PRB 05-75E


# TRENDS IN CONTAINERIZATION AND CAPACITY AT CANADIAN PORTS

**Allison Padova**
**Economics Division**

**30 January 2006**

**PARLIAMENTARY INFORMATION AND RESEARCH SERVICE**
**SERVICE D'INFORMATION ET DE RECHERCHE PARLEMENTAIRES**

# TABLE OF CONTENTS

CANADA
LIBRARY OF PARLIAMENT
BIBLIOTHÈQUE DU PARLEMENT

# TRENDS IN CONTAINERIZATION AND CAPACITY AT CANADIAN PORTS

## INTRODUCTION

Before containerization, cargo handling practices had not changed for over 100 years. Building pallets and loading them into the holds of ships was a slow and labour-intensive process, and the cargoes were vulnerable to damage and theft. Therefore, the invention of containerization is regarded by some as the most significant shipping innovation of the 20th century. Domestic container shipping emerged in the United States in the late 1950s and international flows commenced roughly a decade later.

Using a sealed steel "box" of standardized dimensions (measured in twenty-foot equivalent units or TEUs) to transport cargo has a number of advantages. Most importantly, total shipping time has been reduced because the containers may be transferred from ship to rail to truck, and back again, very quickly. As the box is secure and protects the cargo inside, theft and damage have been greatly reduced. Furthermore, the development of climate-controlled containers has made it possible to ship temperature-sensitive products over great distances by sea, rail and truck. The introduction of containers has lowered the cost of marine shipping to the extent that surface transport services are usually the more expensive components of a total import or export container movement, even though the surface transport is usually over a shorter distance. The lower costs of containerized trade have stimulated global trade, and the use of containers has been credited for double-digit growth in trade with emerging economies.

The shift to containerization was made possible through significant investments on the part of ports, railways and trucking companies. Moving containers required modifications to ships, rail cars and truck chassis so that the boxes could be locked down and, usually, stacked. In addition, investment was required in specialized equipment and infrastructure at marine terminals for transferring containers back and forth from ship to railcar and truck.

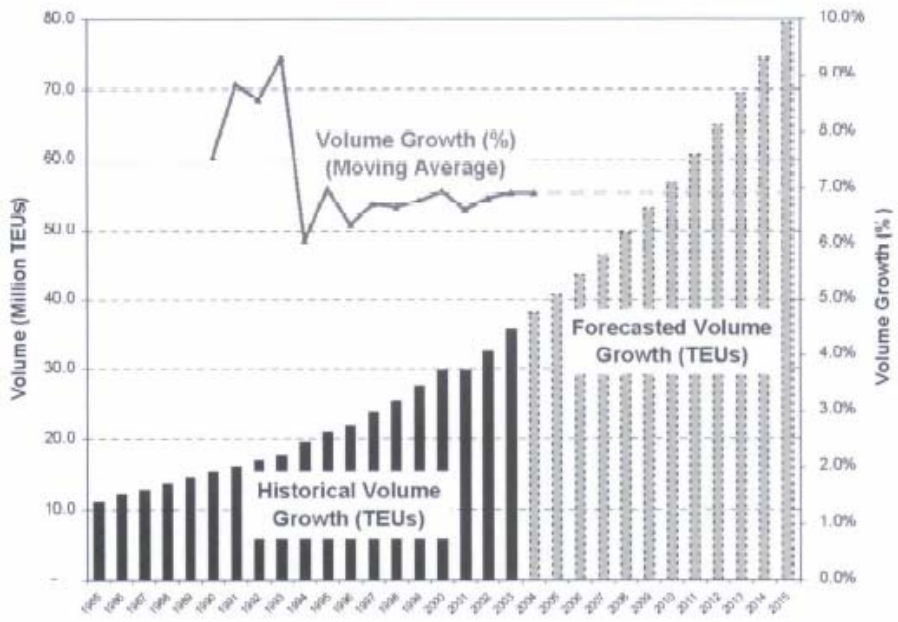
This paper provides a description of the historic and expected future growth in containerization. It then explains the capacity constraints that threaten to limit the growth in North America's container trade. Finally, it provides projections of growth in container traffic in Canada and some information about capacity at Canada's container ports.

## GROWTH IN CONTAINERIZATION

Containers can carry anything, but they are particularly well suited for transporting perishable and manufactured goods. Economic trends such as the globalization of the supply chain and trade liberalization have greatly stimulated the demand for containerized transport.

Growth in North American container volumes outstripped the pace of economic growth between 1990 and 2004. As shown in Figure 1, North American TEUs grew at about 7% per year over this period. That rate is expected to continue, leading to a doubling of North American container volumes in 10 years. Growth rates would vary from port to port, however, depending on their ability to accommodate increases in traffic.

**Figure 1: Container Volume History and Forecast: Continental United States and Canada**




Source: Michael Maloni and Eric C. Jackson, "North American Container Port Capacity: An Exploratory Analysis," *Transportation Journal*, Vol. 44, Issue 3, Summer 2005, p. 2.

World container growth appears to have been even more impressive than in North America alone. One major independent shipping consultancy estimates that growth in container volumes has exceeded 10% annually over the last 15 years. It predicts that container demand worldwide will nearly double by 2015, as shown in Table 1.

**Table 1: Forecast of Container Port Demand by Region to 2015 (Million TEUs)**

| Region | 2004 | 2010 | 2015 |
|---|---|---|---|
| **Asia** | 159.1 | 240.5 | 303.4 |
| **Americas** | 62.2 | 90.7 | 118.8 |
| ***North America*** | *41.1* | *56.9* | *71.6* |
| **Europe/Mediterranean** | 74.1 | 105.8 | 139.5 |
| **Others** | 36.8 | 58.2 | 85.6 |
| ***Total*** | *332.2* | *495.1* | *647.3* |

* Totals may not add due to rounding.

Source: Ocean Shipping Consultants Limited, Press Release, January 2005.

As can be seen in Table 1, Asia is by far the largest market for containers in the world and is expected to continue to grow rapidly. Through 2015, exceptional growth in container demand is expected in the sub-regions of Southeast Asia, Central and South America, South Europe and the Mediterranean as well as the Middle East and the Indian subcontinent. The source of the figures in Table 1 is less bullish about the North American market than the forecast in Figure 1, predicting approximately 75% growth in container demand through 2015.

As container demand has grown, the size of container vessels has also increased impressively. The world's largest container ship in the early 1980s carried some 3,400 TEUs, compared to the largest container ships in recent years which can carry about 9,200. The rapid evolution of container ships is due to the significant efficiency gains and cost savings associated with operating larger ships. Today, the vessels calling at ports commonly carry between 6,000 and 8,000 TEUs, but the evolution continues as 9,600-TEU vessels are currently under construction. Some predict that the next jump in ship size will be to 12,000 TEUs but that it will require advances in propulsion technology to be economically viable. Ultimately, the depth of the Malacca Strait between Indonesia and Malaysia is expected to be the constraint on future ship capacity, limiting it to around 18,000 TEUs.

## CONSTRAINTS ON CONTAINERIZATION GROWTH

It is estimated that over 40% of major North American container ports already experience congestion during peak periods of the year.(1) The deployment of ever-larger ships is expected to cause an even greater strain on facilities during peak periods. Perhaps for this reason, more than half (65%) of major North American container port operators expect congestion to worsen in the next five years.

Shortages in capacity at marine terminals and in surface distribution networks are viewed as the main constraints to current and future growth in containerized trade. To maximize container-handling capacity, marine terminals need deep channels to provide larger ships with access, and efficient and sufficient equipment (e.g., gantry cranes and forklifts) on the dock to load and unload them rapidly. It is also an advantage if terminals have abundant space to stack and store the containers, can offer electrical outlets to plug in refrigerated ("reefer") containers and are equipped with a computerized system for tracking container locations and movements. Furthermore, port managers need to have the flexibility to adopt efficiency-enhancing processes. Unfortunately, the reality at many ports is that financing channel deepening and container-handling and -tracking equipment is a challenge, they have limited space to expand, and the labour unions representing port workers typically oppose changes that increase efficiency because they can threaten jobs.

There are also capacity issues with inland transportation by rail and truck. Ideally, rail companies would have abundant track linking dockside operations into an extensive, preferably transcontinental, network and have sufficient equipment to transport all of the boxes without delay. Similarly, trucking companies should possess sufficient power units (cabs) to transport boxes and sophisticated scheduling processes that can efficiently match their own equipment with that of the ocean carriers or leasing companies (boxes and chassis). Given the periodic congestion existing today at North American ports, it would seem that capacities both at container terminals and in surface transportation networks have not expanded fast enough and/or are not consistently coordinated.

Government and port community stakeholders may present additional obstacles to capacity enhancement. For example, the government may not make a priority of building or

(1) Michael Maloni, and Eric C. Jackson, "North American Container Port Capacity: An Exploratory Analysis," *Transportation Journal*, Vol. 44, Issue 3, Summer 2005.

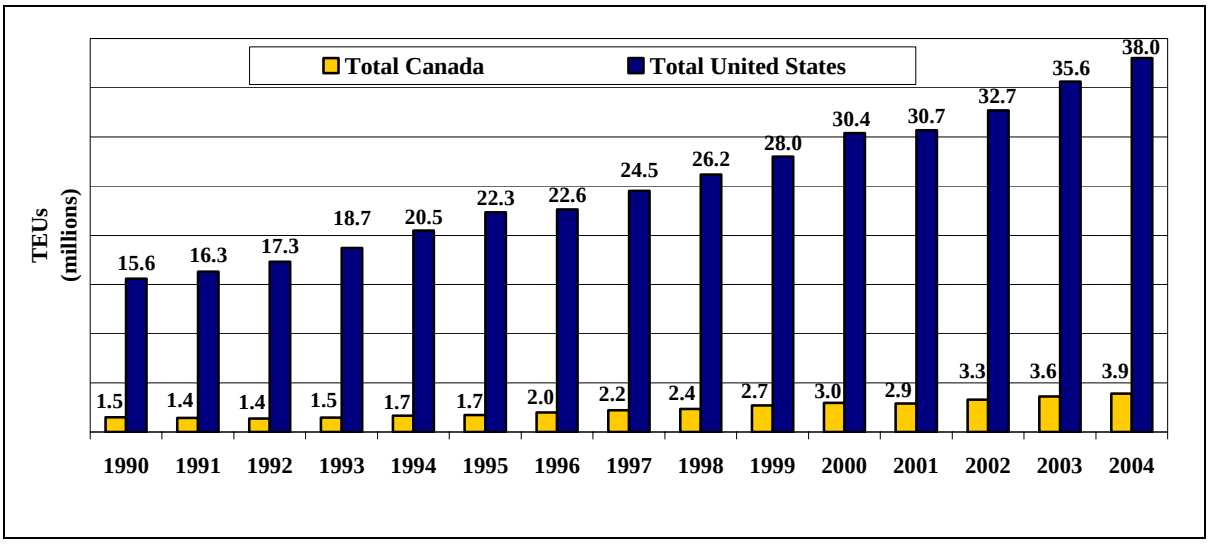
improving road infrastructure so that it can accommodate high levels of container traffic by truck. Also, the risk that the government will make regulation increasingly stringent in the areas of security, environmental protection and safety creates disincentives for new trucking firms to enter the industry and for incumbents to invest further. For their part, communities located close to ports often oppose port expansion projects for environmental and other reasons.

Interestingly, a recent survey that asked the top North American ports to rank 25 capacity factors (e.g., conditions at the terminal, labour issues and surface transport services) revealed that port managers' greatest concern is with the capacity constraints imposed by local roads. Second and third most important capacity factors, according to the ports surveyed, were capacity constraints in rail and truck services. None of these three areas is under the ports' control; they depend on decisions by government and private industry.

## THE CANADIAN CONTEXT – PORT INFRASTRUCTURE

The growth rate in container throughput at Canadian ports from 1990 to 2004 has been slightly above that at U.S. ports, which was just under 7%. In terms of volume, the total container flow through Canadian ports was roughly one-tenth that of U.S. ports, in line with the ratio of the two countries' populations (see Figure 2).

**Figure 2: Canada and U.S. Container Traffic, 1990-2004 (Million TEUs)**




Source: Association of American Port Authorities.

Nearly 4 million TEUs were handled at six mainland ports in Canada in 2004. Site characteristics and known expansion plans at each of these ports are provided below, as well as some information on the new container port to be constructed in Prince Rupert, British Columbia.

### A. Port of Vancouver

The Port of Vancouver has three container terminals and handled 1.7 million TEUs in 2004. These terminals can accommodate the largest container ships in existence today, which carry approximately 9,200 TEUs. The port is linked to the rail networks of the Canadian National, Canadian Pacific and Burlington Northern Santa Fe railways.

Recent upgrades have raised the container capacity at the Port of Vancouver to 1.86 million TEUs per year. Another expansion project, due for completion at the beginning of 2006, is expected to increase capacity by another 423,000 TEUs per year. The Port Authority is currently planning a fourth container terminal to be completed in stages between 2009 and 2012; the environmental review for this terminal is currently under way. The fourth terminal and other capacity expansion projects are expected to raise the port's container capacity by another 2.3 million TEUs, to a total of 4.6 million TEUs when completed. As the Vancouver Port Authority reportedly plans to invest $1.4 billion through 2020, other capacity-enhancing investments will likely take place beyond 2012.

The Port of Vancouver is geographically constrained, and some capacity growth in the future will depend on efficiency enhancements. One initiative to boost the productivity of existing infrastructure was to extend truck gate hours as of January 2006. The program is intended to increase truck gate operations at all three terminals by an average of 20% per year over the next five years.

### B. Port of Montreal

The four container terminals at the Port of Montreal handled 1.2 million TEUs in 2004. The largest vessel that currently can use the Port of Montreal is roughly 4,000 TEUs. There is access to the networks of both the Canadian National and Canadian Pacific railways from the port.

Data on the current capacity at the Port of Montreal were unavailable, but the port is thought to be capable of handling some 2 to 2.5 million TEUs per year. Some capacity growth

is expected over the next five years as the Port Authority plans to devote most of its $152-million capital expenditure budget to container facilities. Like the Port of Vancouver, the Port of Montreal faces geographic constraints and is reportedly planning productivity improvements at existing terminals and possibly establishing an inland terminal rather than building another marine terminal. The Port Authority did not make figures available, but it is possible that total annual container throughput could grow by as much as 50% from these initiatives.

### C. Port of Halifax

The Port of Halifax has two deep-water container terminals that handled 500,000 TEUs in 2004. Like the Port of Vancouver, it is one of the few ports in North America that is capable of handling fully loaded vessels carrying between 6,000 and 8,000 TEUs; typically, however, vessels calling at Halifax carry 5,000 TEUs. Canadian National Railways is the only rail carrier providing service to this port.

Currently, the capacity of the port's container terminals is roughly 1 million TEUs per year. Plans to build a third terminal were deferred recently as management chose instead to increase storage capacity in the existing area, and to lengthen and deepen the vessel berths. Increased dredging is expected to allow vessels carrying up to 10,000 TEUs to access the port, but data on their anticipated impact on annual throughput are unavailable.

### D. Fraser River Port

Fraser River Port, located near the mouth of the Fraser River south of Vancouver, handled 300,000 TEUs at its single container terminal in 2004. The container terminal, Fraser Surrey Docks, can receive deep-sea vessels up to Panamax size (4,500 TEUs). Rail services are provided at the terminal by Burlington Northern Santa Fe Railway, Canadian National Railways, Canadian Pacific Railway and Southern Railway of British Columbia.

As a result of terminal expansion, the annual capacity at Fraser Surrey Docks was expected to be 415,000 TEUs per year by mid-2005, up from 250,000 TEUs. The $190-million expansion initiative included new cranes, more yard area for storage and more holding yard for rail cars. A second phase is already planned to bring capacity up to 600,000 TEUs per year if growth in container volumes is sustained.

### E. Port of Saint John

The Port of Saint John's Rodney Container Terminal handled 50,000 TEUs in 2004; it has an estimated annual capacity of 100,000 TEUs. The Port Authority reportedly has no plans to expand the terminal at this time. The largest ship that can access the terminal can carry up to 3,000 TEUs. Two railways serve the port: Canadian National and New Brunswick Southern.

### F. Port of Toronto

The Port of Toronto's container terminal handled 40,000 TEUs in 2004; its estimated capacity is 175,000 TEUs per year. There are no plans to expand the facility at this time. The size of the locks on the St. Lawrence Seaway limits the size of the container vessels serving Toronto to a carrying capacity of between 600 and 1,000 TEUs. There is rail service by both Canadian National and Canadian Pacific railways to the container yard.

### G. Port of Prince Rupert

Construction on a major container terminal at the Port of Prince Rupert is about to commence. The first phase is expected to create capacity for 500,000 TEUs per year by the third quarter of 2007. The provincial government, federal government (through Western Economic Diversification), Canadian National Railways and other private interests are contributing to the $160-million cost. A second phase, budgeted at $300 million, may get under way between 2009 and 2012, adding 1.5 million TEUs of annual capacity at the terminal. Due to the natural deep-water harbour in Prince Rupert, the terminal is expected to be able to handle 12,000-TEU container vessels when they are introduced. Only Canadian National Railways has track serving this port, and it reportedly plans to spend a total of some $200 million on infrastructure, rolling stock and other equipment for the terminal.

## THE CANADIAN CONTEXT – RECENT POLICY DIRECTIONS

The federal government recently pledged new support for the efficient functioning of trade-related "gateways," i.e., key geographic locations that link to each other and to major markets by transportation corridors. The concept of the Pacific Gateway Strategy, which would

directly benefit container movements, was introduced by the previous government in October 2005 and endorsed by the new government. The Pacific Gateway Strategy, *as introduced in 2005*, provided for:

- the establishment of a Pacific Gateway Council, funded by $35 million for the first five years, to solicit the views of stakeholders, collaborate with existing networks (e.g., the Greater Vancouver Gateway Council) and advise decision-makers on priorities;

- immediate capacity investments in infrastructure (up to $125 million) on a cost-sharing basis with provinces and other eligible recipients;
- an immediate allocation (up to $20 million) to the Canada Border Services Agency to support increased traffic and trade volumes;

- an immediate investment (up to $10 million) in harmonizing standards with the Asia Pacific region; and

- future funding of $400 million to other strategic projects, including those identified by the Pacific Gateway Council and those that could help Canadian businesses take advantage of the opportunities they provide.

At the time of the strategy's introduction, Transport Canada was working on a national policy framework on gateways which could lead to an extension of the strategy to other key trade corridors in the future.

## CONCLUSION

Given the existing excess capacity among Canada's container ports and the planned capacity enhancements, these ports appear to be well positioned to accommodate a doubling of Canadian container volumes (to roughly 8 million TEUs) by 2015. That said, growth in Canadian container volumes could be much higher if there is substantial diversion from U.S. ports and/or the supply of containers from Asia and the rest of the world surpasses expectations. Furthermore, container growth may not be evenly distributed among the ports: it may be considerably higher at deep-water ports (Prince Rupert, Vancouver and Halifax) than at others (Fraser River Port, Montreal, Saint John and Toronto) due to the expected increases in vessel sizes. Another concern is that the planned capacity increases may be delayed due to the regulatory process, as is currently the case with Vancouver's fourth terminal, which now requires

additional environmental impact studies. There is also the question of whether capacity in surface transportation services will be coordinated with that of the ports.

The consequences of severe port congestion in North America could be grave. Facing delays and the possible need to re-route shipments, container carriers would likely charge higher rates to shippers to offset their risk. Receivers might start carrying larger inventories to mitigate the uncertainty of marine transport schedules, which would add to their costs. The combined effects of higher transaction costs for shippers and receivers would result in higher prices for consumers, dampening import and export volumes and possibly economic growth.

Given the number of industry and non-industry stakeholders in the container industry, it would seem that concerns such as these might be best addressed collaboratively. Governments, ports, inland intermodal terminal operators, railways, trucking companies, port communities, shipping lines and other stakeholders all have something to contribute to the process. The recently announced federal Pacific Gateway Strategy, which contemplates funding for immediate investments in infrastructure and the establishment of a council to seek views from stakeholders and make recommendations on priorities to the government, could be a step in the right direction.