MALCOLM CAIRNS RESEARCH AND CONSULTING

FREIGHT RAIL CAPACITY

The capacity of CP and CN and the short lines to handle the ever-increasing volumes of freight traffic is a vitally important factor in ensuring that Canada can achieve the best value from the national rail assets that serve the expanding domestic and trade economies.

I WHAT IS CAPACITY?

The capacity of rail, like other transport modes, is a complex issue. Rail capacity can be considered at several levels:

- Rail transportation market: The capacity of a specific rail transportation market which involves a given origin, destination and commodity;
- Rail corridor: A number of transportation markets may coexist in a given rail corridor with a specific train capacity;
- Rail network: The overall capacity of a railway and its network over a given period of time.

Typical measurements of rail capacity at each level and by type of commodity are illustrated in Exhibit 1.

EXHIBIT 1	BULK	INDUSTRIAL	INTERMODAL
RAIL MARKET	RTMs of Commodity per year Cycle Times	Carloads of Commodity per month Number of train starts per day	Containers per week
RAIL CORRIDOR	Number of trains per day in each direction		
RAIL NETWORK	RTMs of Bulk per year	Total RTMs per year Carloads online per week	Containers eastbound per month

A railway may also be only one segment in a given transportation market which may involve other railways and modes, as well as interchange partners such as ports, terminals, and transload centres, in a supply chain. In this instance the performance of the other supply chain partners will also affect the overall capacity of the supply chain.

Ultimately, capacity for current purposes is measured as the movement of a volume of traffic over a distance in a given period of time. This implies that several factors that impact capacity – such as train speed, dwell time at yards, terminals and ports, and loading and unloading capabilities – are important but only indirectly relate to capacity as defined here.

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II WHAT FACTORS CAN AFFECT CAPACITY?

Capacity depends upon a range of factors:

- **Infrastructure capacity**: track structures, length and spacing of sidings, types of signaling, yard configurations, multiple tracking, and measures to improve plant reliability, are all factors that can increase the frequency, size, and speed of trains in a market or corridor;

- **Equipment capacity**: the availability of larger, more reliable freight cars, more powerful and reliable locomotives are also factors that can increase the frequency, size, speed and carrying capacityof trains in a market or corridor;

- **Operational practices**: scheduled train services, consistent delivery of cars, distributed power, high-tech end-of-train-units (ETUs), improved train crewing, improved operating plans, longer and heavier trains, reduced dwell times, increased velocity – building upon improved infrastructure and equipment capabilities, these operational factors can all contribute to creating increased capacity;

- **Where applicable, supply chain partners capacities**: the time taken for shippers to load and unload cars at their facilities and their storage capacities and hours of operation, the extent of communications between the partners, trucking constraints such as road congestion, marine shipping capacities and speed of transit, port constraints such as speed of cranes loading and unloading ships, and labour relations with longshoremen and truckers – all of these factors may also affect overall supply chain capacity.

Factors such as the above may also vary over time due to externalities such as market demands for varying speeds of different traffic classes, traffic peaking by day of week or seasonally, congestion, or incidents such as maintenance requirements, strikes, accidents, and bad weather.

III WHAT HAVE RAILWAYS DONE TO MANAGE AND EXPAND CAPACITY?

3.1 Capital Expenditures

At the heart of the ability of the railways to increase capacity and meet the challenges of increasing demand is the level of investment or capital expenditures. Exhibit 2 presents the combined capital expenditures of CP and CN in Canada from 2000 to 2013 – the increasing trend is apparent despite the dip during the financial crisis

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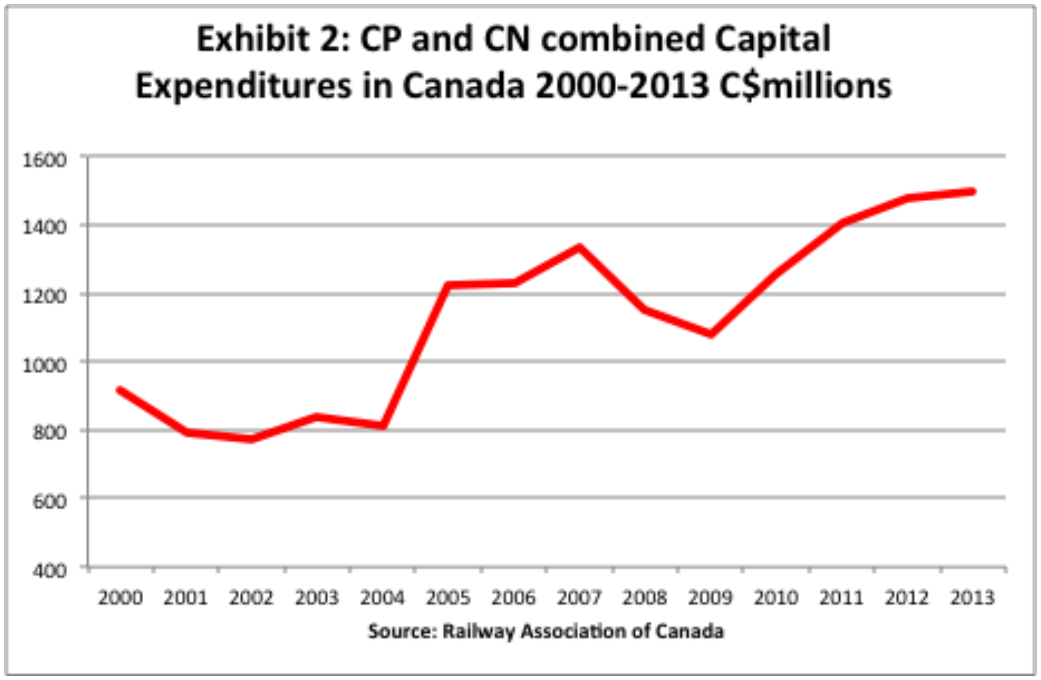
In 2013 the components of the combined capital expenditures were: track and roadway 68%, equipment 14%, information technology 7%, buildings 5%, and the balance was for other projects. The significance of the track and roadway component is related to the size



of the CP and CN rail networks in Canada – capital expenditures do not include ongoing maintenance expenses.

Track and Roadway

Investment in track and roadway components are many and varied:

- Track structures: Increased weight of rail, continuous welded rail, stronger and more durable ties, improved elastic track fastening systems, higher quality ballast, sub-grade and bridges – all lead to increases in train weights and speeds. For example, the maximum gross weight on rail for a conventional four axle freight car has increased from 220,000 lbs. in the 1970s to 2860,000 lbs. today;

- Sidings: The length, spacing, permitted speed, and frequency of occurrence of sidings leads to improvements in the train operations over a single-track corridor;

- Signaling and communications: extending Centralized Traffic Control (CTC) to more of a rail network increases the number of trains per day that can be moved in a corridor. Switch position indicators also alert train crews to avoid possible delays or derailments;

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- Yards: The redesign or elimination of some rail yards can reduce dwell times en route, and remote control devices in yards reduces yard safety occurrences and consequent train delays;

- Multiple tracking: With sufficient property in an existing corridor, double or even triple tracking is possible which will eliminate train meets and significantly improve capacity. CP and CN western corridors through the Rocky Mountains can handle more than 35 trains per day at present – by way of contrast, the western corridors of BNSF and UP in the US can handle over 100 trains per day, which gives a glimpse of what the future rail infrastructure in Canada might look like given the right economic and regulatory conditions;

- Measures to improve plant reliability: Wayside detection and other systems strategically located across a rail network can provide assistance or an alert to conditions that need attention before they fail: over heated wheel bearings, truck hunting, high wheel impact loads, poor wheel profile or brake shoes, car body vertical misalignment, and top of rail lubrication. Advanced track geometry cars measure track gauge and horizontal and vertical alignment, and provide an inspection of joint bars and ties while in motion.

Exhibit 3 presents a graphic indicating current CP track capacity projects.

EXHIBIT 3

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Specific projects include:

- 22 new and extended sidings on the north line between Edmonton and Winnipeg to handle growth and improve efficiency;
- Additional sidings and siding extensions to improve efficiency with better siding spacings and support for long train operations in western Canada;
- Additional sidings and siding extensions to improve the efficiency of train operations in eastern Canada;
- Additional sidings, siding extensions and appropriate siding spacings to improve efficiency and long train operations on the US portion of the CP network;
- Terminal infrastructure upgrades at 8 terminals in the US to reduce dwell times.

Exhibit 4 presents a graphic indicating current CP CTC projects.

EXHIBIT 4[1]

Specific projects include:

- Positive train control (PTC) in the Portal to Glenwood corridor in the US to support increased demand and to meet regulatory requirements;

[1] The acronyms in Exhibit 4 refer to Occupancy Control Systems (OCS), Track Warrant Control (TWC) and Automatic Block Signaling (ABS).

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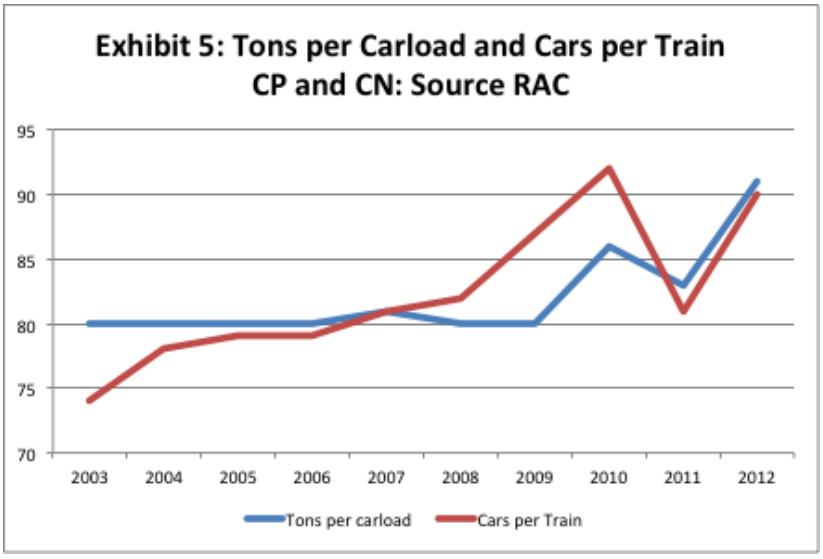
- CTC installation in stages around terminals on the north line with the intent to extend through the subdivisions in later years;

- CTC installation on the coal route in western Canada to reduce the costs of train meets and improve service.

Equipment

Investments in equipment are also many and varied:

- Freight cars: As the freight car fleets are renewed over time, the use of new and lighter materials, stronger and more reliable wheel assemblies, stronger micro-alloy metals for wheels, and lower tare weights has led to increased content volumes per car – see Exhibit 5 where the average tons per carload of CP and CN has increased from 80 to 90 tons per carload between 2003 and 2012;



- Locomotives: As the locomotive fleets are renewed over time, the locomotives have higher HP, with dynamic braking systems, and on board micro-chip sensors for axles and track geometry, which has led to more reliability and fewer locomotives moving heavier trains – see Exhibit 5 again where the cars per train of CP and CN has increased from 74 to 90 cars per train between 2003 and 2012.

3.2 Operational Management

With more advanced and reliable track, roadway and equipment available, railway management have made changes to rail operations that increase capacity:

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- Train crews; with better training, more technical assists, and fatigue management programs, trains operate safely with longer crew runs at higher speeds;

- Distributed Power and ETUs: with the placement of locomotives in the middle of a train consist to reduce excessive in-train and track-train forces, and more high-tech ETUs to reduce human error, the railways now safely and reliably operate longer and heavier trains;

- Operating Plans: more advanced IT-assisted operating plans and service designs enable management to operate scheduled services which also contribute to higher speeds and reduced dell times. They have also enabled a more consistent delivery of cars with more balanced and consistent traffic cycles;

- Reliability: with the use of IT to improve track and equipment maintenance management, and the implementation of safety management systems, there is a reduction in delays and disruptions to train service due to track, equipment or human error.

While these developments have occurred at individual railways, there is also one development that has occurred over the past several years that has enabled CP and CN **jointly** to make more efficient use of existing rail assets – co-production. Co-production is a form of commercial access in the railway industry that covers various types of commercially-negotiated agreements between railways to improve efficiency and service without impacting rail labour. Agreements include components such as:

- Directional running: when two railways have parallel routes each being used in both directions, an agreement can be negotiated to run the trains of both railways in one direction on one route and in the other direction on the other route;

- Reciprocal access to two different bottleneck locations (this is like two homeowners giving access to their private driveways); and

- Reciprocal access over line-haul segments on a corridor: this refers to joint use of segments of line over a given corridor when there is more than one route, enabling redundant segments to be discontinued.

Ultimately the overall effect of these co-production agreements is increased line capacity; improved equipment utilization; improved service and safety with fewer meets and train stops; increased efficiency of operations; elimination of redundant infrastructure or facilities; and provision for alternative operations at times of accidents or weather incidents. Most of these agreements provide direct access to one of the two railways over the rail lines of the other railway – but the important point to note is that this form of access is negotiated commercially, as opposed to regulated. Notable examples include

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directional running in the Fraser Canyon in BC, and the interchange agreement in effect to optimize rail traffic flows in the greater Vancouver region of BC.

3.3 Supply Chain Collaboration

First and foremost in a supply chain beyond the railways are the shippers/receivers themselves. The recent rail service review and subsequent follow-ups has led to the possibility of service agreements between shippers and a railway. Some shippers are unwilling or unable to predict, forecast, or commit shipments to the railways, and therefore a three-tiered approach has been developed:

- Tier 1: A Tier 1 shipper does not provide a railway with any forecasted traffic volumes or specific volume commitment that will be shipped. In such cases, Tier 1 shippers would not be likely be in a position to negotiate specific increased rail capacity;

- Tier 2: A Tier 2 shipper is one that can provide volume forecasts and thereby expand their service agreement to include service standards and non-financial consequences for non-performance;

- Tier 3: A Tier 3 shipper can provide volume forecasts and volume commitments. These shippers can negotiate financial penalties as they provide more predicable traffic through a volume commitment as well as negotiate a premium service for a premium price.

Tier 2 and especially Tier 3 shippers may also be able to negotiate specific increased rail capacity projects, while expanding their rail loading and unloading facilities, that will serve their traffic and justify premium prices.

Elsewhere in a supply chain railways have negotiated Memorandums of Understanding (MOUs) with ports. MOUs have identified joint activities that include:

- Development of a strategy to enhance the supply chain;

- Develop and coordinate mutual ongoing relationship building with governments at all levels on the Canada Marine Act, the Canada Transportation Act, government policies on taxation and trade, the ports strategy, and local and regional land use issues;

- Multi-modal planning aimed at new or expanded port and rail infrastructure and facilities, and the obtaining of regulatory approvals;

- Consultation and coordination of operational changes by either party;

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- Creation of enhanced systems for communications including IT between the parties and their customers – and the development of metrics to support day-to-day transactions.

Commercial agreements are also made between railways and their transload or terminal partners in a supply chain. The precise details of such agreements are generally confidential, but the outlines of such agreements can be illustrated by the announcement by CN on March 10, 2015 of Maher Terminal's expansion plans for its container terminal at Prince Rupert:

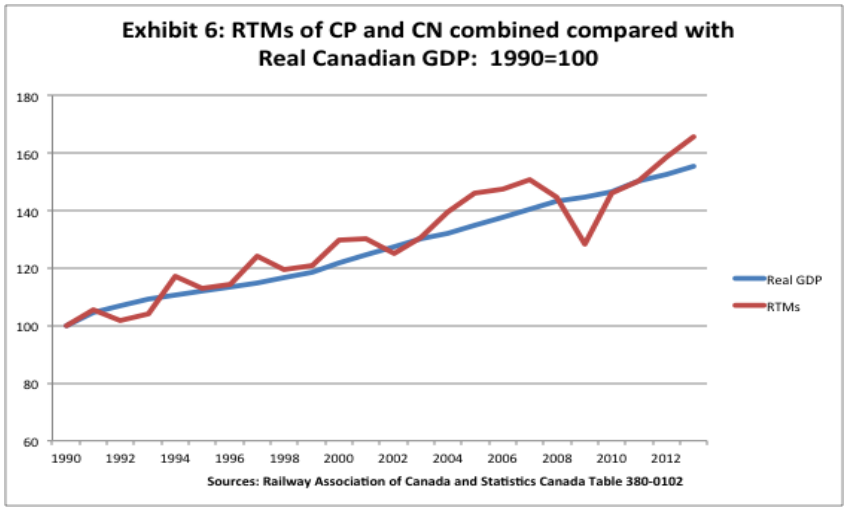
> *"The investment in future growth is testament to the strength of supply chain collaboration among CN, Maher and the Prince Rupert Port Authority. Maher Terminals Holding Corp. will expand the capacity of the Port of Prince Rupert's Fairview Container Terminal to more than 1.3 million twenty-foot equivalent units (TEUs) annually, from the current annual container-handling capacity of approximately 850,000 TEUs"*

Overall, supply chain collaboration continues to encourage increases in capacity for rail and its partners on a commercial basis in line with market demands.

3.4 Implications

A broad assessment can be reached on the impact of these capacity enhancements in general terms.

Exhibit 6 presents a comparison of the combined traffic of CP and CN, in terms of revenue-ton-miles (RTMs), with real Canadian GDP from 1990 to 2013.



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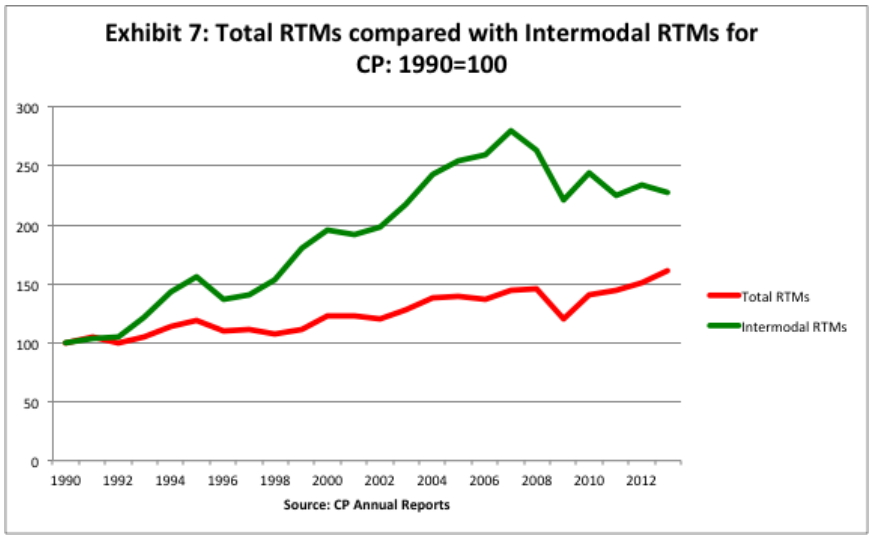
It is apparent that rail traffic growth has kept pace with the national economy for several decades – while real GDP grew by an annual average over the period of 1.9 percent, rail traffic grew by an annual average of 2.2 percent. Note the downturn in rail traffic during the financial crisis of 2008/09 and the subsequent strong recovery.

Exhibit 6 presents the RTMs of all rail traffic, but it is also of interest to examine the performance of rail intermodal traffic over the same period – see Exhibit 7. Rail intermodal traffic is more closely aligned with the trade sector, and it is apparent that rail intermodal traffic has grown at a faster pace than traffic overall, which reflects increased globalization over the period. It is clear that the financial crisis negatively affected rail intermodal traffic, and that it has not yet recovered, but the annual average growth rate between 1990 and 2007 was 6.2 percent, which is in line with the growth in international trade. This paper does not attempt to forecast or project the trajectory of the future Canadian economy, but it is clear that CP and CN have met the challenge to date in serving overall demand.



With future economic growth, there is no reason to suppose that CP and CN will not continue to provide the necessary rail capacity – as illustrated earlier in Exhibit 2 by their recent rising capital expenditures to meet future demand. To emphasize, CP and CN provide the necessary investment in a stable regulatory environment, without government financial support, as it is in their commercial interest.

IV HOW CAN THE GOVERNMENT SUPPORT CAPACITY?

4.1 Regulatory Support

There are two localized current regulatory matters that have a tendency to restrain rail capacity and need to be reviewed.

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First, in 2007 the *CTA* authorized the Agency to resolve complaints regarding noise and vibration caused by the construction and operation of railways under its jurisdiction. The Agency has issued guidelines designed to encourage collaboration among the parties to a railway noise or vibration issue and ensure transparency and consistency in the Agency's decision-making process for complaints. Agency decisions are legally binding on the parties involved, subject to rights of appeal.

These complaints frequently occur in urban areas where new residential or commercial development has been built in close proximity to rail infrastructure or facilities. In most instances the railway infrastructure or facility was built first, and new development was authorized in close proximity despite the obvious risk of noise and vibration. Measures to alleviate the nuisance such as sound barriers often encroach on the railway right-of-way, and this in turn restricts future rail capacity expansion in such locations. For example, future capacity expansion likely involves double-tracking segments of corridors that are presently single-track, and encroachment on railway property may make this impossible. Assuming that public policy is concerned with having the rail capacity to meet future demand, the practice of approving new development too close to rail needs review.

Second, road authorities, municipalities, landowners, or utility companies may wish to cross railway property. If the parties are unable to reach an agreement respecting a crossing, the party proposing a crossing may apply to the Agency. The Agency may authorize the construction of a suitable road or utility crossing or related work, and may rule on any disputed issue within its jurisdiction. It has become common for the Agency to approve such crossings, even though more frequent crossings have a negative impact on the flow of rail traffic thereby reducing capacity. Once again, assuming that public policy is concerned with the rail capacity to meet future demand, the practice of approving an increasing number of rail crossings needs review.

In addition there is a recent regulatory development that warrants concern. Regulated interswitching regulations give CP and CN indirect access to shippers at stations within a 30-kilometre radius of an interchange point on the network of the other railway. In 2014, as part of an issue related to winter rail service for western grain, regulated interswitching was extended for all commodities originating on the Prairies within a 160-kilometre radius of an interchange point. This extension had no bearing on the issue at hand, expressly favoured US railroads over CP and CN, and will undermine pricing freedom and differential pricing. Overall, this will significantly discourage railway investment, thereby constraining future rail capacity, and this legislated extension to interswitching should be allowed to lapse in 2016.

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4.2 Leadership and Financial Support – CP and CN

At a more strategic level, the federal government may be concerned with the prospect that future transportation capacity – including freight rail – in specific corridors may be inadequate to meet the anticipated demands of the national economy.

This was the situation in 2006 when the federal government announced the Asia-Pacific Gateway and Corridor Initiative. The purpose of this ongoing initiative is to strengthen Canada's competitive position in international commerce by more effectively linking Asia and North America. It was intended to:

- Boost Canada's commerce with the Asia-Pacific region;
- Increase the share of North America-bound container imports from Asia; and
- Improve the reliability of the Gateway and Corridor for Canadian and North American exports.

The Asia-Pacific Gateway and Corridor is a network of transportation infrastructure including British Columbia's Lower Mainland and Prince Rupert ports, and their principal road and rail connections stretching across Western Canada. One component is the Robert's Bank Rail Corridor with combined funding of more than $300 million from a range of partners including the federal, BC, and municipal governments, the Port of Metro Vancouver, and the railways- see Exhibit 8. The funding was used to build a number of road-rail grade separations, road detours, and rail and port capacity improvements. This was a highly successful partnership whereby railways funded rail improvements, governments funded road improvements and overpasses, and the port funded improved port-related facilities – all in a coordinated manner to improve the transportation systems as a whole.

EXHIBIT 8 ($ millions)	**Roberts Bank Rail Corridor**
Transport Canada	$75
BC MOT	$50
PMV	$50
Municipalities	$50
Translink	$50
Railways	$32
TOTAL	$307

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This Gateway infrastructure investment approach – which sees CP or CN finance their own rail networks, and governments and other stakeholders fund related infrastructure with public benefits – has been a model used elsewhere in Canada. As a strategic policy framework to strengthen transportation infrastructure it has been very effective. A similar approach recommends itself to meet future strategic needs if and when they arise.

4.3 Leadership and Financial Support – Short lines

In a recent report on the funding needs and opportunities for Canadian short lines[2], the executive summary identified the following:

- Canada's 53 short line railways provide critical links in the Canadian transportation system. One in five carloads originating on Canadian railways originates on a short line. Short lines provide supply chain connectivity, create employment, enable regional economic competitiveness, reduce negative externalities associated with road transport, including emissions, road wear and tear and congestion;

- Low traffic volumes, thin margins, competition from a subsidized trucking sector, and limited access to private financing challenges the ability of many short lines to make capital investments. Short line operating ratios are on average more than 20 percentage points higher than that of CP and CN;

- Short line operations, as with all rail operations, are capital intensive. Short line railways invest approximately 12% of their revenue – by comparison, CP and CN invest approximately 20% of their revenues. Many short lines have only been able to "hold the rail". Investments to increase rail capacity, operating speeds, and performance, are out of reach for many short lines;

- Costs associated with new regulatory requirements, including new grade crossing and safety management regulations, and increases to insurance coverage requirements, will place a significant additional cost burden on short lines and constrain their ability to make investments in their operations. The risk of non-investment is great and can have cascading negative impacts on the rail-based Canadian transportation system, hindering efficiency and competitiveness;

- For most Canadian short lines, government funding support programs are inadequate and difficult to access. For example, despite short line eligibility under some New Building Canada Plan funding envelopes, project funding has focused on municipal and provincial assets. To date, no money has been directed to short lines under the New Building Canada Plan;

[2] "Review of Canadian short line funding needs and opportunities", CPCS, February 26, 2015

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- By contrast, short lines in the US have access to government grants, low interest loan and tax credit programs at the federal level, and many states have programs for maintenance and capital needs dedicated or otherwise geared to short lines.

Based on a best practice assessment of short line and other rail funding, financing, and tax programs, and the specific capital needs and challenges of Canadian short lines, the report recommended that:

- The federal government build in a dedicated short line rail grant component into its existing capital funding program(s) to i) meet new federal regulations, ii) improve existing infrastructure (e.g. increase capacity and speeds), and iii) support network expansion, where this has demonstrable economic benefits;

- Canada establish a tax credit program for investment in short line infrastructure, mirroring the US federal Railroad Track Maintenance Tax Credit program, which includes provisions to assign tax credits to qualified short line shippers and contractors.

V CONCLUSIONS

Canadian freight railways need to continue to increase capacity to meet the increasing demands of the national economy. This paper has developed the concept of rail capacity – at the levels of the market, corridor and network – and detailed the factors that affect capacity – infrastructure, equipment, operational practices and, where applicable, their supply chain partner's capabilities.

Over many years the railways have taken the necessary steps to increase capacity:

- Investment in more advanced track and roadway, freight cars, and locomotives;

- Improved operational management of train crews, train consists, service design and systems reliability has led to longer, heavier, faster and more reliable train service;

- Supply chain collaboration has improved with co-production between railways, service agreements with shippers, MOUs with ports, and commercial agreements with transload and terminal operators.

Overall, the success of this approach has been demonstrated by the fact that total rail traffic growth has kept pace in real terms with the growth in the national economy for several decades. The growth in rail intermodal traffic has also kept pace with the faster growing trade sector that reflects increased globalization over the period. It is apparent

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that the Canadian freight railways should be able to meet future demand, given anticipated economic conditions and a continued stable regulatory framework, as it is in their best commercial interest.

The operations of railway networks are best managed based upon commercial principles where government's role is to provide a stable regulatory framework that encourages investment to support growth, and intervention should be a last resort when markets fail. Government intervention and support for capacity should therefore take several forms:

- Continued regulatory support, while avoiding constraints to increasing rail capacity: from noise and vibration complaints that encroach on rail property; from more frequent rail crossings that impose speed restrictions; and from extended interswitching that discourages investment;

- If the government is concerned with future transportation capacity at a strategic level, then the collaborative approach adopted in the recently successful Asia-Pacific Gateway Initiative recommends itself;

- Financial and tax programs to assist investment in the short line industry should also be considered.

Overall, rail capacity is a complicated issue and is a result of many factors associated with railway activities, but also includes the performance of entire supply chains.

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