Challenges in Developing Viable Inland Container Terminals

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1. Introduction

The ever-increasing volume of import cargo in marine containers has resulted in growing pressure on North American terminal capacity. Existing major ports are facing significant challenges in expanding on- dock capacity due to constraints on land availability in the vicinity of existing terminal and harbor facilities, environmental issues, and local community concerns over traffic congestion and quality of life impacts. These factors have generated growing interest in the concept of inland container terminals as a means of boosting capacity, through potential reductions in container dwell time at on-dock terminals and the transfer of non-essential terminal activity to inland locations.

This paper highlights the results of a study[1] undertaken for the British Columbia Ministry of Transportation to evaluate the viability of an Inland Container Terminal as a means of increasing the effective capacity of on-dock container terminals in British Columbia. While the Inland Container Terminal study focused specifically on the unique characteristics of the B.C. container logistics system, it identified challenges to the viability of Inland Container terminals which appear common to inland container terminals generally. This paper focuses on the viability of an Inland Container Terminal in the Lower Mainland, and identifies the generic challenges through a comparison of these results with those reported to date by the Tioga Group in their study on the potential for inland container terminals in Southern California.[2]

2. The British Columbia Inland Container Terminal Study

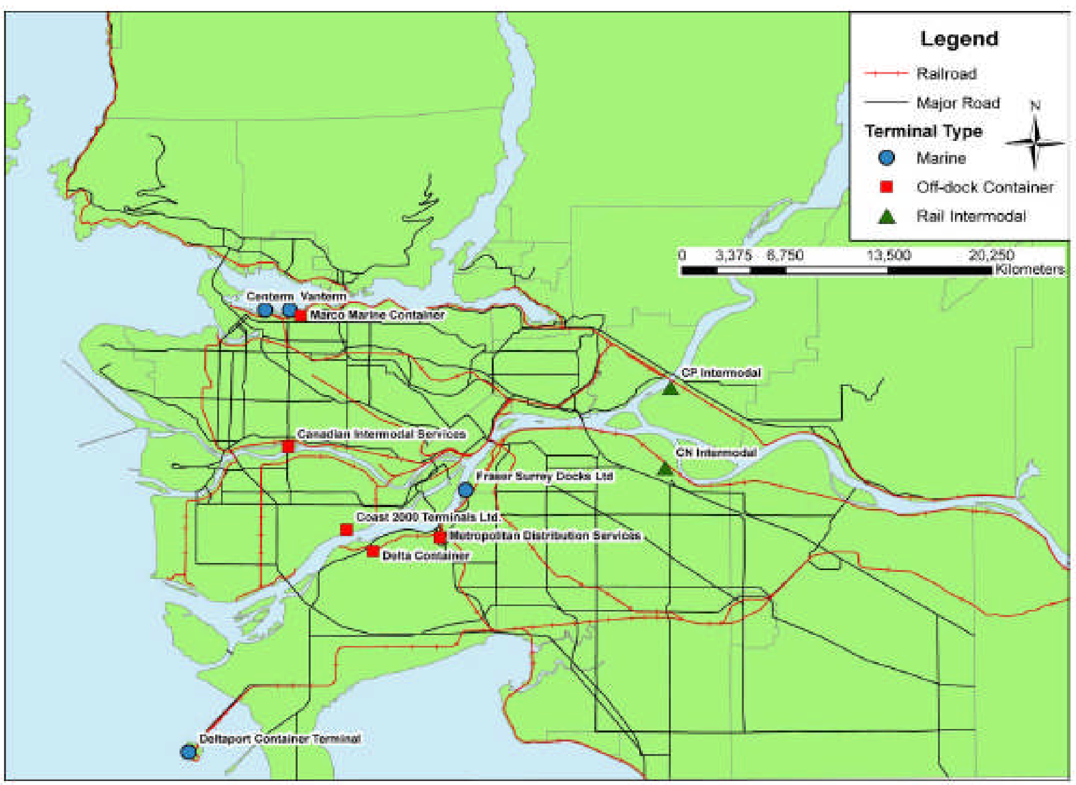
IBI Group in association with Hatch Mott MacDonald was engaged by the British Columbia Ministry of Transportation to undertake an analysis of opportunities to increase effectiveness and efficiency in handling trade goods into and out of British Columbia through the development of Inland Container Terminals. The project included a baseline analysis of inland container terminals, review of best practices and key success factors for inland container terminals, identification of current container flows, and a financial analysis including identification of major cost factors in the establishment and operation of an inland container terminal. The results of this research were used to assess the viability of inland container terminals on both Southern and Northern corridors connecting the Lower Mainland and Prince Rupert BC ports respectively to inland markets. This paper focuses on the findings related to the viability of a facility in the Lower Mainland region on the Southern Corridor.

This research required detailed analysis of the specific factors affecting Lower Mainland container logistics, including terminal capacity constraints, traffic characteristics, and the efficiency of inland transport operations. The results are highlighted below.

(1) Terminal capacity constraints

There are four container terminals in operation in the Lower Mainland. They include two terminals in the Inner Harbor (Vanterm and Centerm), Deltaport on Roberts Bank, and Fraser Surrey Docks located on the Fraser River. The figure below illustrates the locations of the on-dock container terminals, (domestic) rail intermodal terminals, and off-dock storage facilities.

Figure 1: Container Terminals in the Lower Mainland



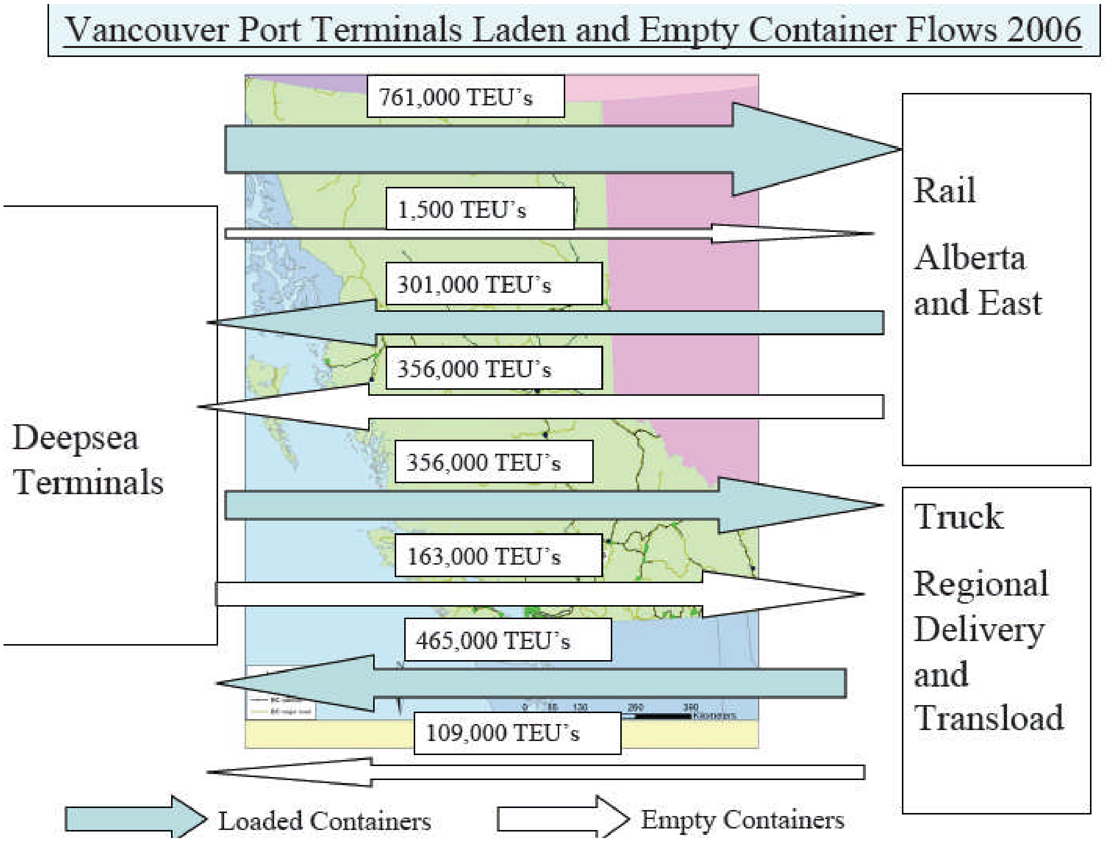
Lower Mainland terminals have experienced periodic capacity challenges beginning with rail service problems in early 2004. In early 2005 Terminal Systems Inc. (TSI), the operator of Vanterm and Deltaport, declared force majeure due to inadequate rail service and ocean carriers were required to cut import volumes. Port operations were disrupted by a trucking strike in the summer of 2005, as drivers withdrew service over issues including low rates, rising fuel costs, and delays and inefficiencies due to terminal congestion and operating policies. In 2006, the TSI terminals again experienced severe congestion. This was due in part to the transfer of former CP Ships container traffic from the Fraser Surrey Docks terminal, which boosted volume at Vanterm and Deltaport above rated capacity at both terminals. Ocean carriers imposed congestion surcharges on shipments through Vancouver terminals in March 2007, though they were removed in April. The major challenges have been related to the ability of the port terminals to load and unload sufficient railcars to maintain the fluidity of terminal operations, either due to inadequate railcar supply or insufficient intermodal yard capacity at the terminals.

(2) Traffic characteristics

The Lower Mainland is one of two major West Coast port clusters with substantial containerized export cargo flows (the other is Oakland). Historically export cargo exceeded imports, but rapid growth in imports has altered the balance and since 2002 the situation is reversed. In 2006, loaded inbound container flows at the Port of Vancouver terminals totalled around 1.1 million TEU's, with loaded outbound traffic of almost 800,000 TEU's.

Details of the loaded and empty container flows are shown in Figure 2.

Figure 2: Loaded and Empty Container Flows at Port of Vancouver Terminals 2006

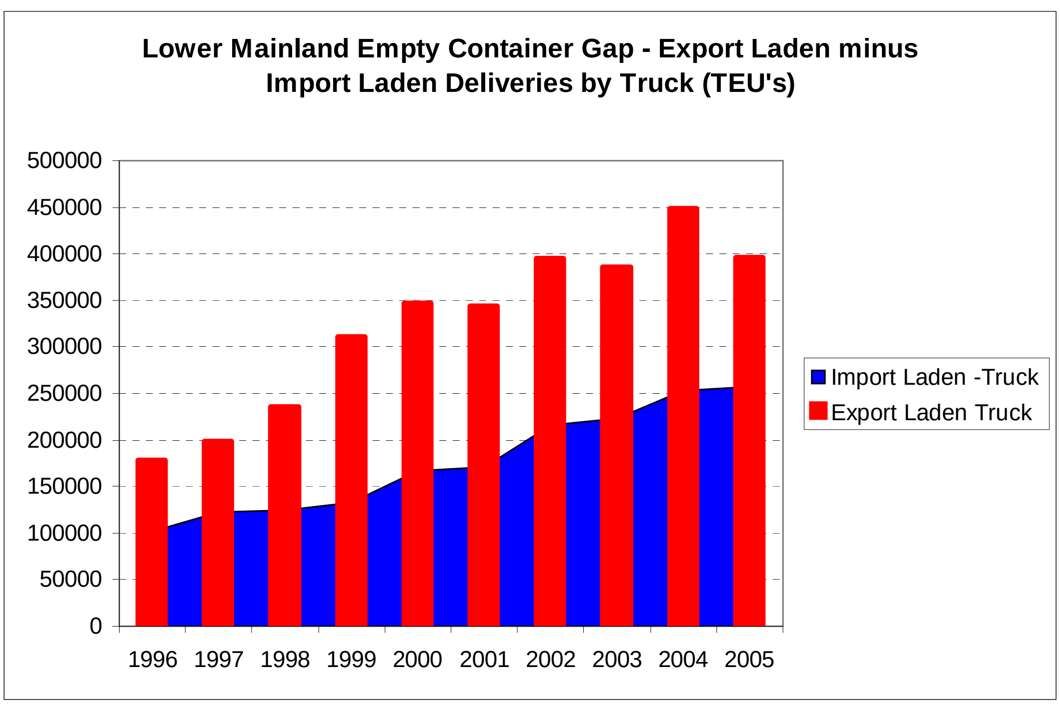


Import cargo is primarily destined for Toronto or Montreal and containers are loaded directly to rail at the on-dock terminals. In 2006, this accounted for 68% of loaded inbound traffic. More than half of these containers are returned empty to the terminals by rail. The remainder of the loaded import containers is picked up by truck from the on-dock terminals and either delivered for local consumption or transloaded for forwarding by domestic intermodal service or by truck.

Loaded export containers are either delivered directly to the on-dock terminals from Eastern Canada by rail, or from local transload operations via truck. Virtually all transloading of export commodities from Western Canada into containers takes place in the Lower Mainland. Major containerized export commodities include forest products (primarily pulp and lumber) and specialty grains. Since the number of empty containers required for transloading in the Lower Mainland exceeds the local supply - i.e. the pool of containers delivered locally by truck - a significant number of empty containers are unloaded at the on-dock terminals and then trucked to local transload warehouses. These containers could be unloaded from railcars at an inland location rather than at the docks and then trucked directly to the transload warehouses, thus reducing the volume of empty containers unloaded from rail and truck gate traffic at the on-dock terminals and freeing up additional capacity. While other models were assessed – including models based primarily on import or export transload activity – this “empty container” terminal was identified as the most promising option in the short term for boosting capacity at the on-dock container terminals.

The Lower Mainland "container gap" - the difference between import containers delivered locally, and the empty containers required for reloading for export - was around 140,000 TEU's in 2005. However, import growth is expected to continue to outpace export growth, and under the assumption that the share of import containers delivered locally will remain constant, the "container gap" is likely to decline. In 2006, it declined to around 110,000 TEU’s as imports surged and exports maintained steady growth. This suggests that the demand for this application of an Inland Container terminal may be relatively shortlived.

Figure 3: Lower Mainland “Container Gap”



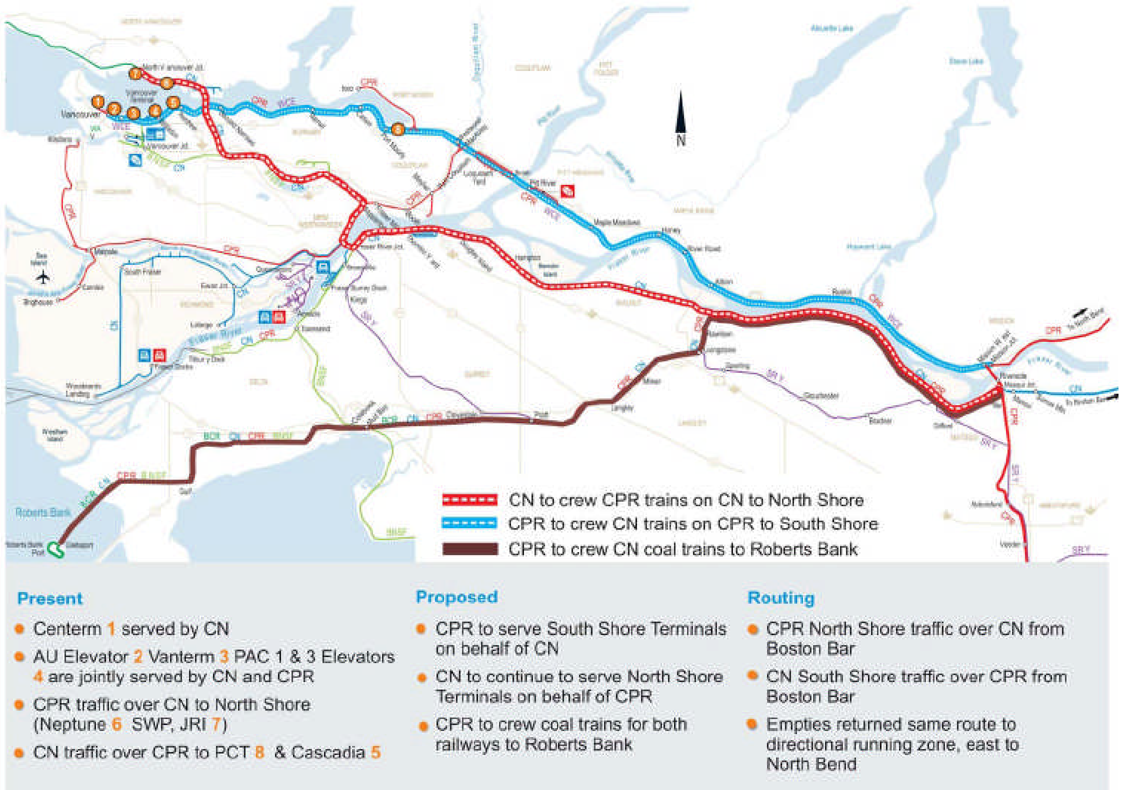
(3) Efficiency of Inland Transport

The Lower Mainland container terminals are served by two Class 1 railways, CN and CPR. Traffic patterns have changed dramatically since 2000 as a result of co-production agreements between the railways.

In 2000 CN and CPR signed an agreement for directional running on their lines accessing the Lower Mainland through the Fraser Canyon. Under this agreement, all CN and CPR westbound traffic travels on the CN mainline, and all eastbound traffic travels on the CPR mainline. Consequently both CN and CPR intermodal trains enter the Lower Mainland on the CN Main Line. Traffic diverges between Roberts Bank and the Inner Harbour at the Mission Bridge.

CN and CPR implemented a new Routing and Switching Agreement in March 2006. Under the new agreement, CPR handles all CN traffic to the South Shore container terminals (Vanterm and Centerm) as well as their own. All of these trains are routed to the CPR yard in Coquitlam which is used as a staging area for trains to the Inner Harbour. CPR then assembles mixed trains (grain, containers, etc.) for shuttling to the Inner Harbor terminals. CPR’s intermodal trains destined for Deltaport are routed eastward from Coquitlam Yard to the Mission Bridge and then proceed on the rail connection to Roberts Bank. CN operate their own intermodal trains direct to Deltaport on the same route.

Figure 4: Train Routing under CN-CPR Co-Production Agreement



The railways are reluctant to "stop the trains" at inland points because it reduces the efficiency of their overall operations in two areas: fluidity and equipment balance. Fluidity refers to the maintenance of the velocity of rail equipment, or the minimization of terminal dwell times. The ideal is operation of intermodal unit trains between the on-dock terminals and major destination/origin points in the U.S. or Eastern Canada. Equipment balance refers to the avoidance of movement of empty equipment. The ideal is running of fully loaded containers both eastbound and westbound between the on-dock terminals and major destination/origin points in the U.S. and Eastern Canada. In practice this is unattainable on the basis of TransPacific container trade alone due to the imbalance between imports and exports in the U.S. and Eastern Canada. Domestic intermodal traffic is handled separately at CP's Vancouver Intermodal Facility in Pitt Meadows and CN's Vancouver Intermodal Terminal in Surrey. Intermodal train lengths average around 11,000 feet for CN and 7,000 feet for CPR.

These factors - intermodal train lengths and the potential demand or "container gap" - were adopted as the key parameters for determining the scale and location for an Inland Container Terminal in the Lower Mainland. In order to maintain the efficiency of rail operations, the terminal has to be capable of handling the maximum train size - 12,000 feet, in the case of CN's intermodal operations. A terminal of this size would occupy approximately 50 acres and have a capacity of around 150,000 TEU's. In order to fully utilize this capacity, it would have to handle empty containers destined for both Deltaport and the Inner Harbour terminals. This dictates a location at or east of the Mission Bridge, where traffic diverges. For these reasons, a 50 acre intermodal terminal located in the vicinity of the Mission Bridge at Matsqui, 40 to 45 miles inland from the container terminals, was chosen as the basis for estimating potential costs for an Inland Container Terminal.

(4) Comparative Costs: Inland Container Terminal vs Conventional Drayage

A number of assumptions were required to generate cost estimates for a Lower Mainland Inland Container Terminal. These include:

- Land costs based on a 50 acre site purchased at current industrial land prices for Abbotsford (CDN$300,000 per acre).
- Capital costs of CDN$38 million including sub-base, base and paving; site preparation and grading; rail infrastructure; top-loader equipment; and access, facilities and services.
- Terminal operating costs of CDN$5.4 million per year including top-lifter operations; train switching costs; track and facility costs; and terminal support staff.
- It is assumed that rail cars would be shuttled from the Inland Container Terminal to the port terminals by a shortline rail operator under a commercial track access agreement with the owners of the existing tracks. This would require payment of an access charge for use of the infrastructure.
- Rail operating costs for shuttling railcars to the port are based on a running time to the Inland Container Terminal of two hours.

Figure 5: Comparative Costs Inland Container Terminal vs Conventional Drayage CDN$

	Cost at $1 Access	Cost at $3 Access
Capital Cost (excl. site preparations and land)	$38,000,000	$38,000,000
Amortization period (years)	20	20
Discount rate	15%	15%
Annual Capital Cost	$6,070,936	$6,070,936
Land (acres)	50	50
Cost per acre	$300,000	$300,000
Total Land Cost	$15,000,000	$15,000,000
Annual Land Carrying Cost	$2,396,422	$2,396,422
Annual Terminal Operating Cost	$5,400,000	$5,400,000
Annual Rail Operating Cost	$4,400,000	$7,727,500.00
Total Annual Cost – Rail and Terminal	$18,267,358	$21,594,858
Annual Traffic (TEU's)	140,000	140,000
Rail and Terminal Cost per TEU	$130.48	$154.25
Total Terminal and Rail Cost per 40 ft Container	$261	$308
Trucking Cost Round Trip (FSD area)	$457	$457
Total cost	$718	$765
Current Cost – Deltaport to FSD		
Trucking (Deltaport to FSD)	$343	$343
Deltaport Gate Charges (Truck in and out)	$116	$116
Handling charges*	$99	$99
Total Cost	$558	$558
Cost differential: Inland Container Terminal vs. current	$160	$208

* Based on yard rehandling charge $49.50 per move

Trucking costs were estimated based on current rates under a Memorandum of Understanding negotiated between trucking companies and owner/operators in the summer of 2005. The MOA rates are not comprehensive i.e. rates between non-terminal locations are not definitively specified. For purposes of analysis, the example of a lumber reload facility in the Fraser Surrey Docks area was used, and it was assumed that the round trip rate of CDN$457 from FSD to Abbotsford (location of the Inland Container Terminal) would apply. The majority of export transload warehouses are located close to Fraser Surrey Docks in the areas along the Fraser River west of the Patullo Bridge.

Based on this analysis, conventional drayage is considerably less expensive, primarily due to the increased trucking distance to access the Inland Container Terminal from existing transload facilities, which are located closer to the port terminals.

This analysis highlights the significance of track access charges. Based on an access charge of CDN$1 per car-mile, the total cost per TEU is estimated at CDN$130.48. Based on an access charge of CDN$3 per car-mile, the cost would rise to CDN$154.25 per TEU.

(5) Rail System Impacts of the Lower Mainland Inland Container Terminal

The cost analysis in Figure 5 is focused on the direct costs for the terminal and rail shuttle operation between the benchmark Inland Container Terminal and the port terminals. However, rail operations are optimized on a system basis and the introduction of an Inland Container Terminal may result in increases in system-level costs which are not captured in the direct cost analysis.

CPR provided detailed comments on the potential impact of an Inland Container Terminal on their existing operations. Presently, CPR service design has intermodal trains (including CN trains destined for the Inner Harbor) arriving at their Coquitlam and Vancouver Intermodal Facility (Pitt Meadows) rail yards, and being switched before cars and containers are delivered to on-dock terminals. The transfers between Coquitlam and Inner Harbour can be as long as 8-10,000 feet in length, and carry grain cars, tank containers, woodpulp and other commodities, in addition to marine containers.

The service parameters and composition of CPR intermodal trains arriving in the Lower Mainland reflect the service demands of shipping lines. Shipping lines require quick transit time and the latest possible cut off at inland origins (the deadline given to customers delivering loaded containers to rail container terminals for loading on intermodal trains). Quick, on-time delivery of loaded export containers is the highest shipping line priority. The second priority is a steady flow of empty containers to the on-dock terminals for loading onto ships. The supply of empty containers available for loading in the Lower Mainland is the shipping lines' third priority.

At origin points, intermodal trains are assembled in accordance with the priorities identified above. Upon arrival at Lower Mainland yards, railcars are shuttled to on-dock terminals in accordance with shipping line instructions. The loaded containers are scheduled for specific vessel sailings at the time of loading at origin terminals. In contrast, the empty container requirements of shipping lines at the on-dock terminals are determined on a daily basis with minimal advance notice – the priority of empty container types by shipping line, terminal and date is currently unspecified at the time intermodal trains are loaded.

For CPR to serve the facility as assumed in the study – i.e. mainline trains intercepted before they reach destination rail yards – would require additional work and cost at originating terminals. Containers destined for the Inland Container Terminal would have to be assembled in a block to facilitate switching. Extra cost and time would be incurred setting off the train. At the assumed location, this set-off could create additional congestion on mainline track in the Mission area.

Efficient use of the Inland Container Terminal in the handling of empty containers would require shipping lines to identify the particular empty containers to be delivered to the Inland Container Terminal so that they can be loaded as a block at origins. The success of the modeled facility would be dependent on the shipping lines' ability to identify empty equipment requirements in the Lower Mainland well in advance.

4. Conclusions

While this study dealt specifically with the unique circumstances of container operations in the Lower Mainland, it highlighted several key challenges in developing an Inland Container Terminal as a viable option to on-dock terminal expansion.

(1) Incompatibility with Class 1 Railway Business Models

The BC Intermodal Container Terminal Study highlighted the challenges in developing a facility which would maintain the efficiency of Class 1 railways' intermodal operations. The Class 1 railways are focused on long haul high volume train movements, and do not have a strong financial incentive to offer short haul shuttle services to port terminals.

This is consistent with the findings reported by The Tioga Group in their Inland Port Feasibility Study Operational Strategy and Site Selection Update, which notes that the original concept of a rail shuttle operated by the Class 1 railways – UP and BNSF – has been superceded by a proposal for a shuttle service operated on the "commuter service' model by the Pacific Harbor Line which currently provides switching services at the Ports. Under this model, UP or BNSF would provide "operating windows' to accommodate shuttle operations on their tracks.

(2) Costs for Additional Rail Infrastructure

In the BC study, the value of scarce rail capacity is reflected in the railways' views on access charges for use of their track by a shortline rail operator. They indicated that access charges in the neighborhood of CDN$3 per car-mile or higher would be appropriate, given the existing demand for both freight and passenger operations, and the expectation that traffic growth will require additional investment in the future. This reflects CN and CPR's preference for financing their own infrastructure investments through commercially negotiated rates and charges, rather than through public/private partnerships.

The Tioga Group notes that public investment would be necessary to accommodate additional short-haul freight traffic. This would include improvements in the port-area rail network to facilitate train assembly, and selected public-private capital investments to maintain network capacity.

(3) Increased Inland Transportation Costs

The BC study estimated that using the Inland Container Terminal would increase costs by CDN$160 to CDN$208 per forty foot container, depending on the level of track access charges, over conventional drayage for a typical export transload facility.

The Tioga Group indicate that use of an Inland Container terminal in Southern California would require a permanent operating subsidy of US$100 or more per container.

(4) Locational Requirements for an Inland Container Terminal

The major factor accounting for the cost differential between an Inland Container Terminal and conventional drayage was the increased distance from existing export transload facilities. This was dictated by the scale requirements to maintain railway efficiency, and the unique traffic patterns in the Lower Mainland due to the division of traffic between the Inner Harbor terminals and Deltaport.

The Tioga Group identifies proximity to existing container handling facilities – specifically import distribution centres in the Inland Empire – as the most promising short-term opportunity for development of an Inland Container Terminal.

(5) Long Term Solutions

Both the BC and Tioga studies identify large-scale logistics parks as a longer term solution to development of a viable Inland Container Terminal. These facilities are typically developed on large sites which incorporate a large rail intermodal terminal along with associated on-site or adjacent logistics and manufacturing facilities which provide the opportunity to minimize drayage costs.

5. Summary

This paper has highlighted the results of the Inland Container Terminal Study conducted for the BC Ministry of Transportation by IBI Group in association with Hatch Mott MacDonald. The analysis of the viability of an Inland Container Terminal devoted primarily to the handling of empty containers identified significant challenges including incompatibility with Class 1 railway business models, additional rail infrastructure costs, increased inland transportation costs relative to conventional drayage, and challenges in locating facilities in close proximity to existing container-handling facilities.

These challenges are similar to those identified by the Tioga Group in their ongoing inland port feasibility Study for the Southern California Association of Governments. This suggests that these challenges are generic to Inland Container Terminals rather than specific to individual sites, and that similar solutions may be required if viable facilities are to be developed.

* The author would like to thank Barry Singer, Norm Hooper and Michael Sheahan of Hatch Mott MacDonald who developed the detailed terminal and rail shuttle cost estimates used in the BC Inland Container Terminal Study.

Endnotes

[1] IBI Group in Association with Hatch Mott MacDonald, Inland Container Terminal Analysis Final Report, Study done for British Columbia Ministry of Transportation, December 2006.
[2] The Tioga Group, Inland Port Feasibility Study Operational Strategy and Site Selection Update, Presentation to Southern California Association of Governments' Goods Movement Task Force, July 18 2007.