How long can trains go?

Railway cars stretching beyond the horizon have bolstered profits for CP and CN, but they have also caught the eye of regulators and are behind many derailments

By Scott Deveau, Financial Post February 26, 2011

A Canadian Pacific Railway 10,000 foot intermodal train near Lake Superior in Northern Ontario.

Photograph by: Handout/ Canadian Pacific Railway, National Post

Shortly after 5:30 a.m. on March 21, 2009, a Canadian National Railway Co. freight train destined for Montreal derailed outside Brighton, Ont., a small town about two hours east of Toronto.

In all, six rail cars were ripped off the tracks — three carrying hazardous materials — after the train, which stretched nearly 2.7 kilometres, came to an unexpected and abrupt stop. This forced some of the heavier cars in the back of the train to crash into some lighter ones closer to the front, causing the knuckle connecting them to break.

Fortunately, no hazardous materials were leaked and no one was hurt.

Derailments like these are not entirely uncommon in the busy Toronto-Montreal corridor, which sees about 40 freight and passenger trains pass through it on average each day.

By most accounts, the accident was pretty innocuous and didn't even fire up the local press.

But it did catch the eye of regulators. Not because of its impact, but because of the sizeable length of the train involved, how it was built, and the echo it carried of previous accidents involving these longer, heavier trains that are increasingly populating the country's largest railways.

The Brighton accident was the tipping point for regulators after seeing such incidents on the rise, said Rob Johnston, Transport Safety Board director of rail and pipeline investigations.

"Some of the things identified in the Brighton report, and were also clearly identified in other investigations, were an eye-opener," he says.

Federal study launched, profits on the rails

Transport Canada launched a six-part study into the long-train strategies at the country's largest railways this month with an eye on developing policies for how these longer, heavier trains are assembled and run. The goal of the two-year study is to develop science-based regulations that will hopefully reduce the number of derailments in the country.

Despite the concern from regulators, these longer, heavier trains in recent years have been a godsend for North American railways, which swear by their safety. Not only do they improve the efficiency of the rails by reducing the number of trains required to transport goods, but they in turn reduce the crews needed and the fuel used to move their shipments.

If properly built, they can also reduce wear and tear on the trains and the tracks themselves by cutting down on in-train forces, lowering maintenance costs substantially over time.

The railway's customers have also welcomed the longer trains, because it allows their goods to be moved more efficiently.

Because of this, the country's largest railways, CN and its smaller rival, Canadian Pacific Railway Ltd., have increasingly shifted toward using longer, heavier trains to transport goods.

Up until the 1990s, the average freight train in Canada was about 5,000 feet (1.54 kilometres) long and weighed 7,000 tons. But it is now not uncommon to see these trains stretch to 12,000 feet, sometimes as much as 14,000 feet (more than four kilometres), weighing up to 18,000 tons.

While CN is comfortable sticking with the size of its longest trains now, about 12,000 feet, CP continues to push the boundaries of how long it can build its trains by developing some of the industry's most cutting-edge technology in recent years to help it do so.

The benefits are clear. CP estimates, for example, that the labour costs alone on a typical transcontinental train are now 30% lower than they would be if it was using smaller trains.

Not every train needs to be built so long, but the ones that can be have driven down the cost of moving things like coal, potash, grain and other merchandise substantially.

The increasing size of these freight trains has, however, come under sharp scrutiny by both the public and regulators after several high-profile derailments, including one in 2005 where a CN train dumped 40,000 litres of caustic soda into the Cheakamus River in British Columbia, causing serious environmental damage in a fragile spawning ground for salmon.

It's not the length, it's how they're built

While much of the public attention has been focused simply on the length of these trains, the outcome of the investigations has linked the derailments more to how they are marshalled — an industry term for the order in which the locomotives and cars are placed throughout the train.

The CN train involved in the derailment outside Brighton, for example, was built as a conventional train would be, with three locomotives in the front hauling 137 rail cars behind. But it was stretched out 8,850 feet and weighed nearly 12,000 tons.

Building a longer train in this manner substantially increases the amount of in-train forces as the cars push, pull and jostle along the track, through curves, and accordion when stopped. It was this kind of in-train forces that eventually caused two cars in the Brighton train to pull apart after being compressed by a heavier load in the back, the TSB investigation found.

Until recently, CN had a history of building its longer, heavier trains in this conventional manner with locomotives located in the head end.

On the other hand, its smaller rival, CP, has championed the development of another system, known as distributed power, where the locomotives are interspersed throughout the full length of the train, cutting down on the in-train forces and making the near-boundless vehicle easier to control.

In these distributed power trains, the lead locomotive is remotely linked with the other locomotives, which synchronizes the acceleration and braking throughout the train.

Mr. Johnston, the Transport Safety Board director, says a 12,000-foot distributed-power train can have smaller in-train forces than a 7,000-foot conventional train.

“So, to say that in general, long, heavy trains are not safe, isn’t really true,” he says.

In Canada, distributed power also carries the added benefit of offsetting the negative impact cold weather has on a train’s air brakes, allowing the braking power to be more evenly distributed, and in turn, allowing the trains to travel at higher speeds more safely in winter weather. Both CN and CP said distributed power helped improve their efficiency this winter.

While distributed power has certainly provided a safer alternative to conventional train marshalling, it is by no means foolproof by itself.

High-reward, high-tech solutions

The disastrous Cheakamus Canyon derailment, for example, involved a distributed power train. The subsequent investigation found that it was marshalled incorrectly, in part because CN’s crews were not adequately trained in managing the distributed power trains it picked up through the acquisition of BC Rail in 2003, the TSB said in its report.

“The use of distributed power in isolation isn’t necessarily going to give you the desired effect of managing these in-train forces,” Mr. Johnston says. “It has to be done in conjunction with these other marshalling restrictions that have been identified in the industry as best practice.”

Of the 10 derailments investigated by the TSB since 2000 involving longer, heavier trains and excessive in-train forces, eight were conventionally built with the locomotives in the front of the train. Nine were CN trains.

But CN’s safety record has steadily improved in recent years, in part because it too has moved more aggressively toward adopting distributed power technology.

“It just seems that the long, heavy train issue is with conventional head-end power,” Mr. Johnston said. “That’s where the problem is, and that’s what CN has begun to address.”

CN was not violating any regulations by pulling its long trains from the front. But the lack of regulations is another issue the TSB indentified as a shortcoming in these derailments.

“The regulator doesn’t have anything in place to deal with train marshalling,” he said. “For the longest time, it has been left up to the companies how they effectively manage trains.”

The federal government hopes to address these weaknesses after its two-year study into these longer trains, said Maryse Durette, a Transport Canada spokeswoman, in an email.

Since the Brighton incident, CN has not only voluntarily agreed to limit the length of its conventionally formatted trains to 8,500 feet, but has also promised to increase the use of distributed power on its larger, heavier trains.

“There’s been a significant amount of work that has been done by CN, which has taken some time for them to acknowledge,” Mr. Johnston said.

The number of accidents at CN fell to a record low of 37 in 2010 from 41 in 2009. That followed a sharp 35% drop in accidents the year before.

Paul Miller, CN safety and sustainability officer, said roughly 45% of its 1,100 locomotives are now equipped with distributed power capabilities. But he said not all its trains require distributed power, in particular the smaller, lighter ones that make multiple stops, and the longer, lighter trains that move empty cars from yards in Chicago to the West, for example.

That said, Mr. Miller said the railway has recognized the benefits that distributed power brings, both in efficiency and safety.

“We’ve just been into the distributed power since about 2004, so we’re relative newcomers in the industry to it,” he said. “But since getting into it, and seeing the advantages, it’s something we’ve moved toward very quickly in the past number of years.”

Two derailments at both CP and CN involving in-train forces are currently being investigated by the TSB, but CP said its investigations involve smaller trains. CN would not comment.

Mr. Miller acknowledged that the methods CN has adopted for marshalling its distributed power trains are similar to CP’s, but “not nearly as advanced.”

Mr. Miller said at this point he doesn’t see CN pushing its distributed power trains out much further than 12,000 feet, in part because the railway’s infrastructure is not built to accommodate trains larger than that.

“You never say never. Who knows what sort of technologies will come along?” he said. “We’re quite comfortable that we’re getting lots of productivity out of that, and our numbers sort of show that.”

CP goes the distance

There’s little doubt, however, that CP has become an industry leader in distributed power technology, and is currently pushing the boundaries on how long trains can safely reach.

CP has used distributed power, in its most basic forms, dating back to the 1960s on its coal trains out West. But its has made great strides in recent years lengthening its trains and building technology that ensures they are safely marshalled.

“In the last couple of years, we’ve undertaken some changes in the technology that has enabled us to go beyond those simple, or earlier distributed power models,” said Mike Franczak, CP senior vice-president of operations, in an interview.

At the forefront of these technological advancements is its so-called Train Area Marshalling [TrAM] software that allows it to model its trains before they are even built. TrAM lets CP simulate the sort of in-train forces its trains would experience across its entire network, taking into consideration things like the actual curves and gradation the trains will encounter. This allows the railway to plot the best marshalling for its trains, for each of its varied routes, before the steel wheels hit the rails, Mr. Franczak said.

CP has an industry-leading safety rating in North America for 11 of the past 13 years and Mr. Franczak says TrAM preparations are the big reason.

And CP hasn’t stopped pushing the boundaries. Currently, its largest trains reach 14,000 feet, but he said they could safely reach much greater lengths in the coming years.

“We’ve got lots of upside here,” he said. For example, he said CP aims to increase its potash trains to 170 cars in the near future from 124 currently, and its grain trains to 168 from 114.

At the same time, Mr. Franczak said the railway has been working closely with regulators to try to educate them about the science behind these larger trains, and will work closely with Transport Canada over the next two years on its study of longer, heavier trains.

“I would tell you definitively they are safe,” Mr. Franczak said. “I make no bones about it.”

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scdeveau@nationalpost.com