



2023–2024

CN Winter Plan

MAKE THE PLAN,
RUN THE PLAN





PHOTO ABOVE:
Blue River, BC

COVER PHOTO:
Blue River, BC



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Message from Tracy Robinson

Canada's railway system is the lifeblood of our country's transportation infrastructure. It drives economic growth and enables the movement of goods required in people's daily lives across North America and beyond. The world economy relies heavily on the uninterrupted flow of goods and commodities to and from our country.

CN is an essential part of this network.

Each year, winter returns with challenges that impact our operations.

However, the challenges of each winter's extreme cold, snow, ice and rain remain unpredictable for us all. The severity, frequency and geographic range of these impacts change year to year. Their reality is also felt on other parts of the supply chain, creating a domino effect on our operations. Increased collaboration, transparency, and visibility across the supply chain are the key to faster adaptation and efficient planning. Our success as a supply chain requires ongoing collaboration with our customers, including through the winter shipping season, when weather conditions can slow or stop the movement of goods. A railway system that operates safely and efficiently during winter is not just a preference; it is a vital component of our economic well-being.

Other challenges, such as the consequences of new labour regulations and the unintended effects of extended interswitching, are within our collective control. We need to consider measures to improve, not reduce, the supply chain capacity and efficiency so critical to our country's competitiveness.



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We know all too well how winter's challenges can be unpredictable, but working together we will find solutions.

I'm therefore pleased to share with you **CN's 2023-2024 Winter Plan: Make the plan, run the plan.** It is a testament to our commitment to running a scheduled railroad in the face of challenges. Our back-to-basics approach has allowed us to operate consistently and run well since it was reimplemented over a year ago.

This year's Winter Plan is focused on working safely, collaborating to meet the demands of our customers, improving network performance and enhancing network reliability. The plan serves as our compass, providing clear direction and objectives. It will enable us to make informed decisions, allocate resources judiciously, and maintain a forward-focused perspective.

As the season and our operational plan evolve, we will continue to collaborate with our customers and supply chain partners to further fine-tune our plan. By working together as one holistic supply chain, and not as individual parts, we can create further capacity and adapt more effectively to the challenges of the winter season.

CN has a strong track record of safety, reliability, and innovation. These are not just words; they are the bedrock of our operations and the commitment we make to our customers, stakeholders, and the communities we serve.



Tracy Robinson
President and CEO

Executive summary

The CN Winter Plan for 2023–2024 is prepared and submitted in accordance with, and as required by, section 151.01(2) of the *Canada Transportation Act*. It is an in-depth review of the many steps we take to prepare for the challenges of operating a railway in a northern climate and is presented to the Minister each year in the fall. The Plan has three main objectives:

- Outline the challenges CN will face operating during winter 2023–2024, including obtaining volume forecasts from customers and adjusting to a changing federal regulatory environment.
- Describe the actions we have taken to effectively plan and execute our operations throughout the season.
- Serve as a framework to support our efforts to safely meet the needs of our customers and stakeholders during the winter months ahead.

The CN Winter Plan details comprehensive, proactive actions, strategies and innovations designed to help meet customer demand by optimizing operations during the coming winter months. The Winter Plan helps maximize CN resources and is shaped by four thematic objectives:

1. Working safely

- CN has an uncompromising commitment to the health and safety of our employees, customers, communities and the environment.
- Training, leadership and technology are key pillars that support our safety culture.

2. Meeting the needs of our customers

- CN's rail network is an important part of fully integrated North American and global supply chains that must work in harmony to connect shippers and receivers.
- Timely and reliable customer demand forecasts are required for CN to plan the necessary resources to deliver the best possible service.

3. Consistently striving to improve network performance

- CN has made fundamental changes to our operating plan to increase car velocity and reduce terminal and yard dwell. As a result, CN can handle more volume with the same number of assets and crews.
- Over the past five years (2018–2022), CN has invested about \$16 billion to improve the safety and reliability of our service, support the growth of our customers, and implement new technologies.
- Capital projects include building long sidings and double tracks, obtaining and modernizing locomotives, acquiring new high-capacity boxcars, high-efficiency grain hopper cars, and other equipment.
- CN is also hiring more crews to ensure we have the right number of people to continue to deliver the best service possible, especially in light of new federal regulations.

4. Improving network reliability

- When temperatures drop below -25°C , CN must shorten trains to maintain safe operations, meaning more locomotives and crews are required to move the same quantity of goods. If the cold weather lasts for several days, the added congestion could result in further delays.
- CN adjusts the volume of local rail feeder lines to match the capacity of the mainline to avoid congestion and allow network productivity to recover as quickly as possible.
- Proactive information sharing and customer forecasts are key to having the right people and equipment in place when needed.
- CN has taken various measures to make the network and equipment more resilient during winter, including proactive maintenance as well as using distributed power and air braking railcars.



Winter is a defining feature of Canada's character. For more than 100 seasons, CN has dealt with and learned from winter's harsh reality. The lessons learned over the years help inform the steps we take to mitigate winter's impact on our operations. The resilience and determination needed to overcome the inevitable challenges have become ingrained in how we keep our railway running.

Whether it is extreme cold, ice, heavy snow or rain, winter weather fundamentally affects what we do and how we do it. Winter weather also impacts the productivity of our customers' and supply chain partners' processing facilities and export terminals. Therefore, we must all work together to deal with the challenges of winter.

We know that no two winters are alike and we should expect the unexpected. Safety factors into everything we do and every decision we make, including those outlined in this Winter Plan, which is aligned with the requirements of the Railway Safety Act. Our goal is to ensure we have done everything possible to prepare and maximize CN's ability to safely deliver the best possible service year-round.

Winter plan in brief

This Winter Plan for 2023–2024 sets out wide-ranging initiatives and strategies to help ensure CN has the capacity and resources to respond safely and efficiently to the needs of our customers in the coming months.

Winter occurs every year, but the duration and severity of winter conditions are not predictable more than a few days in advance. Every year is different and all points in the supply chain are affected in different ways. Given that supply chain capacity is not infinite, and CN is only one player in Canada's interconnected supply chains, CN and our customers must plan together and prepare for winter to the best of our respective abilities. Customers across all CN business segments have market knowledge critical to CN's resource planning. Frequent and open communication ensure customer forecasts and updates are shared so we can better adjust to the uncertainties that impact demand during winter.

As the most northerly Class I railway operating in North America, the challenges of winter and its effects on rail transportation are deeply ingrained in CN's operational and planning activities. We know the challenges that cold, snow, ice, and rain bring every winter. What we cannot know is how persistent and severe the winter conditions will be and where they will hit hardest. The severity of weather conditions that a train will experience transiting from Vancouver to Toronto, for example, will vary markedly during the trip, and be different again on the return trip.

The actions described in this Winter Plan are designed to maximize safety, efficiency, and car utilization. These actions are guided by four objectives: working safely, meeting the needs of our customers, consistently striving to improve network performance, and enhancing network reliability.



Homewood Training Campus, IL

1. Working safely

At CN, safety is a core value. It is embedded in everything we do and factors into every decision we make. We aspire to ZERO... zero injuries, zero incidents, zero harm, to achieve our ambition of being the safest railroad in North America, with an uncompromising commitment to the health and safety of our employees, the customers we serve and the communities and environments in which we operate.

Training, leadership, and technology are the foundations that support our safety goals and culture. CN has comprehensive training for employees, including cold-weather training to prevent frostbite and other injuries, as well as a detailed **safety guide**¹ for our customers and supply chain partners. We know that it may take a little longer to complete a task during winter than it typically would during warmer months, and we may even need to suspend operations when extreme winter weather makes it unsafe to continue. Our first priority is always the safety of our people and the goods that we transport through communities across the country.

We have invested in innovative technologies that help enhance the safety, capacity, and reliability of our network. For example, our Automated Inspection Portals, our Autonomous Track Inspection Program railcars, and our vast network of wayside detectors significantly increase the frequency and quality of track and rolling stock inspections. Millions of data points are collected daily to help us to identify problems before they happen. As a result, CN is providing a safer and more resilient rail network, which translates into greater rail capacity and velocity, as well as fewer disruptions due to track and equipment malfunctions, particularly during winter.

¹<https://www.cn.ca/customersafety>

Effective training to work safely

Our focus on safety is even stronger during winter, when the weather can make safe rail operations more difficult. As part of our strategy to promote a strong safety culture, we ensure our employees have the necessary training to work safely and control exposures in the workplace. Following the pandemic, in-person training resumed at our two state-of-the-art training campuses in Winnipeg, MB, and Homewood, IL, in the fall of 2023. There, CN new hires, experienced railroaders and customers take hands-on and classroom training for all key railway jobs. They receive training in modern indoor labs with equipment such as locomotive and walking simulators. Outdoor labs are equipped with dedicated rolling stock, track, and wayside equipment.

2. Meeting the needs of our customers

CN's rail network connects shippers to receivers, each with their own unique needs, challenges, and supply chain considerations. The fluidity of the North American rail network depends on and is directly related to the fluidity across all rail carriers and supply chain partners. For CN to properly plan our operations across all segments and routes, especially during winter, we need our customers to provide accurate demand forecasts well in advance. It is important to note that such customer forecasts are not always available and/or shared. Collaborative resource planning is critical to deliver the best possible service. That means working with our customers to anticipate and prepare for demand during winter and find solutions on an individual commodity basis. Some examples include:

Propane: Demand for propane grows significantly during winter. In response, we expand our transload solutions across our North American network. We also work with multiple customers to plan the delivery of stored railcars and increase the capacity of their facilities.

Forest products: Ahead of winter, we work with customers to reposition railcars at selected transload and storage locations to reduce transit times. We also provide extensive supply chain solutions throughout North America through interline agreements.

The importance of customer forecasts

Demand for rail service is not constant. It varies through time by commodity segment and market location. Global and national economic variations as well as the specific position of customers in their respective markets influence demand for rail service. CN determines the resources needed to provide rail service based on close coordination and collaboration with customers on their long-term volume forecasts. For CN to effectively allocate resources such as crews, railcars, locomotives, and track capacity in an efficient way requires up-to-date and accurate information sharing from customers on their needs and expectations. Working together and closely coordinating activities with our customers is essential to maximize the efficiency, capacity, and fluidity of the end-to-end supply chain. CN is fully committed to maintaining and increasing communication and coordination with our customers and supply chain partners.



Grain: We are incentivizing grain customers to invest in facility infrastructure, so that loaded grain trains can be fully charged with air before the locomotive arrives at the customer's facility. This reduces end-to-end cycle times and increases car velocity (how many miles a car moves per day on average). In addition, to increase capacity, CN has purchased 3,500 high-capacity hopper cars since 2019.

Intermodal: We are extending our network reach through partnerships with other railroads. For example, with UP and FXE, CN now offers best-in-class intermodal service between Canada, the U.S. and Mexico. CN is also partnering with NS to operate intermodal service through Detroit and Chicago to Kansas City and Atlanta. In the GTA, construction continues on our Milton Logistics Hub, which will provide 730,000 twenty-foot equivalent units (TEUs) of domestic and international container capacity by 2026.

Frac Sand and Drilling Pipe: To prepare for winter, we work closely with shippers and receivers to move as much product as possible into storage facilities before winter starts. We also add transload facilities and keep frac sand railcars closer to where they may be needed to support customers during inclement winter weather.

3. Consistently striving to improve network performance

We implemented comprehensive changes to our rail operating plan in the spring and summer of 2022. Our disciplined adherence to the schedule was essential to our successful operations during the following fall and winter. Car velocity during 2022 and year-to-date 2023 reached the highest levels recorded since 2016.

The changes to rail operations and the discipline that the team applies to making and running the plan drive our overall network performance and service delivery. While CN undertakes numerous planning activities in anticipation of winter, exceptional conditions, like winter storms, persistent extreme cold weather, and track outages, are always a possibility. In the event of a disruption, CN will proactively update customers accordingly and take necessary steps to restore service as soon as possible.

CN's capital investment program totaled about \$16 billion over the past five years (2018–2022), with nearly two-thirds of that investment going into track and railway assets, ensuring the overall health of our infrastructure and increasing capacity and productivity. For 2023, CN's capital expenditures are expected to remain consistent with the range of investments in recent years.

This winter, CN will have about 1,950 locomotives for use on our mainline and for local assignment. CN acquired 57 new high-horsepower AC locomotives in 2022. We also recently announced the modernization of up to 60 locomotives in our existing fleet. We complete our locomotive winterization and equipment inspection programs well in advance of winter, translating into fewer failures during the challenging winter season.

At CN, we go beyond investing in our physical plant by also investing in our people. We focus on ensuring we have the right number of people in the right locations to deliver the best possible service, especially during winter. Of note, CN has not, thus far, made any reductions to our operating crew base despite the current freight recession. As of early September, CN's overall volumes were down nearly 3% on a year-over-year basis in terms of revenue ton miles and down nearly 7% in terms of carloads.

Despite this, CN's operating crew base has increased steadily over the past 18 months in anticipation of new federal Duty and Rest Period Rules for Railway Operating Employees that came into effect on May 25, 2023, as well as previous regulatory changes concerning the number of paid sick days and personal leave days workers in all federally regulated private sector workplaces are entitled to. The union has interpreted these new regulated days off as being in addition to the existing terms of their collective agreement. CN estimates that hundreds of additional employees will be needed in Canada to do the same amount of work as was done prior to the implementation of the regulations.

Another federal regulatory change that is expected to have a negative impact on rail network performance is Bill C-47, which reintroduced extended interswitching in the Prairie provinces. Extended interswitching reduces capacity and efficiency by lengthening routes and adding to equipment cycle times — not what Canadian supply chains need, especially during winter.

Finally, the Government of Canada plans to ban the use of temporary replacement workers, including management, during a strike. Such legislation will create an imbalance in labour relations, resulting in more frequent and longer lasting strikes. Within hours of a walk-out, Canadians will begin to experience shortages of fuel, livestock feed and other critical supplies. Managers must be allowed to step in to maintain core services as well as ensure safety and security are not compromised during the shutdown.

Electronic Track Authority Verification (ETAV)

ETAV is an innovative real-time technology app developed by CN to keep field track employees safer and more efficient. ETAV complements existing processes that Engineering hi-rail operators use to get permission from rail traffic controllers to access and work on tracks. Operators use the ETAV application to monitor their precise location within their authorized track limits in real-time through a global navigation satellite system. If they approach the limits of their track authority, ETAV sends them auditory and visual alerts. ETAV also makes it easier to locate assets such as switches, which is particularly useful in the winter when many are covered in snow. CN earned a 2022 Railway Association of Canada Safety Award for ETAV.

4. Improving network reliability

When temperatures dip to -25°C or below, the most immediate consequence is a reduction in train length to maintain the safe operation of the train's braking system and to comply with Transport Canada requirements. When trains are shortened, more crews and locomotives are required to move the same volume of traffic. The result is increased risk of congestion in rail yards and associated traffic delays. If extreme cold conditions continue for long periods, there is a ripple effect across the rail network. CN accesses various independent weather data sources to predict which geographic areas of the network are expected to experience persistent cold or other extreme winter weather conditions and adjust the operating plan and/or recovery efforts accordingly.

This winter, CN will once again focus on ensuring local rail service is adjusted to match the capacity of the mainline network to accept traffic during periods of extreme weather. This will allow network productivity to recover much more quickly at the end of any prolonged weather event.



The advance weather information is even more critical considering the risk of avalanches along mountainous corridors. CN's avalanche program has been in place since the 1980s, and is focused on avalanche forecasting, control, avoidance, and detection.

When dealing with adverse winter weather, time is of the essence. The key is proactive communication as well as sharing of information and customer forecasts to have the right people and equipment in place to respond as quickly as possible. CN has taken multiple steps to be ready to act when required, including striving to hire more employees in light of the union's interpretation of the new federally mandated days off.

Various measures are also being taken to make the network more durable during winter and mitigate the impact of cold temperatures on braking systems to minimize train length reductions, including distributed power and distributed air braking cars, among many others.

We believe the breadth of the comprehensive, coordinated, and collaborative actions we are taking position CN to deliver the best possible service during the challenging winter months ahead, and throughout the year.

In addition to providing CN with detailed and accurate volume forecasts, customers can also take steps to help avoid delays during the winter months. Some of these steps are outlined in CN's **Customer Safety Handbook**², which includes a checklist of safety measures to deal with adverse winter conditions. A summary is included in Appendix B.

Distributed air braking cars

Unique among Class I railroads, CN modifies boxcars to add air compressors and associated equipment that supplement the air supply to a train's air brake system. These distributed air braking cars enable air pressure to be maintained at required levels, even in extreme cold temperatures. Distributed air cars are very effective for winter operations because they can minimize the need to reduce train lengths for safety reasons. Over the years, CN has made significant improvements to the air cars, such as adding new automation software and heat exchangers. CN has about 100 air cars strategically deployed along our mainline during colder months. Our air cars have travelled more than five million miles since they were introduced in 2006 and have proven to be one of the most effective innovations in dealing with cold.

² <https://www.cn.ca/en/customer-centre/safety-guidelines-and-regulations/>

New actions and initiatives

1 Enhancing the scheduled operating plan.

We are improving our operating plan to build on last year's successes. Running to plan is the key focus around which all our operations are built. The fundamental changes that CN made to operational planning and communication last year delivered the best railcar velocity since 2016 along with strong, consistent traffic movement — and we continue to refine our plan to deliver incremental improvement.

2 Technological innovation. CN expects to implement a new Precision Dispatch System to further optimize train movement across our network and avoid unnecessary delays.

3 Locomotive reliability initiative. Winter is hard on motive power. CN's Mechanical team has taken multiple proactive steps in advance of winter to improve overall locomotive resilience and availability.

4 More locomotives. The acquisition of 57 high-horsepower locomotives brings CN's purchases of new high-horsepower locomotives to close to 300 since 2019. CN's inventory of high- and mid-horsepower locomotives currently stands at approximately 1,950, about the same as last year and the most since 2019 (see Figure 6, p. 29).

5 Locomotive modernization. Modernizing an additional 60 locomotives by upgrading them from direct current (DC) to alternating current (AC) traction and outfitting them with state-of-the-art technology improves the reliability of our existing fleet and contributes to reducing our rail carbon footprint.

6 Rolling stock acquisition. CN took delivery of 800 new boxcars and 500 high-efficiency grain hopper cars in 2023. CN will take delivery of another 750 new hopper cars in 2024, bringing the total received since 2018 to 4,250.



Glen Davidge, Locomotive Engineer
Blue River, BC

7 Developing and preparing our people. CN's staff resourcing for 2023–2024 will be in line with anticipated customer demand. Our labour priorities for the winter ahead focus on employee retention and deepening collaboration across CN teams. Operational adjustments will be required this winter to implement new federal regulations related to work-rest rules, personal leave days and sick days. While the combined impact of these new regulations is still uncertain, CN's initial analysis indicates that hundreds of additional personnel will be required in Canada (mostly in the West) to do the same amount of work and maintain existing customer service levels.

8 Environmental impact reduction. Shipping heavy freight by rail can reduce carbon emissions by up to 75% when compared to trucks. CN is the leader among Class I railroads, consuming up to 15% less fuel per gross ton mile than the industry average. One contributing factor is our exclusive use of air cars rather than adding locomotives to maintain air pressure in brake lines during extreme cold weather. We are also modernizing our fleet with more fuel-efficient locomotives to deliver lower-carbon transportation. In addition, CN is testing green propulsion technologies such as biodiesel and renewable diesel for use in our locomotives to help further improve fuel efficiency and achieve our carbon-reduction targets.

Building on our operational successes

We made many back-to-basics changes to our operational planning, execution and communication ahead of last winter that translated into strong, consistent traffic movement. Key aspects of these changes are as follows:

- Improved collaboration and communications with customers.
- Focused attention on building and running a disciplined scheduled operating plan.
- Renewed emphasis on on-time train departure and car blocking integrity from major rail yards for scheduled train service.
- Implementation of scheduled slots for bulk unit trains in key corridors.
- Strategic staging of bulk unit trains west of Edmonton, AB, to maximize utilization of planned train slots in CN's busiest rail traffic corridors.
- Matching feeder line traffic volumes to mainline capacity during periods of persistent extreme cold to avoid network congestion and recover more quickly.
- Increased frequency of internal coordination and communication among CN teams to get ahead of issues and proactively manage traffic.

Besides delivering the strongest network velocity since 2016 and creating additional capacity, running to plan improved overall CN rail network balance, which is critical to providing efficient rail operations and ensuring the right resources are in the right place at the right time. Now that these changes have been implemented and have delivered real results, CN is focused on refining the operating plan based on lessons learned to drive incremental gains in service and efficiency.

Being able to deliver the benefits of the operational improvements that CN has made will rely heavily on demand forecast accuracy. Within CN, that means the Sales and Marketing team as well as the teams involved in building and running the operational plan must work in an integrated fashion, utilizing precise demand information to make investments in additional network infrastructure and other resources before bringing on incremental business. CN relies heavily on customers to provide accurate and timely forecasts to support our operational planning activities, and that information will become increasingly important to support CN's investment decisions.

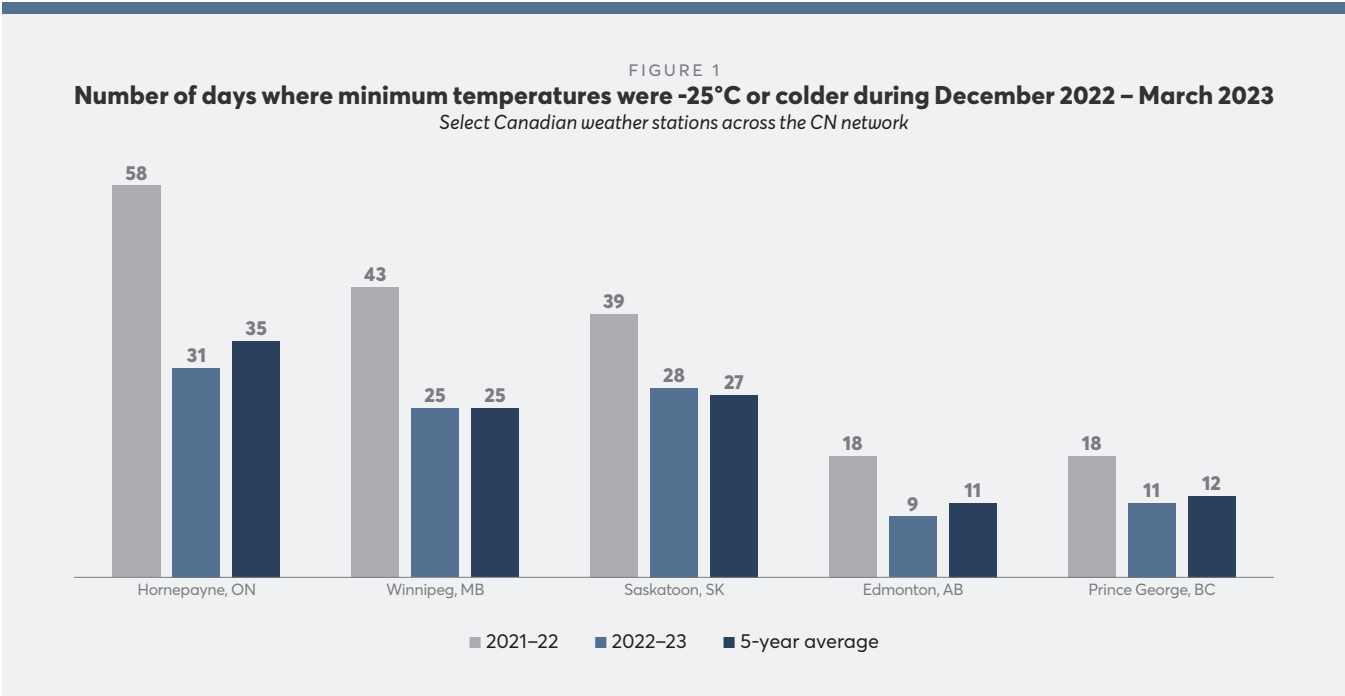
CN operates an on-time scheduled railroad that creates capacity by increasing car velocity with a strong level of safety and commitment to our customers.

Return to normal winter operating conditions

The frequency of extreme cold during winter 2022–2023 was in line with the historical Canadian average. This was in sharp contrast to winter 2021–2022 when the frequency of extreme cold was nearly double normal levels. In our Western Region during the winter of 2021–2022, CN had to deal with temperatures below -30°C for over 50 of the 65 days between late December 2021 and the end of February 2022. During the 2022–2023 winter, that figure fell to almost half those levels in some regions. CN had train length restrictions in effect 45% of the time during the first quarter of 2023 compared to over 65% of the time during the same period in the previous year.

On the other hand, there were many instances this past winter when CN experienced multiple days of extreme cold back-to-back. Compared to just one or two days of extreme cold, longer periods of persistent extreme cold have a more pronounced impact on rail operations because the ability to recover is delayed.

In spring 2023, once extreme cold conditions abated, CN’s network velocity recovered more quickly due in large part to the operational changes CN effected in advance of winter 2022–2023 (see p. 14).



While not as harsh as the previous year’s winter, the winter of 2022–2023 can be considered a typical Canadian winter and far from a mild one. Key learnings include the importance of working closely with all supply chain partners to coordinate train loadings and unloadings with network capacity in real time, taking into consideration ambient weather conditions. We also saw the benefits of being proactive and anticipating the need for tier restrictions and implementing them sooner to ensure network fluidity was maintain during periods of extreme cold. This also helped corridor operations recover more quickly after cold snaps. These learnings will be very useful going into next winter, which CN anticipates will be in line with the five-year average.

The plan for winter 2023–2024

The Challenges

As a starting point, effective winter planning requires understanding the challenges. While winter comes every year, and with it expected operational issues, the frequency, severity, and exact location where the challenges will occur vary from one winter to the next. Recognizing that the North American rail network is interconnected, storms, avalanches, track washouts and other disruptions due to extreme winter weather also impede the movement of rail traffic far from the affected region. The winter conditions that affect the operation of a northern rail network can be summarized in four words: cold, snow, ice, and rain.

1. Cold

Extreme cold dictates slower train speeds to ensure safety. Temperatures of -25°C and below affect the physical properties of steel wheels and rail. We call this the “tipping point.” When steel is cooled it contracts, which adds stress on rails, increasing the likelihood of the rail pulling apart or breaking. Surface pitting on wheel treads also increases as temperatures plummet, which can cause high impacts into the rail and wheel.

Another consequence of temperatures below -25°C is on a train’s braking system. Freezing of air brake hoses can cause stiffness and kinks, preventing air from flowing freely. Moisture can freeze anywhere in the brake system (e.g., shoes, pipes, reservoirs, cylinders, hoses, valves) causing breakage and a loss of pressure, resulting in impaired functionality and longer air brake system charging/recharging times. This significant safety issue forces reductions in train length and speed, resulting in a loss of network productivity.

Extreme cold weather also affects people, as low temperatures and wind chill limit the ability of train crews, maintenance personnel, and people at our customers’ facilities to work safely outdoors. Warm clothing can mitigate the impact of cold temperatures to a point, but -40°C is -40°C .

For more information, view our video *The Tipping Point* available at <https://www.cn.ca/en/your-industry/customer-reports/winter-situation-report/>

2. Snow

Heavy snowfall impedes operations in rail yards, limiting the ability to process railcars until the snow can be cleared. Blizzard conditions make it difficult to move train crews and other operational personnel where they are needed. Switches in our rail yards, along our mainline and branch lines, and at our customers’ facilities, even those equipped with snow melters, can become encumbered by snow and need to be cleared before operations can resume. The accumulation of snow throughout the winter also raises the potential for avalanches that can block the mainline from Edmonton to Vancouver and Edmonton to Prince Rupert.

3. Ice

Ice can be incredibly harmful to rail operations, personnel, and infrastructure. Smooth ice such as a frozen puddle is a slipping hazard for crews and vehicles. Roadways and walkways need to be cleared of ice for safe walking and driving. A build-up of ice under a rail can result in the rail becoming separated from its tie plate, leading to a possible track disruption. Ice in the switch points and flangeways can prevent rail access to customers and lead to missed service. Ice jams in rivers and streams can cause overland flooding, potentially damaging the roadbed, eroding embankments, or causing a washout. Of course, ice storms can be very damaging, leading to downed trees and power lines. The freeze-thaw cycle, where snow and ice melt during the day and refreeze at night, also poses a significant risk to trains.

4. Rain

During the winter months, particularly in British Columbia, whether on the coast or inland, heavy rain can result in washouts that severely impact network fluidity. At the ports, rain can limit or even prevent the ability to load ships with grain and other cargoes. These factors can lead to congestion at the port and backlogs along the system. When a destination terminal, whether served directly by CN or by another rail carrier, cannot accommodate rail traffic, CN must hold trains at origin or along the route, slowing equipment cycle times and effectively reducing supply chain capacity.

5. Other

Beyond the challenges listed above, other factors affect the system's capacity during winter.

Lock/Port closures: The locks along the Welland Canal, the Montreal–Lake Ontario section of the St. Lawrence Seaway, and in Sault Ste. Marie close from January 15 to March 25 each year for maintenance. The marine closures represent the loss of significant throughput capacity. For example, average monthly cargo transiting the Welland Canal declines from roughly three million metric tonnes per month to zero during this time. Grain terminal unloading at the Port of Thunder Bay declines from upwards of 3,000 cars per week to next to nothing. Potash shipments through the Port of Thunder Bay also cease. Prior to the closures and immediately upon reopening, our ships have the strongest hulls on the Great Lakes to maneuver through the ice.

Extended interswitching: Bill C-47 reintroduced extended interswitching in the Prairie provinces as of September 20, 2023. Extended interswitching reduces capacity and efficiency — the exact opposite of what Canadian supply chains need. Expanding regulated interswitching distances to a 160-km radius around defined interswitching points creates a different pattern of regulated service because this longer distance forces railways to dedicate resources to inefficient movements. The forced interchange of railway equipment between two railways requires additional handling and increases dwell time. Furthermore, in many instances, when compared to a direct linehaul move by a single rail carrier, an extended interswitching move frequently results in a much longer route, adding to equipment cycle times. This raises the risk of congestion in rail yards and slows the network, especially during peak demand periods like winter.

Replacement worker legislation: The Government of Canada will introduce legislation by the end of 2023 banning the use of temporary replacement workers during a work stoppage. Such legislation will result in more and longer-lasting strikes, increase the need for back-to-work legislation and create a more hostile labour relations climate. In the event of a work stoppage, a railway cannot simply abandon trains full of goods at any point on its network where they can spoil or be tampered with. Trains, especially those carrying fuel, chemicals, or other sensitive materials, should be brought into protected yards. If they must be left out on the line, proper application of handbrakes and other security measures must be taken by management. Within hours or days of a walk-out, shortages of fuel and other critical supplies can loom. Railways need to continue operating in the national interest.



New federal regulations: CN's operating crew base has increased steadily over the past 18 months in anticipation of new federal regulations. However, the full impact of the new federal regulations on CN's rail operations remains unclear and is a wild card heading into the 2023–2024 winter. CN has assessed the impacts of the new Duty and Rest Period Rules for Railway Operating Employees that came into effect on May 25, 2023. The maximum number of hours per day an employee can work was reduced from 18 to 12 (33% reduction), thereby forcing Canadian railways to reassess the availability of its workforce under the new rules. We have also assessed the regulatory changes that came into effect on December 1, 2022, concerning the number of paid sick days workers in all federally regulated private sector workplaces are entitled to, as well as the previous new government regulation for five leave days. The union has interpreted these new regulated days off as "stackable" to the existing terms of their collective agreement, meaning their members should receive both.

The combined impact of these new regulations is still uncertain. Experience has shown us that tough winter conditions "burn" capacity since shorter, slower trains still need locomotives and employees to operate them, which significantly reduces productivity. The full measure of these regulatory changes will be tested for the first time this winter as operational adjustments will be required to maintain existing customer service levels. CN's initial analysis of these regulatory changes shows that hundreds of additional personnel will be required in Canada (mostly in the West) to do the same amount of work as was done prior to the implementation of the regulations. It is CN's opinion that implementation of policies such as these works counter to the Government of Canada's stated goals of supply chain resiliency, efficiency, and growth.



The Actions

1. Working safely

As CN's core value, safety is central to everything we do. We have an uncompromising commitment to the health and safety of our employees, the customers we serve, and the communities and environments in which we operate. Our focus on safety takes on even more importance during winter, when cold and the elements can directly affect safe rail operations.

First and foremost, we ensure our employees have the necessary tools and training to work safely and control exposures in the workplace. As part of our strategy to instill and reinforce a strong safety culture, we resumed in-person training at our two state-of-the-art training campuses in Winnipeg, MB, and Homewood, IL, in the fall of 2023. There, CN new hires, experienced railroaders and customers take hands-on and classroom training for all key railway jobs. They receive training in modern indoor labs with equipment such as locomotive and walking simulators. Outdoor labs are equipped with dedicated rolling stock, track, and wayside equipment. Experienced mentors delivered a robust curriculum to approximately 6,500 students in 2022.

In Q1 2023, during the heart of winter 2022–2023, CN experienced a significant year-over-year improvement in our accident and injury performance. The accident ratio per million train miles in Q1 2023 was 1.64, reflecting a 41% improvement versus Q1 2022, while CN's injury ratio per 200,000 person hours of 1.02 reflected a 17% improvement compared to Q1 2022.

We recognize that it may take a little more time to complete a task during winter than it typically would during warmer months. For example, CN railroaders wearing the appropriate cold weather gear may have to slow down their activities. To prevent frostbite and other cold weather-related injuries, CN crews take warming breaks as required and receive frostbite awareness training. Finally, if extreme conditions like a blizzard, overland flooding, or extreme cold temperatures prevent safe operations, CN may close sections of track or suspend overnight train operations.

Get the latest customer safety tips and best practices for operating during winter months at <https://www.cn.ca/en/customer-centre/safety-guidelines-and-regulations/>

Customer forecasts: Accurate customer demand forecasts for all types of CN traffic are essential to planning the rail resources needed to deliver the best possible service, especially during winter. Unfortunately, such customer forecasts are not always shared with CN in a timely fashion. CN collaborates with customers to anticipate their needs and prepare for any increased demand during winter. Frequent and open communication ensure customer forecasts are shared so we can better adjust to the uncertainties that impact demand during winter.

Labour shortages: Like many other companies, CN is struggling to deal with a challenging labour market. Compounding a stubbornly low unemployment rate, fewer and fewer people are choosing blue collar careers, especially in rural areas where many CN employees live and work. Demand for employees with the skill sets CN needs is very high in many sectors of the economy. This situation is aggravated by current federal regulations mandating new work-rest rules as well as additional sick and personal days off, which requires CN to hire even more people to move the same volume of cargo.

Other factors: Other complicating factors include disruption of global supply chains resulting from the lingering effects of the COVID-19 pandemic, the war in Ukraine as well as labour disruptions at West Coast ports. The disruptions limit the accuracy of sector supply chain forecasting and vessel planning so crucial to matching shipments at origin with capacity at destination.

At the same time, although rail system capacity is reduced by extreme weather and lock closures, customer demand across many commodity sectors (e.g., grain, forest products, propane, potash) is often at or near its peak during the winter months. The result is greater pressure on the ports of Vancouver and Prince Rupert.

Recognizing the tension between demand and capacity, CN will adhere to the following multi-dimensional winter action plan.

Innovative technologies enable CN to not only ensure and enhance safety, but also provide more efficient and fluid operations to serve our customers. Using advanced technologies like predictive analytics to identify problems before they happen helps avoid network disruptions and keep traffic on the network moving. For example:

Wayside detectors: CN has over 2,800 detectors located on the side of tracks to measure the condition of mechanical train components (e.g., wheels and wheel bearings). These detector technologies and algorithms generate alarms and notifications when problems are discovered to prompt the repair or replacement of the component before it fails.

- **Hot box detectors** situated every 15 to 17 miles along mainline track monitor the condition of wheel bearings to identify overheated components before they reach temperatures that can lead to failure.
- **Dragging equipment detectors**, deployed along side hot box detectors, look for anything that is hanging from the train.
- **Cold wheel detectors** are placed at the bottom of long grades where trains typically apply brakes. Since the braking process generates heat, cold wheels are flagged for brake system inspection.

The use of technologies along CN's right-of-way enhances rail safety as well as network capacity and resiliency. CN aggregates the data collected by its detector network to identify trends and perform proactive maintenance.

- **Wheel impact load detectors** measure the impact of each wheel going over the detector. High-impact wheels are a problem because they can cause parts to rattle loose as well as damage rails and ties. These wheels must be identified and addressed before they cause bigger issues. Last winter, CN's enhanced algorithm for wheel impact detectors considered the frozen rail subgrade, allowing CN to reduce the number of unnecessary wheel replacements. As a result, CN safely changed out 12,400 fewer wheels between November 2022 and March 2023 compared to the previous winter, which increased the availability of railcars for our customers during winter.
- **Acoustic bearing detectors** monitor the sound signatures of bearings to find bearing defects before they generate enough heat to be detected by hot box detectors.
- **Broken wheel detectors** operate by using various technologies, including wheel weight gauges, lasers, cameras, and machine pattern algorithms to identify defects. These systems provide an additional layer of detection to identify both urgent and emerging wheel defects.



Autonomous Track Inspection Program (ATIP) railcars use technology to inspect track and assign preventative maintenance. CN's ATIP consists of 11 railcars equipped with multiple advanced measurement systems. The cars are operated 24/7 within regularly scheduled trains and operate at track speed, allowing for real-time measurement of track conditions under load.

Historically, track inspections have been done between train movements by a track inspector in a hi-rail moving at 15 to 20 miles per hour, consuming precious capacity. Since 2020, ATIP cars have inspected over two million miles across the CN network, with some of our key corridors receiving up to 16 times more inspections than with non-autonomous methods. The result? A 90% improvement in industry-defined track safety KPIs, including a substantial reduction in mainline track derailments attributed to track geometry.



In 2023, CN relied on ATIP's quantitative assessment of track components to strategically invest in track infrastructure rehabilitation and upgrades, improving the resiliency of the network for the coming winter. CN has also deployed new technical capabilities that bring us greater visibility into the health of our rail joints (metal bars bolted to the ends of two rails to join them). Winter operating conditions put additional stress on joints as the rail contracts in the cold, making it critical to ensure the joints are as robust as possible before winter, when they are often obscured by snow. With our Generation 2 and Generation 3 ATIP technologies, CN can gather unparalleled visibility on the condition of joints across the network.

CN also uses ATIP to look for specific winter-related track conditions such as ice jacking (also called ice plating). This is a phenomenon that occurs at temperatures between 0 and -7°C when swirling snow gets into the space between the base of a rail and the rail plate. The snow can melt due to heat generated by friction of the train rolling over that section of rail. When the train has passed and the rail cools, the accumulated water turns to ice. Through successive freeze and thaw cycles, the rail can be slowly lifted and loosened from its plate. This condition is difficult to see from a hi-rail, considering that it occurs gradually and can be hidden by snow. CN developed unique algorithms based on data collected by ATIP to identify locations vulnerable to ice jacking, or where ice jacking is suspected.

Additionally, CN uses technologies that complement ATIP and provide a wider spectrum of data that will be eventually integrated into future generations of ATIP. One of these is ground-penetrating radar used to provide detailed assessments of ballast and subgrade conditions.

Automated inspection portals (AIPs) feature ultra-high-definition panoramic cameras and high-intensity LED lighting that capture a full 360° view of a train and its undercarriage as it travels at track speed through the portals. Artificial intelligence (AI) then helps experienced railcar mechanics identify railcars requiring repair before a train arrives at the yard. By increasing the frequency and quality of inspections, AIPs help reduce accidents related to railcar defects. We have seven AIPs in operation across our rail network, with more AI development expected over the next few years.

During winter, CN adjusts the portals' AI algorithms to better detect what would be considered smaller issues in spring, summer, and fall. In cold weather, even minor issues need to be detected and dealt with sooner to avoid problems. Designed to operate day and night even during extreme temperatures, AIPs increase network capacity by performing real-time train inspections without having to slow trains down for a visual inspection.

Currently, AIPs are used to supplement manual inspections by applying technology to enhance inspection quality. CN is working closely with regulatory authorities in Canada and the U.S. to maximize the potential of AIPs to improve the safety, reliability, and efficiency of our rail operations.

At CN, we continue to build upon our leadership role in rail infrastructure and innovative technologies to monitor the condition of trains and track to proactively minimize risks.



Electronic Track Authority Verification (ETAV) is an innovative real-time technology app developed by CN to keep field track employees safer. ETAV complements existing processes that Engineering hi-rail operators use to get permission from rail traffic controllers to access and work on tracks. Operators log onto the ETAV application to see their precise location within their authorized track limits. Their truck's exact position is monitored in real-time through a global navigation satellite system. If they approach the limits of their track authority, ETAV sends them auditory and visual alerts. Additional features in ETAV make asset location easier, optimizing the employee's efficiency on track and reducing potential incidents, which is particularly useful in the winter when many assets are covered in snow and thus difficult to locate. CN earned a 2022 Railway Association of Canada Safety Award for ETAV.

As a result of these innovations, CN has an even safer rail network with enhanced capacity, translating into greater rail traffic movement. And the potential for major mainline disruptions due to track and equipment malfunction, particularly during winter, has been reduced, improving network resiliency.

2. Meeting the needs of our customers

SUPPLY CHAIN FLUIDITY

When considering the capacity to move rail traffic during winter, CN is just one component of the interconnected global supply chain. Our rail network connects shippers to receivers, each with their own unique needs, challenges, and supply chain connections. In fact, 35% of the volume CN handles is interchanged with other rail carriers to get from origin to final destination (e.g., forest products shipments from Northern B.C. to the U.S. Eastern seaboard). This means the ability of rail traffic to move on the North American rail network depends on fluidity and reliability across all rail carriers, not just CN. This is a key consideration in CN's assessment of CN-supplied fleet size requirements in relation to overall demand. It is not just about how many orders there are; it is also where the cars need to go and how long it will take them to return to CN's network and be available for the next load.

Shipping, receiving, transloading and freight forwarding facilities require the staff, trucks, containers, and warehouse space to quickly load/unload railcars and maintain a balanced rail operation. Delays at the loader and/or unloader reduce car supply for all customers in the supply chain. With most CN customers sharing a pool of CN-supplied centrebeams, boxcars and grain hopper cars, major shifts in car demand or cycle times will challenge other resources such as crew availability.

Considering anticipated demand levels, as well as experience gained in previous winters, CN plans to proceed with car rationing during the coming winter since meeting all demand every week will likely not be possible. Car rationing is not new in Canada, especially in sectors where demand is cyclical such as grain and forest products.

CN will continue to report weekly supply chain performance metrics available at <https://www.cn.ca/en/investors/key-weekly-metrics/>

In cases of extreme cold and/or windchill, not only will CN halt outdoor operations to protect the safety of employees, so will our customers and supply chain partners. If any part of the supply chain experiences delays due to challenging winter operating conditions, the impact will be felt by all parts of the supply chain, including CN. For instance, if a receiver is not able to unload railcars in a timely fashion, trains directed to that terminal must be held back to avoid creating more congestion and the availability of equipment for everyone is reduced. CN and our customers need to work together and closely coordinate activities to maximize the efficiency of the end-to-end supply chain, especially during winter.

PLANNING WITH CUSTOMERS

Demand for rail service is not constant. It varies through time by commodity segment and market location. Global and national economic variations as well as the specific position of customers in their respective markets influence demand for rail service. CN determines the resources needed to provide rail service based on close coordination with customers and their long-term volume forecasts.

For CN to effectively allocate resources such as crews, railcars, locomotives, and track capacity in an efficient way requires up-to-date and accurate information from customers on their needs and expectations. It demands joint planning with all stakeholders on a sector-by-sector basis.

In the absence of accurate customer forecasts that stretch at least six months out, CN makes assumptions based on economic indicators and historical data. Significant changes in demand levels or traffic flows that CN cannot anticipate hinder our ability to respond quickly to the new circumstances, especially when demand shifts in the more challenging winter operating environment. Gaps in customer service can be avoided with better forecasting and communication.



If a customer forecasts increased demand for rail service, capacity may be added, but it will only become available after additional resources (e.g., cars, locomotives, operating crews) have been acquired.

Resource planning requires sufficient lead time to deliver the best possible service. Long lead times are needed to recruit and train crews (~9 months), acquire rolling stock and locomotives (12+ months), and build track and other rail-related infrastructure (18+ months).

Typically, demand planning less than 12 months out is focused heavily on operating crew base and locomotive fleet size. Demand is converted into train counts, which in turn is converted into crew and locomotive demand. Longer-term forecasts focus on rail infrastructure and network capacity. CN monitors traffic levels on individual sections of track and individual traffic corridors to help assess what additional track infrastructure is required. From initial planning to completion, infrastructure investments can take months or years, depending on the project's scale, complexity and permitting processes.

We all seek the same objective—a rail system that operates at peak efficiency. This means we must collaborate as business partners in a transparent manner, sharing information in pursuit of our common goal. Working together and closely coordinating activities with our customers is essential to maximize the efficiency, capacity, and fluidity of the end-to-end supply chain. CN is fully committed to maintaining and increasing communication and coordination with our customers and supply chain partners.

MARKETS

The full context of customer demand during winter requires assessing each commodity on an individual basis, as each brings unique needs that CN must anticipate. The following are examples of key markets and the actions CN is taking to serve them:

Propane: With propane demand growing significantly during the winter months, CN is expanding transload solutions across our Canadian and U.S. network. This increases the total off-loading capacity available to propane shippers through the peak winter season. In addition, CN is working with multiple customers to increase the rail capacity of their facilities, including self-switching and additional self-storage capacity. Increased capacity enables greater propane volumes to be delivered to end-use customers during this critical season.

To avoid congestion and additional switching in harsh winter conditions, CN plans for railcars to arrive at customer loading facilities throughout the month, not all at once at the start of the month. We also work with loading sites on train blocking to reduce switching time and the need to shift cars from one train to another along the route. This improves transit times and network reliability, which we know is important to getting this essential product to market, especially in winter.

CN has identified and is working collaboratively with customers and third-party loaded railcar storage facilities to provide more options to balance the flow of railcars by moving product into and out of storage. Shippers can preposition inventory closer to their end markets to offset cold and precipitation impacts on the supply chain during the heart of winter. This is important for the propane industry as we collectively rely on origins further away from end markets to meet domestic demand as longer shipping distances are more vulnerable to weather-related disruptions. As such, prepositioning inventory enables shippers to meet their customer demand through the variable winter conditions experienced across Canada.

Intermodal: Our close and collaborative partnerships with customers and supply chain stakeholders promote the fluidity of our intermodal business and allow our customers to reach new markets. CN has been resilient in delivering for our customers as we meet the challenges brought about by global supply chain disruptions, and we continue to work with our partners to build capacity.

Shipping by rail for the long haul and leveraging the flexibility of trucks for the first/last mile offer our customers fast and consistent service to all major Canadian, U.S. Midwest and Gulf Coast markets. The environmental benefits of shipping by rail combined with our fluid operations are helping our customers take more long-haul trucks off the road and reach their carbon reduction goals.

Our port partners have efficient operations and available capacity, especially at Prince Rupert and Halifax, where we are the sole serving carrier. Prince Rupert has the best service from Asia, and we are working with our partners to develop the Ridley Island Export Logistics Park. The Port of Halifax, the only East Coast port that accommodates Ultra class vessels, set a record last year and we doubled intermodal train service to Eastern Canada and the U.S. Midwest. This additional service takes advantage of CN's uncongested high-speed network from Canada's East Coast to Montreal, Toronto, and Chicago. This initiative is helping relieve supply chain congestion and improve overall supply chain fluidity.

With close collaboration, CN is prepared to handle growth through the international gateways we serve with connections to major North American markets.

On the inland side, our three core terminals in Montreal, Toronto, and Chicago touch about 70% of our intermodal business every day. CN continues to work collaboratively throughout the industry, as well as with Transport Canada and the Canada Border Services Agency, to maximize the potential of the intermodal supply chain. In Toronto, construction continues on our Milton Logistics Hub, which will provide 730,000 TEUs of domestic and international capacity by 2026.

Partnerships offer new services, increased capacity, transit improvements, extended reach, and volume growth. One example is our new best-in-class intermodal service with UP and FXE from Chicago through Texas all the way to Monterrey and Silao in Mexico. In addition, CN is partnering with NS to offer intermodal service through interchanges in Detroit and Chicago to/from Kansas City and Atlanta. CN is also the sole Canadian partner in the Equipment Management Pool (UP, NS), an interline equipment-sharing program with over 40,000 containers across North America. We are also partnering with Trealmont and Kaptan to develop a new transload facility at our Calgary Logistics Park. All these partnerships will help convert more long-haul truck traffic to rail.

Fluidity in this segment can be enhanced by developing specialty products (e.g., temperature-controlled traffic), expanding smaller terminals, and working with our steamship line customers to improve their round-trip economics. Our successful new Domestic Repositioning Program and export product layers promote more balanced growth, while our digital strategy and self-serve tools improve the customer experience.



Forest products: CN is the largest rail carrier of forest products in North America. We maintain the largest high-capacity centrebeam fleet and one of the biggest boxcar fleets in the industry. Our team’s focus in advance of winter is maximizing the efficient utilization of rolling stock. CN works with shippers and receivers to preposition inventory at strategic transload points before winter arrives. Strategic transload and storage points, both on our network and along partner shortlines, allow for faster transit times. We are also reinforcing other supply chain options to supplement current carload traffic, such as intermodal interline service, providing extensive coverage throughout North America.

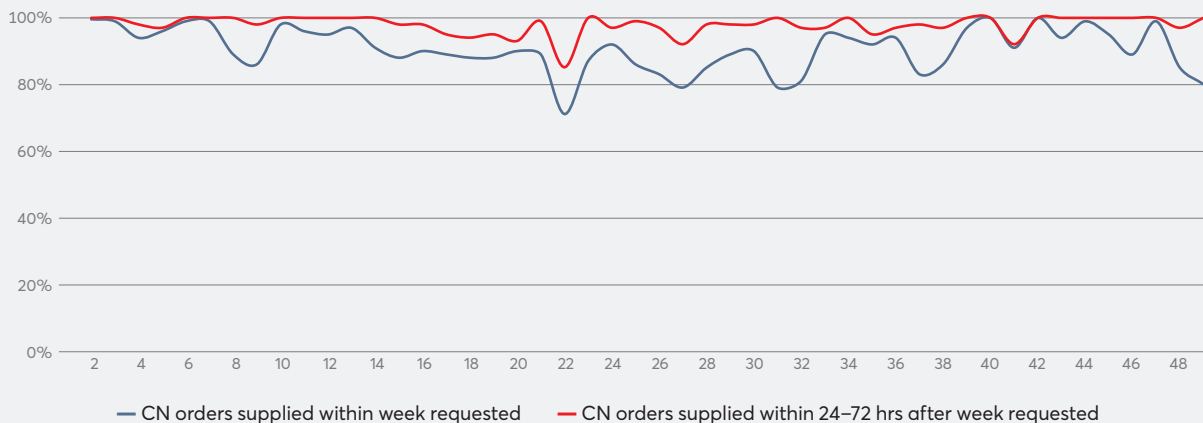
For CN’s Western Canadian pulp export business, we work with our customers and terminals on a management program that stems from CN’s ongoing efforts to maximize the throughput of boxcars at unloading terminals and avoid congesting the Port of Vancouver. It relies on the active participation and collaboration of our customers and terminals to coordinate inbound loads with warehouse space, vessel berths, and container availability.

As part of CN’s Efficient Receiver Program, CN actively monitors and identifies locations off the CN rail network with car dwell times exceeding four days (down from five days in 2022). CN limits the number of cars being sent into areas that show rail traffic buildup to help limit congestion at any one receiver or serving yard. This is a year-round program but is particularly important during the winter months.

Frac sand and drilling pipe: In Western Canada, materials required to support oil and gas drilling programs include frac sand and drilling pipe. In preparation for winter, CN works closely with customers to ensure product is shipped in advance of peak demand surges to fill frac sand storage silos and to have adequate drilling pipe inventories on site. Our dedicated team coordinates frac sand shipments from origin to destination. Transload locations are added to help manage inventories and additional car storage locations for sand are placed closer to destination to support customers should there be any supply chain interruptions due to extreme winter weather or for other reasons.

Grain: A strong, vibrant grain sector, supported by a seamless and well-functioning supply chain, is essential to the Canadian economy. The end-to-end supply chain has finite total capacity, and every link must function as one to deliver at optimal levels. CN’s network investments and hopper car fleet renewal are complimented by in-country grain handling capacity improvements over the past decade. The supply chain’s efficiency has increased to deliver record grain movements in 2022 and 2023. In fact, with increased communication and collaboration between supply chain partners, February 2023 was the best February ever for Western Canadian grain movement on CN’s network. Last winter, CN supplied over 90% of hopper cars within three days of the week they were ordered.

FIGURE 2
Percentage of CN-supplied hopper car orders supplied either in the week requested or within 24–72 hrs of the end of the week requested
 2022–2023 Crop Year





Vegreville, AB

Consistent with the evolution of grain handling infrastructure in Western Canada, CN's incentive programs have evolved to encourage more efficient grain handling. Improved grain supply chain efficiency contributes to stronger overall grain movement, especially during peak grain demand in fall and winter. More efficient grain movement helps improve rail network efficiency for all commodities.

CN's rate incentives encourage high-efficiency unit train facilities that can be loaded in 15 hours or less. This model means a train does not have to occupy the mainline while spotting empties, which improves overall mainline efficiency. Most of the new grain handling facilities being built in Western Canada are hook-and-haul, and most have loop tracks that allow more cars to be spotted in a single placement, which results in improved capacity utilization.

In 2014, CN began incenting grain customers to invest in their grain facility infrastructure to allow loaded grain trains to be fully charged with air, reducing the time required for CN crews to depart with a loaded train. In times of extreme cold, it can take 8 to 12 hours (or more) for a train to be fully charged with air by locomotives. Reducing the time required to charge trains with air cuts end-to-end train cycle times and improves car velocity. More than 95% of CN-served facilities capable of loading grain unit trains have participated in this program, representing a win-win situation for CN and our customers. This program has been extended to non-grain customer facilities as well.

At CN, we understand that timely railcar supply is critical to grain shippers of every size. Today, over 90% of cars are secured by shippers using a variety of CN commercial agreements. Since 2010, the proportional growth in CN's grain shipment volumes during post-harvest peak demand in October and November has exceeded the proportional growth in crop production over the same period, enabling a more efficient and productive end-to-end supply chain. Since 2019, CN has purchased 3,500 high-capacity hopper cars, with another 750 to be added to CN's fleet in 2024.

When considering the eligibility of orders for grain cars, CN works with customers to ensure grain car orders have shipment authorization from the receiving terminal. While originally limited to grain container stuffing facilities, the Terminal Authorization Program was subsequently extended to all receiving facilities to facilitate efficient hopper car order management and support overall rail network fluidity.

Customer volume forecasts are critical to strong capacity resourcing and execution. At the time of writing, the 2023–2024 harvest is still coming off the fields. The quality of the forecasts we receive will impact CN's resource plans not only for the fall of 2023 but will also give an indication of how long peak shipping is expected to last in 2024. Given that each winter is different, understanding customer demand is important to determining the resources needed to support it through all winter conditions.

Other bulk commodities: As is the case for grain, having potash trains charged with air at mine sites reduces the time needed to charge the train's braking system, especially in cold winter conditions. For unit train shipments of coal and other commodities, CN adjusts the length of trains to ensure continued safe handling during cold winter operating conditions. As well, side release agent is applied to coal cars prior to loading at coal mines. This practice allows for clean unloading of coal at the terminal, reduces double dumping of railcars, and decreases coal carry back to coal mines.

3. Consistently striving to improve network performance

At CN, we are focused on improving the safety, capacity, and reliability of our network. The evidence is an effective capital investment program that totaled about \$16 billion over the past five years (2018–2022) for the whole CN network.

DISCIPLINED ADHERENCE TO THE OPERATING PLAN

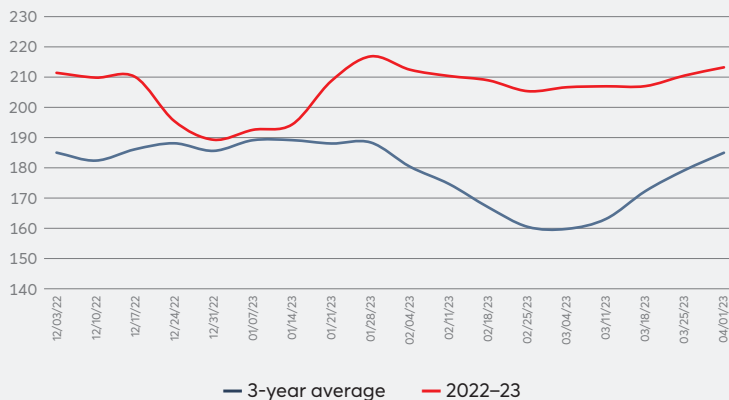
Going into fall 2022, CN was confident we had a comprehensive, strong, and realistic plan in place for the coming winter. As a key link in end-to-end supply chains, we intended to deliver the best possible rail service. Fundamental changes to CN's rail operating plan — including a back-to-basics approach to scheduled railroading, disciplined adherence to the plan, and enhanced internal and external communications and planning — were implemented in the spring and summer of 2022, laying the foundation for a successful fall and winter campaign (see *Making and Running the Plan* on p. 37 for more information).

CN's focus on running a scheduled railroad has enhanced network velocity, improved asset utilization, and created network capacity.

Car velocity: One area where CN anticipates being able to continue to improve network performance this winter is car velocity. Car velocity represents an all-encompassing operating metric that accounts for train speed from origination yard to destination yard, as well as the time (in hours) that a railcar spends in a yard. CN's velocity during 2022 and 2023 increased 30%, reaching the highest levels recorded since 2016. In fact, supported by normal winter conditions, CN's winter car velocity was on par with the levels CN achieved in summer and fall. This is important because speed at which railways move their equipment has a direct effect on their capacity because faster trains shorten cycles, thereby returning equipment for placement at origin more rapidly.

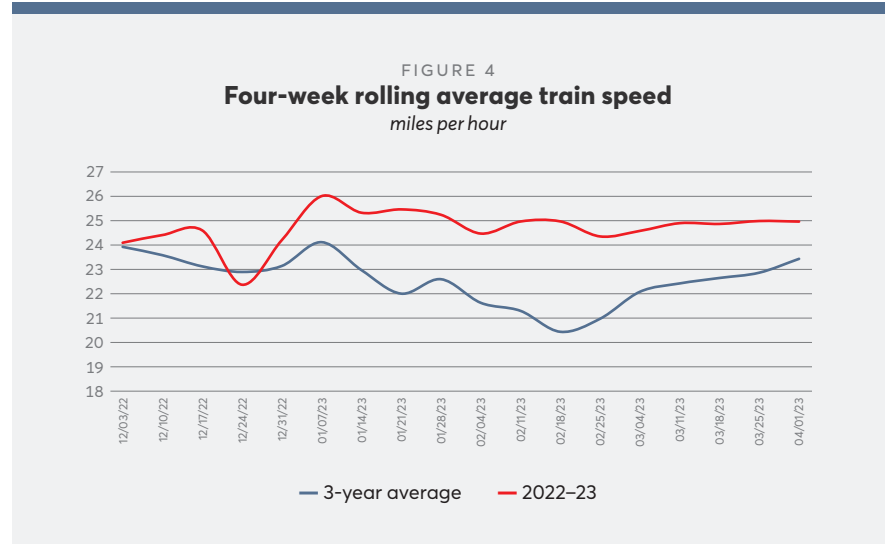
The best way to run an efficient railroad is to run a disciplined, scheduled operating plan. Our plan is sacred. We only run one plan, and everyone understands their role.

FIGURE 3
Four-week rolling average CN network car velocity
miles per day

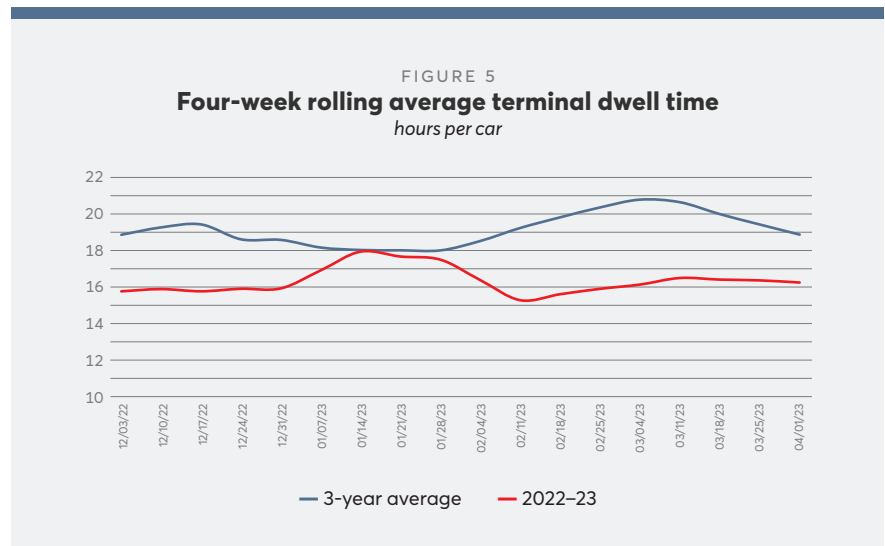


CN operates a disciplined scheduled railroad based on a strong level of safety, with higher railcar velocity, lower terminal dwell, and a commitment to consistently serving the needs of our customers.

Train speed is calculated by dividing total train miles travelled by total train hours operated, including time at terminals. Except in late December, when weather-related factors and a significant mainline disruption in Ontario materially affected network productivity, CN maintained overall average train speed at around 25 miles per hour throughout winter 2022–2023.



Terminal dwell, expressed in hours per car, represents the time a car spends at major rail terminals, from entry to exit. Terminal dwell demonstrated significant improvement compared to the previous three-year average.



CN's focus on adjusting volumes on local branch lines to match the capacity of the mainline network to accept that traffic during periods of extreme weather was key to allowing network productivity to recover much more quickly at the end of any prolonged period of widespread extreme winter weather. Conservative early implementation of tier restrictions also supported quicker recovery in velocity once extreme cold conditions eased.

MULTIPLE LABOUR AGREEMENTS COMPLETED

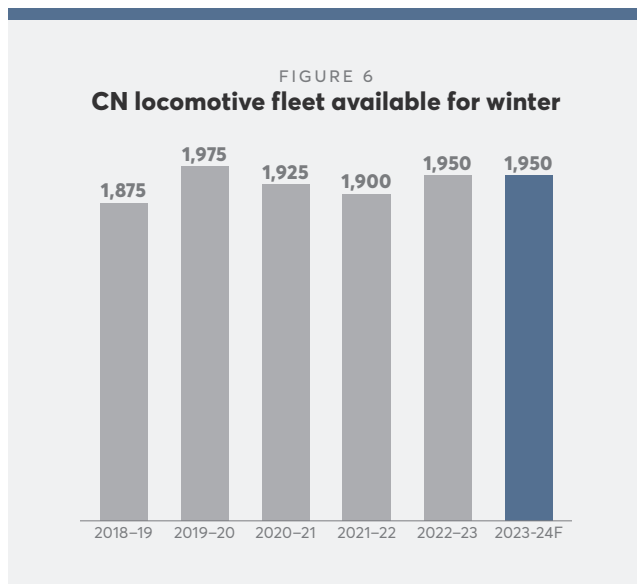
We are committed to working with our railroaders and their union representatives to create a workplace where employees thrive and, together, we deliver better and safer service to our valued customers. In advance of the coming winter season, CN entered into multiple labour agreements with unions representing CN workers.

Discussions with our employees and their unions will continue through to 2024 as we work to ensure a stable labour environment through the winter for both our employees and our customers.

UNION	CN WORKERS IN CANADA	DATE	EXPIRATION
International Brotherhood of Electrical Workers (IBEW)	~750 Signals and Communications employees	October 2022	December 31, 2024
Teamsters Canada Rail Conference (TCRC)	~150 rail traffic controllers	December 2022	December 31, 2025
	~6,000 locomotive engineers, conductors, yard conductors, and yard coordinators	April 2023; ratified on May 26, 2023	December 31, 2023
Unifor	~3,000 employees working in Mechanical, Intermodal, Facility Management, and clerical positions	March 2023; ratified on May 1, 2023	December 31, 2024

LOCOMOTIVE-SPECIFIC INITIATIVES AND ACTIONS

This winter, CN expects to have an inventory of approximately 1,950 locomotives for use on our mainline trains and for local assignments to customer sidings, about the same as in 2022 and 50 more than in 2021.



At CN, we work hard to ensure we have the locomotive fleet required to operate our network and move the traffic offered for shipment by our customers. Because the lead time for acquiring new locomotives is typically 12 months or more, CN must plan acquisitions of new locomotives well in advance. This is another reason why accurate customer demand forecasts are important to support CN resource planning activities.

CN has taken delivery of 57 high-horsepower AC locomotives to augment our fleet. We also added 75 pre-owned high-horsepower locomotives to our fleet in 2021 and nearly 50 in 2022. AC locomotives have significantly better adhesion, improved traction and are less prone to failures than DC locomotives. Last winter, over 55% of CN's locomotive fleet in Western Canada were AC-traction locomotives, allowing the movement of heavier bulk trains and maximizing power-to-tonnage ratios. In addition, CN modernized 25 locomotives from DC traction to AC traction between October 2022 and March 2023. An additional 25 of such modernized locomotives will be added in the fourth quarter of 2023, increasing the proportion of AC traction locomotives in CN's fleet.

CN recently announced the modernization of up to 60 locomotives in our existing fleet, bringing the total modernized fleet to 110 locomotives. These locomotives will be upgraded from DC to AC traction motors and will feature enhancements such as the FDL Advantage engine upgrade and a suite of digital solutions like Trip Optimizer and LOCOTROL Distributed Power. These upgrades are expected to extend the life of the locomotives and provide fuel efficiency improvements of up to 18% through a combination of engine and digital technology enhancements, a more than 40% increase in reliability, and up to a 55% increase in pulling power. The investment supports CN's commitment to drive growth in a sustainable manner and build success for customers, employees, and communities.

There is a difference between the size of the overall locomotive fleet and the number of locomotives available for use on any given day. As with any type of motive power, winter is harder on locomotives and the proportion of out-of-service locomotives tends to increase seasonally. For example, failures related to traction motors, air dryers and compressors increase in snowy weather.



Dufresne, MB

Our locomotive winterization program begins well in advance of winter and focuses on traction motors, air compressors and other air components, and cooling systems. The scope of locomotive winterization work is adjusted using historical performance trends to mitigate the top causes of winter failures and improve performance in harsh winter conditions.

Locomotives must also undergo periodic inspections, some of which are required by government regulations. By completing these inspections prior to the onset of winter, CN keeps locomotive repair shop space open to repair locomotive failures during winter rather than tying up shop space to perform inspections.

The CN Mechanical team has also taken many other actions in advance of winter to increase the number of locomotives in service at any point in time. These initiatives include process improvements to reduce locomotive dwell times and improve reliability. The implementation of locomotive process improvements based upon lessons learned in winter 2021–2022 resulted in a daily average of nine fewer locomotive failures between November 2022 and March 2023. Every additional locomotive in the field makes a difference, especially during the challenging winter months.

CN had 60 locomotives strategically stored during the 2023 summer downtime period due to reduced customer demand. Those locomotives were activated and injected back into the fleet in September owing to best efforts from Transportation, Mechanical and Network Operations teams working together.

As part of CN's "Train Ready" concept, locomotive power was positioned with empty railcars spotted at customers' facilities and remained with the empties until loaded. At facilities equipped with air compressors, the trains were kept powered up and aired up. The improved overall locomotive availability reduced dwell times and allowed for faster turnaround of assets.

ROLLING STOCK PLANNING AND MANAGEMENT INITIATIVES

Investments

Major CN investment initiatives specific to rolling stock include the following:

Boxcars	800 new high-capacity boxcars delivered in H1 2023 to support customer demand for shipments of forest products, metals and minerals, and other commodities across our North American network.
Grain hopper cars	500 new-generation, high-efficiency grain hopper cars added to our fleet during the 2022–2023 crop year. Since 2019, CN has taken delivery of 3,500 new hopper cars, with another 750 coming in 2024.
Centrebeams	283 cars added in 2023 to support our forest products customers.
Ore cars	600 cars being added in 2023–2024 to support our iron ore supply chain.
Bi-level autoracks	300 cars being added in 2023–2024 to transport SUVs for our automotive customers.

Our new high-capacity hopper cars each have 900 cubic feet more loading capacity and weigh less than legacy cars, which means we can haul more grain per car. Each car is also more than four feet shorter than the hopper cars built in the 1970s and 1980s, which translates into being able to spot an additional 8 to 10 cars on the same length of track. More tonnes per car and more cars per train add up to 40% more grain going to port per unit train. Similarly, our new high-efficiency boxcars are 16% shorter than older boxcars yet have greater load capacity. Shorter cars are especially useful during winter train-length restrictions.



Inspections

For many traffic segments for which CN supplies equipment, such as hopper cars, boxcars, centrebeams and gondolas, demand is cyclical. This can necessitate the storage of CN-supplied equipment for lengthy periods. When equipment is stored for a long time, comprehensive inspections are required before the equipment can be put back into service. CN is proactive in inspecting these railcars in advance of demand surges. For example, with more than 4,000 grain hopper cars in storage in mid-July 2023, car inspections and repairs were undertaken in August and September in preparation for the peak grain season that runs through the fall and winter months.

CN supplied rolling stock coming out of storage receives a full inspection by CN personnel focusing on:

- Outlet gates (e.g., gravity dump hopper car outlet gates)
- Trucks (wheel axle frame located under the ends of a railcar)
- Side sills (longitudinal supports that constitute part of the railcar underframe)
- Hopper car hatch covers
- Boxcar doors
- Maintenance advisories (e.g., brake valves, air tests)

CN also has a summer reliability maintenance program for railcars. This program uses repair data to proactively identify cars with a higher probability of failure. It also focuses on repairing cars identified by customers (e.g., gates, doors).

Our Automated Inspection Portals (AIPs) use high-resolution imaging hardware and machine learning software to inspect trains at track speed (see p. 21 for more information). Detector technology is also used by CN to flag cars with partially applied hand brakes, reducing the frequency of wheel defects and improving fuel efficiency (see p. 19 for more information). CN's proactive and comprehensive inspection programs translate into fewer equipment failures in winter.

Customers

Private railcar customers should regularly inspect their cars in active service, especially before winter, and perform a pre-winter inspection on cars coming out of storage, paying particular attention to the air hoses and connecting gaskets. Air leakage is a leading cause of train delays during extreme cold weather. Customers can help trains depart more quickly by properly servicing their fleet for cold weather operations and ensuring the cars' braking system is operating effectively. Carefully inspecting all railcars also ensures safe operations and can reduce the likelihood of cars needing repairs enroute.

Like CN, the customer-supplied fleet needs to be right-sized and shipments regulated to ensure efficient movement throughout the supply chain. Customers shipping long distance also need to be aware of the weather conditions at both ends of their supply chain, as well as the conditions enroute.

With respect to fleet monitoring, customers need to actively monitor shipments to ensure interline shipments make it to destination and are unloaded in a timely manner. The longer a car takes to return to CN, the fewer empty cars will be available for the next shipment. In addition to customers tracking their own shipments, the CN **Efficient Receiver Report**³ provides daily updates (Monday to Friday) on the status of CN's pipeline fluidity and highlights destinations that are unloading cars slowly.

Customers can also track their shipments anywhere on the North American rail network using CN's new tracking tool. The CN One mobile app provides a snapshot of a customer's carload or intermodal shipment in real time, 24/7. Customers can access intuitive map views and multiple tracking features that allow them to share critical shipment information anytime, anywhere.

Learn more at <https://www.cn.ca/en/stories/20230508-cn-one-shipment-tracking/>

Customers shipping from CN origins to CN destinations (65% of CN traffic) can further optimize their supply chain planning by taking advantage of real-time GPS shipment data through a CN Application Programming Interface (API). Combining CN's APIs with other customer planning tools like Advance Arrival Notifications allows customers to react to evolving winter conditions and fine tune their supply chain.

Learn more at <https://www.cn.ca/en/customer-centre/tools/api/>



³ <https://www.cn.ca/en/your-industry/customer-reports/efficient-receiver-report/>



INVESTMENT IN RAIL INFRASTRUCTURE

CN invested about \$16 billion system-wide between 2018 and 2022, with nearly two-thirds of that investment going into track and railway assets. These investments ensure the continued safe and efficient operation of our rail network as well as increase capacity, improve fluidity and accommodate growth. Our capital program also creates optionality and nimbleness to better respond to the unexpected, including extreme winter weather.

Capital projects in 2022 included building long sidings and double tracks, especially in Western Canada. We also invested in our intermodal terminals around Toronto and Chicago to promote gateway growth and deployed advanced technologies to improve decision-making, capacity, and service levels. A significant portion of CN's investments in 2022 were dedicated to track maintenance to support safe and efficient operations, including the replacement of 343 miles of rail and 1.1 million ties, plus upkeep of 448 level crossings, as well as maintenance of bridges, culverts, signals, and other track infrastructure across our 18,600-mile network.

Since 2016, CN has added over 150 miles of double track and completed more than 20 siding projects. Siding and double track projects improve network capacity and fluidity.

Specifics of new rail infrastructure capacity enhancements put into service recently include:

Active fleet management

At CN, we actively manage our fleet to restore fluidity in congested areas by imposing temporary embargoes, including embargoes with permits, to metre the flow of traffic in areas experiencing extreme weather conditions. We also reduce the active fleet during periods of tier restrictions (see the train length section on p. 43) to maintain fluidity on the mainline.

In the case of major mainline disruptions, CN can reroute traffic, including over other railways' lines at CN's expense, to meet our commitments to our customers. Other corridors available to reroute traffic on CN's network include the Prairie North Line, which runs parallel to CN's mainline across the Prairie provinces. CN also has the option of routing traffic north of the Great Lakes between Winnipeg and Toronto or south of the Great Lakes via the U.S.

Efficient production in CN's classification yards is also critical to maintaining network fluidity. In addition, it is important that proper documentation for billing and customs is completed to avoid delaying the movement of cars.

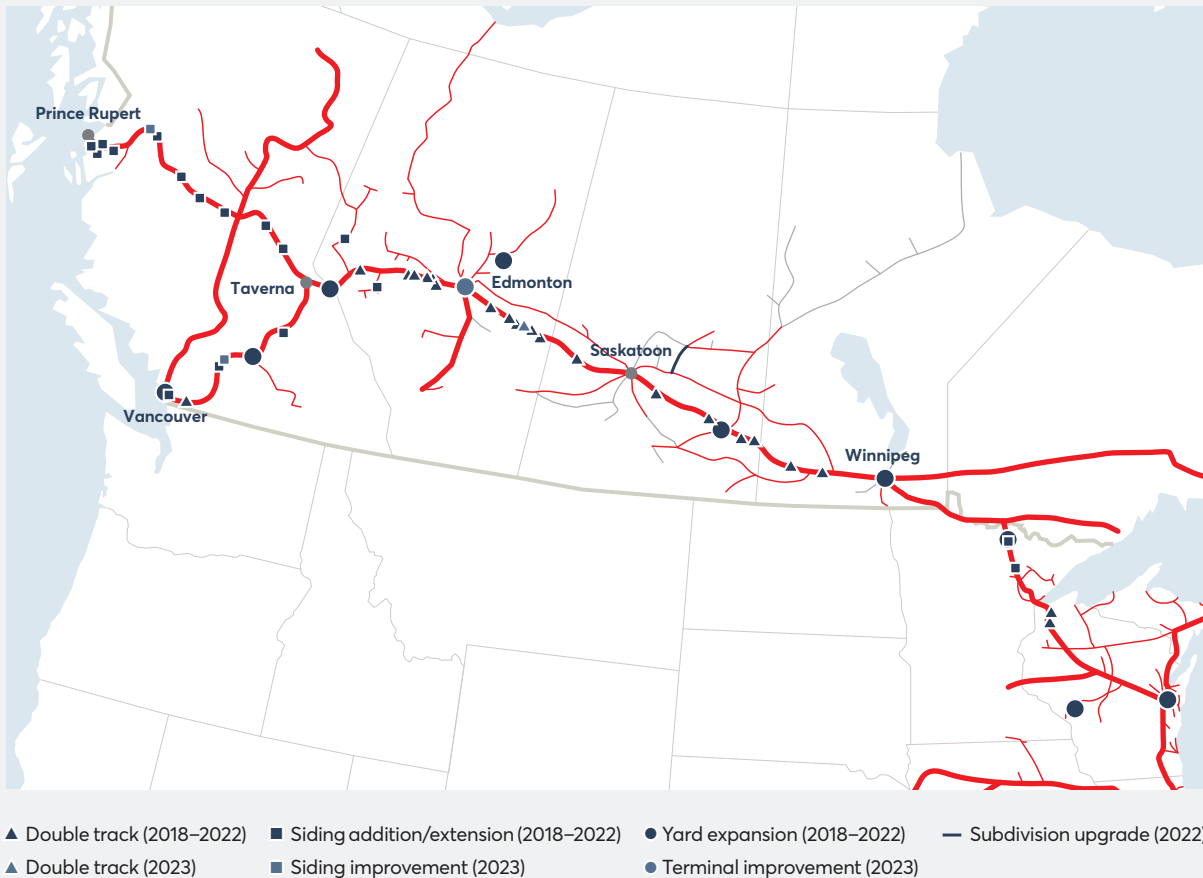
PROVINCE	AREA	DESCRIPTION
Alberta	Wainwright Subdivision	9.5 miles of double track east of Edmonton to increase train capacity along the subdivision.
	Clover Bar and Walker Yard	Centralized traffic control and track improvements to improve velocity and capacity through the Edmonton area.
British Columbia	Bulkley Subdivision	12,000-foot siding between Smithers and Terrace that increases capacity between Edmonton and Prince Rupert.
	Ashcroft Subdivision	12,000-foot siding that increases capacity between Kamloops and Vancouver.
	Chetwynd Subdivision	12,000-foot siding between Prince George and Chetwynd that increases capacity between Prince George and Fort St. John.
	Chetwynd and Fort St. John subdivisions	Track and bridge infrastructure improvements between Prince George and Fort St. John to improve reliability and reduce weight restrictions.

For 2023, CN's capital expenditures are expected to remain consistent with the range of investments in recent years. New major rail infrastructure capacity enhancements expected to be in service in 2023 include:

B.C. North	Siding improvement – Bulkley Subdivision
B.C. South	Siding improvement – Ashcroft Subdivision
Edmonton–Winnipeg Corridor	Construction of eight miles of double track east of Edmonton on the Wainwright Subdivision
	Edmonton Terminal improvements, including upgrade of one siding to improve track velocity

The projects are planned for completion before the onset of winter. Close coordination is required between our Transportation, Engineering and Rail Traffic Control teams to coordinate the construction projects while rail traffic is moving 24 hours a day, 365 days a year. Managing major infrastructure work on busy corridors is a highly complex task, requiring significant planning and resources. It involves temporary interruptions of service to provide Engineering crews with needed protected track time to perform their work. During that track time, rail traffic cannot move through sections of the network where work is being performed or must pass through at a slower speed.

FIGURE 8
Major CN capital infrastructure investments between 2018 and 2023



ADDRESSING BOTTLENECKS

To remove system bottlenecks and create new capacity in and around the ports of Vancouver and Prince Rupert, CN has completed or is in the midst of several multi-year projects. Some are in conjunction with the port authorities and the Government of Canada. The projects include:

Port of Vancouver

- **Thornton Tunnel ventilation** – Installation of fans to improve exhaust ventilation and increase the capacity of the CN Thornton Tunnel, which leads to grain terminals and other facilities on the North Shore of the Port of Vancouver. This change allows trains to pass through the tunnel more frequently (cutting the 20-minute interval between trains to 5 to 10 minutes) and better utilize capacity when the CN Second Narrows Bridge is available for transit. **IN SERVICE**
- **Piper Douglas siding** – Addition of a third track (18,900 feet) to increase capacity between the Thornton Tunnel and Thornton Yard for traffic to the North Shore. CN can now stage trains close to the Second Narrows Bridge instead of staging them much farther back at Thornton Yard. **IN SERVICE**
- **Thornton Yard bypass** – Construction of a 12,000-foot bypass and 6,000 feet of yard track to improve fluidity and yard capacity. **IN SERVICE**
- **Glen Valley double track** – The project will remove the last section of single track infrastructure (3.7 miles) in the 25-mile double-track rail corridor between the end of the CN/CP Directional Running Zone and CN's Thornton Yard, which supports industry and port facilities in the Lower Mainland. The project will also make the network more resilient to disruptions by stabilizing grade slopes with a retaining wall. **ONGOING MULTI-YEAR PROJECT**

Prince Rupert, BC



Port of Prince Rupert

- **Fairview–Ridley Island Connector** – A 5-km road between the Fairview Container Terminal and Ridley Island allows trucks to move more efficiently and supports future infrastructure growth. The route reduces the truck length of haul from 20 km to just 5 km, and truck traffic no longer has to transit downtown Prince Rupert. The road supports current port operations and future terminal expansion and improves the resiliency of the broader port area. **IN SERVICE**
- **Zanardi Bridge renewal project** – Bridge replacement and double tracking will increase the maximum number of trains that can enter and depart the Port of Prince Rupert each day. The bridge capacity expansion will reduce operational conflicts and increase rail capacity to the Port of Prince Rupert to accommodate future growth in import and export trade for all current and future terminals. **ONGOING MULTI-YEAR PROJECT**
- **Road-Rail Utility Corridor expansion** – Expansion of the corridor constructed prior to 2017 will support access to any future terminals on Ridley Island and facilitate unit train access. **ONGOING MULTI-YEAR PROJECT**

PEOPLE INITIATIVES AND ACTIONS

Beyond investing in physical network infrastructure is the need to invest in our people. We are focused on ensuring we have the right number of people to deliver the best possible service, especially during winter. We assess the size of our operating crew base at the regional and terminal level, taking into consideration the time required to train locomotive engineers, conductors, and others working on the railroad. Many variables can affect the staffing of rail operations. They range from major mainline disruptions to the impact of economic demand on our customers' businesses. It is important to note that CN did not make reductions to the operating crew base during the current economic slowdown in 2022 and 2023. In fact, CN's total headcount at the end of 2022 was approximately 1,350 higher than at the end of 2021, with most of the increase in operating crew base.

Heading into this fall and winter, CN will also have rail operating rules-qualified managers available to protect rail traffic movement and support operations during challenging winter operating conditions and periods of high demand. Based in part on rail network capacity demand forecasts, CN also expects there will be opportunities to temporarily deploy operating crews from areas of anticipated crew surplus to areas where additional operating crews are needed. This segment of employees will assist in protecting train service during periods of abnormal winter operating conditions and augment overall rail capacity. CN also has additional rapid deployment teams of dedicated managers from relevant departments in place to take action as needed.

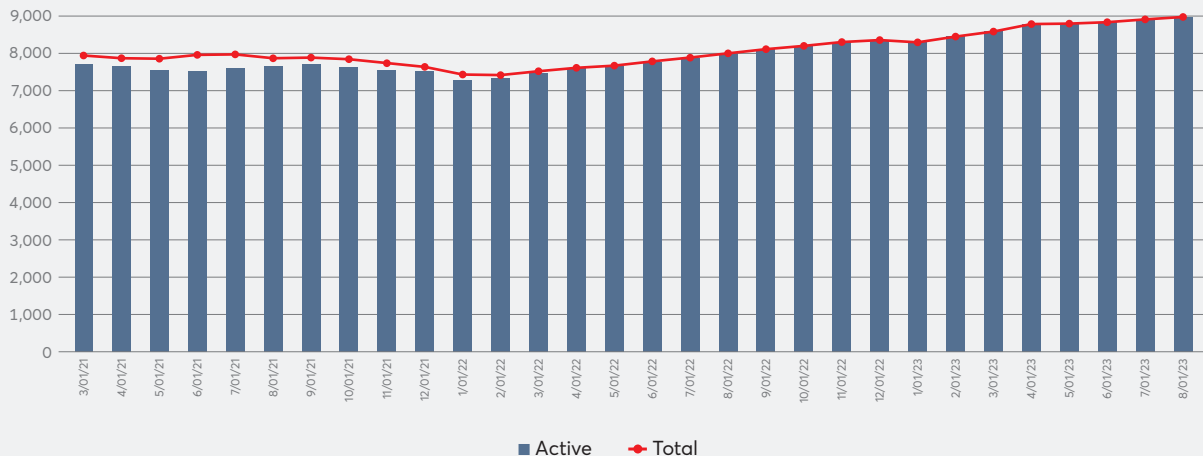
It should be noted, however, while assets such as locomotives can be readily redeployed to other areas of the rail network, resources such as crews cannot. Just like any other employee in Canada's economy, railroaders typically work and make their home within a specific region. Even when employees take short-term assignments to support a high-demand area, it still takes time to train and familiarize them with their new region.

In a challenging labour market with a stubbornly low unemployment rate and fewer and fewer people choosing blue collar careers, CN takes measures to attract potential new employees, including:

- Providing hiring bonuses in hard-to-recruit areas.
- Holding more targeted recruitment information sessions at job fairs and during evenings and weekends.
- Working with postsecondary and technical schools to improve recruitment of graduates.
- Fostering vibrant relationships with Indigenous and other underrepresented groups by proactively promoting job opportunities and our commitment to diversity, equity and inclusion.
- Using new online recruitment and interview tools to accelerate the hiring process.

But the reality is that unemployment levels remain at or near the lowest rate in decades and demand for employees with the skill sets CN needs is very high in many sectors of the economy, especially in rural areas where many CN employees live and work. Our customers and supply chain partners report the same challenges in hiring new workers. This is the prevailing environment in which Canadian railways must provide rail service this winter.

FIGURE 9
CN network-wide operating crew base





MAKING AND RUNNING THE PLAN

Rail networks are complex systems that require careful planning and execution to ensure trains run on time and reach their destinations safely. The Network Operations teams make a comprehensive plan that optimizes volumes for the entire rail network and the Transportation teams run that plan. Together, they monitor the effectiveness of the plan.

Make the plan

The Network Operations teams analyze all volumes across the network and metrics like car velocity and on-time train performance to set a plan that optimizes capacity for the entire network. Effective operational design, planning, coordination, and communication are vital to building the most efficient trip plan and train service package to meet customer demand. They are also critical to maximizing network capacity and making the best use of operating assets (i.e., crews, locomotives, rolling stock and rail infrastructure) to deliver the goods safely and reliably. By analyzing data on train movements and scheduling, we identify potential bottlenecks, refine the model, and optimize train transits and connections to minimize delays and improve overall efficiency and capacity.

Network Operations also manages and directs the safe and effective movement of trains everywhere along the rail network. Having a coordinated and balanced network plan makes it easier to adjust to volume fluctuations and the whole network is more resilient to disruptions, especially in winter.

Key areas of responsibility making the operating plan:

Service Design: The team designs the most efficient trip plan and train service package to optimize transits, connections, and schedules to meet customer demand, maximize network capacity and asset utilization, and ensure the right resources are in the right place at the right time.

Network Operations Centre: Responsible for dispatching and crew planning.

Resource Planning: Ensuring resource balance comes down to effectively managing rail traffic flows across major rail corridors. A good example of managing resource balance is CN's grain hopper car fleet. In this case, corridor balance means CN has a balance of loaded hopper cars moving to destinations such as Vancouver, Prince Rupert, and Thunder Bay, and empty hopper cars moving back to the Prairies for the next load of grain. We use our serving hubs in the Prairies to balance loaded hopper car outbound movement and empty hopper car inbound traffic within individual regions. Surging demand in a specific region that exceeds a hub's capacity causes congestion and reduces network capacity.

Rail Traffic Control (RTC): RTC centres in Edmonton, AB, and Homewood, IL, control active train movements along the network.

Motive Power: When locomotive power is in balance, CN has the optimal mix of locomotives across the network. A locomotive imbalance means that one part of the network is in deficit for motive power while another is in surplus, and assets must be redeployed. The Motive Power team monitors locomotive flows at key CN terminals and between regions and adjusts the power plan as required. The team also optimizes the locomotive mix for individual trains, such as avoiding a mix of AC and DC locomotives on the same train. Ensuring optimal flow of locomotives with distributed power (DP) capability back to Canada and the northern U.S. is especially critical during the winter months to maximize the number of DP units available in areas with colder operating conditions.

Supply Chain: The team is responsible for overseeing traffic movement and planning for individual business segments, providing end-to-end supply chain oversight to ensure smooth network operations and managing fleet size to maintain fluidity and maximize productivity.

Run the plan

When it comes to running the plan, we focus on safety, train speed and on-time performance. Trains need to make their connections at the scheduled time with the correct blocks of cars. We work hard to reduce terminal and yard dwell. And we do not run a train longer than the sidings along its route. These basic principles, when done right, equate to velocity and capacity, and drive balance across the network while lowering costs.

When running on a schedule, it is critical that every train departs on time because its locomotive is expected at the next yard to be put on another train with a new crew. And the railcars are planned for connections so our team can get them to the customers on time. Strict adherence to the schedule drives more asset velocity, more consistent utilization of power and crews, and more predictable and consistent customer service.

To maximize overall network capacity and protect CN's core train schedule, strategic staging of bulk unit trains will once again be key this winter to maximize utilization of planned train slots in CN's busiest rail traffic corridors. CN has identified three rail traffic staging locations in Edmonton, AB, and two in Jasper, AB, to maximize the utilization of rail capacity. While unplanned staging of traffic negatively impacts overall train speed, car velocity and other rail performance metrics, having the right traffic in the right position to take advantage of network capacity opportunities and make best use of train slots in high-traffic areas (through planned staging of rail traffic) is critical. Always having a train in hand to launch when a rail slot is available is key to maximizing planned train slot capacity.



Key areas of responsibility running the operating plan:

Transportation: The team, organized into Western, Eastern and Southern regions, executes the plan in the field. General managers are responsible for the operations within their respective geographical areas.

Working together, the Network Operations and Transportation teams refine the plan on a continuous basis. When any issues arise, they work in lockstep to resolve them at the network level and get safely back on plan. Any changes are always made with a view to optimizing the whole network, not just the train or yard that is currently experiencing an issue, because this is how CN drives efficiency and moves forward.

Coordination with customers: Then there is the day-to-day coordination and planning that occurs between CN and our customers. CN's Customer Service, Supply Chain, and local Operations teams work to maintain a safe network and access to our facilities, while customers need to maintain their tracks for safe movement of cars and equipment. For example, in the potash supply chain, daily discussions between CN and our customers cover shipping plans and requirements on a corridor-by-corridor basis. They involve discussions about the plans and performance of the mines and unloading facilities, the customer's rail transportation requirements of CN and connecting rail carriers, shipment deadlines to meet vessel cut-off times, and end-use customer requirements. Based on these discussions, the plan is developed.

CN's focus is on providing a solid weekly operations plan that takes into consideration all the comings and goings in the end-to-end supply chain, from origin to destination and all points between. The changes to rail operations and planning activities that CN has made in advance of winter contribute to overall network performance and execution of the plan. Running tight to the plan until there is no other option is key to CN's operational success.

When plans do not materialize as expected due to weather or for other reasons, a recovery plan is required. CN places heightened efforts on developing recovery plans that have a high probability of success and communicating these effectively to our customers. CN will also continue to advise customers of exceptional network conditions that impact shipments, like winter storms, persistent cold weather, and track outages.

4. Enhancing network reliability

PROTECTING CN'S MAINLINE FLUIDITY

The health of the CN mainline is critical to rail operations, and that is especially true during winter. Loaded and empty railcar traffic is ordered by customers to and from their respective facilities on the CN mainline or along the CN feeder line network. Rail traffic is directed from the network to CN rail yards to build the longer trains that run along the mainline. Matching the capacity of the mainline to the feeder traffic is paramount to protect mainline fluidity and overall traffic movement.

When temperatures dip to -25°C or below, the most immediate consequence is to reduce train length to maintain safe operation of the train's braking system and comply with Transport Canada requirements. When trains are shortened, more crews and locomotives are required to move the same volumes of traffic. The result is increased risk of congestion in rail yards and associated traffic delays. If extreme cold conditions continue for long periods, there is a ripple effect across the rail network. CN uses supplemental sources of air such as DP locomotives and distributed air cars to reduce the need to shorten trains while continuing to ensure safe operations.

This winter, CN will once again focus on ensuring local rail service is adjusted to match the capacity of the mainline network to accept traffic during periods of extreme weather. This will allow network productivity to recover much more quickly at the end of any prolonged period of widespread extreme winter weather.

Our exceptional footprint provides optionality that is of increasing importance to our customers in a world of emerging and shifting trade patterns.



WEATHER FORECASTING

Weather is often unpredictable and can vary dramatically across the breadth of CN's network. Last winter we dealt with prolonged periods of extreme cold in Western Canada. They were typical examples of what a Canadian winter can bring.

CN uses customized weather forecasts based on sophisticated meteorological models to predict geographic areas of the network that are expected to experience persistent cold or other extreme winter weather conditions. When extreme cold weather is anticipated, where CN will be required to implement train length restrictions (see the train length section on p. 43), CN will advise customers in advance of the potential need to adjust their individual local service to match mainline network capacity and coordinate those modified activities with customers. In addition, CN will continue to work with customers to right-size their private railcar fleets, because surplus inventory cannot be stored on CN's tracks during winter.

With sufficient warning, resources can be moved into the regions that are going to get hit the hardest by extreme weather, with emphasis on keeping yards fluid and preventing congestion. CN must plan for varying weather conditions along the entire route of the train. Extreme cold conditions must be accounted for prior to train traffic entering affected areas. By utilizing the advance information, CN can make informed decisions about train crews, movements, and locomotives to help keep the network fluid without being surprised by significant snowfall or extreme cold events.



AVALANCHE MITIGATION

The advance weather information is even more critical considering the risk of avalanches along mountainous corridors. CN's avalanche program has been in place since the 1980s, and is focused on avalanche forecasting, control, avoidance, and detection. The CN mainline subdivisions that see the most avalanche activity on an annual basis are the Albreda, Robson, Bulkley, Skeena, Chetwynd and Tumbler subdivisions located in northern British Columbia, typically producing avalanche deposits on CN mainline track in multiple instances. CN's B.C. South region also sees intermittent avalanche activity. In total, CN's avalanche atlas identifies 240 individual avalanche paths that require monitoring. Many of the paths in the B.C. South region come from rock cuts and not the natural mountain paths like in the B.C. North region.

We work closely with our avalanche risk forecasting service provider throughout the winter snow season. Risk forecasting is based on weather information collected by CN and from other sources. Many of these weather stations are situated in very remote areas, including at the tops of mountains, and CN must maintain these stations and ensure their effective operation. Wireless communication is also required to transmit data, which presents its own unique challenges. CN upgraded several of the weather stations in advance of winter to ensure we can collect as much accurate weather information as possible to support avalanche risk forecasting activities.

Besides weather information, intelligence collected from various sources concerning snow conditions is also used to assess avalanche risk. A daily regional avalanche risk report is circulated early in the morning to CN Rail Traffic Control centres, Engineering track supervisors, and other individuals involved in rail operations. The daily avalanche risk report details the level of risk associated with each avalanche zone, and the level of risk drives changes to train operations and Engineering track patrols.

Various types of infrastructure help to mitigate the impact of avalanches on train operations:

Snow sheds are structures with sloped roofs situated over tracks in mountainous terrain to redirect snow away from rail infrastructure.

Rock sheds are similar structures that protect against rockslides and can also protect against avalanches.

Berms are also situated alongside vulnerable track infrastructure to protect it from rocks, trees, and other debris generated by avalanches. The areas behind the berms are prepared in advance of winter to maintain effective avalanche catchment and is cleared periodically.

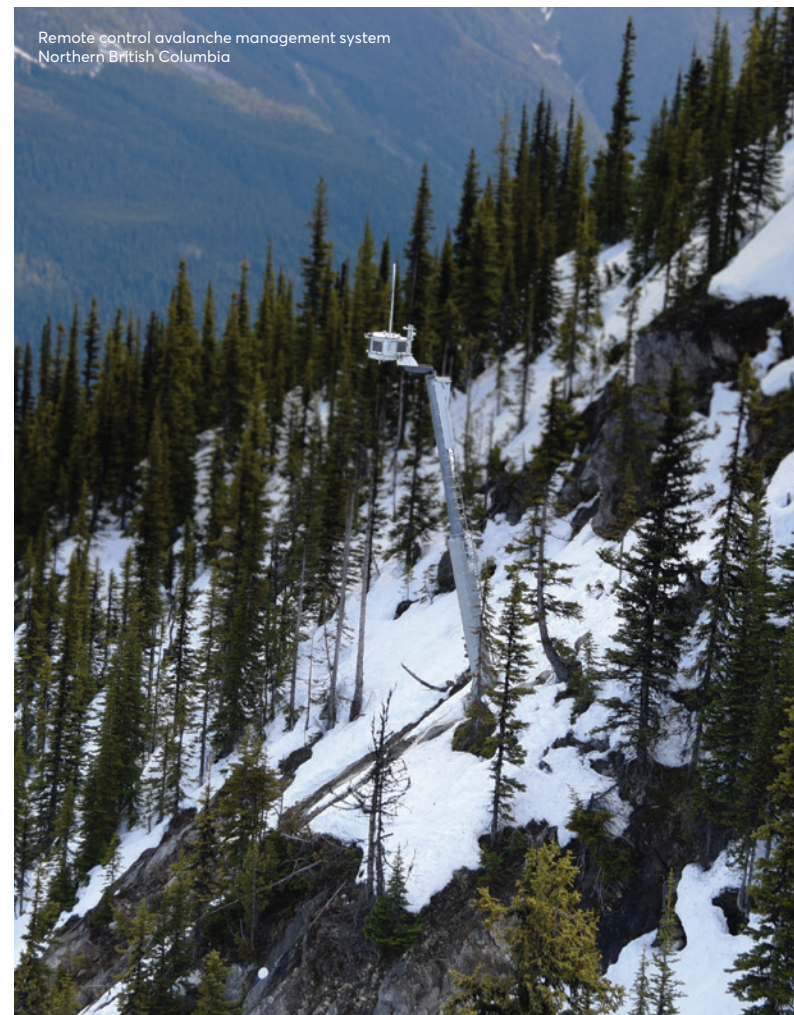
Avalanche detectors: Depending on the location, CN also has slide fence activity sites, which are either trip wires or mercury switch tip-over posts that indicate when debris or heavy snow enters the right-of-way, alerting trains to restrict their speeds and be prepared to stop in the affected area.

Active avalanche control: While the threat of avalanches to train operations cannot be eliminated entirely through protective infrastructure, CN is very proactive in practicing active avalanche control in high-risk avalanche zones. The purpose of this exercise is to artificially trigger small avalanches prior to them developing enough potential energy to occur naturally and in an uncontrolled fashion. CN employs two methods of active avalanche control.

- 1 Under favourable visibility and weather conditions, CN uses helicopters to drop explosives over the avalanche start zone. This method requires very close coordination, especially on CN mainline track, between multiple CN business functions. This includes Engineering personnel to be in position to potentially clear snow from tracks after the avalanche is triggered.
- 2 CN utilizes a unique remote control avalanche management system in high-frequency avalanche paths. CN has one of these systems on the Albreda Subdivision. The system is comprised of a tall tower equipped with explosive charges. An explosive charge can be dropped into the start zone of an avalanche path at the press of a button with a line of sight to the tower. CN has built a second remote control avalanche control system on the Albreda Subdivision to support our active avalanche control activities and improve rail network resiliency.

Being ready to respond quickly to emergencies such as an avalanche, washout or other track damage is key. We have done that by:

- Adding track patrols to identify problems and respond to them more quickly.
- Deploying standby Engineering crews to remove debris or snow from track.
- Staging emergency ballast and track panels in strategic locations to be able to deploy these materials quickly in the event of a track disruption.
- Implementing the **CN Winter Situation Report**⁴, a daily snapshot of current weather conditions across the CN network that is updated every morning at 9:30 a.m. ET. It includes the cold temperature tipping point and the effects it has on tracks, locomotives, and railcars.



⁴<https://www.cn.ca/en/your-industry/customer-reports/winter-situation-report/>

RESPONSE READINESS

When dealing with adverse winter weather, time is of the essence. The key is advance planning to have the people and equipment in place to respond as quickly as possible. CN has taken multiple steps to be ready to act when required.

Mechanical repair teams including mechanics and electricians are placed on standby in key locations across the network. For example, in the Edmonton area, teams are situated in places like Hinton and Wainwright to provide critical corridor coverage. Having teams deployed in the field rather than dispatching them from large central terminals saves time and preserves capacity.

Engineering repair teams are organized in much the same manner, ensuring signals are operating properly along the network and making timely track infrastructure repairs. This includes ensuring CN's 1,400-plus heaters, fans and other devices are operating properly to keep switches clear of snow and ice build up. When CN is notified of a potential rail break, there are typically two reasons: 1) a real problem with a piece of rail, or 2) the result of a signal malfunction. Typically, signal maintenance employees are deployed first to investigate, followed by track crews if a rail problem is identified. In winter, however, signal employees and track repair crews are simultaneously deployed to the affected area to take immediate and effective action regardless of the type of failure.

Backup power generators are deployed across the network in the event of public utility power failures, allowing critical operations to continue even during localized or widespread power failures.

Critical parts inventory: Having the right spare parts in the right place at the right time reduces repair shop dwell time and translates into more locomotives and other pieces of equipment out in the field.

Winter tool kits: CN maintains a supply of tools and equipment on hand in remote areas such as crew change locations in Wainwright and Edson, for example. These include portable heaters, wrap-around hoses and other tools and equipment that are often useful in winter, saving time and keeping the trains running.

CN has strategically stationed excavators and other equipment every 30 miles on busy corridors without road access to facilitate a quick response in the event of a rock slide or other outage.

Strategic deployment of locomotives ensures CN has the motive power needed to keep rail traffic moving and limit delays caused by online locomotive failures, especially in critical corridors. When locomotive demand exceeds supply due to extreme weather in Western Canada, a strategic reserve in the Edmonton area can be readily deployed to maintain rail operations.

Snow fences are put in place to protect track infrastructure in open areas with high winds. Simple and effective, snow fences help prevent snow accumulation on switches and track.

Snow-clearing equipment is strategically prepositioned in the right areas.

SAFE OPERATIONS – MAXIMIZING TRAIN LENGTH DURING PERIODS OF EXTREME COLD

The longer and more frequently conditions such as extreme cold or persistent rainfall occur, the more the supply chain's ability to recover is reduced. CN continues to innovate and find ways to improve our ability to deal with extreme cold and other severe weather events.

CN uses several important methods to mitigate the impact of cold temperatures on braking systems and the need for train length reduction. CN has implemented operational best practices that increase capacity and resilience to maximize network fluidity while maintaining safe rail operations.

Tier restrictions

CN employs a three-tier system to determine the maximum train length allowed at certain trackside temperatures. Last winter, CN implemented the tier restrictions more aggressively. Early implementation of tier restrictions ensured network fluidity was maintained during periods of extreme cold and corridor operations recovered more quickly after cold snaps. Effective communication between all CN departments and external stakeholders was key to ensuring success when tier restrictions were in effect. Anticipating cold weather and being proactive by building tier-restricted trains in rail terminals before tier restrictions were implemented was also very important during periods of extreme cold. Having derived clear benefits for the entire supply chain last winter, CN will continue to proactively anticipate when extreme cold will dictate tier restrictions are needed and implement the restrictions sooner rather than later. Not only does this practice improve safety, it also helps the network recover faster when warmer weather returns.

FIGURE 10
Maximum train length (in feet) allowed at specific temperatures

TIER LEVEL	TEMPERATURE		CONVENTIONAL	A – DP (1x1x0)		B – DP (1x0x1)	C – ADDITIONAL AIR SOURCES	
	°C	°F		HEAD TO MID	MID TO END	HEAD TO END	3RD, 4TH, 5TH AIR SOURCE	
NON-INTERMODAL, NON-SINGLE-COMMODITY BULK TRAINS								
Tier 1	-25	-13	7,000	6,667	3,333	10,000	For each air source added beyond the configuration corresponding to columns A and B, train length can be increased by 2,000 feet (2,500 for intermodal and single-commodity bulk trains) per additional air source, up to a maximum length of 12,000 feet. A maximum of five air sources to be used on a train.	
Tier 2	-31	-24	5,000	5,000	2,500	7,500		
Tier 3	-36 or lower	-33 or lower	4,000	4,000	2,000	6,000		
INTERMODAL AND SINGLE-COMMODITY BULK TRAINS								
Tier 1	-25	-13	8,000	8,000	4,000	12,000		
Tier 2	-31	-24	6,000	5,667	2,833	8,500		
Tier 3	-36 or lower	-33 or lower	4,500	4,500	2,200	6,700		

Notes:

1. For the purposes of this table, Distributed Power (DP) can be remote locomotives or Distributed Braking Cars.
2. For manifest trains running DP 1x0x1, the maximum length allowed from head end to DP remote is 7,500 feet.
3. Iron ore trains on the former DMIR territory are excluded from these restrictions.
4. The specified temperatures refer to the coldest forecasted temperatures between the train's origin and destination.
5. Column C does not apply to key trains.

For more information, visit <https://www.cn.ca/en/your-industry/customer-reports/winter-situation-report/>

Distributed power

CN runs trains as conventional power (meaning locomotive(s) at the head end of the train only) or as distributed power (meaning locomotive(s) also placed in the middle and/or at the end of the train). Locomotives placed mid-train and/or at the end of a train are controlled remotely from the lead locomotive. Distributed power provides more uniform tractive effort, lower in-train forces and more effective braking, thus reducing the risk of separations and/or derailments and is used year-round.

Placing an additional locomotive in the middle or at the end of a train enables air pressure for brakes to be maintained at required levels, even in extreme cold temperatures. Distributed power is very effective for winter operations because it can minimize the need to reduce train lengths for safety reasons. Each year beginning on November 1, our usage of distributed power increases, particularly on trains operating in Western Canada.

Distributed air braking cars

Unique among Class I railroads, distributed air braking cars are CN-modified boxcars containing air compressors and associated equipment. They supplement the air supply to the train's air brake system in a similar manner as distributed power and with similar benefits. In 2006, CN started with 10 air cars. Today, CN has about 100 air cars strategically deployed along the mainline throughout Canada and the Midwestern U.S. during colder months. Over the years, CN has made significant improvements to the air cars, such as adding new automation software and heat exchangers.



Taschereau Yard, QC

CN analyzes data from winter seasons to maximize the effectiveness of the air cars, developing standards for air source configuration and location in trains. CN's air cars have travelled more than five million miles since being put into service and have proven to be one of the most effective innovations in dealing with cold. The use of multiple sources of air including air cars once again helped trains depart terminals with minimal air issues this past winter.

Operating with higher air flow

It is well known that air flow (leakage) is directly affected by cold temperatures. The various temperatures that traffic moving along the network might experience can vary greatly from east to west or north to south. As a result, trains can be subjected to drastic temperature changes along their route, affecting brake hose air flow. For example, a train leaving a region experiencing -20°C and heading toward a region experiencing -40°C will see its air flow demand increase 4.5 times at points along its route. Because of this reality, cold weather operations become more challenging from a safety, efficiency, and customer service perspective. As such, CN has explored ways to mitigate this challenge by adding additional air sources on trains (e.g., distributed power, air cars).

When the current train brake rules were written, the requirement for distributed power trains not to exceed a combined air flow of 90 cubic feet per minute (CFM) did not contemplate the notion of inserting more than two or three air sources. Technology has evolved and now supports up to five air sources, all controlled by a single locomotive.

Based on lab testing, static tests, modelling, and three test exemptions approved by Transport Canada and carried out by CN in the winters of 2020, 2021 and 2022, CN demonstrated that by adding air sources to a train, the overall health of the brakes improves notwithstanding that the combined air flow will exceed 90 CFM. Data results consistently validated that braking response continues to be reliable even in high-flow conditions. Last winter, CN secured a four-year exemption from Transport Canada until May 1, 2026, based on these testing results. CN is required to continue to provide detailed test results to Transport Canada at the end of every year.

Air gaskets

Each air hose connector between railcars contains a rubber gasket. As they wear out or freeze, they become less effective and more air escapes from the brake system. CN changes gaskets systematically as part of normal car maintenance to increase effectiveness. We are continuing our research to identify and implement new air gasket options and materials. CN is piloting a new technology at our Melville, SK, yard that is showing positive results. The device uses thermal and acoustic imaging to detect even the smallest leaks in air brake systems on rail cars.

Enhanced set out

Enhanced set out is another operational tool that CN utilizes to increase operational resiliency and performance during winter. Consider a train with distributed power heading into Saskatoon. With enhanced set out, a portion of that train can be left behind with a locomotive. Using advanced software, the locomotive shuts down and restarts automatically to keep that segment of the train fully charged with air. When an operating crew returns to hook up to the set out portion of the train, they can make a much quicker departure versus spending considerable time to charge the train with air. The ability to use enhanced set out benefits non-unit-train grain customers, for example, considering the nature of car spotting/pulling operations for these customers.

CN has upgraded distributed power software and made changes to other processes that have positioned CN to use enhanced set out this winter.

Big data

Through our locomotive telemetry systems, we collect large amounts of data to improve performance and fuel conservation. In addition, Horsepower Tonnage Analyzer uses the data from the systems to optimize a locomotive's horsepower-to-tonnage ratio, further minimizing fuel consumption and improving performance during cold weather.



Blue River, BC

Key train speed restrictions

Rules Respecting Key Trains and Key Routes approved by Transport Canada in 2021 target key routes and higher risk key trains, which are trains carrying 20 or more cars containing dangerous goods such as flammable liquids or one or more cars of toxic inhalation gas. The maximum permissible speed of these trains is a function of whether the train is transiting signalized territory or not, whether the train is operating in a metropolitan area, and the specific type of key train. The current version of the revised rules also limits the speed of these trains based on ambient track temperature.

While being fully supportive of the need for safe operations, CN is concerned that the speed reductions of these trains will have the effect of slowing all trains on the network. This, in turn, reduces capacity and risks congestion at the time of year when CN already faces difficult operating conditions. The low speed of any given train creates the cumulative impact of limiting the speed of all trains behind it. This situation further compounds the challenges of winter operations and inhibits the capacity of the entire network.

The rules include an option for railways to submit a Winter Operations Risk Plan for Higher Risk Key Trains, which provides for different speed thresholds for sections of track that meet specific safety requirements. CN has developed and implemented a Winter Operations Risk Plan that allows for more flexible winter operations.

For more information, visit Transport Canada's website at <https://tc.canada.ca/en/rail-transportation/rules/rules-respecting-key-trains-key-routes-0>



Biggar, SK



Conclusion

By taking the comprehensive, coordinated, and collaborative approach detailed in this 2023–2024 Winter Plan, we believe CN is well positioned to build on last winter's success and meet the challenges of the coming winter head on. Having operated in Canada for more than 100 winters, we understand the challenges we and our partners face each season, and we continue to innovate to deal with the effects of winter safely and efficiently.

The breadth of our integrated actions and the scale of our planning activities are designed to ensure CN can deliver the best possible service during the winter months. The steps we are taking are based on working safely, meeting the needs of our customers, consistently striving to improve network performance, and enhancing network reliability.

Over the past 18 months or so, we have made essential changes to the way we make and run our disciplined operating plan. In anticipation of winter, we are deepening our commitment to scheduled railroading to power strong network performance and safe service delivery.

It is important to recognize that the railway is only one part of a complex and integrated supply chain network. The challenges winter often presents impact not only the railway's operations, but also those of our customers and supply chain partners. Each of us is a critical component of Canada's transportation system. It is why we continue to collaborate with and deepen our communications with all our stakeholders, sharing information and plans as part of a coordinated and integrated approach to understanding their needs. Because accurate forecasts are key to dealing with winter. Customers look to us to deal with and recover quickly from disruptions. We believe this Winter Plan will help us meet those expectations.

The Winter Plan is also shaped by the knowledge that the rail system has physical limits and must respond to the needs of multiple economic sectors competing for service. They include forest products, grain, propane, potash, intermodal and other commodities. The scale of that task grows significantly in winter when weather often slows rail service and diminishes the capacity of the system, at a time when it is also hobbled by the closure of certain locks and the Port of Thunder Bay.

With all these factors in mind, we are confident we have put in place a comprehensive, strong, and realistic Winter Plan that helps mitigate the harsh effects of a Canadian winter so we can deliver optimal service to our customers.

The best way to run an efficient railroad at any time of year is to run a disciplined, scheduled operating plan. Our plan is sacred to us. We only run one plan, and everyone understands their role to deliver for our customers and move the economy.

At CN, we are determined to succeed and prepared for the worst.

APPENDIX A

Winter impact on CN's network

The map is based on historical data. "Severe" winter conditions indicates the portions of CN's network most likely to experience cold snaps (temperatures below -25°C) at least twice per winter and for more than three days at a time.





- Normal winter conditions
- More difficult conditions
- Severe conditions

APPENDIX B

Preparing for winter

Many service disruptions are due to the accumulation of snow and ice, especially on switches and crossings. Customers can help avoid these issues and minimize the risk of delays, injuries, and derailments by clearing snow from switches before CN operating crews arrive. CN's **track management inspection checklist**⁵ assists customers in assessing track conditions and avoiding track-related disruptions.

Customers must be particularly vigilant when maintaining flangeways, considering that these can become fouled with snow, ice, or other material. At a minimum, they must be cleared to a depth of 1.5 inches to ensure equipment can be safely operated. Crossings are more prone to these types of conditions.

Derailed are devices used to prevent blocking or compromising a track (or collision with anything present on the track, such as a person or train) by unauthorized movements of trains or unattended rolling stock. Derails can become buried under snow and must be cleared so train crews can find them. All derails must be properly identified by a sign to allow them to be easily located. Customers must ensure all derails have been cleared of snow prior to rail service.

Snow must be moved at a minimum of 6 ft away from all tracks and crossings, and not placed in a position where it has the potential to accumulate or slide within 6 ft from the gauge side of the nearest rail. In addition, snow piles must not block the view of train crews or prevent people from seeing an approaching train. Excessive snow on tracks will prevent service if rail movements cannot be done safely.

Customers must ensure icy walkways, particularly trackside, are sanded and/or salted to prevent injuries due to employees slipping and falling in winter conditions. Furthermore, snowfall can easily hide debris where crews normally walk. Ensuring all debris is cleared before winter starts is essential to keeping the site safe.

Besides the **Customer Safety Handbook**⁶, CN communicates many winter-specific resources available to customers, including the following as outlined on our website:

- The **Customer Track Maintenance Guide**⁷ was developed to help bring attention to the additional hazards present during winter months, especially for CN crews performing switching activities.
- Customers are encouraged to post the **CN Switch Clearing Poster**⁸ where it is visible to their maintenance and operations staff. The poster includes a three-step checklist illustrating proper switch-clearing practices.
- For individuals entering CN's intermodal terminals, our **Winter Safety Checklist**⁹ provides details on operating within the terminal when snow and ice are present, as well as detailed requirements for snow removal from intermodal equipment.

⁵ <https://www.cn.ca/en/customer-centre/safety-guidelines-and-regulations/track-management-program/>

⁶ <https://www.cn.ca/en/customer-centre/safety-guidelines-and-regulations/>

⁷ <https://www.cn.ca/en/customer-centre/safety-guidelines-and-regulations/track-specifications-and-maintenance/>

⁸ <https://www.cn.ca/-/media/Files/Customer-Centre/Seasonal-Safety/CN-Switch-Cleaning-Poster-en.pdf>

⁹ <https://www.cn.ca/winter>



www.cn.ca/winterplan