A CN train near Jasper, in the Canadian Rockies. A familiar Canadian winter scene. CN photo

Winter's Impact on Canadian Railway Operations: Fact and Fantasy

Paul Miller

Last winter's rail transport crisis generated headlines across the country about inadequate capacity, mismanagement and disregard on the part of Canada's railways. Engineer and former CN executive Paul Miller explains the crisis from the railways' point of view, addressing the myths and realities of northern rail transportation.

The severe winter of 2013-2014 created widespread disruption in freight supply chains, passenger transportation, manufacturing, and the economy. Canada's railways were certainly not immune; the service they were able to provide during weeks of exceptionally cold weather fell well short of their customers' requirements in many cases.

Critics were quick to suggest that railways were under-investing and lacked the capacity to handle large volumes of traffic. Other myths were also perpetuated: that the railways faced challenges because of bad planning, a focus on financials and cost reduction, and because they simply didn't care about their customers.

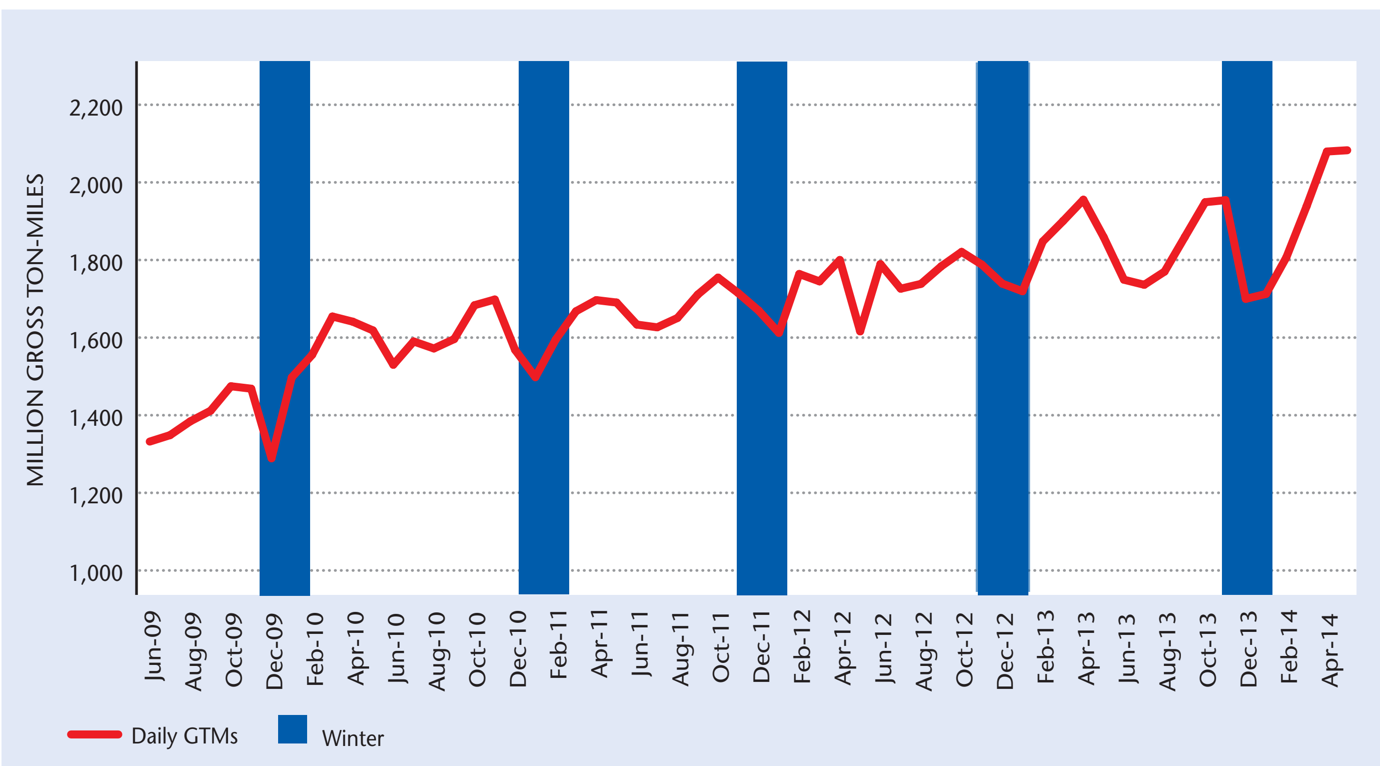
The same technologies that allow railways to be highly efficient, low-cost service providers—steel wheels running on steel rails, and harmonized braking systems that allow cars and entire trains to be routed seamlessly between railways across North America—are affected by a cold-weather tipping point, at about -25 C.

The fact is that, it is simply not reasonable to judge service, or to contemplate policy or regulatory action, based on the railways' performance during the worst eight to 10 weeks of winter weather. For most of the year, Canada's railways provide objectively solid service and capacity to a wide range of customers and markets. All "outdoor" industries—especially those involved in transportation and logistics—suffer during the winter, particularly during severe weather. Equipment breaks down more often, snow and ice slow or stop movement, storms and avalanches occur, and people simply take longer to safely accomplish tasks. However, beyond these shared issues, railways are additionally and uniquely affected by winter, due to the foundational technologies that make railways, railways.

The same technologies that allow railways to be highly efficient, low-cost service providers—steel wheels running on steel rails, and harmonized braking systems that allow cars and entire trains to be routed seamlessly between railways across North America—are affected by a cold-weather tipping point, at about -25 C. At that temperature, steel becomes less ductile, making rails more susceptible to breakage, and wheels more prone to tread damage—which in turn applies greater forces to the rail, adding to the likelihood of rail breaks. Air brakes are subject to failures as well—frozen gaskets leak air at brake-hose couplings, causing braking systems to lose pressure—leading railways to run much shorter trains at low temperatures for safety reasons. Even the newest locomotives can fail in -25 C weather, most often from traction motors whose ground relays are tripped due to snow and moisture ingestion.

Any of these factors can result in a downward spiral of delays. For example, to set off a car with a defective wheel in winter conditions can delay a train for hours, because of the length of time needed to re-establish air brake pressure. That delay can be quickly compounded by opposing and following movements—especially on a single track—putting sidings out of service and causing shortages of key resources such as crews and locomotives. Cold-weather train-length

Figure 1: Canadian Class 1s—Daily Million Gross Ton-Miles



Source: Railway Association of Canada

restrictions can cause similarly cascading effects: a train arriving with 10,000 feet of traffic may be restricted to 7,000 feet on departure. That unplanned 3,000 feet of left-behind traffic, multiplied by the number of arriving trains, will cause terminal congestion, slow down processing and delay outbound trains. And all of this typically happens just as shippers lose other options—through the closure of the St. Lawrence Seaway or the Port of Churchill, for example—and at a time when every setback takes longer to rectify.

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Finally, winter's effects on other supply chain participants can "blow back" onto rail carriers, further impacting their performance. For example, an export terminal that is affected by a winter storm may be forced to stop inbound rail deliveries of product, backing up trains already en route, causing congestion and reducing the supply of empty equipment for inland shippers.

The winter of 2013-2014 was much harsher than other winters in recent memory. The "polar vortex" was a Canadian and US news story for much of the winter, with crippling impacts felt as far south as Arizona and Texas. Winter's impacts on the throughput of Canadian Class 1 railways can be seen in Figure 1.

This graph shows that Canada's railways have been able to meet customer demand as it has increased over time, through investments in infrastructure, equipment and human resources, as well as ongoing process improvements. The fact that railway throughput recovered quickly in the spring of 2014 clearly indicates that sufficient network capacity was in place to meet demand, but the system was overpowered by winter effects. It is also important to note that, even in the depths of the difficult 2013-2014 winter, Canada's railways moved more traffic than they did during the summer of 2011—another indication that network capacity investments have been ongoing, and in-line with the demands of the economy. All of this points to the fact that the issue with winter is not "capacity". Rather, it is "resiliency"—the ability of the rail-based supply chain to withstand the shocks of varying severity, duration, and geographic distribution, given the technological make-up of railway systems.

Efforts to mitigate winter's challenges by railways and researchers have been commendable to date. Canada's railways spent more than $890 million on track improvements in 2013, and have developed innovative technologies to offset winter's most negative effects: ultrasonic detectors to spot internal flaws in rails, and wayside "wheel impact load detectors" to identify treads that are pitted or "shelled" and in need of replacement, to name just two examples. While railway research, development and investments are ongoing, improvements in these and other technologies are expected to be incremental, especially in the short-to-medium term. Simply put—there are no easy or immediate fixes for these tough, structural issues.

How, then, should northern railways—Canadian railways—deal with winter's challenges? Obviously they must, and will, continue to make the investments and process improvements that yield ongoing, incremental gains. They will continue to support the winter-focused research at the Canadian Rail Research Laboratory and other institutions, and to work with their suppliers to produce improvements. And they will continue their relentless "plan–act–measure–analyze–improve the plan/improve the execution–start over" approach.

But Canada's railways believe other opportunities lie within the supply chain itself. Many logistics improvements are underway, involving all supply chain participants, and there have been some successes. But there are additional opportunities in areas such as joint planning and setting of expectations; improved forecasting; shared-access systems for real-time information; and shared performance metrics to drive accountability and action.

We also believe customers can play a role in dealing with the challenges of winter. They can, for example, prepare with inventory management initiatives such as increased storage capacity, and scheduling of shipments prior to the winter crunch. Such initiatives recognize the structural impact of winter and the need to face up to the challenge in partnership with the railways.

The notions that railways are under-investing, that they are not planning properly for winter, or that they are only focused on cost savings, are simply not based on the facts. Canada's railways stand ready to work collaboratively with their partners to achieve end-to-end improvements across the supply chain. P

Paul Miller is Adjunct Professor in the Department of Civil & Environmental Engineering at the University of Alberta, and Railroader in Residence at the Canadian Rail Research Laboratory. He worked for CN for 34 years, retiring as Vice-President, Safety, Sustainability, and Network Transportation in 2011. pcmiller99@shaw.ca