotiations in developing an appropriate market environment.

48. The impact of the flat airline ticket tax on remote business operations.

SUBSIDIES AND PUBLIC DUTIES

49. Are imposed public duties fully compensated?

50. Newfoundland railcar discontinuance. Extra costs to use containers?

51. Cross-subsidization in government subsidized rail services.

52. History of maritime provinces transportation subsidization .... objectives, cost, and benefits.

RATES

53. Why are increases in transportation rates generally higher than the consumer price index? Why are they more frequent than once annually? What geographic differences are at work in transportation pricing and how does this relate to regional price variations?

54. Tariff filing was originally conceived to protect shippers. Does it still do so?

LEGAL

55. Legal aspects of electronic data interchange in international trade.

56. The legal basis of the courier industry in context of traditional rail express.

57. Multimodal liability.

GENERAL AND MISCELLANEOUS

58. Modal share of freight traffic on a mileage basis and by population center. (i.e. identify where infrastructure matches regional demand)

59. Uniform application of electronic data interchange in all phases of transportation; ratemaking to processing and payment of account activities.

60. Shippers' transportation data base (CITL): domestic, U.S., overseas.

61. Commodity pipeline as a competitive mode.

62. Lighter than aircraft movements to haul freight.

63. Telecommunications aspects of electronic data interchange in Canada.

64. History of competition between the Canadian railways and the trucking industry.

65. Instability of transportation systems for 50 to 1000# shipments.

66. Third party ownership of terminal facilities in multimovements.

67. The role of government pricing of fuel in Canadian transportation competitiveness (vs. U.S.).

68. Transportation curriculum developed in Canadian colleges and universities.

69. University research program for transportation.

70. The effect of interest rates on time sensitive shipments.

71. The effect of ceramics in propulsion systems on transportation costs.

72. An economic analysis of the importance of transportation to small business.

73. Canadian shipping needs to the year 2000.

74. Southwestern Ontario future highway requirements, e.g. Niagara to Windsor.

75. Research ways to lower the cost of transportation inputs rather than deciding who does what at every turn.

APPENDIX IV

(Sample of Canadian Transportation Publications)

1.	BUS & TRUCK TRANSPORT	777 Bay Street Toronto, Ontario M5W 1A7
2.	THE CANADIAN SHIPPER	2360 Dundas St. W. Toronto, Ontario M6P 4B2
3.	CANADIAN SAILINGS	4634 St. Catherine St. W. Montreal, Quebec H3Z 1S3
4.	CANADIAN TRANSPORTATION & DISTRIBUTION MAGAZINE	1450 Don Mills Rd. Don Mills, Ontario M3B 2X7
5.	C.I.T.L. TRANSPORTATION INFO.	2360 Dundas St. W. Toronto, Ontario M6P 4B2
6.	MATERIALS MANAGEMENT & DISTRIBUTION	777 Bay Street Toronto, Ontario M5W 1A7
7.	MODERN PURCHASING	777 Bay Street Toronto, Ontario M5W 1A7
8.	MOTOR TRUCK	109 Vanderhoof Ave., Suite 101 Toronto, Ontario M4G 2J2 or 4250 Dawson St. Burnaby, B.C. V5C 4B1
9.	PURCHASING MANAGEMENT	277 Lakeshore Rd. E. Oakville, Ontario L6J 6J3
10.	SEAPORTS & THE SHIPPING WORLD	4634 St. Catherine St. W. Montreal, Que. H3Z 1S3
11.	TRANSPORTATION BUSINESS	310 Dupont St. Toronto, Ontario M5R 1V9

RAILWAY RESEARCH AND DEVELOPMENT and THE REALITIES OF THE 1980's

by

R.A. Shea
CP Rail

1.0 Introduction

The railways of Canada will, in the remaining years of this decade be facing a set of realities in the commercial, operating and regulatory environment in which it exists, which will have significant impact on its Research and Development activities. In the following paper an attempt will be made to show how the realities will shape CP Rail's R&D efforts and in some part the R&D efforts of the industry in general.

2.0 The Realities

The immediate future is rapidly shaping up as one which will see Canadian railways under tremendous financial pressure. This will be the result of a number of factors.

- A major erosion of revenues resulting from the implementation of the new National Transportation Act as it was outlined in Freedom to Move.

- The erosion of the markets for, and the price of, Canadian agricultural and resource products which are shipped primarily by rail from their origin to tide water or the Great Lakes system.

In addition to the financial pressures, the Canadian railways will be called upon to improve their already high safety performance as well as improve their service standards. If we roll into this the impact of the "Via Act" and Free Trade the implications for the railways becomes clear: If the environment in which railways operate, through legislative and other means, results in major reductions in revenue while demanding better levels of service the railway must reduce costs or go out of business.

3.0 Cost Reduction

There are a limited number of ways that costs can be reduced. The most obvious is a rationalization of the plant. Beyond this the railways must find ways to increase productivity both in terms of obtaining more units of transportation for each unit of variable input and by increasing the useful life, in terms of transport units, of capital components. It is these latter items which will drive R&D in CP Rail during the next few years and it is suspected in the other railways as well.

Broadly speaking CP Rail is focusing R&D on five areas.

- reducing energy consumption
- improving useful life of major capital and non-capital components
- improving the productivity of all units of the operation by the application of new and evolving technology
- improving upon the inherent safety of the system
- creating a condition that by better defining our needs to the supply industry we will obtain better products.

Like all things R&D must function within budget constraints. CP Rail does not carry out R&D simply for the sake of doing it. It expects that overall the programs will lead to developments which when implemented will not only cover the costs of development but reduce operating and capital costs over the longer term. Research programs therefore are examined carefully before they begin as to probable costs and expected benefits. In doing this, it is appreciated that by the very nature of R&D not all programs will be successful. In order to minimize the cost of unsuccessful programs a system of milestone reviews is used which allows decisions to stop or proceed to be made at appropriate points in the programs.

The evaluation of probable potential benefits is at times difficult when eventual implementation requires approval from the regulatory agencies. The approval process can lead to serious lags in the implementation schedules and can materially affect subsequent benefits.

It should be noted, before anyone accuses railways of spending inadequate sums on R&D, that railways are a service industry. We do carry out R&D in the classical sense in that we are developing a better understanding of the complex forces that exist in our working environment and

are using this data to aid in the development of better equipment. It is generally this effort that our critics address. However we spend considerable sums in developing new or improved services. Examples of this being the introduction of robot power and the introduction of domestic containers. While these are not viewed as R&D, they do require development and do present considerable financial risk.

4.0 Some Programs Presently Underway

To illustrate the principal thrusts of CP Rail's efforts and that of the industry in general three particular programs will be described. These have been selected to illustrate the diversity of the R&D effort and to demonstrate some of the problems faced in carrying it out. The three programs are:

- the testing and introduction of self-steering railway freight car trucks
- tangent track lubrication
- development and testing of a locomotive using AC traction motors and associated electronic control equipment.

4.1 Self-Steering Trucks

In the late 1960's the railways were becoming more knowledgeable of the behaviour of the standard three-piece truck; its tendency to parallelogram, to hunt when running under light cars, and the relatively high rate of wheel wear, which is inherent in the operation of these trucks, in highly curved track territory.

In response to these concerns, a number of solutions were brought forward. These involved either some means to have the axles steer around a curve, devices for stiffening the trucks, changes in wheel profile or a combination of all of these. In 1975 CP Rail made the decision to proceed on a carefully phased program to test and eventually implement an improved truck for bulk train service. The program would include:

- preliminary testing of up to five different truck configurations
- extended "in service" testing of at least two types of trucks
- implementation on an entire trainset of radial trucks

These steps were taken so that we could evaluate costs

and benefits before further commitments were made. There was also at the time considerable conflicting evidence as to what we could expect from the various designs that were available.

The initial testing examined lateral wheel/rail loads, angle-of-attack under curving conditions and truck stability in operation. These tests led to "in service" testing of two types of radial trucks.

The "in service tests" chiefly were directed to measuring rate of wear of the wheels while carefully monitoring other components, particularly the steering mechanism for deterioration. All wear measurements were to be made with reference to wear on a standard truck which was run under the exact same conditions as the test trucks. After more than 250,000 service miles we have recorded a reduction in tread wear of 39% and of flange wear of 75%, this is illustrated in Figs. 1 and 2. No major deterioration of the steering mechanism has been noticed nor significant deterioration of other truck components.

The data on wheel wear, angle-of-attack and lateral forces were used to estimate potential reduction in rail and wheel wear and in energy consumed on selected train runs. Based on the results an entire coal train of 108 cars has been equipped with radial trucks and entered revenue service in January 1986. The performance of the truck components will be monitored over time. Specific tests also will be carried out, in order that, rail wear, wheel wear and energy consumption can be more specifically measured.

In carrying out these tests CP Rail made use of facilities and instrumentation of the Railway Laboratory of the National Research Council. CP Rail also developed a number of instruments, in particular, devices to obtain a precise measure of wheel and rail wear and for measuring the angle-of-attack of wheelsets. This particular program is at the present time stimulating us to develop a method to measure rail wear resulting from the passage of a single train.

4.2 Tangent Track Lubrication

In 1984 tests carried out at the Association of American Railroads (AAR) test facility at Pueblo indicated that when lubricant was applied on tangent track segments significant reductions in the energy required to move a fully laden train were experienced. Reductions of the order of 30% were reported.

Many railways in North America have been using lubricators on curves for a number of years principally as a

means of reducing rail wear due to wheel flange contact. It was always considered that flange contact on tangent track was negligible. The energy reduction from lubrication however indicated that this was not so or that there was some other energy loss mechanism at work.

In order to try to establish a better understanding for the energy reduction CP Rail agreed, as part of its participation in an industry wide Research and Development activity, to examine the angle-of-attack of a large number of wheelsets on its coal trains on tangent track. Using a laser based device which CP Rail developed some years earlier a sample of 444 carsets was observed at 3 separate locations on the track. The result of the observations on loaded cars is shown in Fig. 3.

At first these results were thought to confirm the notion that there was no significant skewness of the axles. However, analysis carried out by the Research & Test Dept. of AAR indicates that a skewness of as small as 2 milli radians and in the proportions indicated in the sample taken, would account for the change in energy consumption.

In order to obtain further confirmation of the phenomena on its own track, CP Rail ran tests on actual coal trains both loaded and empty. Using a lubricator car and instrumentation supplied by AAR which allowed for correction of different weights in the cars, effects of wind and different train handling, we experienced a saving of 3 to 8.5% on track over a distance of 125 miles. On this section of track curves in excess of 4° are already lubricated and these constitute a significant segment of the track miles.

The conclusion that can be drawn from these tests is that there is potentially an opportunity for a significant reduction in energy consumption. However implementation of full tangent track lubrication illustrates in a classic manner the problems which are inherent in introducing this type of development on a railway. Implementation would present a new set of problems to which there are no immediate answers. Specifically the most important of the problems involves uncertainties of what will happen to the rail. Since lubrication reduces rail wear the principal mechanism governing the life of the rail will probably be some form of fatigue. Incipient failure of a rail due to fatigue is somewhat more difficult to detect than visually observing head wear. Furthermore the presence of the lubricant on the rail might also increase the rate of propagation of surface cracks as well as possibly reduce the available tractive effort of the locomotive.

As a consequence, implementation on a wide scale must be carefully examined with respect to creation of new con-

ditions which might cancel or result in negative benefits. This kind of conumdrum occurs quite often and because the railways must proceed cautiously, it makes railway research appear casual and slow.

4.3 AC Powered Diesel Electric Locomotives

One of the principal causes of locomotive unreliability is the electric traction motors. The present direct current motors have undergone considerable development in terms of improved robustness over the past 25 years, however, they still represent a major portion of our cost of locomotive maintenance. For example, CP Rail renews on the average 215 traction motors per month on a fleet of approximately 1200 locomotives. In winter months the number can exceed 350.

In 1981 it was decided to proceed, with the participation of Bombardier Inc., Brown Boveri Canada Inc. and shared cost funding supplied by the Canadian Department of Industry, Trade and Commerce, with the development of a locomotive using AC Traction Motors.

The principal benefits which we could foresee from AC traction were:

- adhesion levels that are above the levels now available from DC traction units
- dynamic brake capability down to near zero speed
- improved locomotive reliability and a significant reduction in maintenance costs.

This program has resulted in the conversion of a 4000 HP locomotive (CP 4744) using four 1000 HP, 3-phase asynchronous traction motors. The locomotive has undergone extensive performance testing and is performing very close to its design objectives. It is presently in limited revenue service and will shortly be entering regular revenue service where it will be monitored for about a two year period.

5.0 What Do These Programs Demonstrate

The programs described above are but three of a number that CP Rail has underway. They were selected to demonstrate the following characteristics of todays railway research.

- Because the operating environment contains so many variables, replication of this environment in a laboratory is very difficult. While laboratory facilities which are capable of replicating some parts

of the operating environment have increased dramatically in the last 10 years, in service testing is still the final criteria for successful development.

- The operating environment is a complex interactive system. Development in one part of the system must take into account the potential effects on the other parts of the system. Since the nature and degree of many of the interactive elements are not yet fully understood, we must proceed in a manner which allows progress but does not give rise to deterioration in other parts of the system which could impact upon costs and safety.

- In order to shorten the development time the railways must continue their efforts to better understand and to quantify the forces at work in their environment.

- The railways are and will continue to increasingly demonstrate that when they become dissatisfied with equipment which is being produced by their "traditional" suppliers, they will actively encourage development by others and where necessary will support this development in the testing phases.

6.0 Industry Wide Programs

The programs described above are but three of several being pursued within CP Rail. While the programs are of direct interest to CP Rail they are also part of a much broader effort which is being pursued by the industry as a whole. This effort includes such programs as:

- analysis of alternate fuels

- extensive wind tunnel testing of rail car and train configurations to reduce aerodynamic resistance

- extensive testing of components such as rail, ties, ballast etc. at the Facility for Accelerated Testing at Pueblo and in various laboratory facilities

- extensive development of rolling stock to be used for hazardous materials

- development of laboratory facilities for environmental, shock, vibration and component wear testing.

The research activity is being carried out by the AAR in their own facilities or in affiliated University and Research Institutes and by the various major railways in the U.S. and Canada.

A major program also underway is the development of an

Automatic Train Control System (ATCS). This program originated with Canadian Railways and is now being supported on both sides of the border. At present some six million dollars Canadian have been committed to the development of system architecture and component specification. Half of this sum has come from the Canadian Railways.

7.0 Significance for the Railway Supply Industry

The Railways are in the business of providing transportation. We are not in the business of manufacturing major components for our own use. The railways, however, have traditionally carried out considerable design work and then had manufacturers produce to that design. There is at present, a definite change in emphasis. Today the railways are thinking more in terms of defining the performance which they want and of defining, in measurable terms, their operating environment. While we still have some way to go, research work by the industry over the past dozen years has led to a greater understanding of the forces at work which makes the definition of the parameters of the operational environment much more possible.

It can be foreseen that the railways will, in the near future, begin specifying acceptance criteria which will require, on the part of suppliers, the production of documentation that the particular item has met physical, environmental and performance specifications before the railway takes delivery of the item. It is expected that laboratory testing will become more definitive with "in service" testing only being used when there are no alternatives.

As the performance criteria and the operating environment become known, and the railways are able to more precisely define their requirements, the longer term impact on the industry is that it may be practical for a broad spectrum of industries to enter the market for the supply of railway material. It is certainly our hope that this will occur.

8.0 Constraints on Railway R&D

Large as the needs are for continuing or expanding R&D within the railways and its supply industry there are a number of constraints which tend to limit and in some ways direct the effort. There is the ever present financial restraint that all industrial R&D must live with. However, beyond this there are issues which are peculiar to railways, included are:

- The railways have a large capital investment. Consequently changes in components of this investment which are not compatable with the rest of the system are not

acceptable. Therefore before any serious development resource is committed, it is incumbent upon the developer to examine the impact that the eventual product or system would have on the existing infrastructure or operations of the railways. There have been in the past far too many solutions chasing perceived problems.

- The capital write-off imposed upon the railways for taxation purposes does not encourage the replacement of working components unless the cost savings are dramatic. As an example, a 15% reduction in fuel consumption would, at present, not economically justify the replacement of an existing locomotive by a new locomotive.

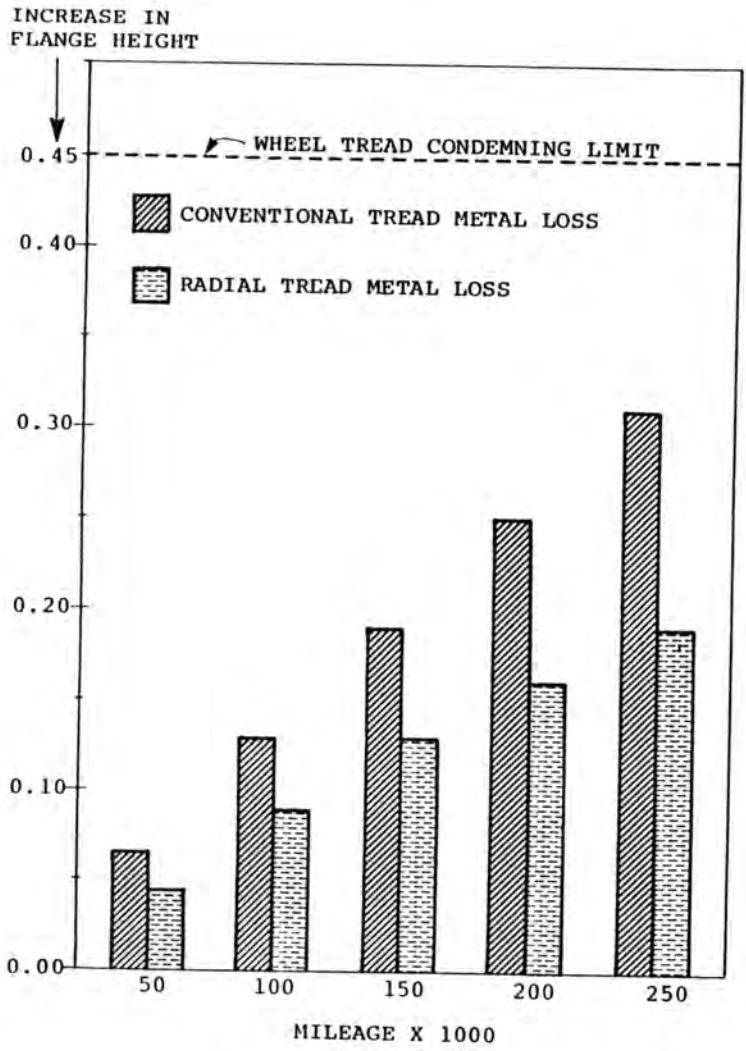
- The implementation of a new or improved technology is at times restricted by the regulatory regime under which railways operate. If the implementation requires any change to regulations or orders then we can find ourselves in an extended period of discussions which can sometimes include public hearings. This process and its inherent delays, represents a serious risk to anyone who sets out to develop new devices for use on the railroad.

9.0 Conclusion

Research and Development is very much alive in the Canadian Railway Industry. Its directions are being shaped by the financial pressures which deregulation will create, by the world market for Canadian products and by and by a desire on the part of the railways to improve service and safety. The programs underway cover both applied and basic research. The applied research is directed at improving the products and systems that we already have in place and developing new products or systems to do our job better. The basic research is a continuing effort to better understand the interrelationship of the multitude of forces at work in the rail operating environment.

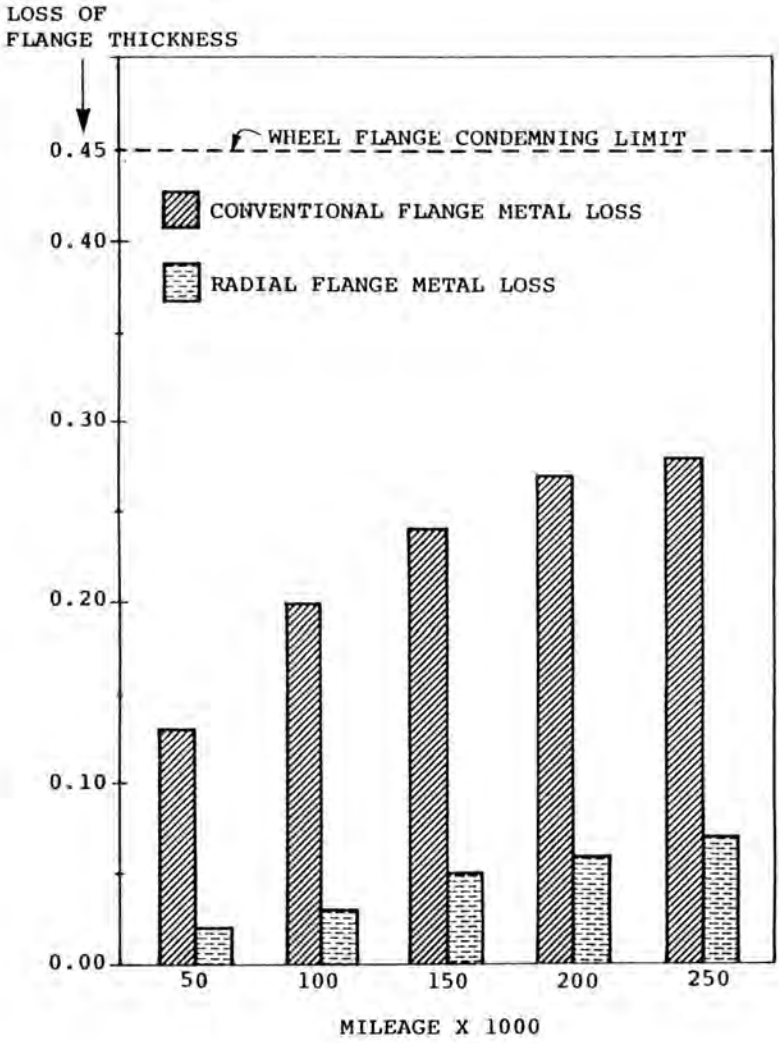
The combined affect of the research efforts will, in time, impact on suppliers of railway equipment and systems because they will be working to performance specifications which will give them some flexibility in design but will also expose them to increased competition.

Research and Development, therefore, will play a significant role in helping the railways to address the challenges of the future;challenges that will be overcome just as those of the past were overcome.



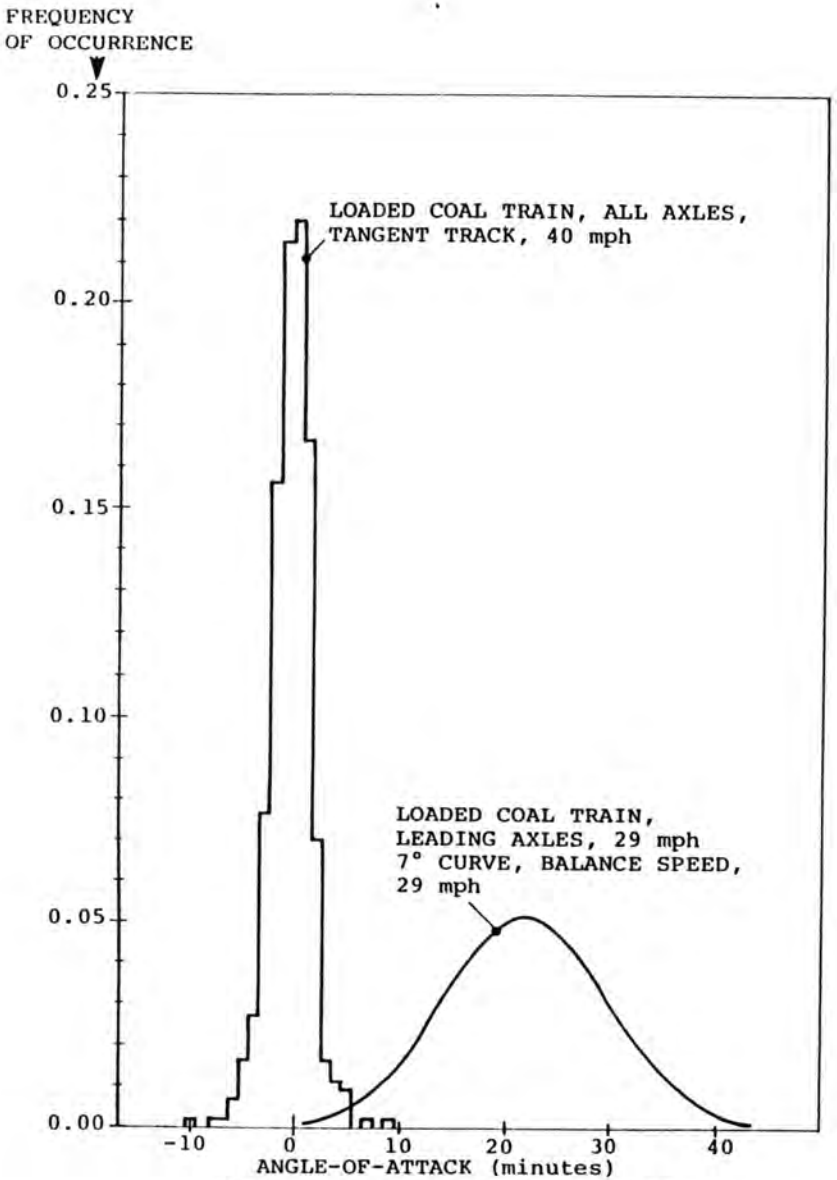
INCREASE IN FLANGE HEIGHT VS MILEAGE

Figure 1



LOSS OF FLANGE THICKNESS VS MILEAGE

Figure 2



ANGLE-OF-ATTACK DISTRIBUTION FOR
A LOADED COAL TRAIN

Figure 3