

2019–2020

CN Winter Plan

100
CN



CONTENTS

MESSAGE FROM JJ RUEST 4

EXECUTIVE SUMMARY 6

INTRODUCTION 8

INVESTING IN OUR NETWORK TO ENHANCE SAFETY AND FLUIDITY TO ENABLE GROWTH 11

PREPARING FOR THE 2019–2020 WINTER 14

OPERATING DURING WINTER 2019–2020 – CONSTANT IMPROVEMENT AND ADVANCED PLANNING ... 15

INNOVATIONS IN SAFETY 18

SUPPLY CHAIN CAPACITY UNDER WINTER CONDITIONS MANAGING THE VANCOUVER GATEWAY 19

CLOSING THE PORT OF THUNDER BAY 20

PARTNERING WITH OUR CUSTOMERS AND OTHER SUPPLY CHAIN PARTICIPANTS 21

CONCLUSION 23

MESSAGE FROM JJ RUEST

As CN celebrates our 100th year, it is with great pleasure that I present our Winter Plan for 2019–2020. It represents a crucial part of our commitment to meet the needs of our customers. As was the case last year, this Plan is an opportunity to explain the specific measures we have in place to minimize the impact of operating in difficult conditions.

While it is a fact that winter happens every year, anticipating how, when and where it strikes is definitely much less predictable. Although our Winter Plan cannot prevent the unpredictability of winter, we diligently prepare for winter by implementing specific measures to meet with the inevitable onset of extreme conditions.

Part of winter planning is looking back at the past winter and determining what worked well and what could have gone better.

As I look back at the winter of 2018–2019, two clear successes jump out at me:

First, the successful use of our innovative air distribution cars to offset the impact of temperature on the flow of air along the full length of the train. Second, the fact that during winter 2018–2019 (Dec 2018–Mar 2019) CN moved record volumes (as measured in billions of gross ton miles) in both Western Canada and across the whole CN network. This is in large part because of the capital investments we have made in our infrastructure in 2018 to meet the growing demands of our customers.

When I look at what could have gone better, you will recall, although CN's performance during winter of 2018–2019 started off very well, it dipped below our planned operating levels when we were hit in Western Canada and Northern Ontario by about six weeks of extreme and prolonged cold in the months of January and February. With temperatures dropping well below the tipping point of -25°C and in some areas well below -35°C , for safety reasons, we imposed Tier 3 and 4 restrictions on our operations.

As we always put the safety of our employees first, we halted operations at nighttime in certain parts of our network. Despite missing some of our weekly targets, this was the right decision to make. Once the most severe period of cold lifted, recovery to normal operations was relatively quick thanks to our capital investments and the hard work of the dedicated CN team.

This year, following on the heels of the 2018 investments, we continue to make strategic investments to enhance safety and



fluidity in order to enable growth. They include:

- continuing double tracking key corridors on our mainline in Western Canada to meet growing customer demands;
- upgrading and modernizing our fleet of locomotives and railcars;
- extending passing tracks and yard tracks;
- adding more air distribution cars for winter operations;
- hiring, recalling and training adequate crews; and
- innovating with new technologies to drive safety and productivity in all types of weather conditions.

Dealing with winter is about safety, resiliency and recoverability. All of these investments increase our capacity, which drives resiliency, as well as our ability to recover quickly after an incident or spate of extreme weather.

CN also welcomes the investments made by some of our customers and supply chain partners to expand their onsite footprints with loop tracks and greater onsite storage at both origin and destination terminals. We view preparing for winter and creating supply chain capacity as a shared responsibility. These investments are aligned with an end-to-end view of the supply chain that is critical for North America to fully realize its potential as a leader in global markets.

There are important other ways in which our customers and supply chain partners can help create capacity and resiliency. These include proactively managing their supply chain so that it does not exceed destination capacity; vigilantly maintaining onsite track so as to remove any buildup of ice and snow,

which could cause a derailment; working weekends to add up to 30% unloading capacity; and resisting the temptation to over-order empty railcars, which adds to congestions and underutilization of precious assets.

Because it is difficult to predict climate or customer demand, CN is preparing for extreme conditions as well as a shifting and unpredictable global trade environment for our customers. We know winter will not be without its challenges but we firmly believe that we are well positioned to once again meet the transportation needs of our customers this season.

In closing, we thank those who took the time to speak with us and share details of your 2019–2020 forecasts. It is unfortunate to see that leading up to winter 2019–2020 much of CN's perishable pre-winter capacity is going underutilized due to punitive trade tariffs on several Canadian export products, wet harvest conditions in some parts of the grain growing areas, high stumpage fees and weaker markets for Western Canadian forest products, and another drop in crude oil shipments.

We encourage others to share any insights into your end markets to assist us in more accurately planning our service and resources. This is invaluable to us and forms the base on which we plan our resources and our investments. CN also welcomes feedback from our customers, supply chain partners and other stakeholders on this plan. We believe that with our Winter Plan, CN is up to meeting the challenges we will face. It is part of our commitment to be the most effective, efficient and innovative railway in North America.



JJ Ruest
President and CEO

EXECUTIVE SUMMARY

CN has prepared this Winter Plan as required by the provisions of the Canada Transportation Act. The CN Winter Plan is based on four key pillars, which form the basis of our operating model for the coming winter and beyond. These are:

- **Safety** – Our unwavering commitment to safety, a core value at CN, underwrites all our decisions and planning. It is especially critical when it comes to our employees and the citizens who live in the communities in which we operate. Because difficult winter operating conditions pose significant challenges to railway air braking systems, we cannot compromise on the train length restrictions we self-impose at temperatures of -25°C and below.
- **Resilience** – Our ability to sustain operations with minimal disruptions through winter operating conditions.
- **Recoverability** – Our ability to recover more quickly from severe winter conditions and disruptions.
- **Partnering** – Our ability to accurately forecast and prepare for winter operations based on strong working relationships with our customers and supply chain partners.

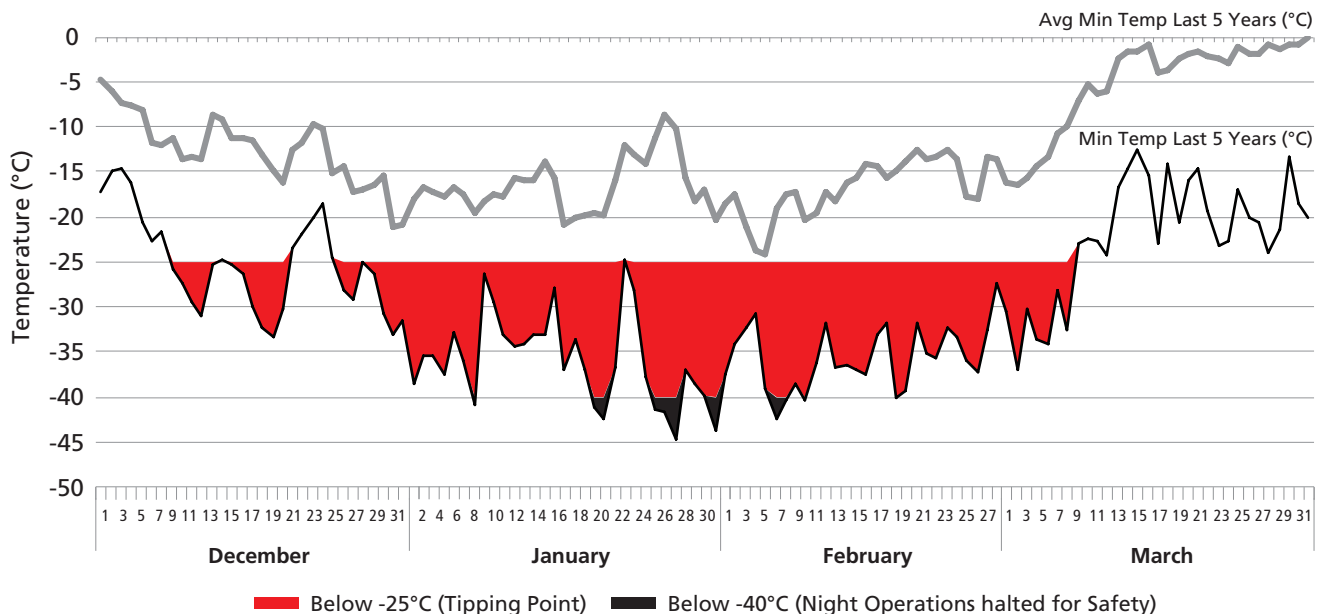
CN recognizes our responsibility to provide an acceptable level of service to all our customers throughout the year,

while ensuring we continue to operate in a safe and responsible manner. CN continues to put in place the following specific measures to meet these obligations:

- Working with our customers to better manage the supply chain and plan our resources
- Use of distributed power
- Use of air distribution cars
- Investing in technology to increase productivity and safety
- Increasing the number and quality of locomotives
- Investing in capacity to meet growing demand

In 2019 CN is investing a record \$3.9 billion focused on enabling growth in all areas of its business. This follows on the then record investment in 2018 for a two-year total of \$7.4 billion to expand network capacity, especially in Western Canada, which has seen the greatest increase in rail traffic. By ensuring we have the capacity to meet demand we also increase the resiliency and recoverability of our network. The value of these investments could be seen during the extended period of extreme cold in early 2019. The positive impact of the investments made in 2018 enabled CN to recover from disruptions more quickly than in previous years.

Average Winter Temperatures on CN's Mainline over the Last 5 Years
(January 2015–March 2019)

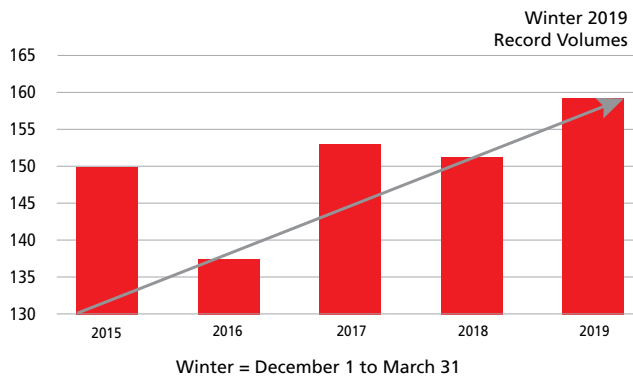


From Environment Canada

Key projects include the addition and lengthening of passing tracks, new sections of double track and increased yard capacity.

In preparing for winter 2019–20, CN continues to grow and modernize its locomotive fleet with the delivery of new AC locomotives from GE Transportation. We continue to recruit, hire and train new employees, while the large number of employees hired in 2018 have become fully qualified and have gained experience enabling them to contribute more fully to CN’s operations.

Winter Volumes (billions of GTMs)



When temperatures reach -25°C, railway technologies including steel rail, steel wheels and long compressed air brake systems become more vulnerable to problems that can disrupt normal operations. The most immediate consequence is the need to reduce train length to maintain safe operation of a train’s braking system. When trains are shortened, more crews and locomotives are required to move the same volumes of traffic. Shorter trains increase the number of trains leading to slower speeds and overall reduced efficiency of the rail network.

CN has a four-tier system for addressing the impact of severe winter temperatures and ensuring safe operations. The further the temperature falls below -25°C the more train length must be reduced. Below -40°C CN halts night operations to ensure the safety of our employees and reduce the risk of derailments.

CN has a number of measures, which we have implemented in recent years to better enable us to maintain train length as temperatures drop. The most valuable of these have

been the use of distributed power. It is achieved by placing an additional locomotive in the middle or at the end of a train to better enable air pressure to be maintained, and the use of air distribution cars to supplement the air supply to the train air brake system. Recognizing the cars’ positive impact on operations last winter, CN has increased its fleet of air distribution cars from 60 to 100 in preparation for winter 2019–20.

CN has led the rail industry with a number of key innovations in safety technology and systems. These include the development of automated car inspection portals, which complement manual inspections and lead to a safer more reliable railway. We have also invested in automated track inspection cars, which gather and analyze massive amounts of track condition data and automatically alert maintenance employees when a defect is detected.

CN works closely with our customers to ensure we have the accurate customer demand information required to enable us to make decisions as to where to best deploy capital, hire crews and how to allocate resources.

CN proactively communicates with customers providing advice on winter preparedness. We also provide updates on the impact of winter weather restrictions.

Recognizing the growth of traffic moving in and out of the Port of Vancouver, CN is particularly vigilant in managing the Vancouver Gateway during the winter months. CN holds traffic outside of the Lower Mainland until space is available so as to avoid congesting the area and negatively impacting overall capacity. CN has also worked with wood pulp customers and destination terminals to design a collaborative remedy for congestion issues, which are particularly problematic in winter.

Driven by our focus on innovation and investment, CN is confident that the measures outlined in this Winter Plan will enable us to maintain service and ensure safe operations through normal winter operating conditions and recover more quickly when severe winter weather does cause disruptions. We appreciate our customers’ and supply chain partners’ willingness to work with us to better enable us to identify ways to reduce the impact of the severe and prolonged winters, which inevitably will impact our service area.



INTRODUCTION

CN has prepared this Winter Plan as required by the provisions of the Canada Transportation Act.

The Plan does two things. First, it outlines the challenges CN faces operating in Canadian winter conditions. And second, it sets out the actions and innovations we have implemented to enable us to maintain our operations through the winter at a level acceptable to the needs of all our customers while ensuring we continue to operate in a safe and efficient manner. It serves as a framework to ensure we meet the needs of our customers and stakeholders in the challenging winter months ahead.

The Winter Plan is based on four key pillars, which form the basis of our operating model for the coming winter and beyond. They are:

Safety is the overarching core value at CN. It shapes our corporate strategy, guides our decisions and is a critical dimension of our Winter Plan. We have invested and continue to invest in our infrastructure and in training our people to drive safer operations and a culture of looking out for each other. Safety is also a shared responsibility. Together with CN, communities, customers and supply chain partners play a critical role in ensuring a safe environment for their citizens, their employees and our employees. Winter brings particular challenges and CN is committed to putting safety ahead of all other considerations.

Resilience – Our ability to sustain operations with minimal disruptions through winter operating conditions.

Recoverability – Our ability to recover more quickly from severe winter conditions and disruptions. It is an outcome that results from CN's record capital spending program over the past two years, which has been particularly focused on projects that enhance our ability to recover from disruptions.

Partnering – Our strong winter operations are very much tied to accurate forecasts, which result from strong working relationships with our customers and supply chain partners. Those relationships ensure that capital is deployed

in the right places where it will provide the greatest positive impact.

CN recognizes its responsibility to provide an acceptable level of service to all our customers throughout the year while ensuring we continue to operate in a safe and responsible manner. Winters in Canada and the northern United States vary in severity from year to year and from region to region and present significant challenges to railway operations.

The winter of 2018–19 was no exception as CN faced normal winter operating conditions across most of its network through the early winter. However, late January and February 2019 brought an extended period of severe cold across much of CN's Western Region, which had a significant negative impact on operations.

The capital improvements and aggressive hiring campaign CN completed during 2018 played an important role in meeting our customers' needs. It ensured CN was able to maintain normal winter operations until the worst of the severe cold hit and, despite the record period of extreme cold, still recover from the cold-weather disruptions more quickly than in previous years.

In 2019 CN has continued with its record level of investment in our network to further improve network capacity to meet our customer's needs. In doing so, we also increased both our operational resilience and our ability to recover from weather-related disruptions. We are confident that these investments will positively impact our ability to deal with the coming winter.





INVESTING IN OUR NETWORK TO ENHANCE SAFETY AND FLUIDITY TO ENABLE GROWTH

CN IS COMMITTED TO CONTINUOUS IMPROVEMENT OF OUR RESILIENCY AND RECOVERABILITY

In the rail industry, resiliency and recoverability are the two critical dimensions of operating efficiently and effectively in the winter months. Resiliency results from the ability to maintain operations by minimizing the effects of adverse conditions through a series of proactive measures. Recoverability is the ability to return to normal operations quickly following periods of disruption on the network.

In 2019 CN has followed up on its record level of capital investment in 2018 with a second consecutive record year. This year, CN is investing a further \$3.9 billion focused on enabling growth in all areas of its business. Over two years, CN will have invested \$7.4 billion to expand network capacity, resiliency and recoverability, especially in Western Canada, which has seen the greatest increase in rail traffic. This level of investment represents approximately 25% of CN's annual revenues. In other words, for every dollar earned in revenues in 2018–2019, CN reinvested about 25 cents back, mostly into our network and equipment.

Recent years have brought innovations that have had a significant positive impact on our ability to operate in winter conditions. The use of distributed power and air distribution cars are examples of innovations that have had a significant positive impact on CN's resilience, enabling us to maintain operations at a high level during normal winter conditions. We were particularly pleased with the positive benefit provided by the air distribution cars last winter and moved quickly to add an additional 40 of these cars to our fleet in 2019, bringing the total number on the network to 100. Air distribution cars are conventional boxcars equipped with large air compressors. These cars are positioned in the train to assist in supplying a consistent flow of air through the brake lines to the end of the train. CN proactively deploys air distribution cars during cold temperatures to avoid reducing train length when we cannot push air to the full length of the train.

RECORD INVESTMENT IN INFRASTRUCTURE

Again this year, CN is focusing on investments to enable a fluid network while accommodating a growing level of traffic. Key projects include the addition and lengthening of siding tracks where two trains can operate simultaneously,

adding new sections of double track and increasing yard capacity. These measures are key to both improving our level of resiliency and particularly to enabling CN to recover more quickly from the impact of extreme winter conditions.

The capacity improvements undertaken in 2019 include the following key investments:

Saskatchewan

- Construction of 10 miles of double track near Atwater, east of Melville;
- Construction of 10 miles of double track near Fenwood, west of Melville;
- Construction of 8 miles of double track near Biggar;
- Construction of 7 miles of double track near Clavet, southeast of Saskatoon.

Alberta

- Construction of 12 miles of double track between Leaman and Nilton, west of Edmonton;
- Construction of 5 miles of double track near Entrance, east of the Alberta-British Columbia border;
- Construction of 7 miles of double track near Greenshields, east of Edmonton; and
- Building new tracks at Scotford Yard northeast of Edmonton to increase yard capacity for growing local demand.

Manitoba

- Construction of 6.3 miles of double track near Exira, west of Portage la Prairie.

British Columbia

- Construction of a new train passing siding at Port Edward, close to Prince Rupert;
- Construction of 2.5 miles of double track west of Prince George; and
- Multi-year initiatives to increase capacity at the Port of Vancouver in collaboration with the Government of Canada and the Vancouver Fraser Port Authority.

- Other basic capital program elements have been focused on the replacement, upgrade and maintenance of key track infrastructure to improve overall safety and efficiency across our network.

CN has worked diligently through the construction season to ensure these projects are completed prior to winter.

Managing major infrastructure work on busy corridors is a highly complex task. It requires significant planning and resources, which CN has implemented. Inevitably, it also involves some disruptions of service to provide work crews with needed access to the network in order to safely construct the new tracks. It's a challenge that requires a balanced approach. It involves the need to maintain the speed and efficiency of our network in order to meet our customers' needs, while at the same time maximizing the work done during the limited construction season to ensure work is completed in time to help us meet the challenges of winter 2019–20. Of the 21 major capacity projects undertaken on our Canadian network this year, 19 are either complete or on track to be completed prior to the end of the year. The other two projects have faced delays due to weather and permitting issues but we are optimistic they will be completed by year end or early in 2020.

EXPANDING OUR FLEET OF MODERN LOCOMOTIVES

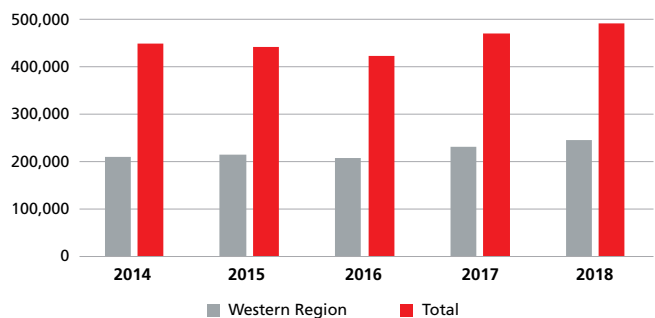
CN operates a fleet of approximately 1,600 high-/mid-horsepower locomotives. We are expanding the fleet with 260 locomotives purchased from GE Transportation. The first 200 of these locomotives have now been delivered with the additional 60 to be delivered in the remaining months of 2019 and early 2020.

During winter operations, locomotives tend to lose traction due to ice, snow and water, resulting in wheel slippage and less efficient operations. To deal with that issue, the new locomotives are 100% alternating current (AC) compared to direct current (DC). The AC locomotives are able to maintain greater overall horsepower by disabling the wheel that senses the slippage and rebalancing the horsepower among the remaining traction motors. AC locomotives are used across our network, including in corridors with higher grades and more exposure to difficult operating conditions.

OPERATING CREWS

Coupled with CN's record capital investments has been a parallel and complementary strategy to invest in human resources. As a result, CN is well positioned from a crew base perspective to meet anticipated levels of traffic moving on its network over the course of the winter of 2019–2020. CN undertook an aggressive hiring campaign in 2018 to ensure that sufficient crews were in place for the 2018–2019 winter season. This campaign added 18% more qualified crew employees to CN overall on a year-over-year basis, with a concentration of 26% more crews in Western Canada. These added crews were key in helping CN deal with the operating challenges caused by the extreme cold in February 2019. As the new crews have become fully qualified and have gained more experience through 2019, their positive impact on CN's operations has grown.

Gross Ton Miles (billions)



CN continues to recruit, hire and train new employees. Both of CN's state-of-the-art, purpose-built campuses, located in Winnipeg, MB, and Homewood, IL, continue to graduate employees into Transportation (conductors and locomotive engineers), Engineering (track and maintenance of way) and Mechanical (car and locomotive repairs). These employees will replace those retiring and increase our base in key areas of higher demand.



PREPARING FOR THE 2019–2020 WINTER



Severe cold and heavy snowfall present significant challenges for railways. All outdoor businesses and particularly the transportation sector face challenges dealing with severe weather conditions. However, railways face unique challenges. They must deal with some particular issues relating to the realities of their steel-on-steel operations and their air brake systems. These systems make railways particularly vulnerable to extreme cold. Steel wheels and rail are more susceptible to breakage during the winter. Coupled with that are the growing challenges of moving air for the braking system through the trains as temperatures drop. Railways operating primarily in warmer southern regions rarely have to deal with these issues. But for CN and others operating in Canada and the Northern United States, extreme cold weather conditions provide an ongoing challenge.

THE TIPPING POINT (-25°C)

The tipping point in terms of difficult operating conditions is -25°C. Below that temperature, railway technologies – steel rail, steel wheels, and long compressed air brake

systems – become more vulnerable to problems that can disrupt normal operations. Welded rails become less flexible, frozen gaskets leak air at brake hose couplings, ice crystals wear down wheel treads, air hoses freeze and air cannot move consistently through the full length of the compressed air system.

In Western and Northern Canada, the reality is that temperatures below -25°C happen every winter. Railways must prepare for and adjust to the temporary operational impacts those temperatures have on speed, fluidity, and effective capacity.

The consequences of winter-prompted issues can have multiple and cascading effects. Chief among them is that overall train speed is reduced because of an increased number of delays caused by broken rails, switch and signal malfunctions, equipment failures, and a host of other factors. CN has produced a video, "The Tipping Point," which explains the impact of winter on rail operations: <https://www.cn.ca/en/media/video-gallery/>.

OPERATING DURING WINTER 2019–2020

CONSTANT IMPROVEMENT AND ADVANCED PLANNING

When temperatures reach -25°C the cold has a cascading and debilitating effect on the rail system.

The most immediate consequence is the need to reduce train length to maintain safe operation of a train's braking system. To work properly, a train's brakes rely on sufficient air pressure through the length of the train. The extreme cold interferes with maintaining the proper air pressure. As a result, trains must be shortened for safety reasons. For example, a 10,000-foot train may be restricted to 7,000 feet. The 3,000 feet of left-behind traffic still needs to move on a new train. When trains are shortened, more crews and locomotives are required to move the same volumes of traffic. The result is backups leading to congestion in the rail yards and on-line delays. If such extreme conditions continue for long periods, there is a ripple effect and adding more trains and crews is detrimental to efforts to regain fluidity. Across large parts of CN's network, resources to move additional trains are stretched and capacity is diminished. The shorter trains increase the number of trains, which are moving at slower speeds, which reduces the efficiency of the system during difficult operating conditions. In winter 2018–19 CN's network experienced significantly colder temperatures than the previous year, with about a 65% increase in nights below -30°C . Furthermore, there were 16 nights where we experienced temperatures below -40°C causing us to halt night operations to keep our employees safe and mitigate the risk of derailments (vs. zero instances the previous year).

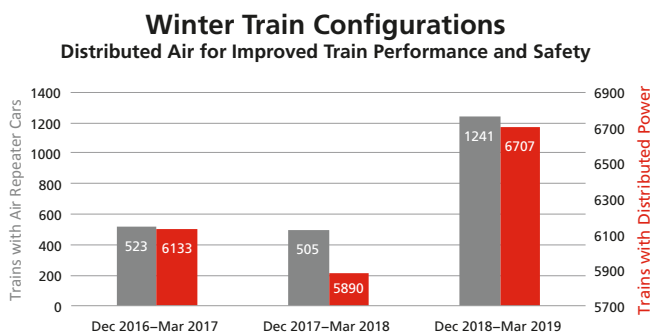
DEPLOYING RESOURCES TO MAINTAIN TRAIN LENGTH

One of the primary factors that reduces rail capacity and efficiency in winter is the need to reduce train length as temperatures fall. In its ongoing efforts to improve resiliency and minimize the impact of normal winter conditions, CN continues to invest in technology and make operational changes to enable us to maintain train length to the greatest degree possible.

As temperatures fall we have several important innovations in place to reduce the impact of cold temperatures on braking systems and minimize the needed reduction in train lengths.

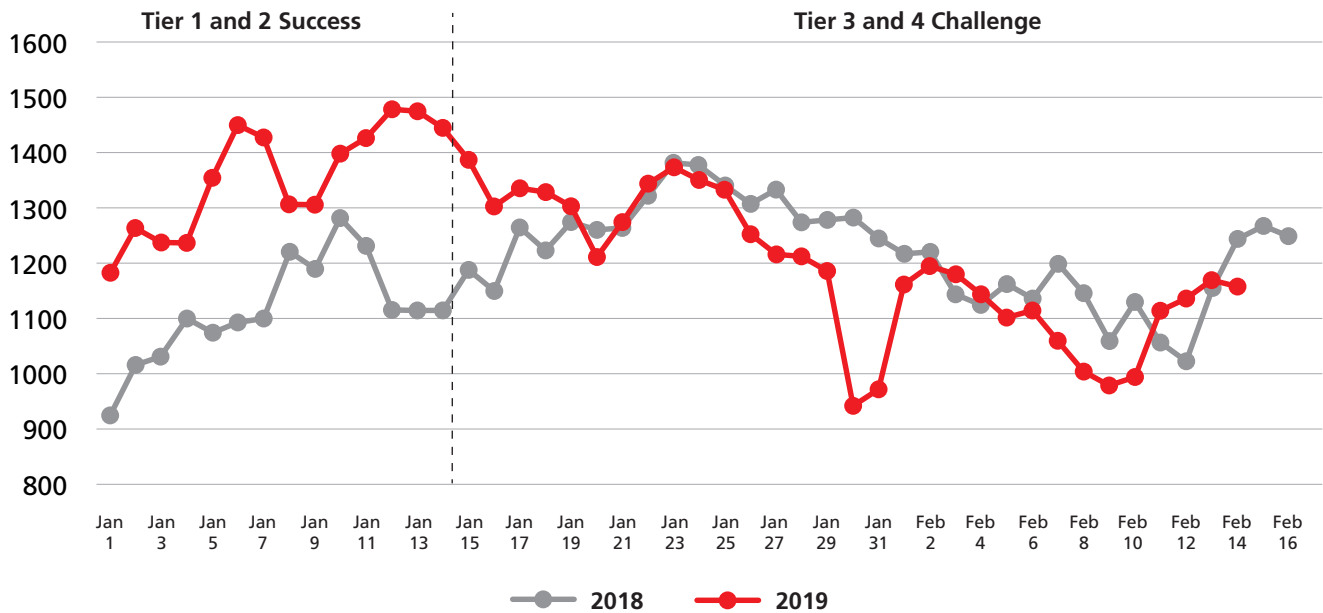
Distributed Power

Placing an additional locomotive in the middle or the end of a train enables air pressure for brakes to be maintained at required levels, even in extreme cold temperatures. This is called distributed power and is very effective for winter operations because the distribution of locomotives can minimize the requirement for reducing train lengths for safety reasons. CN now uses distributed power in some of its operations year round. Beginning November 1, our usage increases particularly on trains operating in Western Canada, positioning the right equipment early and prior to winter to limit impact on train operations whenever cold arrives.



CN has been working with an air brake company to maximize the benefits of distributed power and air distribution cars. By locating the mid-train air source in the optimal position and defining the maximum car length for various types of trains at a range of temperatures we expect to be able to minimize air issues and increase our resiliency from past winters. The benefits of the use of distributed power and air distribution cars are significant. On average, at -30°C we are now able to run trains 40% longer than we were prior to the use of distributed power and air distribution cars.

Daily Volumes (GTM millions)



The innovation of air distribution cars has proven to be a successful tool for Tier 1 and 2 (as demonstrated in the chart above) where CN moved more gross ton miles in 2019 despite colder temperatures than the previous year. In Tier 3 and Tier 4, temperature and volumes decrease in lockstep.

Air Distribution Cars

Air distribution cars are CN-modified boxcars containing air compressors and associated equipment. They supplement the air supply to the train air brake system, in a similar manner to locomotives under distributed power and with similar benefits. The air distribution cars have proven to be one of the most effective innovations in dealing with cold. CN has added 40 additional air distribution cars to our fleet as we prepare for the winter of 2019–20. This brings the total number of air distribution cars in our fleet to approximately 100, five times the number we operated as recently as two years ago. This significant increase in the number of air distribution cars will further reduce the impact of cold temperatures in winter and improve service reliability by enabling CN to maintain train lengths.

Air Gaskets

Each air hose connector between cars contains a rubber gasket. As they wear down and freeze, they become less effective and more air escapes from the brake system. CN is changing gaskets systematically as part of its normal car inspections to increase effectiveness. We are continuing with our research to identify and implement additional options and new materials

that can increase the efficiency of gaskets in cold temperatures.

LOCOMOTIVE RELIABILITY AND DEPLOYMENT

Locomotives provide the power needed to keep a railway moving and CN is now measuring and improving the reliability of each locomotive through key performance indicators. We deploy locomotives with the objective of maintaining network fluidity, limiting delays caused by on-line locomotive failures, especially in critical corridors.

Backup Power Generators

In winter, electrical power failures are more frequent and can slow down operations when they prevent the proper functioning of safety or track equipment, such as railway signals. We are acquiring additional generators that will be deployed across our system in the event of public utility power failures. By being readily available, the generators will allow critical operations to continue even during localized or widespread power failures.

Track and Signal Repair Teams

When train dispatchers receive notification of a potential rail break in the form of a block signal indicating STOP for no apparent reason, there are typically two



Saint-Lambert, Quebec

reasons why. It can either be a real problem with a piece of rail, or the result of a signal malfunction. Typically, signal maintenance employees are deployed first to investigate, followed later by track crews if a rail problem is identified. In winter, however, signal employees and track repair crews will be simultaneously deployed to the affected area to take immediate and effective action regardless of failure mode.

While snow is a challenge to winter operations, its impact is generally viewed as secondary to the effect of cold. Snow nevertheless can disrupt rail operations. When large snowfalls hit a region, trains are forced to slow down or even to stop, resulting in delays. Snow clearing in rail yards is time consuming as it requires extra switching and uses up precious resources, including engines and manpower. These delays, combined with extended cold snaps prompting shorter trains, can compound across the network.

CN has a four-tier system for addressing the impact of severe winter temperatures and ensuring safe operations under these conditions. The following chart shows CN's train length safety-driven policy for cold-weather operations. Reductions in train length are required once temperatures are -25°C or below.

Maximum Train Length Based on Ambient Temperature

	Above -25°C	Tier 1 -25°C to -30°C	Tier 2 -30°C to -35°C	Tier 3 Colder than -35°C	Tier 4 Colder than -40°C
Head End Power					
Unit train	10,000	8,800 -12%	6,000 -40%	4,500 -55%	*
Carload train	10,000	7,000 -30%	6,000 -40%	4,500 -55%	
Intermodal train	12,000	8,800 -33%	6,000 -50%	4,500 -63%	
With Distributed Power					
Unit train	11,300	11,000 -3%	9,000 -20%	7,500 -34%	*
Carload train	11,300	10,000 -12%	8,500 -25%	7,000 -38%	
Intermodal train	14,000	12,000 -14%	10,500 -25%	8,500 -39%	

*No new train starts at night for safety reasons.

INNOVATIONS IN SAFETY

CN is at the forefront of innovation in new safety technology and systems. These innovations are of particular importance in winter operations when broken equipment is more common and the resulting delays can multiply, impacting service across large portions of the network. We continue to make major investments in innovations to improve our safety, reliability and efficiency.

AUTOMATED CAR INSPECTION PORTALS

CN's Automated Inspection Portals will modernize the railcar inspection process by pairing high-resolution imaging hardware with artificial intelligence. Using the latest in machine vision applications, the system complements manual inspections and helps our expert carmen maintain our fleet with more efficiency, leading to a safer and more reliable railway with fewer disruptions. We will have seven portals in operation by the end of 2019. These portals will be of particular value in extreme temperatures improving workforce utilization and increasing employee safety. In addition, with approval from the regulator in the coming years, there are anticipated future benefits from eliminating time-consuming manual Certified Car Inspections (CCIs).

AUTOMATED TRACK INSPECTION PROGRAM

CN is investing in specially equipped railcars using the latest sensor and AI technology. These automated track inspection cars move in regular train service at track speed gathering and

analyzing massive amounts of track condition data. When a defect is detected, an alert is automatically sent to track maintenance employees. The use of this technology in regular train service increases inspection frequency, quality and leads to more accurate preventative maintenance to support our safety agenda.

Furthermore, this consistent and objective data collection system supports predictive maintenance capabilities, improving service reliability by reducing track disruptions and reducing the time required for manual inspections. All of these benefits ultimately free up additional capacity that can be used to move our customers' traffic. CN will have eight of these units in operation before the end of 2019–2020.

HOTBOX DETECTORS

Hotbox detectors located on the side of railway tracks monitor the condition of wheel bearings on railcars to identify overheated components before they reach temperatures that can lead to failure. We have such detectors every 15 to 17 miles on our mainlines, and have increased the reliability of information provided by those detectors by linking the information received from each of them. This allows the data to be aggregated and trends identified as trains operate on CN lines. With the data, action can be taken before problems develop, improving safety, efficiency and effectiveness. Our winter preparation program also includes the replacement of suspect wheel sets to prevent accidents.



Ste. Anne, Manitoba

SUPPLY CHAIN CAPACITY UNDER WINTER CONDITIONS MANAGING THE VANCOUVER GATEWAY

CN is particularly vigilant in managing the Vancouver Gateway during the winter months. The growth of traffic moving in and out of the Port of Vancouver places heavy demands on the rail system in the Lower Mainland. It is a region constrained by both geography and urban growth and where competition for access to existing capacity does

not put a priority on rail. CN often holds traffic outside of the Lower Mainland until space is available so as to avoid congesting the area and negatively impacting overall capacity. Our ability to recover from disruptions further inland is negatively impacted if the Lower Mainland becomes congested.



Jasper, Alberta

CLOSING THE PORT OF THUNDER BAY

Ice buildup every year closes the St. Lawrence Seaway System, with shipping normally ending the last week of December and not reopening until late March. But the exact dates entirely depend on weather conditions. With the closure of the St. Lawrence Seaway System comes the closure of the Port of Thunder Bay during the three-month peak period of grain shipments.

That lost capacity of more than 2,500 grain carloads per week cannot be replaced by redirecting all those shipments west to Prince Rupert or Vancouver. Instead, customers shift demand to St. Lawrence area locations or to the U.S., alternate destinations that involve much longer distances and cycle times.

An average move from Eastern Saskatchewan to a terminal in Montreal is approximately 1,200 rail miles longer than the move to Thunder Bay, while the movement to Vancouver is

750 miles longer and Prince Rupert is 950 additional miles. This extra distance directly impacts how quickly cars can be returned to Western Canada for loading and reduces weekly available capacity.

WINTER LOADING CHALLENGES ON THE WEST COAST

It is not just snow and cold. Frequent rain at the Port of Vancouver, particularly during the winter months, impacts Canada's logistics supply chain, particularly in grain. Grain cannot be loaded in the rain with vessel cargo hatches open. While some terminals are equipped to load vessels that have grain feeder holes, other terminals do not have this option. Even when this option is available, it remains subject to the authorization of the ship's captain and loading productivity is always reduced compared to free loading into open cargo hatches.



PARTNERING WITH OUR CUSTOMERS AND OTHER SUPPLY CHAIN PARTICIPANTS

Effective winter planning depends heavily on having accurate information on customer demand. CN relies on its own forecasting combined with forecasts provided by customers to make decisions as to where to best deploy its capital, where and when to hire crews and how to allocate its assets. Unanticipated growth in demand is always difficult to manage given the long lead time required to acquire locomotives and cars and to hire staff. However, in winter when difficult operating conditions inevitably impact capacity, good forecasts are even more essential.

CN also works with our customers to ensure the effective management of their supply chains as the best way to avoid congestion. At the Port of Vancouver, CN has worked with its wood pulp customers and waterfront destination terminals to design a collaborative remedy for congestion issues, which are particularly problematic in the winter. CN, with the cooperation of our customers, has initiated a collaborative program aimed at ensuring that demand for railcar spotting at participating terminals in Vancouver will not exceed their daily operational unloading capacity. Through this program, CN and our customers believe we will avoid congestion, which can quickly escalate and impact the vital corridors to the Port of Vancouver.

The always challenging task of trying to forecast demand for rail services across a wide range of sectors has been greatly exacerbated by the current uncertainties surrounding global trade and the economic outlook in general.

In 2019, CN has seen a significant impact on traffic as a result of tariffs, trade restrictions and a range of unpredictable events. Our customers and CN traffic levels have been impacted by abrupt changes in demand, geopolitical realities like the still unresolved softwood lumber dispute, the yet to be ratified replacement to NAFTA, the Chinese ban on Canadian canola and Indian tariffs on peas and lentils, the tariffs and uncertainties currently impacting trade between the United States and China and the volatility of oil and frac and movements due to issues regarding pipeline capacity have all exacerbated the normal challenge CN and its customers face trying to predict traffic volumes.

While many customers work closely with us to try to forecast traffic in these challenging times, some customers still maintain the position that given our common carrier obligation to move their goods, they do not have to provide CN with traffic forecasts. While technically true, this positioning makes it even more difficult for CN to plan asset levels and appropriate deployment of crews and equipment across our network. While always challenging, these forecasting issues are even more problematic when already dealing with the uncertainties of winter operations.

CN continues to work with our customers encouraging them to take measures to assist in our operating efficiency in winter by installing and operating air compressors in their facilities. With this equipment, railcars being picked up are coupled together and already have the needed air pressure in the brake lines for safe operation of the train's brakes, reducing the time it takes to prepare a train for departure. This increases overall efficiency. CN provides incentives to encourage customers to make this positive investment in efficient winter operations.

Before winter starts, CN proactively communicates with our customers about winter preparedness, providing advice on a variety of steps customers can take to prepare their tracks and employees for the oncoming season and the need for increased safety vigilance. During the winter season, these communications include updates to customers on the impact of winter weather restrictions to our customers. Corridor-by-corridor winter impact is provided on our website and customers receive personalized information on our notification system and through our service delivery centres.

A snapshot of CN's corridor-by-corridor winter impact information:



CONCLUSION

Winter and the often extreme cold it brings is simply a fact of life in Canada. CN believes it is up to the challenge that winter presents. Our Winter Plan puts in place the strategy and specific measures to help alleviate the challenges that cold weather will inevitably bring to the rail system. It reflects our ongoing commitment to innovate and invest in a way that enables us to more effectively deal with the realities of winter operations.

As outlined in this Plan, our record level of investment in 2018–19 enhanced our resilience and recoverability enabling us to deal effectively with the record cold we faced in late January and February of this year. We are convinced that our new record level of capital spending in 2019 will further increase our capacity and thereby also enhance our winter operations. The added miles of double track, new and lengthened sidings and additional air distribution cars will be particularly valuable in this regard.

We appreciate our customers' willingness to work closely with us to ensure we can constantly improve our ability to manage the challenges that inevitably come with operating through Canadian winters. We recognize that they expect us to continue to meet their needs throughout the year and when disruptions occur, to be able to recover quickly while keeping them informed of the status of their shipments. It is our belief that this Winter Plan provides the basis for us to meet and exceed their expectations.

100
CN

cn.ca/winterplan