Investigating the Social Benefits of Short Line Freight Railways in Canada

Robert McKinstry, Railway Association of Canada
Fares Bounajm, Railway Association of Canada

Introduction

The *Canada Transportation Act* of 1996 instigated the emergence of many short lines in Canada. By removing some of the regulatory restrictions on the discontinuance of rail lines, the *Act* allowed Canadian National (CN) and Canadian Pacific (CP), the two national Class 1 freight carriers, to reorganize their operations by selling or leasing some of their low-density segments. The result was an exceptional growth in the number of short lines[1] from merely 12 in 1996 to around 50 in 2009 (QGI Consulting, 2009).

The railway industry is highly capital intensive and one of the main challenges facing the short lines today is the ability to meet their long-term capital requirements. A crucial factor for capital investment is financial and regulatory certainty. In the absence of certainty, financing long-term investments in rail infrastructure becomes very difficult. The same is true even for Class 1 railways. For instance, Figure 1, "Impact of Regulatory Uncertainty on Capital Investment" highlights the importance of regulatory certainty by showing that the Class 1 railways appear to have invested more during periods of regulatory certainty.

While short lines enjoy some advantages over Class 1 railways, specifically their less restrictive labour relations, they have limited capacity to increase revenue due to the low density nature of their lines. The traffic density of short lines, as measured by the ratio of

[1] In this paper, any reference to "short lines" also includes regional railways.

revenue tonne-kilometers (in millions) over track miles, was around 1.75[2] in 2007, or less than one fifth of that enjoyed by the Class 1 railways, putting a damper on their profitability. For instance, while Class 1 railways enjoy operating ratios of no more than 75%, short lines have operating ratios that are over 90%.[3]

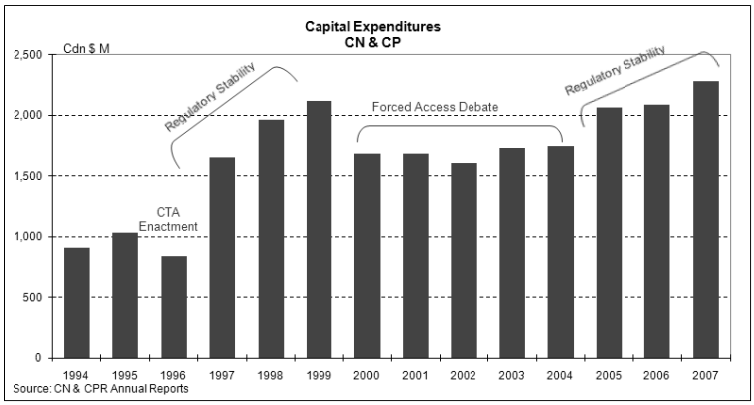

Figure 1 Impact of Regulatory Uncertainty on Capital Investment

Given the low profitability of short lines and the environment of high uncertainty that arises from it, they are often unable to meet their infrastructure investment requirements, resulting in the deterioration of their infrastructure over time.

Many short lines today require significant infrastructure investment. The objective of the paper is to highlight the need for public investment in the short line and regional railway system, recognizing that short line railways offer significant social benefits.

[2] Calculations based on data from Transportation in Canada, 2008 Addendum (Transport Canada)

[3] See Transportation in Canada 2008 Addendum, Table EC-71

Importance of Short Line Railways to Canada's Transportation System

At present, short lines in Canada have aggregate revenues of more than $650 million, employ over 3,000 workers across Canada and operate around 20% of total railway track miles. They originate approximately 28% of total railway tonnage and carry about 5% of the industry's total revenue tonne-kilometers (rtkm).[4] Additionally, they pay over $30 million annually in property, fuel, capital, and income taxes.[5]

Through their ability to operate at lower average costs, due primarily to less restrictive labour agreements, short lines uphold low-density lines that would have otherwise been abandoned by the Class 1 railways, thus retaining local shipper access to the broader Canadian and North American railway network while providing a range of flexible services.

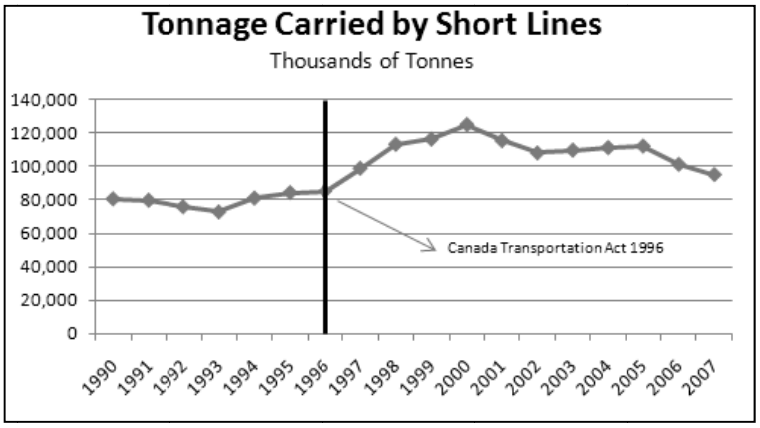

Figure 2 Tonnage Carried by Short Lines (Thousands of Tonnes)

[4] A revenue (or net) tonne-kilometer (RTK) is the movement of one revenue-producing ton of freight the distance of one kilometer. It excludes the tonne-kilometers involved in the movement of railway materials or any other non-revenue movement.
[5] All figures are based on the Railway Association of Canada's database.

Yet while the period following the 1996 *Canada Transportation Act* witnessed a rapid expansion in the number of short lines and the tonnage they carried, this growth reached a plateau around the year 2002 and traffic has even declined in the last few years. Whether this reversal was a temporary blip or will continue into the future is yet to be determined. However, the potential of short line railways to grow their traffic in the future will be challenged without significant investment into their infrastructure.

Social Cost Consideration

In recent years, Canada has treated road transportation as a public good (CTA Review Panel, 2001). Under such a policy, charges per a given user does not properly account for the proportion of costs incurred by this user. This fact is well-documented by the 2001 report of the Canadian Transportation Act Review Panel, "Vision and Balance".

This is problematic for two reasons. The first is that user charges do not fully cover the costs of transportation by road. A 2005 report by Transport Canada estimates that the federal, provincial, and municipal governments only recovered between 67 to 91 per cent of the overall costs of road transportation (Harris, 2005).

Of equal importance, the second problem is that road transportation simply does not possess the economic characteristics of a public good. Public goods are by definition non-rival, i.e. they can be used by an unlimited number of consumers without preventing others from using it. However, road congestion is a great opportunity cost while road usage also leads to the deterioration of roads and an increase in pavement maintenance costs. Heavier vehicles require exponentially higher pavement costs. A study in the United States found that one heavy truck (five or more axles) has the same impact on pavement costs as 90 passenger cars (Gibby et al, 1990).

In the context of this paper, for example, railways do not compete with trucks on an equal footing, since, while trucks pay a fraction of

the costs they incur, railways have to bear the full financial cost of their infrastructure. This produces a relative advantage for truckers, who would be able to charge transportation rates at a level below that produced under an efficient allocation of resources. In effect, treating roads as a public good is equivalent to subsidizing trucking.

Moreover, financial costs are not the only relevant factors. Road and other modes of transportation users produce congestion, noise, and emit greenhouse gases (GHGs) and criteria air contaminants (CACs). These are all negative externalities that, if not accounted for, distort the allocation of resources in the economy in an inefficient way.

In this environment, treating roads as public goods and failing to account for social costs leads to an inefficient economic allocation of transportation resources whereby incentives are distorted such that road users use the roads excessively as they are not paying the full cost of their usage.

Socio-Economic Benefits of Short Lines

Short lines connect shippers in remote areas to national, North American and international markets. The cost-efficiency of rail over truck transportation also allows short lines to provide service at a lower cost to shippers. Their higher fuel efficiency also reduces the volatility of their prices as their rates are not as influenced by fuel prices. The use of short lines, as an alternative to trucks, reduces road and highway maintenance costs.

In addition to these economic benefits, short lines also have many social benefits. They emit fewer amounts of GHGs and CACs and do not cause traffic on the roads and highways. We attempt to measure these benefits drawing on the findings in The Full Cost Investigation (FCI), a multi-year project launched by Transport Canada at the beginning of 2004 with the support of provincial and territorial departments of transport. The project aimed at estimating the full costs of transportation in Canada by transportation mode.

Air Pollution

The FCI monetizes pollution costs based on the impact of criteria air contaminant (CAC) emissions on human health costs, changes in agricultural productivity and visibility impacts. Transportation emissions were based on *Environment Canada*'s Criteria Air Contaminant Emission Inventory and pollutants included those that reduce air quality directly or through the secondary formation of particulate matter (PM) and ozone.

Adjusting the FCI findings to 2010 price levels, the air pollution costs of carrying one million tonne-kilometers by trucking is approximately $6,000, compared with only $1,635 by rail. Knowing that short lines carried just over 21.46 billion revenue tonne-kilometers (rtkm) in 2008, if all current short line traffic were to shift to trucks, this would result in extra pollution costs of around $93.68 million per year.

Greenhouse Gas Emissions

Setting a price for greenhouse gas emissions is problematic because there is no Canadian market for GHG emissions and no known accurate estimates of what the price of carbon should be. Yet, there is little doubt that emitting GHGs imposes an invisible cost on society that emitters currently do not pay for. The FCI uses middle estimates of the 2006 unit price of carbon on the *European Carbon* Exchange. This, however, does not resolve all problems associated with carbon pricing as the price of carbon on the European Carbon Exchange is very volatile as is exchange rate between the Euro and the Canadian Dollar. Thus all estimates are to be considered with caution.

Recently, likely due to the global recession, the price of carbon has been significantly lower than 2006 and ranged between 8 € to 16 € per tonne of CO_2 equivalent in 2009,[6] well below the range of 15 € and 30 € per tonne used in the FCI. However, given the constant volatility of prices and the fact that there are many planned initiatives

[6] www.europeanclimateexcchange.com

to increase future prices,[7] we use the same figures used in the FCI report assuming no change in prices.

Under these assumptions, the GHG costs of carrying one million rtkm by trucking is estimated at $5,560 but only $559 if rail is used instead. This means that the existence of short lines lead to savings of over $107 million per year in GHG emission costs. Differences between short lines and Class 1 do not materially change this result as costs per rtkm for short lines are comparable to those of Class 1 railways and are even somewhat lower.[8]

Accidents

FCI estimates for accident-related costs are intended to cover costs such as ambulance transportation, first aid, and hospitalization. The most significant part of accident costs, however, is the "Value of Statistical Life" (VSL), which is the cost attributed to the death of individuals. The FCI uses the willingness-to-pay method and estimates VSL within a range of approximately 3 to 5 million Canadian dollars.

Rail transportation can lead to significant accident cost savings, being approximately seven times less costly than trucking on a tonne-kilometer basis. Accident costs for transportation by truck are estimated as $7,296 per million rtkm compared with only $1,097 per million rtkm for rail transportation. This implies total savings of over $133 million per year owing to the use of short lines.

Noise

The FCI estimates noise economic costs for both and road and rail transportation, using engineering models to estimate the quantity of noise and a mix of hedonic models and stated preference studies to estimate its economic damage. However, while it attributes a

[7] See for example: Regina Betz, and Misato Sato: Emissions trading: lessons learnt from the 1st phase of the EU ETS and prospects for the 2nd phase. Climate Policy 6 (2006) 351-39

[8] See *Locomotive Emissions Monitoring Program 2007* for more details

relatively small cost of $4 per million rtkm for freight rail, it chooses not to allocate its estimated road noise costs to the "freight" and "passenger" transportation categories, citing problems with the complexity of the task and the lack of sufficient data.

A European study on the external costs of transportation in Europe estimated an average a 3,200 € per million rtkm for rail transportation compared with a 7,400 € per million rtkm for trucking (Maibach et al, 2004). These numbers far exceed the Canadian estimates for rail by the FCI. Part of the reason lies in the fact that population density is much higher in Europe, but perhaps a difference in methodology may be the primary reason for the vast difference in estimates. For this paper, we use the FCI estimates of the per tonne-km cost of noise for rail and compute and estimate of the corresponding costs for truck transportation using the same ratio of costs estimated in the European study. Therefore, assuming economic damages of $4 per million rtkm for rail transportation and $9.25 per million rtkm for trucks, we estimate that short lines save around $0.11 million per year in noise costs.

It is important to note that Transport Canada believes its estimates for noise damage costs may be too low and acknowledges that more work is needed in this field, especially in terms of reconciling Canadian noise damage cost estimates with those of other countries in the world.

Congestion

The FCI does not attempt to compute delay costs for freight transportation. It does however estimate the cost of congestion on passenger car users by calculating the amount of time passengers lose due to congestion, valuing that time by half the average hourly wage. The total estimate of congestion costs is $6.4 billion per year[9].

Although we do not attempt to measure marginal costs of delay attributable to truck transportation, it is worth noting that congestion

[9] $5.2 billion in year 2000 Canadian Dollars

costs exhibit increased marginal costs due to the fact that, while the presence of few vehicles do not cause any congestion, increasing the number of vehicles after a threshold volume of traffic leads to an exponential growth in congestion. Furthermore, trucks are on average larger than passenger and other vehicles. Thus, the congestion costs of trucks are certainly significant enough to be mentioned and taken into serious consideration. Even small amounts of time that can be saved due to the existence of short lines are very valuable. High congestion costs mean plenty of time is being wasted on the road instead of spent resting with family or performing other less stressful and healthier activities.

Road Maintenance Cost Savings

We estimate road maintenance costs using three different methods. The first method involves using the Full Cost Investigation estimates, the second is based on figures supplied by the Ministry of Transportation of Ontario, while the third is based on an academic study in the United States.

The FCI allocates a road infrastructure cost of around $51,726 per million rtkm for truck transportation. This would imply that a massive total of $948.8 million of infrastructure costs are being saved every year due to the presence of short lines.

Under the second method, the Ministry of Transportation of Ontario provided estimates[10] as follows: The Average Marginal Equivalent Uniform Annual Cost (EUAC) for a typical two-lane highway:

- 1.60 cents per rtkm, with 100% empty returns
- 1.59 cents per rtkm, with 75% empty returns
- 1.58 cents per rtkm, with 50% empty returns

[10] Figures appear in Canarail's "Economic Benefit of Ontario Short Lines", Final Report, December 2007

Assuming the most conservative estimate of 1.58 cents per rtkm, the figures above would imply annual savings of about $339.1 million in road maintenance costs.

Finally, we use a third method to estimate the costs. Basing their estimates on an older empirical study (1990, Gibby, et al) and updated for the year 2009, the New York State Department of Transportation estimates that the yearly pavement maintenance costs per truck vehicle miles traveled is $USD 0.03.

To make use of this figure, we would need to know the total number of truck vehicle miles saved due to the presence of short lines in Canada.

Short lines carried approximately 81 million metric tonnes of freight in 2008 with an average length of haul of around 200 km per tonne. Using this average distance traveled of 200 km, the number of trips required can be computed by dividing the total tonnage shipped by the average potential weight carried by trucks. Knowing that the average truck load for 2008 was 9.9 tonnes (Statistics Canada, 2010), we estimate that the total distance that would be traveled by trucks if they were to replace the short lines. Finally, applying the 2009 average USD-CAD exchange rate published by the bank of Canada, we estimate that the full pavement maintenance cost savings by short lines amount to approximately $56 million per year.

We believe the second method is preferable to the others. First, it lies in between the two extreme estimates, but it also has the advantage of being based on information provided by the Ontario Ministry of Transportation specifically for the purpose of making estimates such as those we make in this paper. Furthermore, the third method is based on a study in the United States, where the climate is different from Canada's and the truck weight limits are also significantly lower. While the weight limit for heavy trucks is 62.5 tonnes in most Canadian provinces, it is merely 36.3 tonnes in the United States (Schulman, 2003).

Summary: Annual Social Benefits of Short Line Railways

Summary of Annual Total Estimated Benefits				
	Costs per million rtkm			
	Truck	Rail	Net Benefit	**Total Benefits**
Air Pollution	$5,999	$1,635	$4,365	**$ 93,679,418**
GHG	$5,560	$559	$5,001	**$ 107,335,827**
Accidents	$7,296	$1,097	$6,198	**$ 133,033,960**
Noise	$9	$4	$5	**$ 108,475**
Road Maintenance	$15,800	-	$5,800	**$ 339,127,716**
TOTAL	$34,664	$3,296	$31,368	**$ 673,285,396**

Note: Total benefit for each category is determined by multiplying the net benefit, for each category, by total short line revenue-tonne km (21.46 billion revenue tonne-km)

Future Study: Economic Benefits to Shippers

Due to their fuel efficiency and much higher capacity, short lines typically have lower variable costs than trucks. The productivity advantage is reflected in the rates charged to shippers. Generally, truck competition with short lines is intense, short lines are thus forced to charge shippers rates that are only slightly above their variable costs. The amount of savings by shippers largely depends on the degree of rates charged by trucks. Therefore, estimating the savings by shippers requires a very detailed study that examines each corridor separately and takes into account the types of goods that are shipped and the other alternatives available to shippers. One study does exactly that (2007, CANARAIL). Consultants from

CANARAIL estimate that shippers save between $408 and $547 million per year in shipping costs owing to the short lines in Ontario.[11] However, further study is required to determine the economic benefits, to shippers, of short line rail service for all of Canada.

Conclusion

Short line railways are an important component of Canada's freight transportation system, as they provide shippers rail access to Canadian, North American and international markets. Understanding the social benefits of short line railways can assist governments in furthering their understanding of the importance of short line railways within Canada's transportation system.

Through our investigation it was determined that short lines railways derive social benefits worth $673.3 million dollars annually. Clearly, society benefits from the existence of short line railways as they provide significant cost saving associated with air pollution (CACs), GHGs, accidents, noise and road maintenance.

[11] Different assumptions on rail pricing are responsible for the range of estimates

References

Canada Transportation Act Review Panel. 2001. “Vision and Balance.”

CANARAIL. 2007. “Economic Benefits of Ontario Short Lines.” Prepared for the Railway Association of Canada.

Harris, J. 2005. “Interim Estimates of the Financial Costs and Revenues Associated with the Provision of Road Infrastructure in Canada, Provincial Estimates, 2000.”

Gibby, A. R, ,Ryuichi Kitamura, and Huichun Zhao. 1990. “Evaluation of Truck Impacts on Pavement Maintenance Costs.” Transportation Research Record 1262, (Washington DC: Transportation Research Board, 2008).

QGI Consulting. Poirier, Moore and Hemmes. 2009. “Description of Canada’s Rail Based Freight Logistics System.” Study prepared for Rail Service Review.

Maibach, Markus et al. (INFRAS-IWW). 2004. “External Costs of Transport: Accident, Environmental and Congestion Costs in Western Europe. Zurich & Karisruhe”.

Schulman, Joseph. 2003. “Heavy Truck Weights and Dimension Limits in Canada.”

Statistics Canada, 2010. “Trucking Commodity Origin and Destination Survey.” The Daily. January 25.

Transport Canada. 2009. “Transportation in Canada 2008 – Addendum Tables and Figures”. Table RA-1, Table RA-7, Table EC-71.

Transport Canada. 2008. Estimates of the Full Cost of Transportation in Canada.