

GREATER VANCOUVER GATEWAY COUNCIL LOWER MAINLAND RAIL INFRASTRUCTURE STUDY

Final Report

December 17, 2004



Transport Canada / Transports Canada



Western Economic Diversification Canada
Diversification de l'économie de l'Ouest Canada



BRITISH COLUMBIA

Ministry of Transportation

Greater Vancouver Transportation Authority

GVTA



BOREALIS



CANADIAN PACIFIC RAILWAY

BNSF



SOUTHERN RAILWAY
OF BRITISH COLUMBIA



The Railway Association of Canada



IBI
GROUP

in association with

Hatch Mott MacDonald, Golder Associates Ltd. & PricewaterhouseCoopers LLP



December 17, 2004

Mr. R.V. Wilds
Managing Director
Greater Vancouver Gateway Council
#1905 – 800 Robson Street
UBC @ Robson Square
Vancouver, BC V6Z 3B7

Dear Mr. Wilds:

Lower Mainland Rail Infrastructure Study: Final Report

IBI Group, in association with Hatch Mott MacDonald, PricewaterhouseCoopers LLP and Golder Associates, is pleased to submit this Final Report for the Lower Mainland Railway Study.

In accordance with the Terms of Reference, this project examined the current capacity of the railway system in the Lower Mainland to accommodate freight traffic forecasts and forecast passenger rail traffic as provided by participating stakeholders, and to determine deficiencies and required infrastructure improvements. This study confirmed that most of the improvements identified in the Major Commercial Transportation System: Rail Capacity Study undertaken by the Gateway Council are required, as well as some additional improvements, in order to accommodate the very substantial increase in traffic expected over the planning period to 2021.

One of the primary issues examined was the capacity of the New Westminster Rail Bridge, a critical link in the railway network in the Lower Mainland. Current capacity of this bridge is expected to be reached by 2010, unless cooperative operating arrangements can be made among the railways to share rail capacity, similar to the recently announced cooperative rail operating arrangements between CN and CP. Five key recommendations stem from our analysis:

1. Carry out an engineering analysis to confirm the physical feasibility and risk of maintaining and rehabilitating the existing New Westminster Rail Bridge.
2. Encourage all appropriate parties to develop an implementation strategy to expand the capacity of the railway system by constructing the improvements described herein.
3. Do not release land for other uses in the Waterfront and False Creek Flats areas until railway requirements are determined.
4. Pursue a strategy of coordinated rail operations among the railway companies.
5. Work with the railways to help resolve mainline capacity issues.

In the event that the engineering investigation of the New Westminster Rail Bridge determines that the bridge cannot be rehabilitated to provide security of use over the planning period to 2021, then the preferred improvement alternative is to replace the bridge with a new, higher level, lift bridge, at a cost of approximately \$110 million, much less than the \$420 million cost of a tunnel. The benefits accruing to the railways, the ports and Canadian economy, of maintaining the rail service and capacity in the Lower Mainland, including the continued functioning of the New Westminster Rail Bridge, are well in excess of the costs of the network improvements.

We would like to take this opportunity to express our appreciation for the assistance provided by the many stakeholders involved in the project. The cooperation of the stakeholders in the provision of the current and forecast freight volumes was very helpful to our efforts to successfully undertake this project.

Yours truly,

IBI GROUP

A handwritten signature in black ink that reads "Andy McNally". The signature is written in a cursive, flowing style.

R. A. McNally, P. Eng.
Director

cc: Mike Kieran – IBI Group
Philippe Raymond – PricewaterhouseCoopers LLP
Doug Hinton – Hatch Mott MacDonald

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1.0 EXECUTIVE SUMMARY

The Major Commercial Transportation System (MCTS): Rail Capacity and Regional Planning Issues Overview, dated February, 2003, prepared by the Greater Vancouver Gateway Council, presents a proposal to make best use of existing transportation infrastructure and provide a blueprint for investments in new infrastructure in the Lower Mainland.

Railways are an essential component of the MCTS, and they are vital to the success of port operations in the Greater Vancouver area and therefore to the metropolitan, provincial and national economies. Over the past decade, the rail companies have responded to considerable growth in traffic volumes, but the dramatic growth in demand for Vancouver Port and Fraser Port is showing no signs of abatement in the foreseeable future. Rail capacity limitations are emerging which may constrain future economic growth.

The **objective** of the Lower Mainland Rail Infrastructure Study is to complete an assessment of future infrastructure needs based on forecast freight transportation demand, while being responsive to regional economic and social development goals and related emerging rail passenger, tourism and commuter needs. Port and Railway services in Vancouver are vital to successful international trading relationships of the nation. There is a clearly expressed interest in exploring critical improvements to the rail infrastructure, key among them being the Fraser River crossing options, in sufficient detail for traffic justification, technical feasibility assessment, economic and financial feasibility and compatibility with the long term strategic plans for the Region.

The **Steering Committee** of the Lower Mainland Rail Infrastructure Study comprises a wide range of stakeholder interests, including the Greater Vancouver Gateway Council, federal departments of Western Economic Diversification, and Transport Canada, the Railway Association of Canada (and representatives of each of CN, CPR, BNSF, BC Rail and Southern Railway of BC-SRYBC), the Vancouver Port Authority, the Fraser River Port Authority, Borealis Infrastructure Fund, the Greater Vancouver Transportation Authority (GVTA), the City of Vancouver and the Province of British Columbia. Consequently, the scope of the assessment to be carried out is multi-faceted and comprehensive.

IBI Group, in association with Hatch Mott MacDonald, PricewaterhouseCoopers LLP and Golder Associates, conducted this rail infrastructure assessment/needs study.

1.1 GENERAL BACKGROUND

This study is "pre-feasibility" in nature and strategic in orientation. This means that data used in the study are from existing sources and previous studies. The strategic orientation is represented by a long range projection to the year 2021, and a scope that encompasses technical, operational, economic and financial evaluations. Primary research, inspections or investigations are not carried out beyond visiting key facilities and interviewing officials to obtain information and insights.

Confidentiality of proprietary data is also a concern for parties that have provided information on their commercial operations. In order to respect this concern, conclusions and observations reported in this document are aggregate views of the information analyzed.

The Major Commercial Transportation System Report (2003) identified a number of proposed improvements to the rail system in the Lower Mainland, shown in **Exhibit 1.1**. The most significant improvement is the replacement of the New Westminster Rail Bridge (NWRB), which is considered a constraint to rail growth in the region.

This study carried out an economic and financial assessment of the benefits and costs of alternative scenarios for replacement of the bridge, and individual cost estimates and aggregated benefits associated with the other MCTS recommended improvements, as well as improvements identified by the project team.





Current & Planned Infrastructure - Rail

MCTS Rail Infrastructure Priority Projects

First Priority

- A. New Westminster (Fraser River) Bridge - Upgrade/Replacement
- B. Pitt River Swing Span Rail Bridge - Upgrade/Replacement
- C. Roberts Bank - 41B Grade Separation
- D. Mud Bay - West Leg of the Y - Double Track
- E. BN New Yard to Spruce St. - Double Track
- F. Colebrook - North/South - Double Track
- G. Colebrook - East/West - Double Track and/or Boundary Bay - Siding/Grade Separation

Second Priority

- H. Westwood St. - Grade Separation
- I. Harris Road - Grade Separation
- J. King Edward Ave. - Grade Separation
- K. Pemberton Ave. - Grade Separation
- L. Victoria Drive - 4 Quadrant Gates
- M. Queensborough Bridge - Widening
- N. Front St. - Grade Separation
- O. BNSF Burrard Inlet Line at Powell St. - Double Track/Grade Separation
- P. BNSF Line - CN Junction - Siding
- Q. Chilliwack - Yale - Grade Separation

Legend

MCTS Roads	Other Roads
BN Rail	BC Rail
SR of BC	CN Rail
CP Rail	Major Industrial Areas
Major New Investments	Rail Priority Projects



The NWRB is owned by the Government of Canada, operated and maintained by CN, and used by all the railways in the area, except West Coast Express at present. The bridge is 100 years old and has sustained major closures due to marine accidents and bridge fires over its life. The bridge is a swing bridge and is closed to rail traffic approximately 5 hours per day to accommodate marine traffic on the Fraser River. As a result, the capacity of the bridge is limited to approximately 65 train movements per day. It carries approximately 46 train movements per day at present, mostly CN and SRYBC. Clearly, continued growth in rail movements will be constrained by the capacity of the bridge, unless other remedies are pursued.

This study examined alternative rail operating procedures to determine whether rail traffic growth, freight and passenger traffic, can be accommodated by operational arrangements, or whether the bridge needs to be replaced. Under **Status Quo Operations**, each railway operates generally on its own tracks within the study area, seeking to minimize its own costs. The Status Quo case represents a peak-traffic 24-hour interval in 2001 for which data on all train movements in the Study area were provided by the railways. Status Quo projections represent growing these operations by applying the overall traffic growth rate for the Lower Mainland to each segment of the network.

An alternative rail operations strategy, and one which the railways are pursuing incrementally on an “as needed” basis, involves the railways sharing, in a coordinated arrangement using commercial agreements, the available rail capacity. With such a **Coordinated Rail Operations** arrangement there is substantial network capacity available to accommodate projected growth, at least to 2021. Co-production initiatives recently announced by CN and CPR represent an example of Coordinated Rail Operations; coordinated rail operations does not mean open rail access to all parties. Accordingly, three improvement scenarios are identified to meet projected market demands. They are as follows:

- Scenario #1. **Status Quo Operations with a New Bridge:** Under this scenario, the NWRB is replaced with a new bridge at a capital cost of \$110 million, plus a number of other network improvements to increase capacity, and the Status Quo arrangements for railway operations would be continued;
- Scenario #2. **Status Quo Operations with New Tunnel:** Under this scenario the NWRB is replaced with a new tunnel at a capital cost of \$420 million instead of a new bridge, and otherwise it is similar to Scenario #1; the additional network investments for Scenarios 1 and 2 cost about \$70 million (\$2004).
- Scenario #3. **Coordinated Rail Operations:** Under this scenario, the NWRB is not replaced, but rehabilitated at regular time intervals, and all infrastructure improvements projects required to achieve Coordinated Rail Operations would be implemented – (approximately \$90 million \$2004), i.e. \$20 million more than Scenarios 1 and 2, but does not require the replacement of the NWRB.

These three improvement scenarios are compared to Status Quo Operations (without improvements) in order to capture the marginal benefit relative to marginal cost. Status Quo represents rail operations in 2001, prior to recently announced co-production initiatives of CN and CPR.

While the NWRB is an important aspect of this study, it is recognized that it is one element in a larger system and its adequacy should be reviewed in the larger system context.

For purposes of this study, the Greater Vancouver Gateway Council identified three distinct corridors that comprise the Lower Mainland rail system:

- Corridor 1 extends from Burrard Inlet Port Complex, where it serves the commodity and container terminals, to the US border and contains the New Westminster Rail Bridge (NWRB).
- Corridor 2 is the CPR main line that serves the Port of Vancouver and handles traffic destined to and from the North American market; and,

- Corridor 3 is the 23-mile BC Rail Port Subdivision that connects the Class 1 railways and Southern Railway of BC to port terminals at Roberts Bank.

1.1.1 Stakeholders and their Respective Agendas

The need or urgency for making major additions to the physical infrastructure in the rail network depends on the pace and effectiveness with which all participants collaborate in striving for a common vision. Various solitudes and divergent priorities characterize the present situation, as summarized below:

- Port Authorities -- Least complex for purposes of this study because they are naturally dependent on concerted actions and are already aligned with objectives for growth in the system; as landlords, they have much to gain from overall rail efficiency and effectiveness by being in a stronger position to attract shipping lines.
- Shipping Lines – Naturally indifferent to Vancouver Gateway issues; they are the customers for this market and will be attracted by reliable service and low costs – capacity is key to that. Their ships, like water on which they float, will follow the path of least resistance.
- Terminal Operators – Primarily focussed on their own local concerns despite multi-national ownership, striving for market share within the Port – complexity is introduced in terms of coordinated arrangements that would require sharing benefits with a competitor, confidentiality is a sensitive topic for these stakeholders.
- The Railways –
 - CN, CPR and BNSF (the Class 1 Railways) are competitors on a North American scale and highly driven by market share;
 - BC Rail Port Subdivision and SRYBC have minor positions in the global market, but they do have much to gain by being focussed on market size;
 - VIA, AMTRAK, West Coast Express and Rocky Mountaineer Railtours have local focus and are indifferent to market share/size issues for freight so long as their plans can be accommodated;
 - Railway motivations are very complex because the main assets they have are people, infrastructure, motive power, and rolling stock, and they work together by necessity rather than by choice;
 - CN and CPR have announced co-production arrangements in the Waterfront and North Shore areas while this report was being edited; these arrangements were implemented concurrent with the study, but no data is available, concerning carloads handled.
- GVTA -- Regional transportation priorities may sometimes conflict with freight efficiency needs. Passenger mobility issues, and impacts of freight movement on the major roads network in the Lower Mainland are the main overlapping priority areas .
- City of Vancouver -- Vancouver is a special case because of the historic role of the Waterfront and False Creek Flats. Local land use, public response to trains, and traffic issues dominate their interest; and, there is continuing pressure to free up existing railway lands for urban development.
- Other Municipalities -- Langley, Surrey and Delta have issues with future rail traffic growth in the Roberts Bank Corridor which may also overlap GVTA issues. North Vancouver has priorities for waterfront development that may influence future rail access development on the North Shore.
- The Government of British Columbia – The Government of British Columbia is preparing a Ports Strategy that is intended to provide an environment that will ensure that the Pacific Ports are an efficient, reliable and competitive port system.

- Government of Canada – Trade and economic growth are high on the federal agenda (market size) and the focus is global.

1.2 ANALYSES AND MAIN OBSERVATIONS

The core concept of the study methodology is to develop a "logical" description of the Lower Mainland Railway system as a network comprising links connecting nodes. The goal is to set up a model to capture all of the key routing options for traffic and operations in the study area. Computerized mathematical models are used to analyse traffic demand characteristics (i.e. inputs) and to generate projected flows over links in the network, subject to minimizing operating costs (i.e. outputs).

1.2.1 Integrated Network

The central notion is that the entire Lower Mainland rail network is one integrated system. Changing one area or corridor cannot be isolated because it causes changes to the entire network. The approach of this study seeks the most efficient and effective use of all network resources for a given demand. It is most appropriate for strategic policy and plans with respect to future demand, operations and infrastructure investments affecting all stakeholders. It is high-level and aggregate in nature, tuned to system-effects and useful to identify and assess major resource allocation options.

This systems approach is especially significant in the case of the present study because of the great complexity of overlapping institutional jurisdictions, operational and regulatory practices, and financial interests. This is particularly crucial to keep in mind concerning the Waterfront and False Creek Flats, where land is seriously constrained and subject to many pressures from most port stakeholders.

1.2.2 Sustained Market Growth

Market demand is represented by actual and forecast freight traffic. Forecasts are provided by Vancouver Port Authority (VPA) and Fraser Port Authority (FPA) by year and by commodity for the period 1999 to 2020 in the case of VPA, and for the period 1999 to 2007 in the case of FPA. Growth rates provided by Vancouver Port Authority are applied to carload and domestic intermodal traffic on the railways, and for Fraser Port estimates beyond 2007.

Historical information includes allocation of traffic to port areas (i.e. groups of terminals) to match the rail network with port facilities. Interviews and inspection trips with railway and port officials and the consultants' general knowledge of the rail operations of the region were the main sources for traffic assignment. Data are aggregated to maintain confidentiality of commercially sensitive information proprietary to individual railways, marine terminal operators, importers and exporters.

Various levels of future demand are considered and evaluated allowing for variation in a wide range of factors such as growth rates by year or by commodity type, allocation of growth to different port areas, and varying conversion factors used to translate port data (in metric tonnes) to railway workload in carloads and train loads. The study methodology is based on weekly time frames; thus the annual data are converted to weekly amounts based on 52 weeks in a year.

Exhibit 1.2 provides aggregated highlights of trainload forecasts for selected years. The base case is represented for 2003. The planning reference case is represented for 2011 and 2021. Train movements are estimated based on tonnes originating and terminating in each port area and typical carload and trainload characteristics for each commodity.

Exhibit 1.2 Estimated Weekly Train Movements

Terminal Node	2003		2011		2021	
	Weekly Train Movements		Weekly Train Movements		Weekly Train Movements	
	EastBound/ Southbound	Westbound/ Northbound	EastBound/ Southbound	Westbound/ Northbound	EastBound/ Southbound	Westbound/ Northbound
Port Coquitlam	14	14	24	24	37	37
Sapperton	9	9	10	10	11	11
Thornton Yard	22	23	25	26	26	27
Livingston	3	3	0	0	0	0
North Vancouver	31	31	43	41	49	46
Burrard Inlet	37	34	57	50	73	63
Lulu Island	5	5	6	5	6	5
Annacis	1	1	2	2	2	2
Fraser Surrey	9	12	11	13	13	16
Roberts Bank	74	65	94	79	122	100
Port Moody	15	15	19	19	24	24

Train movements in **Exhibit 1.2** represent originating and terminating traffic by area. Operational analysis is based on these data and supplemented by estimates of local train movements and passenger train movements on each link of the network.

Growth rates for bulk and breakbulk traffic are lower than those for automobiles and container traffic by a significant margin. The former is expected to grow approximately 25% to 35% by 2021, while the latter is anticipated to almost triple in magnitude over the same time frame. The combined impact is that terminals will likely see rail traffic double, considering all commodities, by 2021.

The terminal areas expected to see the highest participation in future growth are Burrard Inlet (Vancouver Waterfront between Canada Place, Second Narrows Bridge and south to the False Creek Flats), Roberts Bank, and North Vancouver.

1.2.3 Economic and Financial Evaluation

Economic Output

The Lower Mainland rail network is a key part of the integrated national transportation network and improvements to the network in any one area have a positive impact on direct and indirect users throughout the country. If demand for rail transportation exceeds capacity in the Lower Mainland, the Canadian economy as a whole will suffer. It is estimated that an estimate of additional direct economic output for the Canadian economy of over \$700 million¹ in 2021 if the rail capacity constraints in the Lower Mainland are resolved. Economic output adds all revenues at each stage of production together as a measure of total production in the economy. This economic output estimate is based on economic impacts studies on the Port of Vancouver undertaken by InterVISTAS Consulting Inc in August 2001 and in March 2003, and several broad assumptions were necessary to translate the capacity constraint into direct economic output. This figure should be taken as an order of magnitude estimate of the direct economic value of addressing the capacity constraint.

Incremental Benefits and Costs

In addition to the direct economic output for the Canadian economy, the report assesses the incremental benefits and costs for the primary stakeholders, the railway companies and the ports, for each scenario

¹ Amount in \$2004.

compared to Status Quo Operations without improvements². Incremental costs include the additional costs required to build, maintain, rehabilitate, and operate the rail network compared to the Status Quo Operations without improvements. Incremental benefits are the additional benefits to stakeholders of eliminating the bottlenecks (i.e. rail capacity constraints) in the Lower Mainland.

Incremental costs occur every year for all three scenarios. **Exhibit 1.3** shows the estimated annual incremental costs at selected points in time over the study period (5-year intervals) for the three scenarios, and the net present value during the study period to 2021 and over 100 years, the life of the improvement. The Net Present Value (“NPV”) is calculated using a discount rate of 8% real based on an estimate of the weighted average cost of capital (WACC) for organizations such as railway companies.

Exhibit 1.3 Incremental Costs versus the Status Quo Scenario

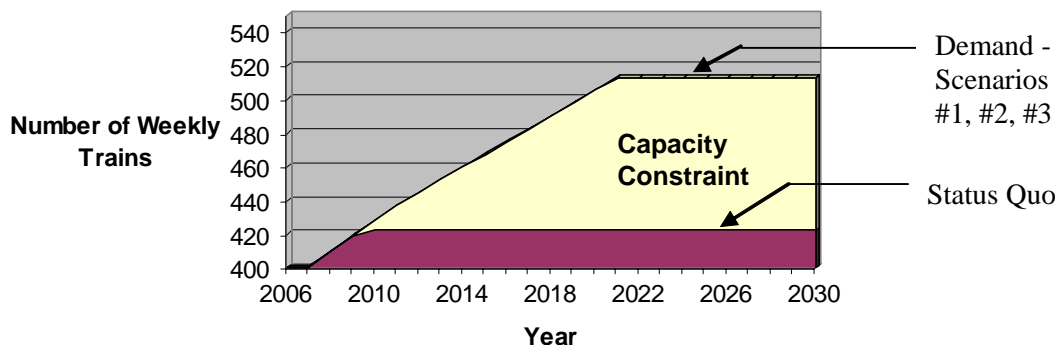
Costs:(\$ 000's, in 2004 real dollars)	Year				NPV @ 8% real as of 2004	
	2006	2011	2016	2021	2006 - 2021	2006 – 2105
Scenario #1 Status Quo Operations – New Bridge	85,987	7,431	331	15,356	147,828	150,478
Scenario #2 Status Quo Operations – New Tunnel	189,320	10,031	2,931	17,956	435,563	446,333
Scenario # 3 Coordinated Rail Operations, Rehabilitated Bridge.	57,705	7,216	13,316	15,151	71,547	93,855 (*)

(*) Assuming there is another 100-year life on the NWRB.

In all of the scenarios examined, the cost figures shown are the incremental cost or savings over the Status Quo Operations with no improvements. The NPV of future costs appears to almost double comparing the New Bridge to the Coordinated Rail Operations Scenarios, and triple comparing the New Tunnel to the New Bridge Scenarios. Clearly, the least cost alternative is Scenario #3.

Incremental benefits are calculated based on the avoided rail network capacity constraints in the Lower Mainland if scenarios #1, #2 or #3 are achieved. **Exhibit 1.4** presents the estimated weekly train movements by year for each of the three scenarios, compared to the Status Quo Operations without improvements.

Exhibit 1.4 Lower Mainland Rail Network Production



This exhibit shows that the Lower Mainland rail network is currently operating slightly below capacity. Under the Status Quo Operations without improvements, by 2010 the Lower Mainland rail network would reach its

² Status Quo Operations without improvements assume there would only be required safety improvements to the NWRB and the rest of the rail network, but no other improvement projects to the Lower Mainland rail network.

theoretical capacity of 423 freight trains per week inbound plus outbound due to rising demand. The critical link in the system is the NWRB, and it would reach its capacity at this overall train volume.

Demand after 2010 could be met if scenarios #1, #2 or #3 are achieved. Each scenario requires a different treatment to the NWRB, but all scenarios require the implementation of common improvement projects in the Lower Mainland needed for the entire system to grow. These are referred to as the Common Elements. Implementing any one of these scenarios would avoid facing a capacity constraint in the Lower Mainland rail network (i.e. demand would exceed supply).

Incremental benefits for the purposes of the scenario analysis are derived from avoiding the capacity constraint shown in **Exhibit 1.4**. Benefits quantified in this report are the ones estimated to accrue to the railway companies and ports. These benefits amount to approximately \$97 million in 2021, and have a net present value of \$229 million for the period 2006-2021. The benefits are associated with expanding rail capacity and they are calculated based on the net income that would be foregone if they could not accommodate the forecasted rail traffic due to rail capacity constraints. The majority of the benefits quantified in this report due to avoided rail capacity constraints accrue to the railway companies with the remainder to the ports. However, other stakeholders would also benefit from the improvements such as commuters, municipalities, marine traffic, road users and the overall Canadian economy.

In addition to the benefits quantified above for the railway companies and the ports, there are other benefits that would accrue to various stakeholders such as:

- Rail capacity benefits for passenger trains;
- Marine traffic benefits due to fewer bridge closings;
- Reduced accident risk due to marine collisions with the bridge;
- Improved Seismic Protection in the case of a new bridge or new tunnel;
- Avoided capacity losses due to bridge fire in the case of a new bridge or new tunnel;
- Avoided employment losses due to any bridge disruption, whether structural, seismic, accident or fire;
- Additional employment benefits due to increased freight movements.
- Travel time savings for rail, car and truck users;
- Environmental benefits as a result of greater use of rail rather than truck freight movements; and
- Social impacts.

The **Net Benefits** are calculated by subtracting the incremental costs from the incremental benefits and they serve as the basis to calculate the internal rate of return (IRR) of each Scenario. **Exhibit 1.5** presents the estimated IRR of the net benefit streams associated with each of the scenarios compared to the Status Quo Operations without improvements. These IRR are presented for a typical rail trip length of 1,200 miles (approx. 1,900 km).

Exhibit 1.5 Estimated Internal Rates of Return for the Three Major Scenarios

Note: Internal Rates of Return (IRR) are in real terms	Scenario #1: Status Quo Operations – New Bridge	Scenario #2: Status Quo Operations – New Tunnel	Scenario #3: Coordinated Rail Operations, Rehabilitated Bridge
Average rail trip length of 1,200 miles			
IRR for study period horizon (2006-2021)	14%	2%	24%
IRR for whole life of assets (2006-2105)	18%	10%	27% (*)

(*) Assuming there is another 100-year life on the NWRB.

These figures show that Scenario #3 (Coordinated Rail Operations, Rehabilitated Bridge) generates the highest return, followed by Scenario #1 (Status Quo Operations, New Bridge), and that Scenario #2 (Status Quo Operations, New Tunnel) has the lowest return. All three scenarios generate similar benefits, but Scenario #3 has lower costs, therefore, it would appear to be the Preferred Scenario.

This finding is contingent, however, upon successful implementation of Coordinated Rail Operations, particularly in the Burrard Inlet, and continued functioning of the NWRB and all other assets. Multi-lateral agreements among railway companies to share risks and benefits to achieve the best overall result is an essential aspect of Scenario #3. While the ranking of Scenarios is clear, justification of an investment decisions is more complicated for this reason.

One principle of Coordinated Rail Operations is that the benefits are distributed across all carriers of rail traffic. Each individual project is part of a larger system, not isolated. Thus, no single party accrues a dominant share of the benefits. Further complicating the matter is the fact that the calculation of incremental benefits is based on a total average journey from inland terminal to onboard ship; but the incremental costs apply only to the Lower Mainland rail network and not to the entire rail network. The threshold IRR for a railway to take on the investment could be higher than this IRR to the extent that mainline capacity shortcomings would have to be addressed concurrently.

The larger picture of rail capacity issues and the associated costs of developing and maintaining the required mainline capacity across the country need to be taken into account before investment decisions can be made. Under the coordinating role of Transport Canada, these costs and benefits associated with the mainline improvement need to be determined to complete the financial assessment.

I.3 CONCLUSIONS

This analysis indicates, that if coordinated operations among the railways can be achieved by no later than 2008, and if the detailed engineering analyses confirms that the bridge life can be extended through rehabilitation to at least 2021, then Scenario #3 is preferred and is the recommended strategy.

If coordinated operations among the railroads cannot be achieved, or if the existing function of the bridge cannot be maintained through the planning period (2021), then the preferred Scenario is replacement of the bridge with a lift bridge i.e. Scenario #1.

Scenario #2 (construction of a railway tunnel) is not recommended.

Regardless of the major strategy selected, there are immediate bottlenecks in the system that would need to be dealt with. Such actions are referred to as the Common Elements.

I.3.1 Common Elements

The important elements needed to sustain the entire system, regardless of which scenario actually materializes are the following:

1. Grade Separation at 41B St. in Delta to provide rail and road user benefits by permitting greater efficiency in the building of long container trains at Roberts Bank; the estimated cost over 20 years is \$ 5,300,000 (constant \$ 2004). Although this project is considered

³ Economic Impact Analysis of Investment in a Major Commercial Transportation System for the Greater Vancouver Region, Greater Vancouver Gateway Council, 2003, by Delcan and Economic Development Research Group.

⁴ For Scenario 3, it is assumed that the NWRB can be operational for up to 100 years more, provided it is rehabilitated at periodic intervals, costs of which are included; whether it is feasible to maintain the bridge for another 100 years requires an engineering assessment and risk analysis.

- immediate priority, an alternative of closing 41B St. should also be examined, because of the constraint that the constructed overpass may impose on further construction of parallel tracks in this important corridor.
2. New Siding between Roberts Bank and Hydro – most likely as recommended by MCTS in Mud Bay – to add needed capacity to the system; the estimated cost over 20 years is \$7,620,000 (constant \$ 2004); this project is an immediate priority.
 3. New Siding between Blaine and the NWRB -- most likely as recommended by MCTS in Mud Bay – essential for adding to AMTRAK frequency and to meet freight growth ; the estimated cost over 20 years is \$7,000,000 (constant \$ 2004); there is immediate need for one siding, and there is a forecast need for further expansion around 2016 to meet freight growth projections, for additional cost around \$8,600,000 (constant \$2004).
 4. Add double track and/or sidings between Roberts Bank and Mission Bridge (5 to 8 miles) – not included in MCTS portfolio -- a consequence of expanding Deltaport according to latest growth projections; total cost around \$22,400,000 (constant \$ 2004); future need 2011 – 2016, depending on actual growth rate and timing of Deltaport expansion.
 5. Add a second main track to CN Yale between Matsqui Jct. and Hydro – not included in MCTS portfolio – this link can become a bottleneck depending on how Roberts Bank grows and on the extent to which cooperation among the three Class 1 railways is achieved – even with optimal cooperation this would become a bottleneck towards the end of the study period; the estimated cost is \$15,800,000 because the terrain is very difficult; the timing would be 2016 – 2021.
 6. Several important grade separation projects are considered (e.g. Westwood, Harris Road, King Edward Avenue), but the direct road user benefits alone are not sufficient to justify the grade separations. Rather, further potential benefits, such as benefits to local rail operations, safety and accident benefits, environmental benefits, aspects which are beyond this study, need to be considered by the transportation authorities in evaluating these grade separations.

Three other types of project can be considered as Common Needs based on the MCTS recommendations, but which are not common to all scenarios investigated in this study. Three projects in this area include:

7. Install double track between the BNSF yard in New Westminster and Spruce St. -- this is about half a mile in a difficult area; the project cost is estimated to be \$3,200,000 (constant \$ 2004); railways indicate the need for this is immediate.
8. Install a new siding near Willingdon (BNSF/CN Junction); the project cost is estimated to be \$6,800,000 (constant \$ 2004); this also is considered an immediate need by the railways;
9. Powell Street double track and road/rail grade separation; the estimated cost of this is \$11,200,000 for a grade separation and \$2,900,000 for installation of double track; this also was identified as an immediate need in the MCTS.

The rationale for these projects is based on yard and terminal operations that require detailed simulations to validate. Such simulations would be included in subsequent design and planning work rather than within the scope of this study. Status Quo operations identifies these as urgently needed projects. The capacity that would be added by these projects does not appear to be required as quickly with Coordinated Rail Operations, because much of the traffic would be arriving at the waterfront over the CPR route. However, it is reported there are problems today on account of yard activities in these areas, and the analysis carried out in this study is not sensitive to yard switching factors. While these projects are expected to be needed some time over the next 10 – 15 years, detailed analysis is required for definitive conclusions on the timing for these projects.

Finally, one new area of need is addition of receiving tracks for full trains in the Waterfront area from Second Narrows to Canada Place including the False Creek Flats. It may be argued that this is a common need for all scenarios, because of the complex operations that now occur and the congestion that follows as a consequence. This was not included in the MCTS, and it has significant institutional implications for all stakeholders, especially CPR, CN and BNSF. It is included in the Coordinated Rail Operations scenario to enable termination of trains close to the marine terminals; 4 receiving tracks of 7,000 feet to be installed over a 17 year period at a total cost of \$37,200,000 (constant \$ 2004) including soft costs to work out the arrangements between existing stakeholders. Soft costs in this case can be substantive (a provision of \$10 million for this alone is included in capital costs). At this time it is unlikely that one of these receiving tracks could be located in the Waterfront area without obtaining agreement among the several landowners. Because of this difficulty, such an option has not seriously been considered in the past. However, potential benefits are great enough to seriously encourage public incentives for port terminals, the railways, and the other stakeholders in the waterfront area, such as GVTA, to work together to develop sufficient receiving tracks within the existing footprint and/or using the adjacent land such as False Creek Flats, to handle this future rail traffic growth.

1.3.2 NWRB Replacement

One of the central questions motivating the sponsors to engage in this research is whether or not the existing NWRB can accommodate future demand. Previous trends signalled warnings that the NWRB was rapidly running out of capacity to handle trains; this trend is confirmed through the present analysis of "Status Quo Operations" scenarios.

However, CN and CPR have initiated some "Coordinated Rail Operations" in the Vancouver terminal area since the "Status Quo Operations" data were generated by them. Those changes have resulted in improved operating efficiencies, and have relieved the bottleneck for the present.

There is an engineering and safety perspective which is extremely important also. The existing NWRB is of century vintage. There would need to be a full primary survey and inspection of the bridge, beyond the scope of this study, to determine how long its useful life can be extended and how much money that would take. The analyses reported in this study consider need for rehabilitation of approximately \$20 million near 2020, and the financial projections were based on a similar amount being required every 20 years. More detailed assessment of this would require a detailed engineering survey and inspection to compare the cost of maintaining the bridge with building a new bridge and to identify the most appropriate circumstances that would trigger replacement.

Estimates of the expected life of the bridge and risks to safety and continuity are carried out here only to the extent that existing documentation would support. Many studies have been carried out over the years, but a conclusive bridge survey is not available. This would need to be carried out before any final determination of the need for replacing the NWRB could be made. External benefits cited in Section 1.2 should be incorporated in the scope of such a review.

If cooperative operations cannot be fully implemented, then straightforward projection of the historical operations indicates the need to replace the NWRB within 7 years.

The main issues that need to be resolved for the future is to determine: whether the NWRB has a physical and economic life that extends up to 2021 for safe operations; and second, whether Coordinated Rail Operations can be implemented throughout the entire Lower Mainland rail network, while also including all four existing freight railways.

Status Quo operations will likely advance the need to replace the NWRB. Recent cooperative initiatives by CN and CPR bought time for what was emerging as a crisis need.

The ultimate potential of Coordinated Rail Operations as evaluated in this study suggests that the NWRB would not be the main bottleneck in the network, and would provide adequate capacity beyond the study time horizon of 2021.

1.3.3 Waterfront (Including False Creek Flats)

One of the busiest areas for freight in the Port of Vancouver is Burrard Inlet. The waterfront is also an important area for passenger cruise ships, public transportation (including the Seabus, SkyTrain, West Coast Express, Harbourlynx ferry, Heliport terminals and Float Planes), and pleasure craft. The waterfront also includes the rail facilities in False Creek Flats.

The rail lines serving the Port in this area are regarded by some as an obstacle to other social and economic pursuits. Backup land for marine port facilities and for efficient rail operations is a serious constraint in this area. These facilities are located in waterfront areas that carry a high appeal for other social and economic purposes (e.g. tourism, commercial development and housing).

The West Coast Express (WCE) downtown terminal is in this Waterfront area. In approximately 1993, WCE made a significant investment in mainline track improvements and yard storage for its cars between Mission and its downtown terminal. As part of this, WCE built its own storage area both at Waterfront and in Mission. This investment provided additional capacity for the operation of commuter trains and provided enhanced operational flexibility in the rail corridor.

The land is owned by various interests, including the railways as separate entities. There are serious constraints in the area, and potential for conflicting purposes and pursuits. The City of Vancouver has expressed its desire to examine the City's need to continue to serve the downtown, the Port, and the False Creek Flats by rail and how to respond to the emerging development pressures occurring in the area.

False Creek Flats is also the location of Pacific Central Station that serves:

- AMTRAK -- 2 trains per day at present, with plans to expand to 6 trains per day (3 each way - the higher frequency of service is incorporated in the traffic levels that are simulated in this study); expanding this service has capacity implications considered in the analysis, and incorporated in the study results.
- Rocky Mountaineer Railtours (RMR) – 6 trains per week (3 each way) between May and October at present, with occasional departures over the balance of the year; RMR has indicated plans to increase service frequency;
- VIA Rail Canada -- 6 trains per week (3 each way), and a rail passenger equipment maintenance facility in False Creek Flats; VIA has stated its intentions to increase to daily service in both directions.

Both CPR and CN point out that increases in frequency for VIA and RMR are entirely contingent upon mainline capacity additions to accommodate them. Such additions would have to be funded by passenger train sponsors. The current level of 26 passenger trains per week could remain the same or increase to as much as 70 trains per week. The highest level of activity will likely require the existing VIA Rail yard facilities to expand.

With respect to freight activity, the Glenn Yard and both the CN Yard and the BNSF Yard are used as staging and back up storage for the Port operation. CN has an arrangement with BNSF to store cars on the south side of Industrial Avenue. The ultimate requirement for tracks and track configuration in this area depends upon cooperative efforts that remain uncertain at this time. It would be natural to expect BNSF to seek a higher return on its own surplus land assets in the area, and this would more likely be through sale for development or co-development rather than short-term leases for rail car storage.

Future planning of the False Creek Flats area by the City of Vancouver must take into account these growing needs for freight and passenger rail traffic and terminal requirements.

1.3.4 Roberts Bank

Roberts Bank also has a number of issues, but they are different from those in downtown Vancouver. The rail corridor runs from Mission through Langley and Boundary Bay and onto the Causeway. There is a steady volume of coal trains for export, and container traffic in both directions. Container trains operate at lengths over 3.5 kilometres regularly.

A significant portion of the line is owned by the province of British Columbia (as the BC Rail Port Subdivision, which has been retained by the Province following the sale of BC Rail to CN). The Port Subdivision controls train movements over the line, but does not operate any of its own trains. All four operating railways (BNSF, CN, CPR, and SRYBC) use at least portions of the line.

This line cuts through a populated and growing area. There are numerous level crossings at present, and interference between rail and road traffic is an important consideration in planning the future infrastructure requirements in this area.

Projects identified as being common to all scenarios feature prominently on this route. The 41b Street grade separation, Mud Bay sidings and future double track are all needed eventually regardless of who operates the trains going into the Causeway.

Long trains and high growth pose a real challenge for rail, port terminals and communities hosting the rail line. Proximity issues and future urban development affecting level crossing traffic volumes are all planning issues that will require close cooperation between Railway planners and surrounding municipalities.

1.4 RECOMMENDATIONS

The Lower Mainland rail system is complex and the stakes are large. There are many directions that might be taken once the initial steps are successfully completed towards meeting future freight demand expectations.

The outstanding questions concerning the need to replace the NWRB are technical and institutional. If a detailed survey and inspection of the bridge establish that the bridge cannot be expected to continue beyond 2021, then that becomes the determining issue concerning replacement of the bridge. None of the work done to date is sufficiently detailed or current to respond to this question.

Therefore **Recommendation #1 is: Carry out an engineering condition assessment and risk assessment of the NWRB, to establish the remaining life expectancy, maintenance requirements and structural vulnerability, to verify it can sustain traffic for the planning period (2021) and to quantify the disruption period that would be caused by a seismic event, ship collision or bridge failure.**

The result of such a review would either confirm or cause modification to the financial and economic estimates upon which the conclusions of this study are based. The Pitt River and Mission Bridges are also crucial to future capacity of the network. Although there are no immediate issues apparent, a similar assessment should also be considered for these bridges.

Recommendation #2 is: Commence discussions with all appropriate parties to negotiate sponsorship arrangements for implementing MCTS projects identified as Common Elements and, if required, replacement of the NWRB.

The economic analysis of system enhancements identified the railways as the major beneficiaries. If it were as simple as that, then the respective railways would proceed with the projects over their own lines, to incur the costs and reap the benefits. This analysis, however, is incomplete without further information or detailed participation from the railways. In this analysis, benefits associated with the increased traffic are calculated over the entire inland rail movement, while the only costs included in this analysis are within the Lower Mainland Rail network. The railways argue that margins on the traffic are insufficient to provide for all of the capacity needs from origin to destination. This needs to be brought forward in more specific detail to assess the nature of the benefits and costs accordingly and to identify who should be the main participants in undertaking the risks of proceeding.

There is scope for an innovative approach to establish financial incentives for the "Common Elements" projects, i.e. the distribution of costs and benefits between the railways - if all are going to use portions of the network. There is potential for an active role by some neutral third party, or governments, to facilitate a network investment plan such that each railway would not necessarily have to be fully responsible for all of the investments on their own track. There are models to consider for this approach, such as the CREATE project in Chicago, and the Alameda Corridor in California.

The same requirement applies in part to the issue of NWRB replacement. The railways would be the main beneficiaries from a capacity point of view. However from a technical and safety perspective, the Government of Canada as the owner of the existing facility is a direct participant as well. The need for the technical information is covered above in Recommendation # 1. Participation in risks and rewards over service enhancements made possible by a new facility should become part of the larger negotiations on sponsorship arrangements.

Recommendation #3 is: Determine the rail network and operational requirements in the Waterfront and False Creek Flats areas and do not release land for other uses until such needs are determined.

This recommendation deals more with process than a specific outcome. The City of Vancouver is taking the initiative and is attaching urgency to determining the future usage of False Creek Flats. As a major stakeholder, this urgency is significant for all the other stakeholders. It would be a common interest of all concerned to identify both crucially important and potentially surplus railway lands so that all stakeholders could proceed with long-term plans and continue to work cooperatively with other parties.

The Waterfront area will be accommodating significant growth by 2021 and congestion delays will pose a critical limiting constraint unless there is a significant change in the fundamental way in which the terminals in this area are serviced. In the False Creek Flats area, there will be additional need for support services for freight activities on the waterfront. At the same time there will be significant passenger growth, potentially to a level and scope that will require expansion of the existing yard. While it is possible that not all of the lands in the False Creek Flats will be needed for rail support, it is important nevertheless to carry out the detailed planning for rail service requirements before releasing significant parcels of land to alternative use.

One of the biggest challenges will be to find the appropriate incentives for parties with diverse and sometimes competing interests to strive for maximization of growth potential in this valuable and congested area.

Recommendation # 4 is: Pursue a strategy of Coordinated Rail Operations.

Coordinated Rail operations has proven itself to be successful in several locations in the Lower Mainland. However, the challenge in the downtown waterfront is much more complicated because of the long history and established footprints of many varied stakeholders. The systems analysis carried out in this study, and the economic analysis that follows from it clearly indicate that the economic benefits of achieving efficient cooperation throughout the network are substantial compared to the scenario that continues to project the Status Quo operating arrangements.

It will be important for these discussions with railways to focus on getting a sense of the scope and dimension of Coordinated Rail Operations, in what timeframe, and to what degree of implementation. Less than full Coordinated Rail Operations will require some projects to be implemented sooner. These issues and timing need to be determined with the railways.

Recommendation #5 is: Work with railways to help resolve mainline capacity issues.

This course of action would not only assist in understanding a fuller picture of the costs and benefits of the Lower Mainland Rail system improvements, as reflected in Recommendation number 2, but it is also crucial to ensuring that whatever improvements are made in the local network can be carried through to the end customer, otherwise it would be all for naught. A secondary benefit is in providing an opportunity for both railways and other stakeholders in the Lower Mainland to build mutual trust and understanding.

Finally, these recommendations speak to launching processes that bring parties together seeking a common set of goals related to economic trade development. The analyses carried out in this study point to a vision with potential benefits. As discussions evolve, so also the vision and goals might evolve commensurately. If directions are changing, then it would be appropriate to make a deliberate decision to proceed on with the change of course, or else to correct and get back on course. The process of establishing timeframes, expectations and milestones or checkpoints should be included on the agenda of progressing with any of the recommendations above.