

The Port Mann Mega-Bridge Taking its Toll on the Tax Payer

**A financial analysis of the Highway 1
Port Mann Corridor Gateway Program**

By Evan Robinson

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Overview

After examining the financial assumptions around the Highway 1 / Port Mann corridor portion of the Gateway Program, I conclude that the conditions for success are unlikely to occur. Of 24 scenarios (rates of traffic growth, construction cost, and interest rates) I examined, only one scenario is financially stable without drastically increasing congestion in the corridor during the 40-year lifespan of the project.

In order to break even financially, traffic trips must grow at a rate determined by interest rates and the cost of construction. If interest over the next 40 years runs at or near historical averages (about 5.25%), trips must grow at 2.4% (if the project comes in on budget of \$2.4 billion for construction plus \$900 million additional costs) or 3.45% (if the project runs 20% over budget). In either case, congestion in 2050 will be considerably worse than it is today.

If traffic grows at 4% or more annually, the new corridor will be more congested than the present one is now by 2025 or 2030, requiring huge additional infrastructure investment. As an aside, this traffic growth would result in greatly increased greenhouse gas (GHG) emissions over a similar investment in transit; which increase is likely incompatible with the provincial commitment to reduce greenhouse gas emissions 33% by 2020.² If traffic doesn't grow at all, tolls collected cannot pay for the initial investment within 40 years, requiring the taxpayers to bear unexpected costs.

Overall, the proposed solution to congestion on the Highway 1 / Port Mann corridor is not resilient. It only comes close to success in a very narrow set of conditions: 127,000 trips every day growing very near 2.5% - 3.5% annually. Other conditions result in failure to break even financially or in additional congestion exceeding the present levels long before the 40-year time horizon of the project.

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² A detailed analysis of GHG emissions is beyond the scope of this document, but recent literature suggests that technology improvements would be inadequate to achieve the required emissions reduction in the face of increased automobile travel. The Washington State Climate Action Team Policy Option Recommendations of December 2007 says "[w]hile new technologies and cleaner fuels are vital to reducing GHG emissions, as long as annual vehicle miles traveled (VMT) continues to grow, we'll never be able to meet the state's 2020, 2035, and 2050 goals." Report is online at http://www.ecy.wa.gov/climatechange/InterimReport/122107_TWG_trans.pdf, pg 16, accessed 2009.04.15.

Defining “Success”

As a consultant, I often have to ask clients “what do you want?” as a way to establish possible conditions of success. In the context of the Port Mann Bridge, I consider success to be:

- ★ Financial “break-even” (paying back the costs of construction) over 40 years (this is a condition because the Province has suggested a Public Private Partnership [P3] in which a private company will build the bridge and charge tolls to pay back the construction costs – thus making the expansion nearly or absolutely revenue neutral to BC);
- ★ Congestion reduction over at least the financial break-even period (40 years) and preferably over the useful lifetime (75 years) of the bridge

In order to decide whether the project is likely to be a success, we must therefore make educated projections about how whether or not the project will break even financially in 40 years and what the growth of traffic trips over the bridge will be over at least 40 years and perhaps over 75 years.

It should be noted that this is not a comprehensive analysis of the costs of the project. Direct expenses like widening municipal roads to deal with increased traffic volumes would not be covered by toll revenue in any of the scenarios considered. Indirect expenses such as health care costs due to increased air pollution and the cost of increased congestion of municipal roads are also not covered. Therefore, success as narrowly defined in this analysis does not imply that the project would be a net benefit to the people of BC.

Estimating Break Even

Three variables dramatically effect whether or not the Highway 1 / Port Mann corridor section of the Gateway Program will break even on a simple monetary basis. All are unknown: construction cost (measured in billions of dollars); traffic growth (measured in trips per day); and interest rates (measured in annual percentages) over the payback period (set to 40 years).

Construction Cost

In 2005, the provincial estimate for this project was \$1.5³ billion. In early 2009, two figures are widely reported for the construction cost: \$2.42⁴ billion and \$3.33⁵ billion. There is some indication in published reports that the line item cost is \$2.4 billion and the total cost of capital (including interest) is \$3.3 billion. As an added possibility I will also consider a 20% overrun. I assume construction costs of \$2.4 billion are split evenly over the three-year construction period 2009 – 2011, with interest costs of \$900 million added in 2011. Increasing construction costs reduce the likelihood of breaking even.

³ Gateway Program, Preliminary Economic Costs and Benefits, 2005.09.19, MMK Consulting, Inc. Online at http://www.th.gov.bc.ca/gateway/reports/Gtwy_Benefits_Costs_Sept-2005.pdf, retrieved 2009.03.01.

⁴ Financing falls through for \$2.4 billion Port Mann, CTV News, 2009.02.27, online at http://www.ctvbc.ctv.ca/servlet/an/local/CTVNews/20090227/BC_port_mann_financing_090227/20090227?hub=BritishColumbiaHome, retrieved 2009.03.03.

⁵ NDP’s Carole James warms to Port Mann crossing, Georgia Straight, by Matthew Burrows, 2009.02.26, online at <http://www.straight.com/article-203115/ndps-james-warms-port-mann-crossing>, retrieved 2009.03.03.

Traffic Trips and Growth

Traffic usage of the existing Port Mann is 127,000 trips/day. Whether that is 127,000⁶ trips per weekday (250 days/year) or every day (365 days/year) is unclear. The conservative assumption is that it is an every day average (more potential toll revenue). The expanded Port Mann corridor is expected to provide twice the capacity of the existing bridge. Growth rates are not specified, so I will examine 0%, 2%, 4%, and 6% annually.

Figure 1: Congestion According to Growth Rate

Growth Rate	Equal Congestion
2%	2047
4%	2030
6%	2024

Figure 2: Trips in 2050 per Trip in 2008

Growth Rate	Throughput Increase 2050
2%	2.1
4%	4.4
6%	9.2

When daily trips double (254,000) the level of congestion should approximately match the current congestion. The doubling occurs in 2024, 2030, and 2047 for 6%, 4%, and 2% growth, respectively.

Higher growth rates gradually increase the annual number of trips and income, but also increase congestion. By 2050, 2% growth will slightly over double throughput, but 4% will result in a 4.5x increase (doubling the effective congestion over today), and 6% growth provides a 9.2x increase in trips by 2050, between 4 and 5 times the current congestion. High growth rates make the economics look better, but sharply reduce the useful lifetime of the new Highway 1 / Port Mann corridor.

Interest and Inflation Rates

Possibly the largest effect upon break even is provided by interest and inflation rates over the next 40 years. Because “break even” is calculated by a procedure called “net present value”, interest rates over the payback period have an enormous effect. A simple example illustrates the relationship between Future Value (FV) and Net Present Value (NPV):

Suppose you lend someone \$1000 today in return for a payback in two years. How much should they pay you back? In order to break even, you need to get back your \$1000 plus enough money to cover inflation over those two years. If inflation is 10% annually, you need to get back \$1210 ($\$1000 * 110\%$ [for the first year] $* 110\%$ [for the second year]). Thus the Future Value of \$1000 in two years at 10% inflation is \$1210, and the Net Present Value of \$1210 in two years (assuming 10% inflation) is \$1000. The higher the inflation/interest rate, the less money in the future is worth now.

⁶ Gateway Program Definition Report, B.C. Ministry of Transportation, 2005.01.31, online at http://www.th.gov.bc.ca/gateway/reports/Gateway_PDR-ExecSumm.pdf, retrieved 2009.03.03.

Determining the NPV of the Highway 1 / Port Mann corridor is more complex, but essentially the same process: we start by investing construction money for the first three years, then we sit back and collect tolls for the next 40 years. The question is whether the tolls (discounted by inflation over 40 years) add up to the construction cost (discounted by inflation over three years).

To answer the question definitively we need to know the cost and timing of construction, the number of tolls paid each year, and the rate of inflation over the next 43 years (three years of construction and 40 years of toll collection). Unfortunately, we don't know any of that. And we can't do the project and then wait until 2054 to decide if we're going to do the project. So we make reasonable assumptions about construction costs and number of daily trips. In order to estimate future interest rates, I turned to historical interest rates, which show that the normalized constant average annual bank rate is about 5.25%⁷ over a 40-year period.

Break Even Scenarios

Assuming 0% or 2% traffic growth, neither scenario breaks even at historic interest rates of 5.25%, while at 4% and 6% annual traffic growth both scenarios break even. Figure 3 shows summary information for the two basic scenarios: \$2.4 billion and a 20% cost overrun. I assume current trips average 127,000 every day and historical average annual interest rates of 5.25%.

Figure 3: Summary Return per Dollar Spent⁸

i = 5.25%	Trip Growth Rate				
	0%	2%	4%	6%	BE%
Base Cost	\$0.69	\$0.92	\$1.30	\$1.93	2.40%
20% Overrun	\$0.57	\$0.77	\$1.09	\$1.61	3.45%

The BE% column shows interpolated "break-even percentage" of growth. Assuming no cost overrun, 2.4% growth breaks even over 40 years at 5.25% interest rate. 3.45% growth is required to break even assuming a 20% cost overrun.

Figure 4: Trips in 2050 per Trip in 2008 at Break-even growth rates

Growth Rate	Throughput 2050
2.40%	2.5
3.45%	3.6

At break-even growth rates, traffic congestion in 2050 will be about 25% worse than now if the project finishes at budget. With a 20% cost overrun, traffic will be about 80% worse than now because of the additional tolls necessary to pay for the overrun. Even if the project finishes on budget at \$2.4 billion (and remember, the original budget was \$1.5 billion) and traffic expands exactly enough to break even, traffic will be 25% to 80% worse in 2050.

⁷ See Appendix: Historical Interest Rates for details.

⁸ Base cost means \$2.4 billion spread evenly over three years of construction with \$900 million of interest accounted for in the third year of construction; 20% overrun means \$2.9 billion spread evenly with just over \$1 billion in interest in the third year. Growth rates are trips annually. All scenarios assume a \$3 toll and no toll inflation.

Conclusion

The proposed solution to congestion on the Highway 1 / Port Mann corridor is not likely to succeed. It's easy to project break-even financially over 40 years whether or not the construction finishes on budget. Unfortunately, the necessary trip growth rate to break-even financially means that the congestion problems will just be put off into the future. The difficulty of projecting financial conditions in the midst of the worst global economic downturn since 1936 increases the uncertainty – even using historical interest rates there is at least a 50% chance that high interest rates will derail financial break-even⁹.

⁹ In the 5000 simulated 40 year periods, almost 53% (2639) of the runs produced an average normalized annual interest rate about 5.25%

Appendix: Historical Interest Rates

In order to estimate future interest rates, I turned to historical interest rates, starting with the Bank of Canada's Bank Rate¹ from 1935 to 2008. I then applied a technique called stochastic regression or Monte Carlo analysis: I used random numbers to generate 5000 40-year sequences of interest rates from the historical data. For each 40-year sequence of annual interest rates, I calculated the total growth percentage and reduced it to an annual average. Thus, if a sequence generated a total 7.04x growth, it is almost exactly equivalent to a 5% annual growth rate for 40 years:

Figure 5: Normalizing 40 Years of Growth to a Constant Annual Average

$$\sqrt[40]{7.04} \approx 1.05 = 105\% = 5\% \text{ growth}$$

I generated 5000 sequences using the entire historical data and 5000 more using only the data for the period since 2000:

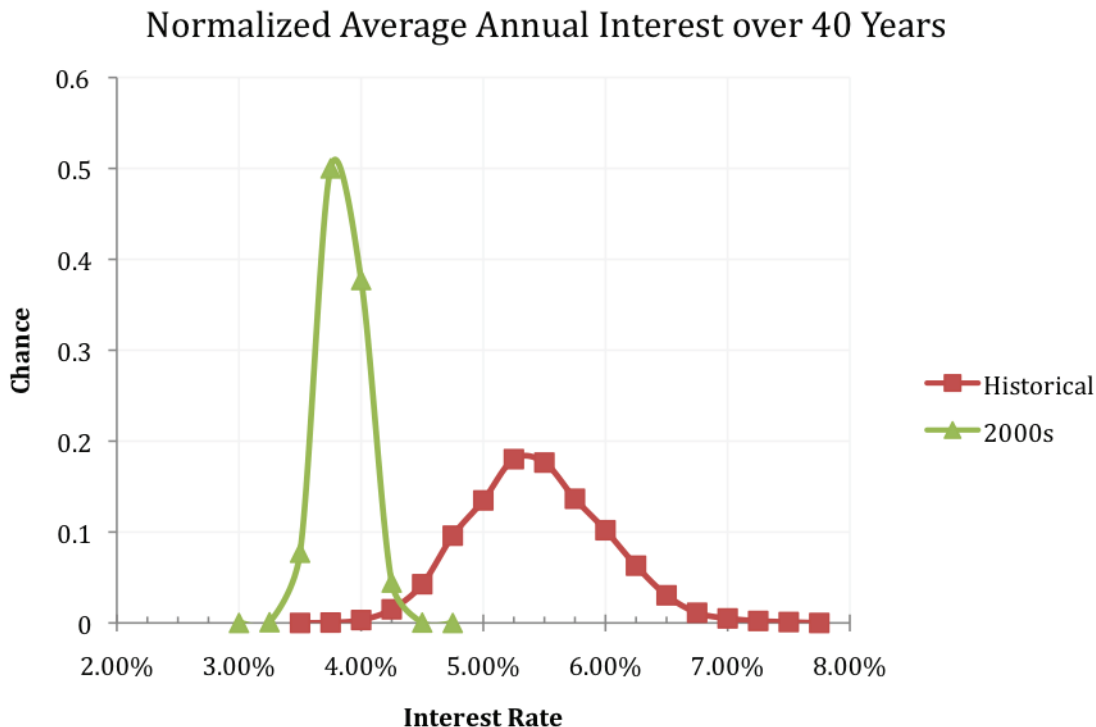


Figure 6: Average Annual Interest over 40 Years

Using the total historical data, the mean normalized annual interest rate is 5.3%². Using only the data from the 2000s, the average normalized annual interest rate is 3.72%³. So if you expect the next 40 years to be like the last eight, break even is more likely.

¹ Selected Historical Interest Rates, at http://www.bankofcanada.ca/en/rates/sel_hist.html, accessed 2009.03.01. The bank provides monthly rates. I calculated annual mean values for each year.

² Mean 5.31%, median 5.28%

³ Mean and median