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Contents

Potential energy and cost savings using multi-use trailers in Canada

Abstract

FERIC developed a model for estimating the potential of multi-use trailers to reduce haul costs and the environmental impact of haul operations by reducing the number of trailers on the road, using the remaining trailers more efficiently, and reducing total travel distances. The model demonstrated that significant savings are possible in all regions of Canada, with dramatic savings possible in some regions.

Keywords:

Multi-use trailers, Optimization, Economics, Model, Energy efficiency.

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Introduction

Forestry truckers often can't perform "backhauls" because their trailer configurations are adapted to specific products. However, wood fiber flows between various mills in most regions. Multi-use trailers are designed to efficiently haul different products at different times and offer a potential alternative for truckers because the trailers can carry a payload during a greater proportion of their total travel time. For example, truckers hauling roundwood to a sawmill could carry chips to a pulp mill on their way back to the woods.

FERIC has investigated the potential of these trailers since the mid-1990s. Our early projects were successful and resulted in the construction and operational use of trailers capable of hauling both roundwood and chips, and these vehicles continue to operate in Quebec (Michaelsen 1996). Recently, a prototype B-train (Figure 1) capable of hauling both roundwood and wood chips was designed, and has been used operationally in western Canada since January 2001 (Webb 2002).

Figure 1. A multi-use B-train designed to haul roundwood and chips.

Though specific vehicles have been successful, widespread implementation has been slow even though many operations could save up to 40% in their transportation costs by adopting this approach. Various reasons have been proposed for slow adoption, including a lack of suitable trailers, logistical problems that complicate planning and transportation contracts, and the fear of adopting "unproven" technologies. Moreover, the lack of tools to accurately estimate the potential savings has made it difficult to recognize operations potentially suitable for multi-use trailers.

Trailer manufacturers are reluctant to invest in new technology without being confident there is a market for the trailers. To help evaluate the savings and the

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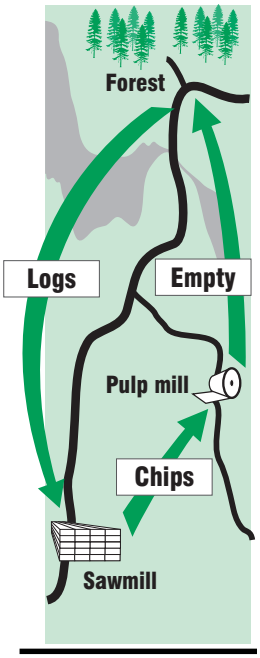

Figure 2. An example of a triangle route.

potential market, FERIC developed a model that can identify on which routes multi-use trailers can be cost-effective. This report describes the analytical model, the results of applying this model, and what parameters must be measured to evaluate whether individual operations could benefit from multi-use trailers.

The model

To calculate the overall potential for multi-use trailers, we developed a spreadsheet model based on mill locations, mill fiber requirements, and the locations of the forests that would supply the fiber. The model's purpose was to identify all the economical and logistically viable triangle routes between forests, sawmills, and pulp mills that would let truckers take advantage of multi-use trailers. A triangle route (Figure 2), in which a multi-use trailer could haul payload on at least two of the three legs of a trip, represents the most common opportunity for economic benefits.

For the model to consider a triangle route economical, the route had to generate lower total haul costs than the combined cost of hauling logs from the forest to a sawmill using conventional log trailers and the cost of hauling chips from the sawmill to a pulp mill using conventional chip vans. The model used the following parameters to identify potential routes:

- Sawmill locations, volume of logs received, and volume of chips shipped.
- Pulp mill locations and volume of chips received.
- Forest locations and potential volume of logs shipped.
- Hourly rates, payloads, average travel speeds, loading and unloading times, and fuel consumption for roundwood trailers, chip vans, and multi-use trailers.
- The minimum acceptable savings required to trigger a switch to multi-use trailers.

Model results and discussion

Table 1 presents the results produced by the model based on national averages for trucking values, and the mill locations and production values obtained from our national and provincial survey and from various industry catalogues. Brown et al. (2003) provide details on the model, the variables used, and the results. The model assumes that a route would be viable for multi-use trailers if it generated a saving of at least $1.00 per green tonne of product transported.

Although every region of Canada showed some potential for multi-use trailers, areas of particular interest include the Abitibi region of Quebec (included under "Western region" in Table 1), northwestern Ontario, northern Alberta, and the northern interior of British Columbia (included under "Mainland" in Table 1). Table 1 reveals significant potential savings from implementing multi-use trailers:

- costs reduced by nearly $15 million/year
- travel reduced by 16.5 million km/year
- fuel consumption reduced by nearly 10 million L/year
- emissions of greenhouse gases reduced by more than 27 000 t/year

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Table 1. Potential savings from implementing multi-use trailers across Canada (assuming a minimum required savings of $1/t transported)

	Potential trucks replaced		Potential number of multi-use trailers implemented	Savings			
	Chip trucks	Log trucks		Cost (thousand $)	Distance traveled (thousand km)	Fuel consumption (thousand L)	Emissions of greenhouse gases (t)
Region							
Newfoundland	0.7	0.9	1.4	47	59	36	98
Nova Scotia & Prince Edward Island	1.8	2.5	3.5	241	277	166	457
New Brunswick	9.5	15.9	21.2	1 072	1 331	799	2 197
Quebec							
Gaspé–Lower St. Lawrence	5.4	7.1	9.9	531	757	454	1 250
South-central	3.7	3.8	5.9	321	488	293	806
Northeastern	8.7	12.3	16.7	869	1 161	697	1 916
Western	27.4	30.0	44.6	3 068	3 701	2 221	6 107
Ontario							
Southern and Northeastern	13.7	10.9	20.0	986	1 419	852	2 341
Western	12.8	13.3	20.1	1 581	1 777	1 066	2 932
Manitoba	3.5	6.4	8.1	477	473	284	780
Saskatchewan	2.5	2.0	4.2	137	133	80	219
Alberta	16.5	21.6	31.0	2 209	2 003	1 202	3 305
B.C.							
Mainland	20.5	21.7	37.2	1 582	1 863	1 118	3 074
Vancouver Island	8.6	9.5	14.0	1 452	1 159	695	1 913
Canada	**135.3**	**158.0**	**237.8**	**14 572**	**16 602**	**9 961**	**27 395**

The economics are obviously attractive, but the environmental benefits are also important given society's growing sensitivity towards the risk of climate change. Furthermore, the transport industry is facing a shortage of truck drivers, and thus any application that could reduce the pressure to find more drivers should be welcome. The reduction in the number of trucks on the road would also improve road safety.

Implementation

Figure 3 provides a means of quickly assessing whether multi-use operations would be worth investigating in more depth. The graph illustrates the conditions under which a saving of $1/tonne could be expected based on the locations of the mills and the forests that supply them. For

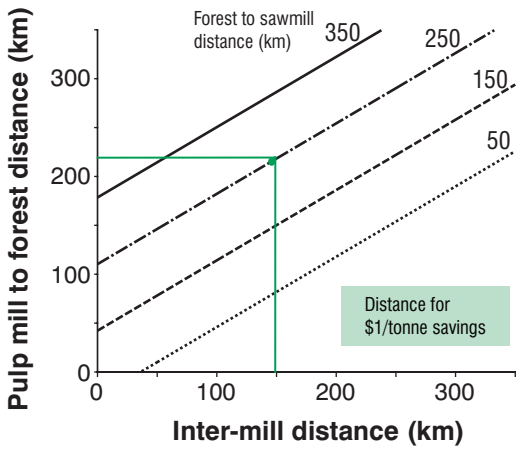

Figure 3. A graph to help determine the potential for multi-use trailers as a function of the distance between mills and the distances from the mills to the forest.

example, with a sawmill and pulp mill located about 150 km apart and a forest located about 250 km from the sawmill and 220 km from the pulp mill, switching to multi-use trailers could yield a savings of around $1/tonne. With a shorter distance between the forest and the pulp mill, the savings would be even greater. To use this figure for your own operation, find the inter-mill distance and choose the forest-to-sawmill distance line that best reflects your situation to determine the maximum distance from forest to pulp mill that would be attractive ($1/t savings). If the actual distance is less than the value determined from Figure 3, you should investigate the use of multi-use trailers in more depth.

Implementing operations with multi-use trailers can be complex, since it involves both capital investments and complicated logistics, potentially including cooperation between mills owned by different companies. To implement such operations successfully:

- Determine whether multi-use operations are likely to generate significant savings under your specific operating conditions. Figure 3 provides a quick means of assessing your situation.
- Decide whether you are willing and able to make the operational changes required to attain these potential savings. These changes may include discussions between mills, renegotiation of contracts with haul contractors, and providing the reassurances necessary to persuade contractors to invest in the new vehicles. A good price structure that leads to a situation in which both the forestry company and their truckers benefit will be required.
- Assemble detailed information on trucking costs and payloads, haul distances, mill demand, mill and forest locations, and the wood volumes produced in the forest and at the mill. This information is required to model your use of multi-use trailers.
- Work with FERIC to model your operations and identify possible itineraries that will generate the predicted savings. FERIC can also guide you in the selection of suppliers and specification of appropriate vehicles. FERIC's "star truck" program has helped several forestry companies achieve dramatic cost reductions by selecting the most effective vehicles for their operations.
- Perform final cost evaluations that include the estimated implementation costs to confirm that the approach meets your company's criteria for the implementation of operational changes.
- Implement a limited trial of multi-use trailers and conduct ongoing tracking to identify unanticipated problems and provide "real world" data that confirm the estimated costs and savings. If the results are positive, implement this approach fully.

References

Brown, M.; Michaelsen, J.; Hickman, A.; Provencher, Y. 2003. Potential for multi-use trailers in the Canadian forest industry. For. Eng. Res. Inst. Can. (FERIC), Pointe-Claire, Que. Contract Rep. CR-0196-1. 35 p.

Michaelsen, J. 1996. A new Temisko multipurpose trailer for tree-length logs and chips. For. Eng. Res. Inst. Can. (FERIC), Pointe-Claire, Que. Field Note Loading and Trucking-50. 2 p.

Webb, C.R. 2002. Log/chip B-train: a new concept in two-way hauling. For. Eng. Res. Inst. Can. (FERIC), Vancouver, B.C. Advantage 3(8). 8 p.