2018-2019

# CN Winter Plan

*Building Resiliency*

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# MESSAGE FROM JJ RUEST

We are very pleased to present our Winter Plan for 2018-19. When we published our Grain Plan in July of this year, I confirmed our commitment to regain the confidence of the business community, and enhance Canada's reputation as a reliable export partner.

We acted on this commitment with a Company-wide targeted focus on initiatives that will assist CN for years to come, but particularly during the coming winter months. We increased our overall capital investments to a record $3.5 Billion for 2018. We are on schedule to complete an investment of $400 Million in infrastructure projects by the end of 2018 for the specific purpose of building resiliency by increasing train throughput velocity at strategic locations in Western Canada. Likewise, we have increased our resources by hiring 1,200 additional crew members, expanding our locomotive fleet and tripling the number of air repeater cars that help maintaining train length during the severe cold. We are investing capital and innovating across multiple dimensions, to reduce winter related bottlenecks and failures.

The Winter Plan is an opportunity to explain the measures we have put in place to minimize the impact of operating in difficult conditions. As you will see, we have reinforced our commitment. Our attention is on preparing for the coming months of December to March. We significantly improved our performance since March of this year but we do remember last year's challenges and have assigned resources to the task.

We are a proud North American company with very deep Canadian roots and as our geography dictates, we are taking the challenges of winter head on. We have taken action and we continually work to ensure we are ready. The following describes our strategy and ongoing efforts to deliver for our customers and Canada's economy.

**JJ Ruest**
President and CEO

# INTRODUCTION

As part of our commitment to meet the needs of our customers, including grain customers, we are outlining our Winter Plan that will form the cornerstone of our operations in the coming months. In July of this year, consistent with the requirement of the Government of Canada, CN filed its 2018-2019 CN Grain Plan "Moving Canada's Grain." We are now taking the next step.

The objective of CN's Winter Plan is clear. It is to build resiliency and minimize the impacts of difficult operating conditions on the CN rail network. We are taking direct action to help deal with the challenges in a way that meets the needs of our customers.

In recognition of the level of service owed to all railway customers, we are required to provide a winter plan that describes the measures CN has taken to **move grain along with other traffic such as potash, forestry products or manufactured goods**, when faced with difficult operating conditions. We target systemic issues associated with rail operations in winter to maintain a proper balance of resources to move all commodities. We understand and embrace our responsibilities to our customers and Canada's economy. From new capacity resulting from infrastructure investments, the hiring of new employees or the acquisition of new equipment, we needed to act and this Winter Plan explains what we have done to prepare, and what we will do tactically when our network and operation is inevitably affected by winter conditions in the coming months.

Our Winter Plan is realistic. It recognizes the variable, uncontrollable factors that can make rail operations in the winter months far more challenging than during the rest of the year. The effects of extreme cold or heavy winter snowfall, coupled with the loss of port export capacity in Thunder Bay in the case of our grain exports, puts significant pressure on the effectiveness and efficiency of rail service. CN understands nevertheless that it must provide reliable, efficient and timely rail delivery for all its customers. Given those realities, CN's Winter Plan is designed to maximize its operational capacity to meet the needs of all our customers during the cold winter months.

# PREPARING FOR THE 2018-2019 WINTER – BUILDING RESILIENCY

In the rail industry, resiliency is the ability to maintain operations by minimizing the effects of adverse conditions through a series of measures. Targeting multiple risks and opportunities, CN has been preparing for the 2018-2019 winter for months now with our largest-ever capital expansion program of $400 Million to add new infrastructure needed to boost the railway's capacity and network resiliency. We are confident this will eliminate many network bottlenecks which tend to manifest themselves during winter as losses of throughput velocity. The addition of new locomotives, rail cars and hundreds of new crew members across the network are also keys to preparing for the upcoming winter.

**NEW LINE AND TERMINAL CAPACITY – ON TARGET**

When more trains operate on the network under difficult operating conditions, a key to maintaining the fluidity of movements is infrastructure improvements, such as siding tracks where two trains can pass and operate simultaneously. As well, adding double track and yard capacity improves network resiliency, which in turn allows CN to better manage through, and recover from, unplanned network disruptions.

We are investing $400 Million to build 20 new infrastructure projects across Western Canada. The projects are progressing on schedule toward completion by the end of 2018. They will improve capacity and winter resiliency by eliminating known bottlenecks on key main line corridors. They include additional long passing sidings and additional sections of double track – both of which allow additional trains to operate over a corridor while minimizing delay – as well as terminal capacity expansion projects.

*Saskatchewan*

- Construction of 10 miles of double track just east of Melville; about 7 miles of double track west of the Saskatchewan-Manitoba border; about 11 miles of double track near the Alberta-Saskatchewan border and new track capacity at CN's Melville Yard.

*Alberta*

- Construction of 12 miles of double track west of Edmonton across Parkland County; about 7 miles of double track near Wainwright, east of Edmonton; about 7 miles of double track near Tofield, east of Edmonton; about 11 miles of double track near the Alberta-Saskatchewan border; a new bypass track at Walker Yard in Edmonton; new storage and bypass tracks at Scotford Yard northeast of Edmonton; and new track capacity at CN's yard in Swan Landing.

*Manitoba*

- Adding a dozen new and extended tracks within Symington Yard in Winnipeg.

*British Columbia*

- Construction of 4 new passing sidings between Prince Rupert and Jasper, Alberta; extension of 3 existing passing sidings between Prince Rupert and Jasper; and extending a siding north of Kamloops on CN's Vancouver to Edmonton corridor.

These projects are important to increase the resiliency of our network. More trackage at strategic locations increase our overall capacity and enable us to maintain the movement of trains when difficult operating conditions would otherwise affect our operations.

Other basic capital program elements such as replacing and upgrading track infrastructure to improve overall safety and efficiency also are key to preparing CN's network for winter operations.

**Our largest-ever capital expansion program of $400 Million will add new infrastructure needed to boost our capacity and network resiliency.**

**By the end of 2019, CN will have added 200 new locomotives to its fleet since the end of the 2017-2018 winter.**

### 1,250 MORE CREW MEMBERS READY FOR WINTER

We have added hundreds of conductors to the field so far this year, with a particular focus on crews in Western Canada in anticipation of peak demand to move grain and other commodities to market during the winter months. Approximately 1,250 additional new qualified conductors will be in the field network-wide before winter, compared to heading into the 2017-18 winter. This will bring our total number of qualified conductors and locomotive engineers to approximately 7,800. More crews will enable us to maintain our operations when winter conditions require additional resources.

### EXPANDING OUR LOCOMOTIVE FLEET

We are buying 260 new locomotives over the next three years from GE Transportation. CN is the only North American railway company acquiring such a large number of locomotives and the purchase is a major component in our capacity expansion. The first 60 new locomotives will be in service by the end of 2018 with dozens more coming early in 2019. By the end of 2019, CN will have added 200 new locomotives to its fleet since the end of the 2017-2018 winter. CN operates a fleet of nearly 1,900 high-horsepower locomotives of 3,000 horsepower or greater, which includes 130 additional locomotives leased last winter. Such an investment speaks to CN's commitment to serve its customers under challenging conditions by having more resources to move traffic.


PHOTO CREDIT: GE


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# OPERATING DURING WINTER 2018-2019 – TACTICAL READINESS

Difficult operating conditions represent an everyday challenge to railway operations. CN has prepared a number of measures to reduce the number and severity of weather-related disruptions and react quickly to minimize the consequences.

## MAINTAINING TRAIN LENGTH

We have several important methods 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. This year, CN started applying distributed power on trains operating in Western Canada on September 15, positioning the right equipment early and prior to winter to limit impact on train operations whenever cold arrives.

### *Air repeater cars*

Air repeater 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. In the winter of 2017-18, CN operated with 20 air repeater cars and in 2018-19 we will triple the number of air repeater cars in operation. Approximately 45 air repeater cars will be deployed in the Prairies where the impact of cold temperatures is the most significant with the remaining 15 assigned to locations on an as-needed basis. This significant increase in the number of air repeater cars will 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, or gladhand, 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 doing further research to identify and implement additional options and new materials that can increase the efficiency of gaskets in cold temperatures.

## RESPONDING WITH RAPID-DEPLOYMENT TEAMS

For the 2018-19 winter, we have established rapid-deployment teams made up of dedicated managers from relevant departments available to quickly take action when a service disruption occurs. The newly structured rapid-deployment teams result from lessons learned in 2017-18 and form a critical new component of CN's Winter Plan. They will include staff to rework train schedules, develop work and contingency recovery plans to deploy and manage needed equipment and repair crews.

## LOCOMOTIVE CAPTIVE 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.

## BACK UP 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 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.

# PREVENTATIVE MEASURES TO AVOID RAIL INCIDENT

The prevention of accidents is critical for safety reasons and for preventing operational disruptions, especially during winter when the resulting delays can multiply. CN uses a number of methods to prevent incidents from happening. They include:

### INSPECTING TRAIN CAR WHEELS - HOTBOX DETECTORS

Hotbox detectors located on the side of railway tracks monitor the condition of wheel bearings on rail cars to identify overheated components before they reach temperatures that can lead to failure. We have such detectors every 15 to 17 miles on our main lines. This year we 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.

### TRACK INSPECTIONS

We are executing a more substantial proactive track inspection program on the busiest corridors to identify and repair potential track defects before winter. Inspections will be completed by October 31, enabling CN to take preventive actions and reduce the risk of incidents caused by track problems in cold conditions.

# SUPPLY CHAIN CAPACITY UNDER WINTER CONDITIONS

**Frequent rain at the port of Vancouver, particularly during the winter months, impacts Canada's logistics supply chain, particularly in grain.**

### CLOSING THE PORT OF THUNDER BAY

Ice build up 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 re-directing all those shipments to Prince Rupert or Vancouver because those corridors are already at capacity. Instead, customers shift demand to St. Lawrence area locations or to the U.S., alternate destinations that involve much longer distances and cycle times. This directly impacts how quickly cars can be returned to Western Canada for loading and reduces weekly available capacity.

### 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 reduced compared to free loading into open cargo hatches.

# THE IMPACT OF CLIMATE ON RAIL TRANSPORTATION

**Severe weather can cause plant closures, equipment failures and changes in human performance.**

All transportation systems are climate-sensitive. These sensitivities can translate into infrastructure damages and deterioration, disruptions to operations and unsafe operating conditions. Winter factors in all outdoor industries across the Canadian economy, resulting in a significant loss in productivity. For those involved in transportation and logistics, severe weather can cause plant closures, equipment failures and changes in human performance.

Climate affects us all, including railway infrastructure, equipment and people.

# RAILROADING THROUGH THE CANADIAN WEATHER

**Below -25°C, railway technologies – steel rail, steel wheels, and long compressed air brake systems – become more vulnerable to problems that can disrupt normal operations.**

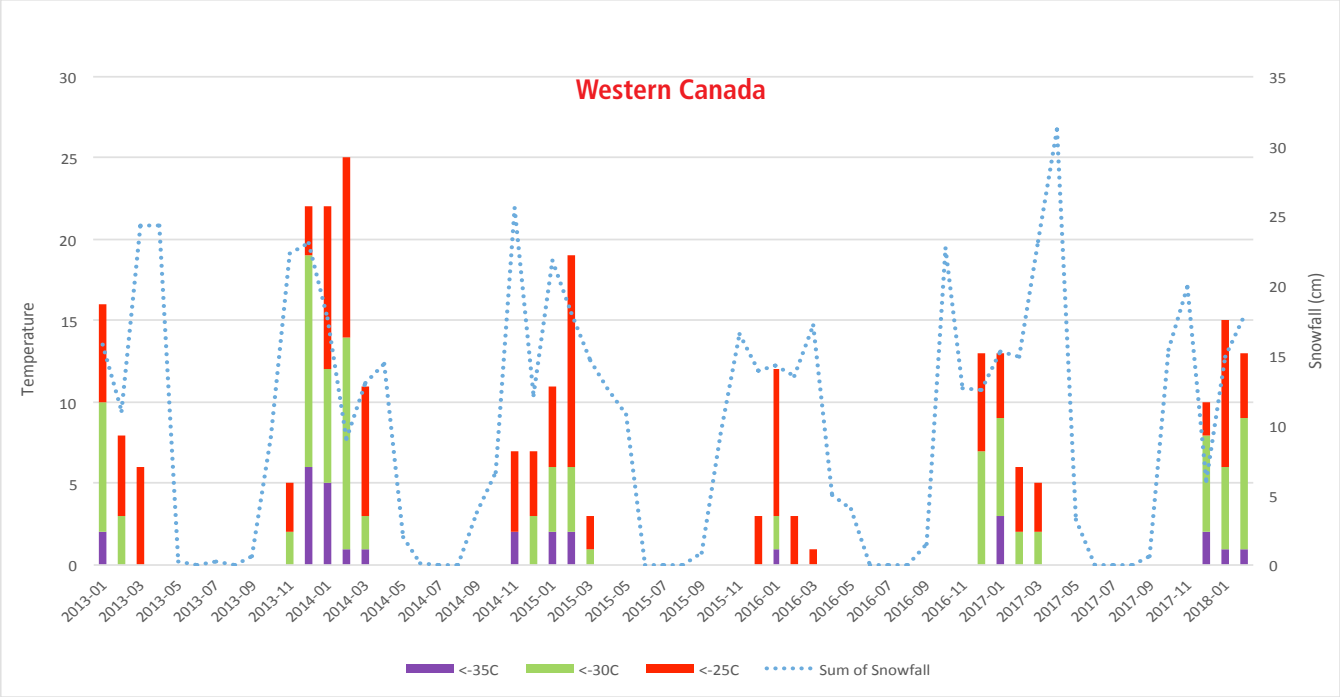
Difficult operating conditions uniquely affect railways due to the fundamental technology of rail transport. The efficiency of railway operations stems from the low degree of friction between steel wheels on steel rails. This advantage for efficient long-haul transportation is tested in extreme conditions by the very nature of this mode and the equipment and infrastructure the mode uses.

**The tipping point (-25°C) – Vulnerability of rail movements**

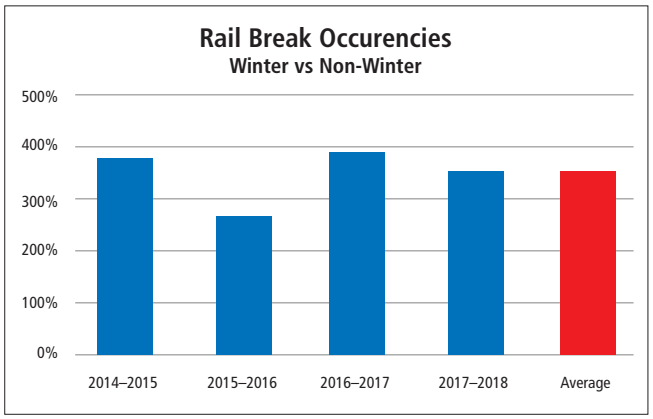
The tipping point in terms of difficult operating conditions is -25°C. Below that temperature, railway technologies – steel rail, steel wheels, and long compressed air brake systems – become more vulnerable to problems that can disrupt normal operations. Welded rails become less flexible, frozen gaskets leak air at brakehose couplings, and ice crystals wear down wheel treads.

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

The following graph illustrates the variability of temperatures in Western Canada along with snow volumes from 2013 to the 2018 winter.



The impact of cold temperatures is significant. For example, in the last five years, train speed was reduced on average by 10% between December and March in comparison to other months of the year. Likewise, rails break more frequently in the winter, causing outages and delays associated with repairs.




The consequences of winter-prompted issues can have multiple and cascading effects. Chief among them is that overall train speeds are reduced because of an increased number of delays caused by broken rails, switch and signal malfunctions, equipment failures, and a host of other factors.

## TRAIN LENGTH RESTRICTIONS – MORE RESOURCES TO MOVE SAME VOLUMES

When temperatures reach -25°C, the most immediate consequence is the need to reduce train lengths 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 that air pressure, making it harder to maintain. 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 delays. If such extreme conditions continue for long periods, there is a ripple effect. 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.

The following chart shows CN's train length safety-driven policy for cold-weather operations. Reductions in train length are required as soon as temperatures below -25°C are anticipated.

| Maximum Train Length Based on Ambient Temperature | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Above -25C | -25C to -30C | | -30C to -35C | | Colder than -35C | |
| **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% |

While snow is a challenge to winter operations, its impact is generally viewed as secondary to the effects of cold. Snow nevertheless can disrupt rail operations. When large snowfalls hit a region, trains are forced to slow down or even stop, resulting in delays. These delays, combined with extended cold snaps prompting shorter trains, can compound across CN's network.

# PARTNERING WITH OUR CUSTOMERS

Our customers can assist in operating efficiently in winter by installing and operating air compressors in their facilities. With this equipment, rail cars being picked up can already have the needed air pressure 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 taking this win-win option.

# CONCLUSION

As described in this Winter Plan, CN is making investments and taking action as we work with supply-chain partners to increase our resiliency and achieve logistics system improvements that meet the challenges of a Canadian winter. We are proud to have large Canadian operations. We understand and accept that this means facing weather related challenges in the winter months. We know our customers understand this as they face similar challenges during the same period. Understanding the challenges of operating in winter, they have made their expectations clear. They do expect our best effort in the form of a plan that contemplates the reality of winter, which meets and exceeds their adjusted expectation. With that consideration uppermost in our mind, we respectfully submit this Winter Plan.

**More information about railroad operations in winter is available at www.cn.ca/winterplan**

www.cn.ca/winterplan

10/2018