



# 2022–2023 CN Grain Plan





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# Message from Tracy Robinson

Having grown up on a grain farm in Saskatchewan, I understand how important agriculture is to Canada's economy. Agribusiness on the Prairies is continually evolving, and CN is evolving along with it. Farming and railroading are both very capital-intensive businesses, and the past decade has seen investment in all aspects of the end-to-end grain supply chain. Grain producers, grain companies, and railways have invested heavily in technology and infrastructure, with \$27 billion of capital investment by CN. This combined effort led in part to CN's record grain movement during the 2020–21 crop year, demonstrating that strategic investment and co-ordination can yield great results.

I also understand the reality of weather impacts on farming and railroading. This past year served as a reminder about how extreme weather can impact the end-to-end supply chain:

- Extreme heat and fires last summer in British Columbia had a devastating impact on many communities that CN operates in and severely disrupted rail movement.
- The worst drought in 20 years drastically reduced grain production across Western Canada.
- CN experienced an unprecedented three-week disruption to our rail traffic in Southern British Columbia in November and early December due to flooding and track washouts, followed by one of the worst winters in recent memory.

Through all that, CN employees were out there every day running trains and maintaining the integrity of rail infrastructure. CN is proud of our team of railroaders, and we will always ensure that their safety comes first.



As we look forward to the 2022–23 crop year, we know that there will be predictable events that CN can plan for and mitigate to the extent possible. But last year reminded us that there is always the potential for unpredictable events that will impact the quality of service that CN can deliver. A lot can happen over an 18,000-plus mile rail network over the course of 12 months — we must all keep that in mind when evaluating end-to-end supply chain performance.

The pandemic has produced one of the most significant shocks ever to hit global supply chains, and COVID will continue to be a wild card in the months and years to come. Now, the war in Ukraine has fundamentally altered commodity trade flows for the foreseeable future and will put pressure on Canada’s transportation network. These events challenge long-established assumptions about trade flows and confirm we must make our business plans and capital investment decisions in a global context. It is not business as usual. If we want to ensure a rail transportation system that better meets both your needs and ours, we cannot do it in isolation. Collaboration, co-operation, and communication need to define our relationship with CN’s customers. We must work together and plan out as far as possible.

I am squarely focused on improving CN’s product offering to our customers by getting back to basics. This spring and summer, CN has made significant changes to our rail planning and operations that have improved rail network productivity and service to our customers. More changes are planned as we move towards the fall and beyond. We are also increasing the size of our locomotive fleet, acquiring new hopper cars, making efforts to increase our operating crew base, and investing in rail network infrastructure. All this will make a difference. We will keep you regularly informed of our progress in relation to the Grain Plan through our weekly grain supply chain performance reporting and monthly Grain Plan updates.

My commitment to you is that CN is focused on helping to power the agriculture economy and that means getting grain to market. Heading into this fall, we are confident that the adjustments CN has made to our operations and planning activities, combined with the investments that CN has made with an eye to future economic growth, will deliver a strong 2022–23 Grain Plan and produce results for Western Canadian agriculture.



**Tracy Robinson**  
*President and CEO*



Prince Rupert, BC



# Introduction

CN's 2022–23 Grain Plan has been prepared in accordance with Canada's *Transportation Modernization Act* and has two main objectives.

- First, the Grain Plan sets out CN's assessment of how much grain and processed grain products it expects to move over the course of the 2022–23 crop year based on the information available, including the expected size of the crop and other supply- and demand-related estimates.
- Second, the Grain Plan assesses CN's ability to move this anticipated volume of grain over the course of the crop year based on demand forecasts and the resources expected to be available.

During spring and early summer, CN consulted with its grain customers and other stakeholders concerning the 2022–23 Grain Plan. CN also engaged with its **Agricultural Advisory Council**, which involves a cross-section of industry leaders from across Western Canada to provide ongoing advice and feedback on grain transportation and CN's interaction with producers. CN meets with its Agricultural Advisory Council quarterly on routine planning items, and at other times throughout the year as needed. We would like to express our thanks to the stakeholders that provided their input and engagement on CN's 2022–23 Grain Plan.

## Highlights

CN's Grain Plan for the coming crop year is outlined in the pages that follow. The highlights of this year's plan include:

- 2021–22 grain volumes were reduced due to drought, while severe weather events, the pandemic and the war in Ukraine disrupted supply chains.
- Movement of Western Canadian grain via carload on CN in 2022–23 is forecast to rebound to 24.5–27.0 million metric tonnes (MMT), with grain shipped via container direct from Western Canada in addition to these volumes.
- Forecasting, collaborating, and communicating with customers is key for 2022–23 resource planning.
- Demand from all commodities for rail capacity between Edmonton and the West Coast is expected to exceed capacity during some weeks in the fall of 2022 and in early 2023.
- Corridor balance is required to maximize supply chain capacity.
- CN has the capacity in place to ship the anticipated crop volumes in the coming crop year.

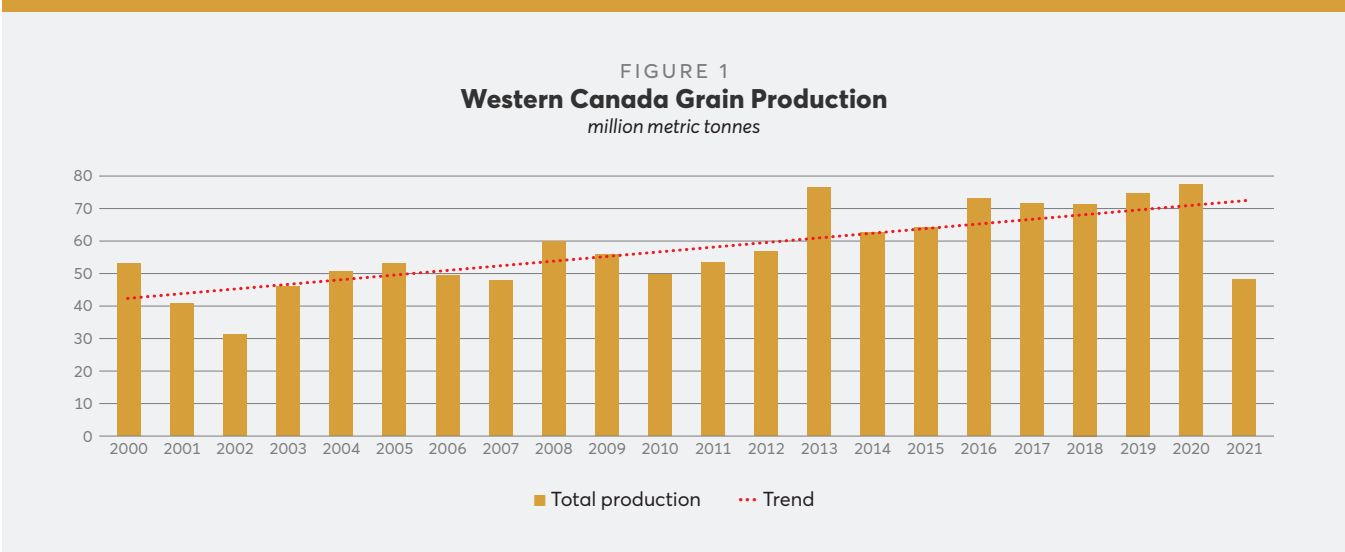
# The 2021–22 Crop Year in Review

Before turning to our plan for the 2022–23 crop year, it is important to review the significant events that affected CN operations and overall grain traffic movement during the 2021–22 crop year. This year was exceptional on many fronts, and these events had real impacts on rail capacity and the movement of grain.

### Reduced grain volumes due to drought

Drought reduced 2021 grain production in Western Canada by over 28 MMT (-38%) compared to the three-year average, sharply reducing demand for grain transportation by rail. Peak customer demand for CN-supplied grain hopper cars occurred at the end of September, with demand quickly falling off from that point forward. By mid-November, demand for CN-supplied grain hopper cars was roughly half of levels seen at the same time during the previous crop year, falling to roughly 40% of previous year’s levels during February–April 2022.

- 2021 grain production was down 38% from three-year average due to drought.
- Global pandemic, unexpected demand increases, shifts in trade patterns, congested coastal ports, and shortages of shipping containers influenced grain movement.
- Extreme weather events such as widespread flooding in BC heavily impacted rail operations for all sectors of the economy, including grain.



Overall, CN moved 18.2 MMT of bulk and processed grain products via carload during the 2021–22 crop year, representing a decline of 36% compared to the three-year average. In addition, CN moved an estimated 0.8 MMT of grain from Western Canada via container, bringing total Western Canadian grain volume shipped by CN during the 2021–22 crop year to 19.0 MMT. Including volumes shipped from Eastern Canada, CN shipped over 20.5 MMT of grain and processed grain products during the 2021–22 crop year.



## Disruptions to global supply chains

Grain supply chains during the 2021–22 crop year were impacted by many of the same global factors that impacted other sectors. Unexpected demand increases, shifts in trade patterns, congested coastal ports, shortages of shipping containers — all had a direct or indirect influence on grain movement throughout the crop year. CN worked with its customers to make continual operational adjustments to maintain service as customers in all sectors adjusted to a changing business environment and tried to take advantage of new opportunities.

## Southern British Columbia wildfires

Even though forest fires in British Columbia happened at a time of reduced demand for grain movement, they nevertheless showed how sudden and dramatic natural events can interfere with our operations and affect the supply chain. Rail traffic on the CN mainline between Kamloops and Vancouver was halted for 13 days as a 615-foot bridge was put back into service, with more than 130 CN Engineering employees working 24/7 to rebuild it. Fires forced CN to stop or slow operations to accommodate the fire-fighting efforts of local emergency services and to ensure the safety of our crews and cargo. Fires also damaged rail infrastructure and the communities where our crews and neighbours make their homes. In many locations, wildfires eliminated the vegetation that helps stabilize slopes and prevent washouts from extreme precipitation events. During the period of the fires, Transport Canada imposed rail track speed slow orders and required Canadian railways to develop new rules about operating in extreme conditions. CN actively participated in the development of these rules, which were recently approved by the Minister of Transport.



## Rail network disruptions in Southern British Columbia due to extreme precipitation

Southern British Columbia experienced three atmospheric river precipitation events in November 2021. Simultaneously, snowmelt in the mountains exacerbated run-off issues, causing extensive damage to rail and road infrastructure. During the last half of November, CN experienced 58 outages on its mainline between Kamloops and Vancouver and on the CN Squamish Subdivision between Prince George and Vancouver. The scale of the challenge was staggering. It took a massive amount of engineering and reconstruction work to get the line back in full operation. CN had more than 110 pieces of heavy equipment operating around the clock to get the line back into service, with more than 400 employees and contractors responding to the outages. 282,000 cubic yards of rock, earth, and backfill materials (equivalent to over 25,000 truckloads) were moved to rebuild damaged locations.

Service on the CN mainline between Kamloops and Vancouver resumed on December 4, leaving a significant accumulation of rail traffic of all types on either side of the disruption. In the three-week period specific to the mainline disruptions, CN carload shipments of all kinds across the CN network averaged just 95,000 units, representing an average decline of 18,000 units per week (-16%) compared to the four-week average preceding the washouts.

At the time of the resumption of service in Southern BC, CN estimated that working through the accumulation of traffic would extend into January 2022. By the end of the third week of December, the productivity and capacity of its network in BC had nearly returned to pre-washout levels, while CN continued to work through the volume of traffic that had accumulated during the mainline disruptions.



*Temperatures of minus 25 degrees Celsius and colder require CN to implement train length restrictions in those parts of the network experiencing extreme conditions.*

### **Impacts of persistent extreme winter operating conditions**

From late December through February, rail operating conditions were extremely challenging, limiting CN's ability to recover in a timely fashion from the Southern British Columbia rail outages and causing significant delays in the movement of grain and other commodities on the CN rail network. While CN implements multiple measures to help mitigate the impact of extreme cold, heavy snowfall, and blizzard conditions, the severity and duration of extreme cold and poor winter operating conditions materially impacted CN's ability to transport traffic this past winter.

Within CN's Western Region, CN experienced temperatures below minus 31 degrees Celsius for over 50 of 65 days between late December and the end of February. Temperatures of minus 25 degrees Celsius and colder require CN to implement train length restrictions in those parts of the network experiencing extreme conditions. These restrictions have the effect of requiring significantly more resources compared to moving the same volume of traffic under normal conditions. The restrictions are nevertheless consistent with Transport Canada's safety requirements aimed at maintaining safe operating conditions, protect CN employees, and protect the communities in which we operate. Compared to a few days of extreme cold, weeks of extreme cold have a considerably greater impact on rail operations and network fluidity, considering that overall network capacity is reduced over a much longer period, resulting in a significant accumulation of traffic to move once conditions improve.

The Ministerial Order restricting the speed of certain trains transporting dangerous goods based on cold temperature thresholds also significantly impacted rail network capacity this past winter. In signalized territory, the speed of those trains must be reduced when temperatures drop to minus 25 degrees Celsius, and at just minus 15 degrees Celsius in non-signalized territory. Trains operating at reduced speed in turn slow the train traffic moving behind them, with a material impact to overall network capacity.

## COVID-19-related business impacts

The third exceptional circumstance which materially impacted Canadian supply chains is events attributable to the global pandemic during 2021 and 2022. The result was a reduction to the overall operating crew base CN had available to deploy across its network between mid-November and the first quarter of 2022. Consistent with COVID-19 case trends observed across the general population in Canada tied to the onset of the COVID-19 Omicron variant, CN experienced a significant increase in COVID-19 cases commencing around December 20. The peak number of positive cases occurred towards the end of the first week of January 2022. This spike in COVID cases materially reduced the effective operating crew base across the CN network.

In August 2021, the Government of Canada announced its intent to require COVID-19 vaccination for employees in the federally regulated air, rail, and marine transportation sectors. Transport Canada's Ministerial Order of October 29, 2021, required CN employees, as well as contractors, consultants, agents and suppliers and anyone accessing CN properties in Canada, to have at least one dose of a COVID-19 vaccine before November 15, 2021, and to be fully vaccinated before January 24, 2022. People not compliant within the timeline were unable to work. This Order materially impacted the size of CN's active operating crew base commencing in November 2021.

On June 20, 2022, following the removal of most COVID-19 health restrictions in Canada, the federal government suspended the mandatory vaccination requirement for federally regulated transportation workers, while also reserving the right to re-impose the mandate if warranted.

## Communications

In January 2022, CN heard from grain customers frustrated with rail service disruptions following the BC floods. Like CN, their operations since late December had been impacted by weeks of extremely cold weather and staff being away due to COVID-19 factors. To improve customers' ability to plan in this environment, they requested CN explore ways to improve operational communications and coordination at individual grain terminal locations. As a result, CN will work with grain handlers and exporters during the 2022–23 crop year to improve the two-way flow of information on forecast car delivery and pick up timing, as well as loading and unloading schedules at grain terminals.

## Key takeaways from 2021–22

- During the 2021–22 crop year, CN experienced 58 significant rail washouts in Southern British Columbia caused by unprecedented flooding.
- The outages were immediately followed by extreme cold for over 50 of 65 days in CN's Western Region that reduced network capacity.
- COVID-19 and government measures aimed at preventing the spread of COVID had a material impact on CN's workforce and operations.
- Finally, improved two-way communication between customers and CN may help to alleviate the impact of service disruptions at some locations.

These are exceptional circumstances, unprecedented in the history of Canadian railway transportation, and all occurring within a compressed period. CN is proud of our employees' resilience in dealing with the extreme conditions that affected the rail network. We are also proud of the collective effort we were part of during this period. Our customers, all levels of government, and supply chain stakeholders worked together this past winter to address the issues challenging the Canadian economy. There is no doubt that this was a test for the Canadian supply chain, but we all stepped up together.

# Factors Affecting Overall Rail Capacity

- Demand forecast accuracy determines short- and long-term resource planning
- Resource planning includes crews, locomotives, rolling stock and infrastructure
- Extreme weather events and global politics can impact planning and trade flows.

## Forecasting is key

Timely and reliable demand forecasts across all segments of CN's rail traffic is critical to accurate resource and operational planning. In the absence of accurate customer forecasts, CN is required to make assumptions, often relying upon historical data. Significant changes in demand levels or traffic flows that CN is not made aware of, or that CN cannot anticipate, hinder our ability to respond quickly to the new circumstances. Long lead times are required to recruit and train crews, acquire locomotives or rolling stock, and invest in track and other rail-related infrastructure to meet increased customer demand. The result is potential gaps in resource levels that could have been avoided with better forecasting and communication.

It typically takes six to nine months to recruit and train conductors in the field and familiarize them with the region they are operating in. That also assumes that people are available to recruit to begin with and are interested in becoming conductors.

We have been aggressively recruiting people to become qualified conductors, but CN has not been able to hire as many people as we wanted. Unemployment levels are at five-decade lows and demand for employees with the skill set CN needs is very high in many sectors of the economy. Our customers and supply chain partners report the same challenges hiring new workers. Media reports confirm available human resources are scarce. This reality will likely affect CN's overall operating capacity in Q4 2022.

In the case of locomotives, the lead time required to secure additional capacity, particularly for new locomotive units, is roughly 9 to 12 months, and can be as much as 18 months depending on market conditions. Investments in track and other rail-related infrastructure can take months or even years to complete, depending on the type of construction required.

Improved short- and long-term customer demand forecasts will support the supply chain's ability to plan for growth. CN will work with our customers' senior management teams to identify demand forecast enhancements and increase information sharing.



## Resource planning

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 forecasting is focused on rail infrastructure capacity. CN monitors traffic levels on individual sections of track and individual traffic corridors, and when a specific workload threshold is approached, CN assesses what additional track infrastructure is required. From initial planning to completion, timelines of infrastructure additions are measured in months or years depending on the scale. In addition, engineering and permitting processes consume considerable amounts of time, hence the need to secure forward-looking forecasts so decisions can be made well in advance of traffic wanting to come online.

Unlike rolling stock, which is dedicated to specific types of rail traffic movement, locomotives, crew base, and rail infrastructure are resources that are shared across all rail traffic moving on CN's network. For this reason, demand for the movement of grain and processed grain products cannot be considered in isolation in relation to the other rail traffic segments that CN participates in. This is also why it is so critical to have accurate demand forecasts across all business segments to ensure effective long-term resource planning. Recognizing that capacity is not infinite, rail traffic increases associated with sudden demand shocks due to significant global events or sharp changes in market conditions are not easily absorbed.

*CN and its customers need to work together and closely coordinate their activities to maximize the efficiency of the end-to-end supply chain.*

While assets such as locomotives can more readily be re-deployed to other areas of the rail network in response to shifts in demand, resources such as crews cannot be. Just like employees in other sectors of the economy, railroaders typically work and make their home within a specific region. However, when demand exceeds crew resources for a specific region or terminal, CN can respond in the short term through actions such as a temporary shortage bid, which allows active employees elsewhere on the network to move from their terminal, assuming that the terminal is in a current surplus situation, to assist in that crewing effort. It takes a couple of weeks to re-position the employee, and at least another week beyond that for the employee to become familiarized with the new region. In any event, this is a short-term solution.

When considering capacity to move traffic, it is important to note that CN is one component of the supply chain, with other factors also affecting the overall efficiency and capacity. For example, in the end-to-end grain supply chain, activities at the origin level as well as the destination need to be considered. If an export terminal is congested and lacks space to unload rail cars, trains being directed to that specific terminal must be held out of the destination terminal and staged along the route to the destination or held at the origin. Considering that most of the hopper car fleet moving grain is a shared asset among customers, fleet efficiency utilization is impacted in this scenario — cars returned more slowly to the interior for the next load means that the supply chain is slowed down. CN and its customers need to work together and closely coordinate their activities to maximize the efficiency of the end-to-end supply chain. CN is fully committed to working with customers to improve communication to ensure this coordination and efficiency can occur.

## Impact of weather and other factors on rail operations

External factors beyond anyone’s control, particularly weather-related factors, also have a real impact on supply chain capacity.

Winter occurs every year, but the duration and severity of winter conditions is not predictable — every year is different — and all points in the grain supply chain are adversely affected in different ways. Each of us must respond to ensure continued safe operations. Extreme cold not only affects the rail infrastructure, rolling stock, locomotive power, and the people operating the railroad, it also affects operations at grain handling facilities along with grain movement into the primary elevator system. Severe cold even hampered railcar unloading operations in the Port of Vancouver this past winter.

The longer and more frequently those conditions occur during a given period, the more that the supply chain’s ability to recover is reduced. CN will continue to innovate and find ways to improve its ability to deal with extreme cold and other severe weather events. The development of CN’s air distribution braking car fleet, which is now up to roughly 100 cars, is just one example of implementing a new technology to mitigate the impact of extreme cold temperatures on rail operations.

## Other considerations

The events of the past few years have served as a reminder that external forces play a large role in determining overall demand for transportation services. These events include blockades and strikes. The pattern of overall demand has been far from predictable or stable, mostly because demand is determined by factors outside the control of the supply chain participants. This has also led to a shift from “just in time” to “just in case” supply chain planning, placing added pressures on the transportation system. However, rail capacity cannot quickly adjust to demand shocks driven by sudden changes in market conditions or significant global events. There are only so many trains that can move through the mountains at any point in time. Train counts cannot simply be doubled overnight to recover from a major mainline disruption or to accommodate a spot market opportunity measured in weeks.



Vegreville, AB



## War in Ukraine

In addition to the supply chain disruptions caused by the pandemic, the war in Ukraine has created dramatic and sudden disruptions in global trade flows that will be felt well beyond 2022 and 2023. The price of grain, fertilizer, coal, and many other commodities has increased considerably over the past number of months, creating more attractive opportunities in the market for global suppliers and amplifying demand for transportation services in the process. Sanctions imposed on Russia have significantly affected shipments of potash and other fertilizers, grain, coal, and other commodities, leaving many customers to source product from new suppliers. Many countries have also banned the import of crude oil and energy products from Russia, causing massive disruption in the trade patterns of those products.

There are numerous examples of significant market disruptions due to the war in Ukraine, and their impacts on all segments of the global transportation system cannot be underestimated. Discussions with our customers suggest the impact of the war in Ukraine on the rail service demand is somewhat unknown, although no customers have predicted significant demand shifts to eastern corridors.

## CN's expectations for 2022–23

CN expects intense pressure on Canada's transportation system during the 2022–23 crop year, especially with respect to rail movement to Canada's West Coast ports. **At this point, based on current demand forecasts and the best economic and market information available, CN expects that total demand for rail capacity between Edmonton and the ports of Vancouver and Prince Rupert will exceed network capacity during some weeks in the fall of 2022 and in early 2023.**

Considering the uncertainty that hangs over the global economy, the expectation that the railway has capacity available and ready, wherever and whenever required, must be balanced against the fact that there will always be limited capacity to respond to demand shocks driven by sudden changes in market conditions or significant global events. Capacity is not infinite, and CN and its customers must plan together and prepare for the future to the best of our respective abilities. Customers across all CN business segments have knowledge that is critical to supporting CN's demand and resource planning process. To that end, frequent and open communications ensure customer forecast and resource updates are shared and CN can better understand and adjust to the uncertainties that impact markets and demand.

Customers must also make the most efficient use of the capacity available in **all** rail corridors and throughout the year, not just the rail corridors that yield the best margin and in a constrained timeframe. The Eastern Canadian transportation system is significantly underutilized and represents an opportunity to increase shipments of grain and other commodities, especially during peak period demand for grain movement during the fall and winter. Corridor balance is required to maximize supply chain capacity.

*CN and its customers must plan together and prepare for the future to the best of our respective abilities.*



North Battleford, SK



# Estimating 2022–23 Western Canada Grain Supplies

- Crop production volumes in Western Canada are generally trending higher.
- CN relies on feedback from external sources, including grain companies, private market analysts, and government agencies to project yearly grain volumes.
- Yearly acreage and yield forecasts can change dramatically due to weather and other factors.

Crop production volumes in Western Canada have trended upwards over the past 10 years. CN has invested in its network infrastructure, purchased new locomotives and hopper cars, and worked with grain customers to extend sidings and build loop track that will support continued sector growth.

However, the past two crop years were a stark reminder that there is significant variability in crop production potential from one year to the next, as well as regionally within Western Canada. The 2020–21 crop year saw record grain production in Western Canada, followed by the drought-reduced crop of last summer that saw grain production decline by over 28 MMT (-38%) compared to the three-year average, with significant regional differences in crop production conditions as well.

Forecasting the volume of grain and processed products to be moved during the crop year requires the consideration of three key items:

- 1 Grain production**, the largest factor affecting the overall volumes to be moved.
- 2 Carry-in** from the previous crop year, which, combined with grain production, represents **total available supplies**.
- 3 Domestic use and exports**, leaving the balance as **carry-out**.

In projecting volumes, CN relies on feedback from external sources, including grain companies, private market analysts, and government agencies such as Agriculture and Agri-Food Canada (AAFC). It is also important to emphasize that crop production forecasts are subject to significant variability given the impact of weather during the growing season on crop development and yield potential.

Generally speaking, and in advance of the growing season, the grain industry uses trendline yield forecasts and estimates of seeded and harvested area to determine crop production forecasts, and estimates are modified through the growing season to reflect changes in harvested acreage and yield potential driven by weather and other factors. The first official producer survey of crop production is carried out by Statistics Canada in July, with the survey results released at the end of August.

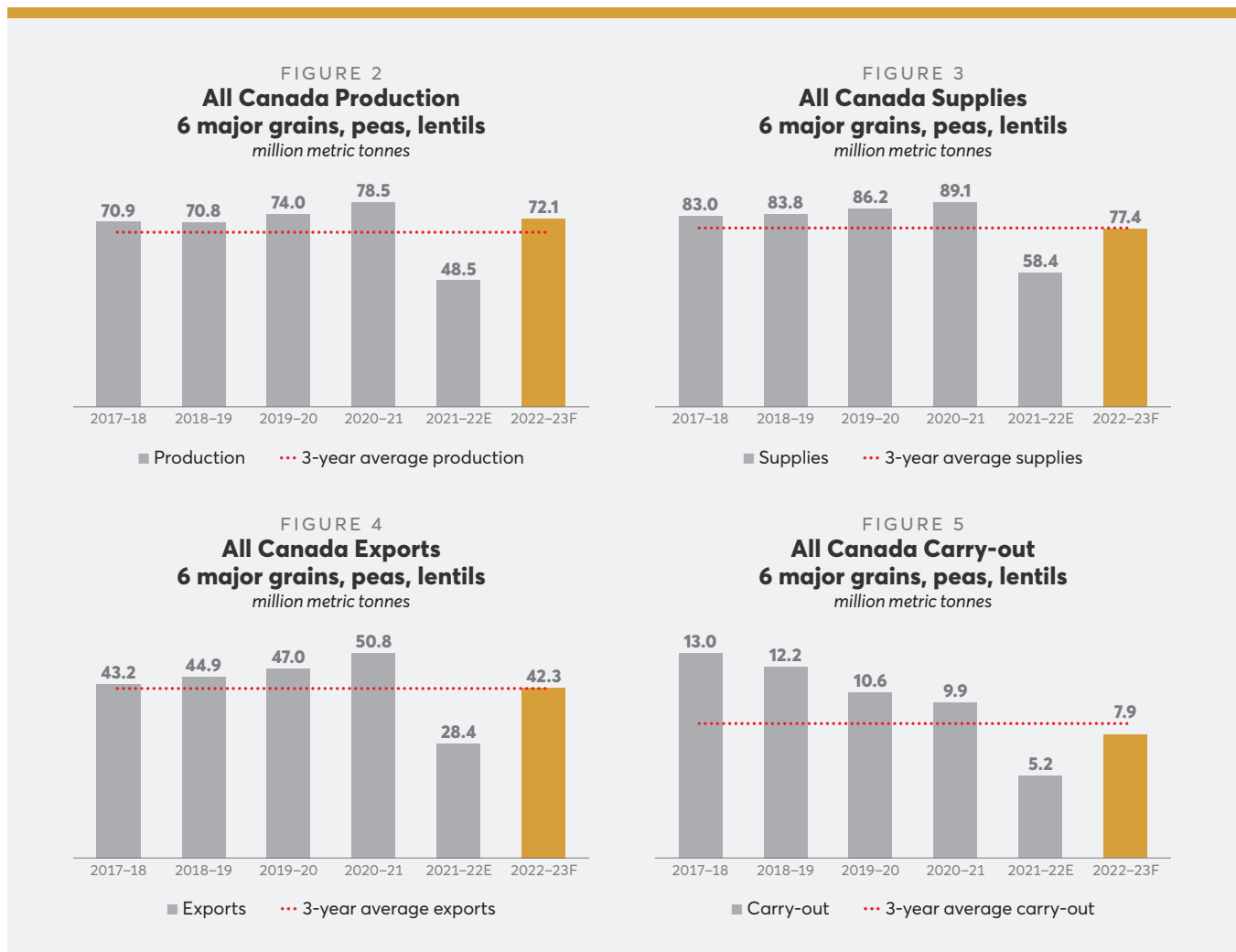


Vegreville, AB

As previous years have demonstrated, there can be sharp changes in survey estimates from the first official survey to the last, as was the case in 2013 when overall final yield estimates for Western Canadian grain production ended up being sharply higher compared to the initial July survey results. Conversely, Prairie crop production expectations in the summer of 2021 declined sharply from the start of the growing season to final harvest results.

AAFC projects the following for the 2022–23<sup>1</sup> crop year:

- **Carry-in** supplies of the six major grains,<sup>2</sup> peas and lentils to be 5.2 MMT, well below the three-year average of 10.9 MMT.
- **Production** of the six major grains, peas, and lentils to be 72.1 MMT versus 48.5 MMT in 2021–2022 and the three-year average of 67.0 MMT.
- **Total available supplies** to be 77.4 MMT compared to the three-year average of 77.9 MMT.
- **Exports** to be 42.3 MMT compared to the three-year average of 42.1 MMT.
- **Carry-out** for 2022–2023 to be below the three-year average at 7.9 MMT due to reduced overall supplies.



<sup>1</sup>Based on the AAFC July 2022 Outlook for Principal Field Crops: <https://agriculture.canada.ca/en/canadas-agriculture-sectors/crops/reports-and-statistics-data-canadian-principal-field-crops>

<sup>2</sup>Wheat, barley, oats, flax, rye, and canola

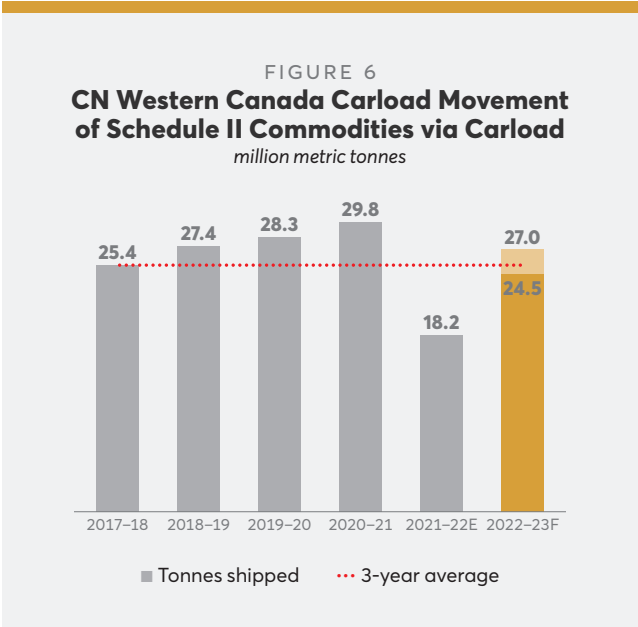
During consultation with customers and grain industry participants, some concerns were expressed about the late development of the crop, particularly in eastern areas of the Prairies where spring seeding was delayed by excessive precipitation. The impact of long-term dryness, particularly in western areas of the Prairies, was also a concern, with timely rains needed to maintain yield potential. Overall, however, many individuals that provided feedback were anticipating an average crop overall. Customers in general expressed heavy focus on grain shipment demand to the West Coast, although there was the potential for incremental grain shipments through the Eastern Canada supply chain. These projections, along with feedback from grain industry participants, are used to estimate the overall grain movement demand for the crop year and measured against CN's market share for rail transportation services.

**Grain shipment forecasts**

This Grain Plan assesses CN's ability to move the volumes of grain expected to be offered up by its customers for movement during the crop year. Specific to CN, the following volumes of Schedule II commodities have been moved in hopper cars, tank cars, and boxcars over each of the past five crop years, with grain volumes moved directly from Western Canada using intermodal equipment being in addition to these volumes.

**Based on the estimates above, projected movement of grain and processed grain products via carload on CN over the course of the 2022-23 crop year is projected to be 24.5 to 27.0 MMT, with grain shipped via container in addition to these volumes.** This forecast is well above 2021-22 levels given the expected recovery in grain production in Western Canada this fall. Experience shows that forecasts may not always reflect reality. Therefore, CN will refine its assessment of anticipated volumes to be moved based on overall crop production and other market factors based in part on information collected from grain customers and other industry stakeholders.

Containerized grain shipments direct from Western Canada are an important means of getting grain from the Prairies to domestic and overseas markets. As noted previously, CN moved an estimated 0.8 MMT of grain direct from the Prairies via container during the 2021-22 crop year, with the decline in containerized grain volumes in proportion to the decline in Western Canadian grain production. CN expects that containerized grain shipments direct from Western Canada will continue to represent a significant volume of grain shipments in the upcoming crop year.



# Establishing Maximum End-to-End Grain Supply Chain Capacity

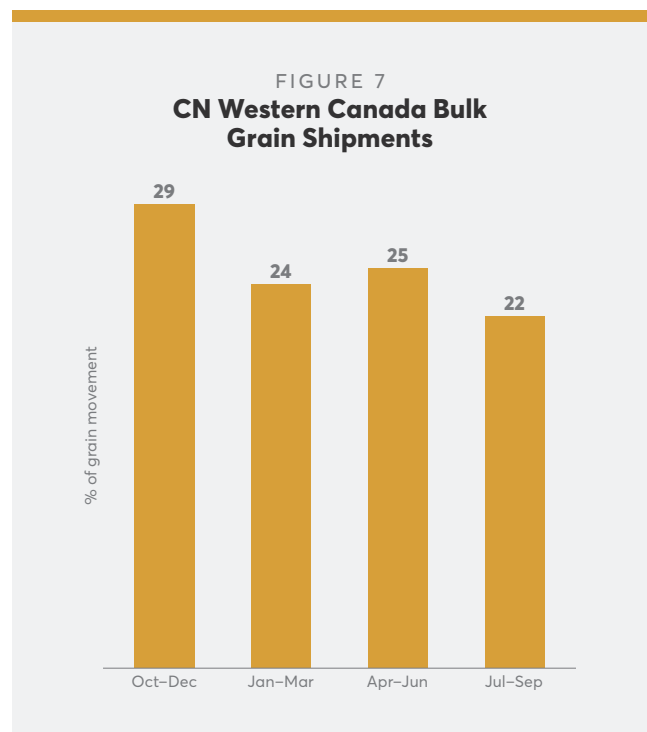
- Maximum sustainable grain supply chain capacity is a function of the capacity and operational efficiency of the individual pieces of that supply chain, from origin to destination.
- CN has invested in rolling stock, locomotives, rail infrastructure, technology, and labour recruitment initiatives to help improve overall supply chain capacity.
- All parts of the supply chain must work together to ensure that the use of available rail corridors is balanced.

The capacity of Canada's grain supply chain varies through the crop year, and multiple factors place a real limit on the volume of grain that can move through the end-to-end grain supply chain at any point in time. The maximum sustainable capacity of the grain supply chain is also a function of the capacity and operational efficiency of the individual pieces of that supply chain, from origin to destination.

While most rail-served industries generate a relatively steady flow of traffic, the pattern of demand for grain movement creates a unique transportation situation. The harvest occurs over a short period of time, generating very large volumes of inventory that cannot be all moved immediately after harvest. This peak demand period also typically corresponds to the period reflecting the most profitable grain handling and trading margins, along with peak farmer grain delivery pressure. The challenge is how best to align demand with end-to-end grain supply chain capacity and total rail capacity, as all that grain cannot move into the supply chain at once.

The peak demand for grain movement in Q4 coincides with high demand from many other commodities, especially to the West Coast. During that period, many industries are increasing shipments to Vancouver and Prince Rupert. Considering the demand shocks that have impacted commodity markets in particular due to the war in Ukraine, greater coordination by all parties in the supply chain will be required.

Consistent with this reality, the idea of corridor balance must be taken into consideration for grain and other commodities. When the combined demand for grain movement for all customers in a specific rail corridor for a given week exceeds the capacity of that rail corridor for all commodities, it becomes strategic to shift volumes to another corridor where capacity is available. Alternatively, demand must be revised to match capacity in





## Great Lakes – St. Lawrence Seaway system considerations

The Port of Thunder Bay represents significant grain throughput capacity when the Great Lakes – St. Lawrence Seaway system is open outside of winter and presents a key opportunity to optimize corridor demand balance. There are six major terminals focused on bulk grain exports plus a direct hit loop track facility that handles unit train shipments of grain and other bulk commodities. CN also accesses multiple grain handling facilities in the Port of Duluth. Grain from these ports can be shipped directly overseas via ocean-going vessels, or grain may be shipped by laker to facilities along the Great Lakes for domestic consumption or to one of six major transfer elevators along the St. Lawrence River (located in Montreal, Quebec City, Trois-Rivières, Sorel, Baie Comeau, and Port Cartier) where grain is subsequently re-loaded onto ocean-going vessels. Making the most of grain handling capacity at the Lakehead via the Great Lakes – St. Lawrence Seaway System will be key to maximizing grain shipment volumes in the 2022–23 crop year, especially considering some of the unique factors that are expected to impact the supply chain.

Typically grain shipment volumes at the Lakehead decline during December in advance of the closure of navigation season for the Seaway System, and end-to-end grain supply chain capacity is significantly reduced when the Great Lakes – St. Lawrence Seaway system is closed. Therefore, it is important for grain customers to maximize the use of the Lakehead while the Seaway is open.

Along the St. Lawrence River, CN directly reaches grain transfer elevators at the Port of Montreal and the Port of Quebec City, and CN can also interchange traffic for movement to the Port of Trois-Rivières. Historically, grain shipments during winter by direct rail to these ports represented a significant grain export program. Combined export throughput capacity of these direct rail facilities represents fifteen-plus unit trains per week. The unique circumstances associated with the upcoming crop year represent an opportunity to utilize unused grain export capacity in the eastern supply chain during the winter months and optimize overall corridor demand balance.

the corridor or deferred to a future week when the demand can be accommodated. If a mainline disruption occurs that prevents the shipment of grain in a specific corridor, that places a real limit on the capacity of that rail corridor during the period of the disruption, and capacity is effectively reduced. As we anticipate that demand will be extremely high in Q4 2022, all parties in the supply chain will have to work together to ensure grain shipments take full advantage of all the capacity available.

This is also where the concept of terminal shipment authorization comes into play. Grain handling export facilities have a real limit as to the number of railcars that they can individually accommodate for unloading at any point in time, and traffic directed to a given destination terminal must be authorized by the receiving terminal. As a result, any car orders not authorized by the destination terminal for shipment are not considered legitimate orders by CN. A number of these unauthorized orders are removed from CN's grain order book on a weekly basis and customers can re-order cars in subsequent weeks once they have authorization from the receiving facility to ship cars. To maximize end-to-end supply chain capacity, it will continue to be critical that grain handling facilities provide shipment authorization only when the grain shipped is needed to meet commercial commitments.

## CN's 2022–23 grain marketing programs

Consistent with the evolution in grain handling infrastructure in Western Canada, CN's efficiency incentives have also evolved over time to encourage more efficient grain handling infrastructure. CN's programs include rate incentives which encourage high efficiency unit train facilities that have a hook-and-haul model for grain trains that can be loaded in 15 hours or less. This model keeps trains from occupying the mainline while spotting empties or pulling loads, which improves mainline efficiency. Most of the new grain handling facilities being built in Western Canada are hook-and-haul facilities, and most of these new facilities have loop tracks that allow more cars to be spotted in a single placement, which means improved capacity utilization. Since 2015, 41 of these new facilities have been constructed or are in the process of being built. Twenty-six of these facilities are served directly by CN.

Starting in 2014, CN and its customers coordinated investments in grain facility infrastructure to allow loaded grain trains to be fully charged with air to reduce the time required for CN crews to depart the origin with a loaded train. Otherwise, in times of extreme cold, it can take 8–12 hours (or more) for a train to be fully charged with air by locomotives. Reducing the time required to charge trains with air reduces end-to-end train cycle times and improves car velocity. Over 95% of CN-served facilities capable of loading grain unit trains have participated in this program, representing a win-win situation for CN and its customers.

With respect to commercial car supply products, CN prioritizes a large segment of its pool of CN hopper cars for customers interested in a year-round car supply, which in turn supports CN's and customers' demand planning activities. These commercial car supply products also include reciprocal penalties for both CN and customers. CN anticipates that, for the 2022–23 crop year, over 80% of CN-supplied grain cars will be committed to customers in advance of harvest through commercial car supply agreements and other commercial car supply products, with reciprocal penalties for both CN and the customer. CN makes these products available to the market to ensure their widest possible application, with car block sizes of as few as 10 cars.

CN's commercial and export fleet integration programs allow customers to integrate high-quality jumbo-capacity hopper cars into CN's common pool, in turn receiving priority car supply based upon the type of lane that the traffic is moving in (i.e., shorter distance traffic to Thunder Bay / Prince Rupert / Vancouver compared to longer distance traffic moving primarily to Eastern Canada and the United States) and the number of cars supplied by the customer. This program started in Western Canada in the 2014–15 crop year and has been very popular with customers of varying sizes.

CN also makes a segment of car supply available from its general pool of equipment, and customers can signal their demand up to 16 weeks forward in CN's grain car ordering system. In reviewing car orders on a weekly basis, and once car orders without terminal authorization are removed from the car order book, CN first allocates cars against valid customer orders that are tied to commercial car supply products. The remainder of available car supply for a given week is allocated across the remaining orders.



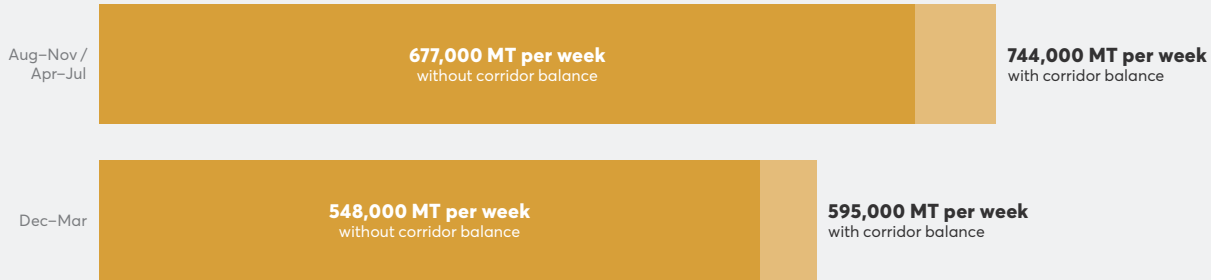
Vegreville, AB

It is CN's view that on a sustained basis, the end-to-end grain supply chain can accommodate up to 7,800 cars per week (up to 744,000 metric tonnes per week) of bulk grain and processed grain products outside of winter, and up to 6,250 cars per week (up to 595,000 metric tonnes per week) of bulk grain and processed grain products during winter. Of these volumes, approximately 900 cars per week are anticipated to be shipments of processed grain products such as canola meal, canola oil, and malt.

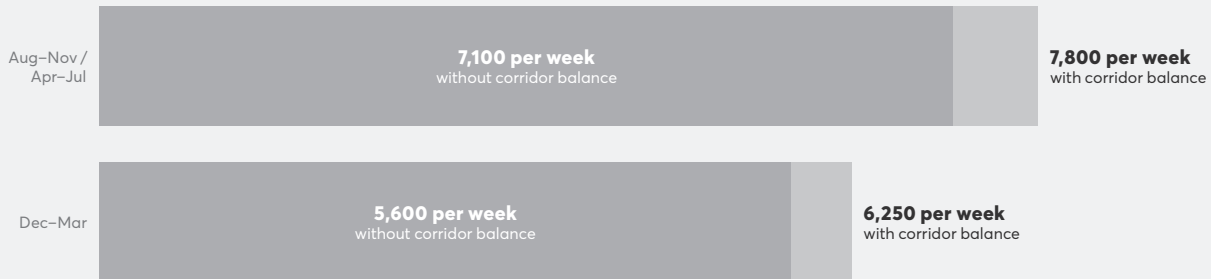
These maximum end-to-end grain supply chain capacity levels on CN assume that multiple conditions must be in place to achieve these levels. These conditions must include, but are not limited to:

- grain supply chain fluidity, capacity utilization and demand balance across all major rail corridors
- sufficient demand to meet these levels
- seven-day continuous operations at all major grain export facilities
- grain railcar unloading and vessel loading during inclement weather at all grain facilities
- normal winter rail operating conditions (issues related to winter operating conditions and measures CN has taken to address the impact of winter on rail capacity will be addressed in our Winter Plan)
- no significant labour disruptions
- no mainline or other major supply chain disruptions
- a stable global trade environment, and
- no material impacts on the capacity of the supply chain due to COVID-related impacts, including impacts to CN's field force or the workforce of supply chain partners

**FIGURE 8.1**  
**Maximum Sustainable End-to-End Grain Supply Chain Capacity – Bulk Grain and Processed Grain Products**  
*metric tonnes shipped per week*



**FIGURE 8.2**  
*cars shipped per week*



These conditions are real factors that limit the amount of grain that can move through the supply chain at any point in time. If these conditions are not all in place for a given timeframe, it can be expected that grain shipment volumes will not reach maximum sustainable levels. In the case of a lack of corridor balance, for example, these maximum sustainable supply chain capacity levels may be reduced by as much as 8 to 9%. On an annualized basis, the end-to-end maximum sustainable supply chain capacity on CN represents grain supply chain shipment capacity of up to 36 MMT, which is significantly higher than anticipated grain shipment volumes on CN for the 2022–23 crop year.

It can also be reasonably expected that demand for CN-supplied equipment will exceed the maximum sustainable capacity of the end-to-end supply chain in some weeks, especially post-harvest and during grain companies' trading margin peak profitability periods. These limitations are considered in CN's planning efforts, as are its obligations to provide rail service to other segments of the Canadian economy.

*On an annualized basis, the end-to-end maximum sustainable supply chain capacity on CN represents grain supply chain shipment capacity of up to 36 MMT, which is significantly higher than anticipated grain shipment volumes on CN for the 2022–23 crop year.*





# CN Capacity

The following section outlines CN's expectations for hopper car fleet size, locomotive fleet size, and operating crew base over the course of the 2022–23 crop year, along with CN's rail infrastructure investment plans for 2022:

## Hopper car fleet size and efficiency

Based on current overall demand forecasts, CN's assessment is that the grain hopper car fleet will be sufficient to move the anticipated volume of grain over the course of the 2022–23 crop year.

CN's approach to fleet composition for the movement of bulk grain has fundamentally changed over the past five years. What was once a fleet dominated by leased and owned CN-supplied hoppers is now much more diverse. This approach includes customer-supplied high-capacity hoppers integrated into CN's common pool, brand-new CN hopper cars, and high-capacity, customer-controlled private cars.

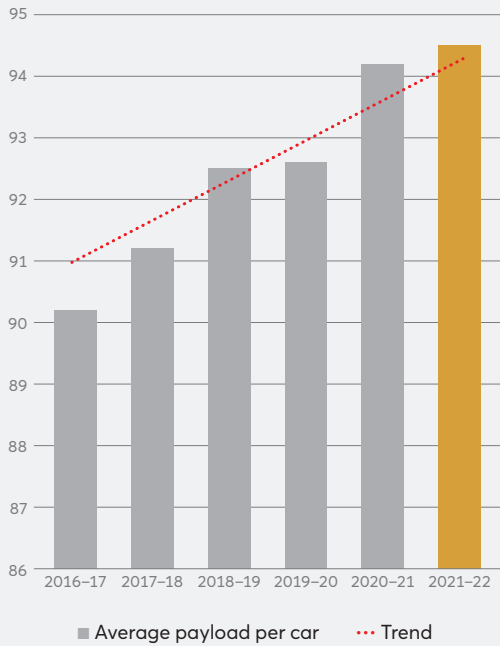


*CN's assessment is that the grain hopper car fleet will be sufficient to move the anticipated volume of grain over the course of the 2022–23 crop year.*

This fall, CN expects to have an owned/operated/leased fleet of approximately 11,600 grain hopper cars focused on bulk grain service in Western Canada. Once customer-supplied private hopper cars moving in bulk grain service are taken into consideration, the effective size of the hopper car fleet moving bulk grain from Western Canada on the CN network is expected to be approximately 13,500 cars.

Over the past four crop years, thanks to the wide variety of fleet solutions that customers can utilize, the average tonnage shipped per car on CN out of Western Canada has increased by over four metric tonnes, or over 4%. Moving more tonnage per car means moving more tonnage during peak hopper car demand.

**FIGURE 9**  
**Average Payload for CN-originated Bulk Grain Shipments ex Western Canada**  
*metric tonnes per car*



CN is also continuing its multi-year hopper car modernization program and expects to take delivery of 500 high-efficiency hopper cars during the 2022–23 crop year. Since 2018, CN has taken delivery of 3,000 new generation, high-efficiency hopper cars, including 500 new hopper cars during the 2021–22 crop year. The increased cubic capacity of the new hopper cars (5,431+ cubic feet) means more tonnage of lighter density commodities such as canola, barley and oats can be loaded in these cars before the car reaches its maximum permissible gross weight. The cubic capacity of existing standard jumbo hopper cars is in the range of 5,150 to 5,250 cubic feet, compared to 4,550 to 4,750 cubic feet for Government of Canada hopper cars. The shorter length of these 55-foot five-inch to 55-foot eight-inch hopper cars also means that more of these cars can be spotted on the same length of track compared to conventional hopper cars that are between 58 and 60 feet in length.

When CN's multi-year hopper car fleet renewal program is completed, the CN-owned high-efficiency hopper car fleet will grow to 6,000 hopper cars. In addition, almost all the customer-supplied cars moving as private, discrete sets are comprised of high-efficiency hopper cars.

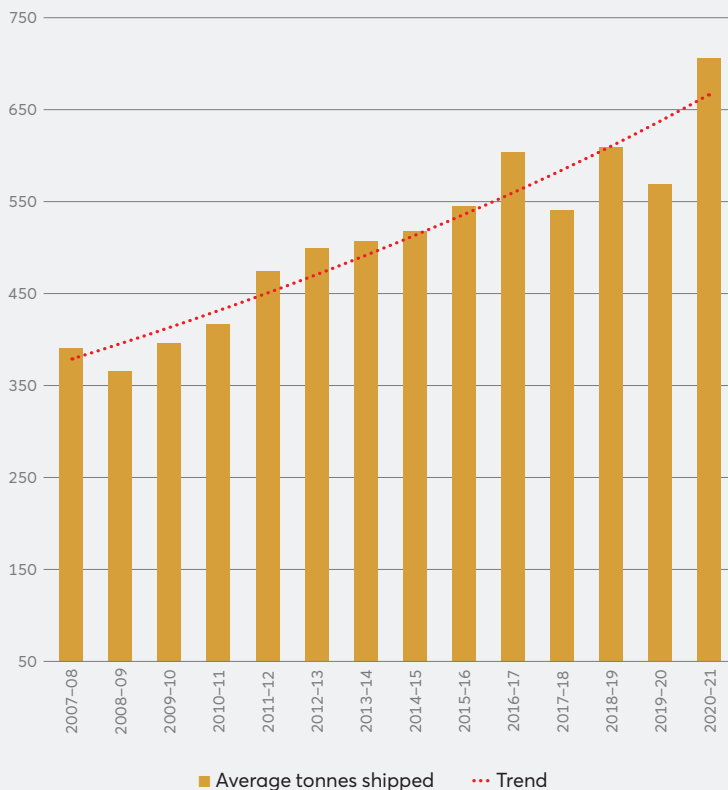


Aberdeen, SK

Between increased average payload per car and more cars per train pulled from the same origin, the efficiency gains add up fast, especially for lighter density commodities — up to 20% more wheat moved per train and up to 40% more canola depending on track capacity at the originating grain handling facility. CN's innovative approaches to hopper car fleet supply and management, combined with investment by CN and customers at all levels of the end-to-end grain supply chain have translated into stronger grain movement, with higher annual compound growth in weekly grain shipment volumes post-harvest compared to the compound growth of Western Canadian grain production.

*CN's innovative approaches to hopper car fleet supply and management, combined with investment by CN and customers at all levels of the end-to-end grain supply chain have translated into stronger grain movement.*

**FIGURE 10**  
**CN Average Grain Tonnage Shipped October–November**  
*000 metric tonnes per week*





*CN has undertaken various actions to further increase the number of locomotives available for use across the CN network, as well as improving the overall efficiency of our locomotive fleet.*

## **Locomotives**

Based on CN's current overall rail traffic demand forecasts, CN's assessment is that the locomotive fleet will be sufficient to move the anticipated volumes of Western Canadian grain shipped during the 2022–23 crop year.

CN works hard to ensure it has the locomotive fleet required to operate its rail network and move the traffic offered for shipment by its customers. Because the lead time for acquiring new locomotives is typically 9 to 12 months, 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 undertaken various actions to further increase the number of locomotives available for use across the CN network, as well as improving the overall efficiency of our locomotive fleet. Besides CN's acquisition of 260 high-horsepower locomotives from GE Transportation between 2018 and 2019, CN acquired 75 high-horsepower and 13 low-horsepower locomotives from the secondary locomotive market in 2021 and Q1 2022. These locomotives can become available sooner than new locomotives. CN has also suspended locomotive retirements to maximize locomotive availability.

CN has also recently undertaken a modernization program for 100 locomotives between 25 and 30 years in age. These locomotives will be upgraded from DC-traction motors to AC-traction motors, and state-of-the-art technology will be installed to support improved productivity and reliability. CN has also recently acquired 57 high-horsepower locomotives to augment its CN-owned locomotive fleet, of which 47 are expected to be operating on the CN network this fall and 10 are expected to be operating on the CN network in Q1 2023.



LEFT TO RIGHT: Kaitlyn Rondeau, Transportation Manager; Katie Kennedy, Transportation Supervisor; Roxane Cayouette, Conductor; Mahir Abdulle, Transportation Manager. Edmonton, AB

## Operating crew base

Based on current overall demand forecasts, CN's assessment is that the active operating crew base will be sufficient to move the anticipated volume of grain over the course of the 2022–23 crop year.

It was noted earlier in the Grain Plan that CN could not hire and train all the conductors that we wanted to have in place for Q4 2022. CN also anticipates demand from all business units that will exceed the capacity of the Western Corridor during that quarter. For these reasons, considering that CN must move all traffic offered on our network in accordance with our statutory level of service obligations, we anticipate periods during the crop year where short-term demand may not be met. CN faces significant pressures on rail capacity from all rail traffic segments in relation to the operating crew base required to move all that traffic.

When considering the workforce available to move rail traffic, the focus is on conductors and engineers, referred to here as operating crew base. CN assesses operating crew base at many different levels, including at the regional and individual terminal level. It is important to assess operating crew base at the terminal level, considering limitations associated with moving conductors and engineers between regions should there be unanticipated increases or decreases in demand.

Recognizing, for example, grain traffic moving from the Prairies to Vancouver or Prince Rupert must move across Alberta and British Columbia, the operating crew base in each of the rail terminals that the traffic will move through along the route must be sufficient to facilitate efficient rail movement.

The ability to resource individual terminals is dependent on labour and economic dynamics in those individual regions, including proximity of the

region to major population centres, cost of living, availability and affordability of housing, availability of education and other services. It is relatively more difficult to recruit and retain operating crew base to be deployed in remote areas compared to other parts of the CN network, with these regions also corresponding to some of the heaviest CN rail network traffic density and demand pressure across multiple rail traffic segments.

These labour market challenges are not unique to the rail transportation industry, considering that unemployment levels are currently at their lowest levels in five decades and changes in population demographics are shrinking the potential size of the workforce. Furthermore, generational change and approach to various aspects of employment is also taking place in the workforce, with individual perspectives on work-life balance and shift work/weekend work in a state of transition for many individuals.

To combat these challenges, CN has implemented additional measures to recruit and retain employees working in the field. These measures include improved retention and signing bonuses for hard-to-recruit areas; new recruitment information sessions targeted at evenings and weekends; increased participation in employment events such as job fairs; new work with post-secondary educational institutions to improve recruitment of graduates with transferrable skills; and pilot projects to try new online recruitment and interview tools for critical operational positions.

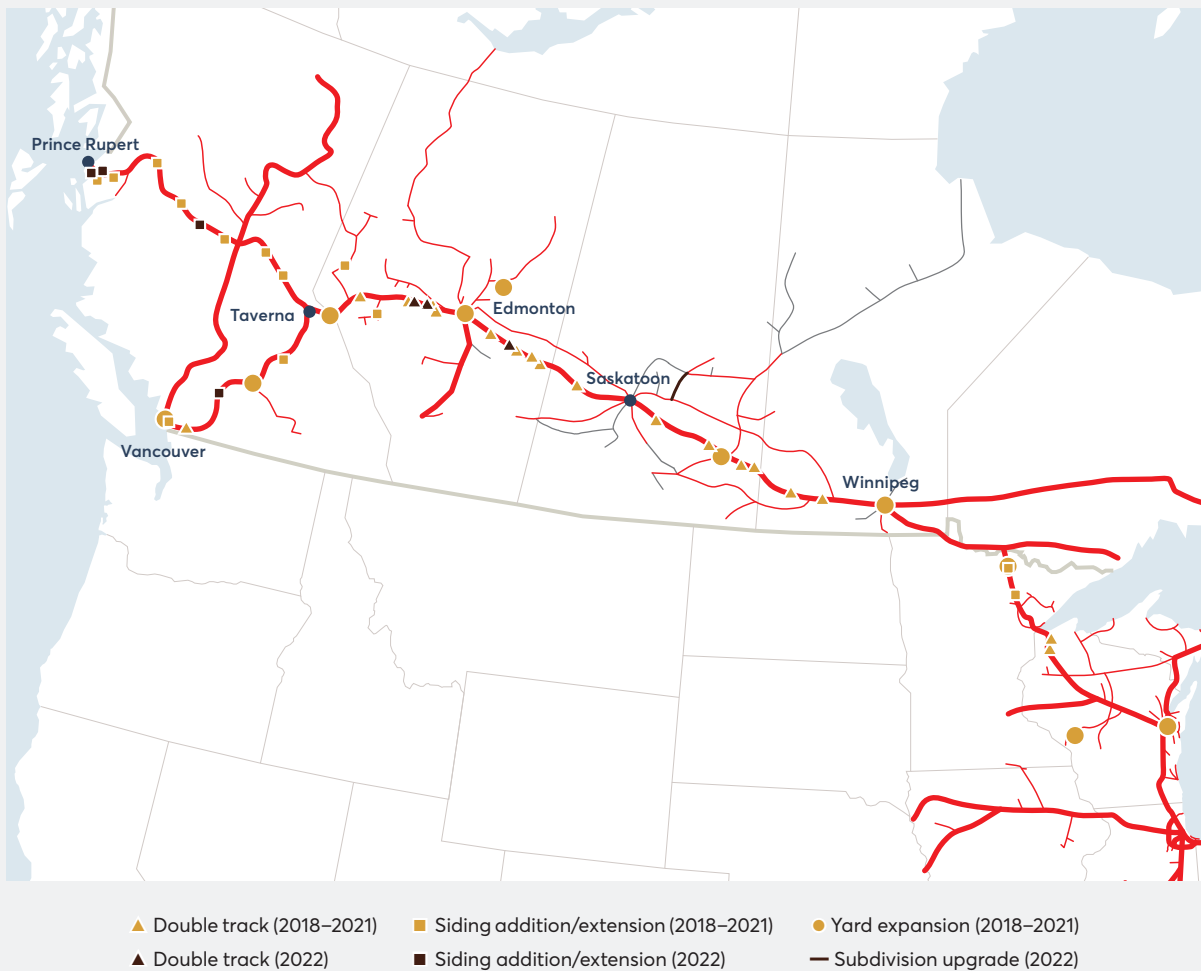
Further, CN's training campuses located in Winnipeg, MB, and Homewood, IL, continue to graduate employees into Transportation (conductors and locomotive engineers), Engineering (track and maintenance-of-way) and Mechanical (car and locomotive repairs). These employees will replace those retiring and increase our crew base in key areas of higher demand.

Looking into next year, CN is actively reviewing the new federal *Duty and Rest Period Rules for Railway Operating Employees* that come into effect on May 25, 2023. It is important to understand the impact extended rest periods will have, and what operational adjustments will be required to maintain existing customer service levels.

## Rail infrastructure

Between 2018 and 2021, CN invested over \$13 billion in its rail network, maintaining its North American leading position among Class I railways in terms of capital investment as a percentage of annual revenues. The investments include many major, multi-year maintenance and capacity-enhancing projects that will improve network fluidity and resiliency. During the global pandemic, when many other companies were scaling back investment, CN did not, investing \$5.8 billion between 2020 and 2021 with an eye to future growth in rail traffic as the Canadian economy grows.

FIGURE 11  
Major CN capital infrastructure investments between 2018 and 2022



In 2022, CN's capital investment plan is expected to represent approximately 17% of revenue. As is normally the case, a significant portion of CN's investments in 2022 will be dedicated to track maintenance to support safe and efficient operations, including the replacement of rail and ties, bridge improvements, as well as other general track maintenance. A summary of the core maintenance and capital investment specific to the Prairie provinces and British Columbia is as follows:

- 191 miles of rail to be replaced in 2022
- Approximately 425,000 ties to be replaced in 2022
- Close to 130 road crossing surfaces to be re-built in 2022
- Over \$1.1 billion of capital investment in 2022 and over \$4.7 billion of capital investment over the past five years

Specifics of the new rail infrastructure capacity enhancements expected to be in service in 2022 include the following:

## SASKATCHEWAN

- Upgrading of the rail infrastructure on the CN St. Brieux Subdivision between Humboldt, SK, and Melfort, SK, to a 286,000-pound gross weight restriction.

## ALBERTA

- Nine miles of double track east of Edmonton on the CN Wainwright Subdivision to increase train capacity along the subdivision.
- Seventeen miles (two separate sections) of double track west of Edmonton on the CN Edson Subdivision that will increase subdivision train capacity. All trains destined to or originating from Vancouver and Prince Rupert must transit through this subdivision.

## BRITISH COLUMBIA

- A 12,000-foot siding south of Kamloops on the CN Ashcroft Subdivision that will allow for more frequent passing trains and increase throughput along this subdivision. This siding is in the Directional Running Zone where CN and CP coordinate their activities and effectively operate their single track rail infrastructure as a section of double track to increase overall capacity in the Vancouver corridor.
- A 12,000-foot siding between Smithers and Prince George on the CN Telkwa Subdivision that will increase capacity between Edmonton and Prince Rupert.
- Two 12,000-foot sidings near Prince Rupert on the CN Skeena Subdivision that will support current operations, support future Prince Rupert expansion, and provide optionality for broader port area resiliency.

CN is working diligently to ensure these projects are completed prior to the coming winter. Managing major infrastructure work on busy corridors is a highly complex task. It requires significant planning and resources and involves some temporary disruptions of service to provide work crews with needed access to the network.



## Long-term investment to support future growth

CN expects significant growth in rail traffic volumes in its Western Region over the next decade. Besides the growth expected in Western Canadian grain production attributable to anticipated yield gains, other rail traffic segments such as potash, propane, intermodal, and forest products are also expected to increase in volume, among others. Long-term investment in rail infrastructure will be required to create capacity, especially in the Edmonton–Prince Rupert and Edmonton–Vancouver corridors. As part of its ongoing network capacity assessments, new projects for 2023 and beyond are well into the planning phase. The CN Service Design team works closely with CN's capacity planning group to turn traffic volume forecasts into workload for individual sections of the rail network, which in turn drives the planning process with respect to the addition of new network infrastructure to support long-term growth, network fluidity, and network resiliency.

CN also has multi-year capital projects focused on removing bottlenecks and creating new capacity in the area around the Port of Vancouver and the Port of Prince Rupert. Many of these projects are in conjunction with the Port Authorities and the Government of Canada. These projects include the following:



Installing soil anchors for protection slab, protecting a utility crossing. Surrey, BC

### PORT OF VANCOUVER

- **Thornton Tunnel ventilation** – Installation of fans to improve exhaust ventilation and increase 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 will allow trains to pass through the tunnel more frequently (reducing the current 20-minute interval between trains to 5-10 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 Thornton Tunnel and CN Thornton Yard for traffic to the North Shore. CN can now stage trains close to the CN Second Narrows Bridge instead of staging trains much further back at Thornton Yard, moving trains to the North Shore more quickly when the bridge is available for transit. **IN SERVICE**
- **CN Thornton Yard by-pass** – Construction of a 12,000-foot bypass and 6,000 feet of yard track to improve fluidity and yard capacity. **IN SERVICE**
- **Burrard Inlet Road and Rail improvement** – Construction of a 13,700-foot railway track parallel to the existing Burrard Inlet mainline (the “BI Line”) on the CN New Westminster Subdivision. This project will make the Vancouver South Shore rail network more resilient to disruptions by ensuring that an alternate route for South Shore access is maintained and improves the capacity and reliability of operations in the area. **ONGOING MULTI-YEAR PROJECT**
- **Glen Valley double track** – The project will address a significant bottleneck — 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 (DRZ) and CN's Thornton Yard, which supports industry and port facilities in the Lower Mainland. The project will increase corridor capacity and make the network more resilient to disruptions by stabilizing grade slopes with a retaining wall. **ONGOING MULTI-YEAR PROJECT**



*Under the leadership of our new CEO Tracy Robinson, CN is taking a back-to-basics approach to its rail operations to effect improvements in rail traffic velocity and other measures of operational performance that translate into improved rail service delivery for CN's customers.*

#### PORT OF PRINCE RUPERT

- **Zanardi Bridge renewal project** – Bridge replacement and double tracking that will increase the maximum number of trains per day that can enter and depart the Port of Prince Rupert. 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** – The Corridor was constructed prior to 2017. Expansion of the Corridor will support access to any future terminals on Ridley Island and facilitate unit train access. **ONGOING MULTI-YEAR PROJECT**
- **Fairview–Ridley Island Connector** – Construction of a 5 km road between Fairview Container Terminal and Ridley Island will allow container trucks to move more efficiently and support future infrastructure growth. The route will reduce truck length of haul from 20 km to just 5 km, and truck traffic will no longer have to transit downtown Prince Rupert. The road will support current port operations and future terminal expansion and improve the resiliency of the broader port area. **ONGOING MULTI-YEAR PROJECT**

#### **Operational planning and capacity**

Effective operational planning and communication maximizes rail network capacity by making the best use of operating crew base, locomotive fleet, rolling stock and rail infrastructure. Under the leadership of our new CEO Tracy Robinson, CN is taking a back-to-basics approach to its rail operations to effect improvements in rail traffic velocity and other measures of operational performance that translate into improved rail service delivery for CN's customers. CN is effecting these changes during Q2 and Q3 2022, with the timing of these changes in sync with the increased rail traffic volume anticipated this fall with an expected return to typical grain demand levels.

Recognizing that resources such as locomotives, operating crew base and rail infrastructure are shared across all CN business segments, operational performance improvements for grain are tied in large part to overall rail operating performance. In April 2022, CN brought renewed focus to ensuring that trains departing the four largest railcar traffic processing yards in its network (Winnipeg, Toronto, Chicago, and Memphis) are departed on time with the right traffic blocked to destination. In May 2022, the same approach was applied to three smaller railcar processing yards that rely on locomotives to move traffic into the correct classification track to be blocked properly to destination.



Prince Rupert, BC

These initiatives, along with focus on effecting on-time train departures and running the core operational plan for carload and intermodal traffic has been delivering stronger operational results such as increased overall railcar velocity. Operational adjustments such as these and others are being implemented well in advance of the upcoming harvest and the associated uptick in demand expected with a more normal crop production level.

CN's Scheduled Grain Service model also contributes to overall network efficiency, and CN's back-to-basics approach has applicability here as well. CN utilizes its serving hubs within the Prairies and through our grain corridors to maximize grain supply chain and network efficiency. CN uses a hub-and-spoke model where we have major terminals in Winnipeg, Melville, Saskatoon, Edmonton, and Jasper. These major terminals allow CN to have a serving yard or consolidation point within a couple hundred miles of all country elevators and grain processing facilities. CN can run as much as 200+ loaded or empty grain cars back and forth from these serving hubs to port, allowing CN to maximize train loads and maximize network capacity.

Customers place orders for CN-supplied hopper cars on a weekly basis, with CN's car ordering system able to record customer orders for CN-supplied equipment up to 16 weeks in advance. Individual grain elevators have a specific day of week designated for service, with exceptions communicated by our operations and planning teams directly to customers. Our goal is to spot empty hopper cars by 0700 hrs on the scheduled service day, leaving locomotive power with the train in anticipation of timely railcar loading, making it key that grain is in position to be loaded to contribute towards improved hopper car velocity.

Balance is also required between loaded traffic moving to destination and empty car supply returning to origin to ensure corridor fluidity. The CN pipeline management and port operations groups are in daily contact with grain shippers and with other rail carriers to efficiently manage the flow of grain traffic to destination, recognizing that vessel arrival times, vessel readiness for loading, and weather impacts on terminal productivity are continuously changing.

The operational performance of other rail carriers also has a direct impact on CN, considering that a significant amount of traffic CN handles does not terminate at a destination directly served by CN. A good example of this is the grain traffic that CN interchanges with CP in Vancouver for furtherance to South Shore grain terminals. CN and CP pipeline management/port operations groups coordinate the flow of traffic within the Port of Vancouver, but the arrival of railcar traffic at destination can be delayed if plans changed for any number of operational or other reasons, or if the windows available for the interchange of traffic were significantly modified. Considering that most bulk grain traffic moves in CN-supplied equipment and recognizing that this is a shared pool of resources among customers, any delays in the unloading of railcars or the return of empty railcars to the interior for loading impacts all grain customers and serves to place a limit on end-to-end supply chain capacity.

CN is adding staff to support the management of loaded/empty grain traffic as well as port operations coordination with a focus on enhancing coordination and communication with CN Transportation, Customer Service, the Motive Power team, and other key points of contact and delivering more timely information to customers.

*Investing in technology also allows CN to identify problems before they become more serious.*

## Advancements in technology to create capacity

While intense capital investment in network infrastructure like double tracking, the addition/extension of long sidings, or a rail yard expansion creates more physical capacity, technology can be used to create a more fluid and reliable railroad and increase capacity. Investing in technology also allows CN to identify problems before they become more serious, like a steel wheel breaking. In that way, the potential for network disruptions can be reduced, keeping traffic moving on the network. Two major technological innovations that CN has implemented are the automated track inspection program (ATIP) and automated inspection portals.

Up until recently, the primary means of track inspection was by a track inspector in a high-rail vehicle moving at 15 to 20 miles per hour directly along the track, with stops along the route to have a closer look. The inspector has a fixed amount of time to assess the stretch of track being inspected, and during that time the track is unavailable for freight movement. Today, CN has 10 specialized track inspection cars moving in the CN rail network. ATIP cars are specially equipped railcars with the latest sensor and AI technology and are being used to fully automate inspections.



Automated Track Inspection Car  
Abbotsford, BC

Whereas today, the ATIP car moves at train speed right within a freight train already moving along the network, assessing such items as track gauge, geometry, and alignment. These fully autonomous railcars inspect 100% of CN's mainline and 45% of the entire network on a consistent basis. In 2021, some of our key corridors received up to 20 times more inspections than with previous methodologies. ATIP cars unlock capacity and improve service reliability by reducing track disruptions. Use of the ATIP technology in the United States, for example, has resulted in a 51% reduction in delays from engineering-related temporary slow orders on our key Chicago–New Orleans freight corridor since its introduction in 2019, and maintenance and repair workload has increased 16% through 2020 as more conditions were identified by ATIP technology.

In the case of the automated inspection portals, high-resolution imaging hardware coupled with powerful machine learning software are fundamentally changing how CN inspects its fleet.



Automated Inspection Portal  
Winnipeg, MB



Distributed Braking Car  
Montreal, QC

The portals allow for inspection of a train at track speed versus a roll-by inspection at train departure from a yard, significantly reducing initial train start delays and improving yard capacity. The individuals performing roll-by inspections can be freed up to work on repairs and other tasks, using their time more efficiently. High-resolution cameras can take photos of equipment at all angles, with the quality of the images as if the train is standing still and an individual beside it is observing the train. Increased frequency and improved quality of inspections, especially on parts of the railcar more difficult to assess, like the undercarriage, support CN's safety agenda — and safety is a core value at CN. CN currently has seven inspection portals in operation across its network. Thanks to the inspection portals, many critical defects, which could have resulted in significant operational disruption or personal injury, have been detected and corrected.

Other advancements in technology are far simpler. CN's distributed braking cars, which are unique to CN, are simply boxcars equipped with an air compressor. These cars are used as an air source in the train to maintain air brake pressure and extend operating train length. Each of these cars used within a train (up to a maximum of five air sources including locomotives) allows CN to run an additional 1,500 feet of train length. CN has approximately 100 of these cars available for use, and the cars are deployed along the mainline in one of CN's most traffic-dense corridors (Edmonton to Winnipeg). During the extreme cold snap that occurred in February 2021, for example, the deployment of distributed braking cars resulted in CN being able to deliver over 240,000 feet of train capacity compared to if these cars had not been available for use, representing the equivalent length of close to 40 grain unit trains.

## Grain-specific supply chain reporting

Beyond simply projecting and reporting on the total amount of grain and processed grain products being shipped from Western Canada over a specific period, CN also measures and reports grain supply chain performance in many other ways, including the quality of the service being provided. This information is available in significant detail on a weekly basis through CN's Western Canadian Grain report and has been produced since the 2016–17 crop year.<sup>3</sup> This voluntary reporting captures 100% of grain shipments moving in CN-supplied hoppers and private hoppers along with detailing 100% of the orders received for CN-supplied equipment.

CN reports total grain tonnage moved on a weekly basis by corridor for bulk grain and processed grain products, along with crop year-to-date shipments, followed by detail concerning customer orders for CN-supplied hopper cars. Preliminary car orders received for the week are reported, and car orders with no authorization from the receiving facility to be shipped are identified and removed from the car order list. What remains is valid orders. Customer self-cancelled orders are accounted for and the balance of car orders remaining is measured against the maximum sustainable supply chain capacity on CN. Sometimes orders far exceed what the end-to-end supply chain can realistically handle at any point in time for various reasons, and these orders cannot be accepted.



CN also reports in detail on how CN executed against the grain spotting plan. This reporting describes what happened to the CN-supplied hopper car spot plan after the plan was finalized (accounting for subsequent customer self-cancelled orders, for example) including the number of cars spotted for the week they were ordered in, cars spotted that were associated with the previous week's plan, and car orders spotted in advance of the week that they were requested for. On a weekly basis, CN indicates what percentage of CN-supplied hopper cars were supplied against the current week's spot plan along with the percentage of orders that were supplied either in the week requested or within 24 to 72 hours of the end of the wanted week.

There is also additional detail specific to grain reported to Transport Canada as part of these reporting requirements.<sup>4</sup> Grain car order placement and fulfillment data, for example, is reported by origin province. There is also information on the number of grain cars loaded and billed moving in the system by province. Performance measurements are as follows:

- Cars loaded and billed, all systems
- Cars loaded and billed, train service
- Cars loaded and billed, other
- Orders placed
- Orders filled
- Orders 1 to 10 days past due
- Orders 11 or more days past due

<sup>3</sup> Available at <https://www.cn.ca/en/your-industry/grain/western-canadian-grain/>

<sup>4</sup> Available at <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2310027501>





# Summary

Based on the information and assumptions outlined in this document, CN is confident it has the resources in place to move this year's harvest over the course of the 2022–23 crop year. The acquisition of 57 high-horsepower locomotives, along with 500 new-generation, high-capacity grain hopper cars to be delivered during the upcoming crop year, will further contribute to achieving CN's grain movement targets and deliver quality service.

During the 2020–21 crop year, CN moved record grain volumes thanks to strong operational performance, record supplies, strong domestic and global demand, and the investments CN and its partners have consistently made over the years. The team that is in place at CN today is the same team that delivered 14 consecutive months of monthly record grain shipments. CN has made significant changes to its rail operations to deliver stronger operational results and improve the quality of service to its customers.

The external factors that influenced end-to-end supply chain performance during the 2020–21 crop year when CN moved record volumes of grain were markedly different from the external factors that resulted in the deterioration of supply chain performance during the 2021–22 crop year. With the right conditions, CN will be able to deliver strong performance for this upcoming harvest and beyond. During the 2022–23 crop year, CN is well positioned to ship **up to 7,800 cars per week (up to 744,000 metric tonnes per week) of grain and processed grain products outside of winter, and up to 6,250 cars per week (up to 595,000 metric tonnes per week) of grain and processed grain products during winter, assuming all the conditions required to meet these levels across the end-to-end supply chain are in place, including demand balance across corridors.**

Based on the best forecasts available, and recognizing there are external variables beyond its control, CN is confident the 2022–23 Grain Plan will meet the needs of its grain customers.

# ANNEX A

## Grain Flow on CN Network



**Western Canada CN-Served Grain Network Expansion since 2015**

- Canadian grain
- U.S. grain
- Ports served by CN
- Announced new grain elevators
- Completed new grain elevators
- Waterfront export facilities





Saskatoon

Winnipeg

Thunder Bay

Toronto

Chicago

Memphis

New Orleans

Mobile

Montreal

Quebec

Saint John

Moncton

Halifax



Vegreville, AB

# ANNEX B

## Grain Handling and Transportation System

This annex features additional detail on the workings of the grain supply chain.

### 1 GRAIN MOVEMENTS BEGIN WITH A SALE

Grain companies enter into contracts to sell Western Canadian grain, at an agreed time in the future, to their customers in many countries around the world.



### 2 GRAIN IS DELIVERED TO A COUNTRY GRAIN ELEVATOR

Grain companies gather grain into Prairie grain elevators from many producers who have the type and grade required to fulfill the sales contract — all grain starts in a truck from the farm gate.



### 3 GRAIN COMPANIES ORDER RAIL CARS

As the sales contract date approaches, the grain companies order railcars from the railway and instruct the railway where to place the car (i.e., to which Prairie grain elevators).



### 4 PIPELINE MANAGEMENT

CN works closely with grain companies and terminal operators to ensure the fluidity of each corridor. For instance, when a waterfront terminal is encountering weather challenges and cannot offload railcars, the grain companies will cancel some of their car orders into that pipeline to avoid worsening terminal congestion.



### 5 CAR SHIPMENT

The railway delivers the empty railcars to the particular Prairie grain elevators for that week, as determined by the grain companies.



### 6 CAR LOADING

Prairie grain elevators load railcars with the type and grade of grain specified by the grain company to meet their sales contract. The more rapidly the railcar is loaded and released to the railroad, the quicker it can be delivered to port, emptied and sent back to the country. Prairie grain elevator infrastructure varies resulting in different levels of efficiency (i.e., single car loading; block loading; unit train loading; loop track).



### 7 LOADED CARS ONLINE

Once the loaded railcars are released from the Prairie grain elevator, the railcars begin their journey to destination. In most cases, this is a four- to five-day journey to the West Coast. However, there can be occasional rail network disruptions, or staging of trains en route at shippers' request to manage inbound pipelines and terminal capacity.



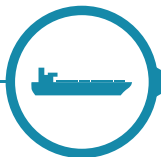
### 8 UNLOADING CARS AT PORT TERMINAL

Railways place the railcars at an export terminal, and the terminal unloads the grain to the storage silos or directly loads a vessel. The more rapidly the railcar is unloaded and released empty back to the railroad, the quicker the empty car can be sent back to the country. Availability of labour, weekend and holiday downtime, and planned and unplanned maintenance shutdowns can all affect the speed with which railcars are unloaded.



### 9 LOADING OCEAN-GOING VESSELS

Port terminals load grain into ocean-going vessels, either from storage silos or directly from arriving grain hoppers. Poor weather can delay vessel loading, which will slow or stop railcar unloading.





[www.cn.ca/grain](http://www.cn.ca/grain)