Updated Cost & Ridership/Revenue For Calgary Edmonton High Speed Rail

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The Van Horne Institute

by

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1. INTRODUCTION

In response to recent interest in High Speed Rail (HSR) in the Calgary-Edmonton corridor, the Van Horne Institute (VHI) requested an update of the cost and potential ridership revenues for HSR based on:

- The 2011 update of project capital costs in the VHI's 2004 HSR Feasibility Study;
- The 2009 Market Assessment of HSR carried out by TEMS, Inc and Oliver Wyman; and,
- an update of operating costs estimated in the 2004 study.

2. CAPITAL COST UPDATE

Both the 2011 and present capital cost update are based on the project parameters and assumptions underlying the cost estimates generated in the 2004 study. New site investigations of land availability for the alignments, station locations and the maintenance facility have not been undertaken. Other aspects, such as changed environmental regulations and codes, right-of-way engineering issues and routing changes, have not been factored into this update.

The reader is therefore cautioned that costs may vary if land development subsequent to the 2004 report's completion has encroached on areas previously assumed available for the rail right-of-way, or because other 2004 assumptions require modification. Nevertheless, this updated project cost should provide a reasonable ballpark estimate of the current cost of implementing HSR in the corridor.

The following outlines the approach taken to complete the present cost update.

Property

The 2004 study identified the need for five stations – downtown Calgary, suburban Calgary in vicinity of Calgary International Airport, Red Deer, a location near Edmonton International Airport or Anthony Hendy Drive and downtown Edmonton adjacent to the Grandin LRT station – and a maintenance centre in proximity to Red Deer. In downtown Calgary, downtown Edmonton and Red Deer as well as the approaches to both cities, minimal land acquisition requirements were assumed as stations and the alignment for both the CPR and Greenfield HSR options utilized the CPR corridor in order to minimize urban impacts and land costs.

The current cost estimate for station and maintenance facility land acquisition has been based a survey of current commercial land sale price listings and recent transactions. Based on these sources, the current cost for station and maintenance facility land acquisition was estimated to be approximately $31.7 million (2013). However, this figure assumes minimal land acquisition in downtown Calgary and

Edmonton, where acquisition of a site adjacent to the existing CPR rail line could prove challenging if pursued privately without powers of expropriation. Although opportunities may also exist to defray station costs by seeking joint private sector development partners or integrating these downtown stations into publicly owned properties, this also has not been factored into the cost estimate.

The 2004 study also identified the need for 108 to 309 hectares of land acquisition for the CPR option right-of-way[1] and 1,490 hectares for the Greenfield options plus 1,211 hectares in land severances. Two methods were employed to calculate the right-of-way acquisition costs in 2004. In the case of the CPR option, CP Rail provided data on recent sales prices paid for land acquisition according to different sections of the alignment. Where the land required for the Greenfield options deviated from that of the CPR option[2], average land costs provided by Alberta Transportation were used.

To update land acquisition costs for right-of-way purposes in 2011, Statistics Canada's data on the increase of farm land values between 2004 and 2010 (67.76%) was used to inflate the 2004 estimates for right-of-way acquisition. As Statistics Canada has not updated this data since 2010, the increase in land values reported by Farm Credit Canada from July 2010 to January 2013 was applied (21.4%) to derive the current estimate.

The following are the current estimates of total property acquisition cost for the options.

PROPERTY COST ESTIMATE (STATIONS, MAINTENANCE FACILITY & ROW)		
Options	**$ 2004 (millions)**	**$ 2013 (millions)**
CPR Option	$22.8	$35.3
Greenfield Options	$47.8	$82.3

Rolling Stock

Market research carried out as part of the 2004 feasibility study revealed that travel time of two hours or less was the threshold required to attract significant demand in support of the HSR service. To meet this travel time threshold, technology options able to operate at 200 kph or more are necessary. The 2004 study used two rolling stock technology options for illustrative purposes – the 200/240 kph *JetTrain* and 320 kph electric trains. The CPR option's design was predicated on 200 kph due to concerns about mixed freight traffic operations, whereas the Greenfield option was designed for both 240 kph *JetTrain* and 320 kph electric train operations.

Since completion of the 2004 study, various market and technological changes and advances have occurred that influence not only rolling stock sourcing and supply

[1] This included land severances.
[2] Common alignment was assumed entering both Calgary and Edmonton to avoid acquisition of a new rail right-of-way in these congested urban areas.

but also pricing and possibly infrastructure and alignment design due to higher speed capabilities of trains. These include:

1) Bombardier's *JetTrain,* which had been developed in conjunction with the US Federal Railway Administration and was available in prototype form in 2004, failed to secure a contracted buyer and has not proceeded into production.[3]

2) Additional players in the design and manufacture of high speed rail equipment, including both Korea and China, have entered the market, introducing greater supply and price competition.

3) Out-sourcing of manufacture and parts to lower priced markets combined with cost spread of development costs over multiple orders for specific vehicle models over the past decade has resulted in price reductions for rolling stock.

At the same time, several limiting conditions that affected Calgary-Edmonton HSR in 2004 remain.

1) Despite the Obama administration's commitment to advance HSR in the US, implementation of HSR comparable to that found in Europe or Asia has yet to be achieved. Only, the *Acela* (240 kph) service in the US Northeast corridor between Boston and Washington is currently in operation. Thus, issues concerning adaptation of proven European or Asian HSR rolling stock to meet North American safety standards are still supply and cost consideration factors.

2) The Calgary-Edmonton order is small both in terms of the number of train sets (five) and seating capacity requirements, which translates into a higher per unit cost, particularly that a tag-on order to a large European or Asian procurement is precluded by the former consideration.

3) HSR rolling stock orders remain relatively few and far between and fraught with individual conditions, such as local supply and manufacture conditions that affect price. This makes benchmarking current costs based on recent orders very difficult especially given the former two limitations inherent in the Calgary-Edmonton HSR context.

The inherent limitations of the Calgary-Edmonton HSR rolling stock procurement were thoroughly analysed in developing the 2004 cost estimate for rolling stock. For this reason, one approach was to update the 2004 rolling stock cost estimate by using the Canadian rate of inflation since 2004 (18 %). To test the reasonableness of this approach, rolling stock supply contracts for high speed (200 to 250 kph) and very high speed (320 kph plus) trainsets awarded to the three largest train manufacturers (Alstom, Bombardier and Siemens) between 2004 and 2013 were

[3] Alternative higher speed diesel trains that can meet the 200 kph design speed of the CPR option are available on the market.

reviewed. In addition, an adjustment factor for North Americanization and the small size of the Calgary Edmonton HSR order used in 2004 was applied and then inflated to current dollars.

The following table compares the results of these two approaches:

ROLLING STOCK COST ESTIMATE (CDN $ 2013 MILLIONS)		
5 Train Sets	Inflated 2004 estimate	Supplier Based Estimate
Up to 250 kph non-electric (8 cars)	$387	N/A
(10 cars)	$438	N/A
Up to 250 kph electric (8 cars)		$338
(10 cars)		$348
320 to 380 kph electric (10 cars)	$444	$443

As the supplier based estimate may not include an adequate premium for the small order and North Americanization of rolling stock and to be conservative the inflated estimate has been adopted for the purpose of this assignment. Based on the above, the cost for rolling stock for the purpose of this exercise has been assumed to range from $390 to $445 million (Cdn) in current dollars for the options.

Other Capital Costs

Estimates for the Calgary Edmonton High Speed Rail were originally prepared in April and May 2004. The 2011 estimates were inflated on the basis that work would commence in the year 2011, and further inflate over the construction period. The overall inflation rates used to derive the 2011 base costs are as follows:

2004 to 2005	7.00%
2005 to 2006	7.00%
2006 to 2007	9.00%
2007 to 2008	8.00%
2008 to 2009	3.00%
2009 to 2010	2.00%
2010 to 2011	2.00%

These percentages were further analysed into labour, material, equipment, overhead and fee elements. Equipment was inflated at 2% per annum. The inflation rate reflected the high material inflation experienced in 2004 and 2005, together with the construction industry being extremely buoyant in 2006 to 2008 with labour costs increasing at very high rates often at around 10%. To update, costs for 2013 labour, material, equipment, overhead and fees were increased by 5%.

COMPARISON OF CAPITAL COSTS ($ 2013 MILLIONS)			
	CPR (200 kph)	Greenfield (250 kph)	Greenfield Electric (320 kph)
Property	35.3	82.3	82.3
Rail Infrastructure	1,073.9	2,048.9	2,048.9
Stations and Parking	39.5	39.5	39.5
Maintenance Facilities & Equipment	96.6	107.4	112.0
Road Work	398.5	175.3	175.3
Electrification	0	0	888.7
Total Construction Costs	1,643.9	2,453.5	3,346.8
Vehicles, TVMs & Communication Systems*	409.4	481.9	491.8
Engineering	126.9	227.3	313.3
Project Management	13.9	137.4	190.1
Testing and commissioning, Ops prep	11.7	11.7	11.7
Insurance & Bonding	24.9	88.3	116.5
Total Engineering & Management	177.4	464.7	631.6
Contingencies	346.0	525.3	716.1
TOTAL PROJECT COSTS	2,576.6	3,925.4	5,186.3

* TVM – Ticket Vending Machine

The reader is cautioned that the above estimates do not include either interest or inflation during construction as the period over which this would take place is unknown. In addition, the above is an inflated estimate of the project as reported in the 2004 study. Given the passage of time and potential for changes to have occurred, an addition of 5% to the contingency has been included in the updated estimate.

Because of the caveats concerning the cost estimate update, it is recommended that the project cost be rounded as follows:

- $2.6 billion for the CPR option
- $3.9 billion for the Greenfield non-electric option
- $5.2 billion for the Greenfield electric option.

By way of comparison, capital costs converted to 2013 dollars for HSR construction in Europe range from $16 to 63 million per km depending on terrain and density of urbanization within the corridor. The cost for the Greenfield Electric Option at roughly $17 million per km falls at the low end of this range, which appears reasonable, given the character of the corridor.

3. RIDERSHIP/REVENUE UPDATE

The 2004 HSR study included a preliminary assessment of ridership and revenue potential but recommended that a more in-depth assessment of market potential be carried out as a follow-up to this study. In 2008, TEMS Inc/Oliver Wyman completed this in-depth analysis. Survey and data collection work for this study was conducted primarily in 2007 and included extensive stated preference surveys of air and bus passengers as well as car drivers intercepted on Highway 2. This preference and usage survey data was input into predictive models based on population, employment and income and economic projections, including changes in traffic congestion and fuel prices.

The study resulted in the following ridership and revenue forecasts:

CORRIDOR RIDERSHIP (MILLIONS)

Ridership	200 kph		240 kph		320 kph		480 kph	
Year	2021	2051	2021	2051	2021	2051	2021	2051
Worst Case	1,254	1,860	2,034	2,839	3,359	5,068	4,766	7,180
Base Case	1,554	2,821	2,518	4,301	4,136	7,657	5,816	10,745
Best Case	2,207	4,618	3,583	7,058	5,615	11,947	7,897	16,751

CORRIDOR REVENUES ($ 2006 MILLIONS)

Ridership	200 kph		240 kph		320 kph		480 kph	
Year	2021	2051	2021	2051	2021	2051	2021	2051
Worst Case	60.6	90.2	105.3	177.1	204.7	353.3	489.3	902.8
Base Case	75.2	137.1	156.7	269.0	328.2	609.9	608.0	1,127.9
Best Case	119.2	250.6	223.0	441.7	485.3	1,035.7	825.6	1,758.7

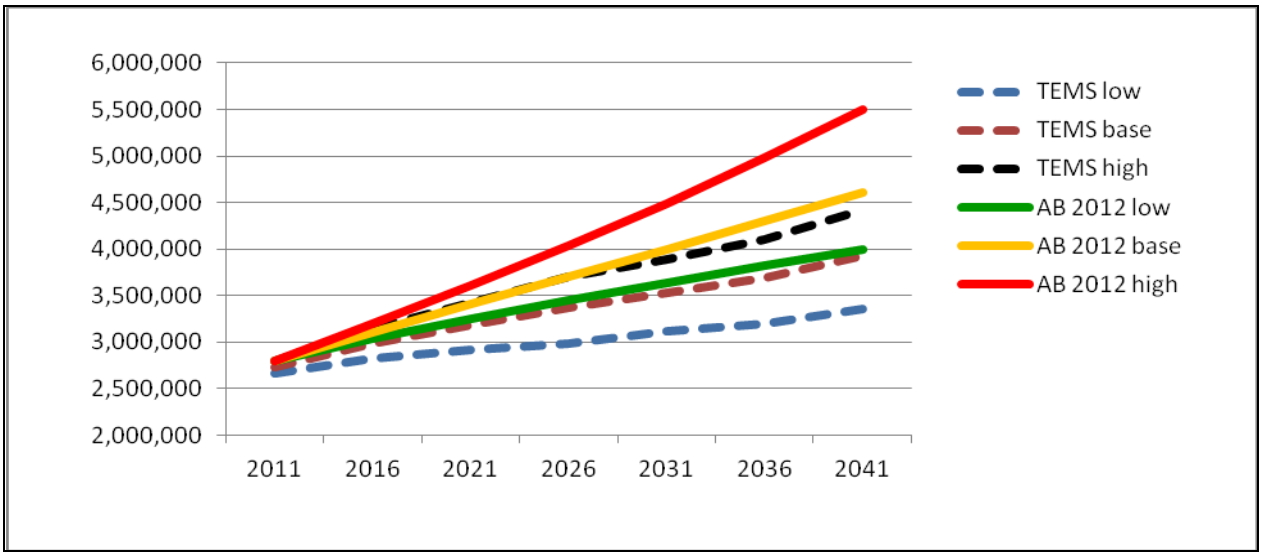
Sensitivity analysis carried out on the model results found that the most critical variables that influenced either an increase or decrease in ridership and revenue were demographic change, congestion levels and gasoline prices.

Given limitations of time and budget, collection and analysis of new survey data is well beyond the scope of this update. In addition, access to the models used in the 2008 study or use of similar models was not possible. Instead, assuming that methodology was basically sound, a review and comparison of the demographic, economic and other model inputs to actual experience and current forecasts was undertaken to confirm the TEMS base estimate or suggest whether the more or less favourable ridership and revenue estimate by TEMS was indicated.

Demographic Factors

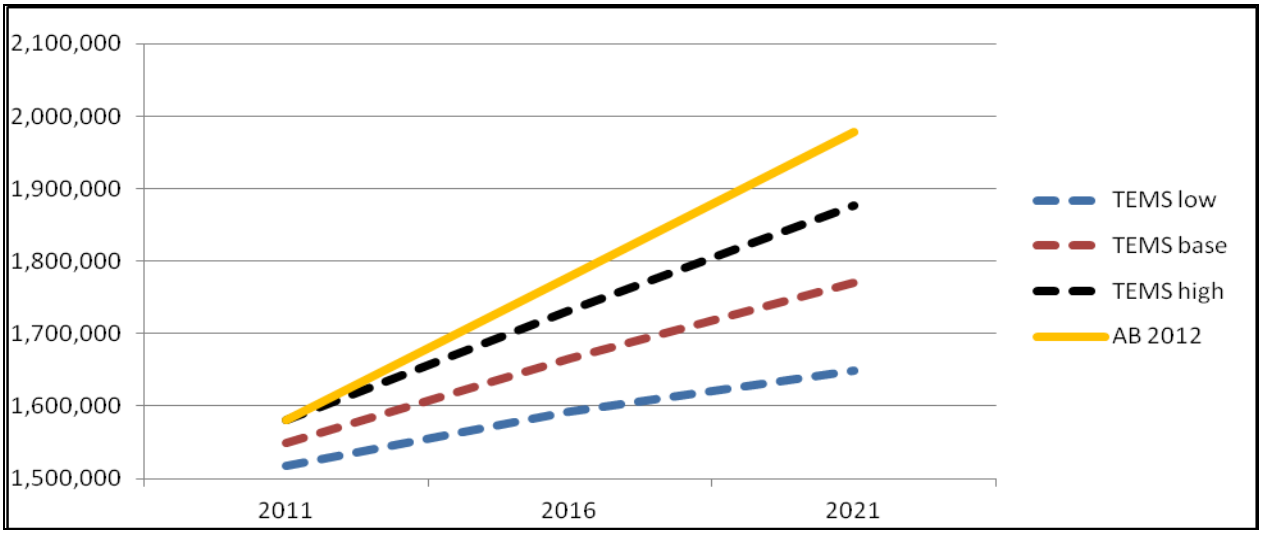
The TEMS model included three scenarios for population, employment and average household income growth at five year intervals between 2001 and 2051.

FIGURE 1 – CORRIDOR POPULATION PROJECTION COMPARISON



A comparison of current population projections by Alberta Treasury and Finance to those used in TEMS ridership forecasting reveals that population growth has and is expected to be stronger than previously anticipated. Figure 1 above shows that the current base population projection correlates closely to the TEMS high projection, whereas the current low population projection is in line with the TEMS base projection.

FIGURE 2 – CORRIDOR EMPLOYMENT PROJECTION COMPARISON[4]

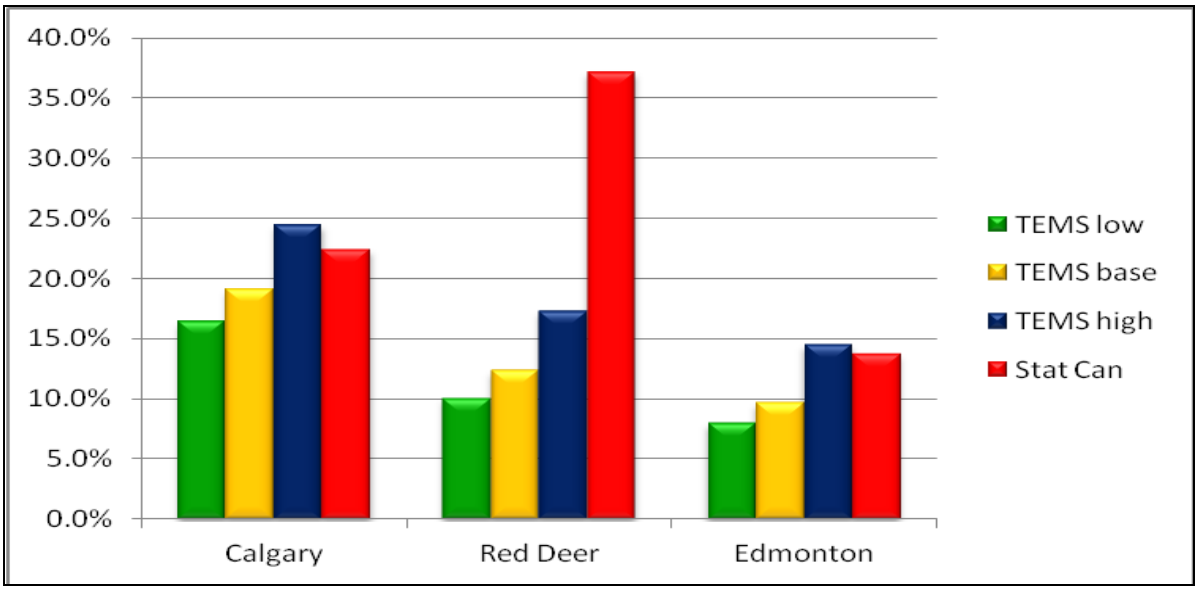


[4] Sources: AB 2012: 2011 actual employment – Stats Canada Labour Force Survey; Alberta Human Services, *Alberta's Occupational Demand and Supply Outlook 2011-2021*.

Figure 2 above compares the employment projections used by TEMS with the 2011 Statistics Canada employment estimate as well as projections derived from Alberta Treasury and Finance and Alberta Human Services. Unfortunately, the current projection only goes out as far as 2021 and does not provided a full range for the TEMS estimate period. Nevertheless, the comparison shows that employment in 2011 met the TEMS high forecast for this year and the current projection also shows a significantly higher employment growth trend than that assumed in the TEMS ridership forecast.

The third demographic factor used by TEMS was average household income. The source of this data and its form (eg., nominal or constant dollars and which year) are unclear. The only currently available data on income is that derived from Statistics Canada and this applies only to historic data to 2010. Alberta Treasury and Finance report that they do not forecast average household income. As a result, a comparison of the percentage growth in average household income between 2001 and 2011 as predicted by TEMS was compared to that reported by Statistics Canada from 2001 to 2010 as illustrated below in Figure 3.

FIGURE 3 – AVERAGE HOUSEHOLD INCOME % GROWTH 2001 TO 2010/11



This comparison shows significantly higher income growth than TEMS expected for Red Deer and income growth in both Calgary and Edmonton that is fairly comparable to the high estimate by TEMS.

Other Factors Affecting Demand

The two other factors that TEMS found had a significant impact on ridership growth were fuel cost and traffic congestion. The combination of high or low demographic growth, as well as fuel cost and traffic congestion increase was found to influence ridership demand by +45% to -30%.

Fuel Cost

The TEMS analysis included three scenarios for fuel cost based on the cost for West Texas Intermediate Crude (WTI) per barrel as well as the estimated per liter at the gas pump. The former were compared to the average cost reported by Alberta Treasury and Finance in the 2012 Fiscal Plan, whereas the latter were compared with the annual average gas price for Calgary reported by Natural Resources Canada.[5]

FIGURE 4 – WEST TEXAS INTERMEDIATE CRUDE COST PER BARREL

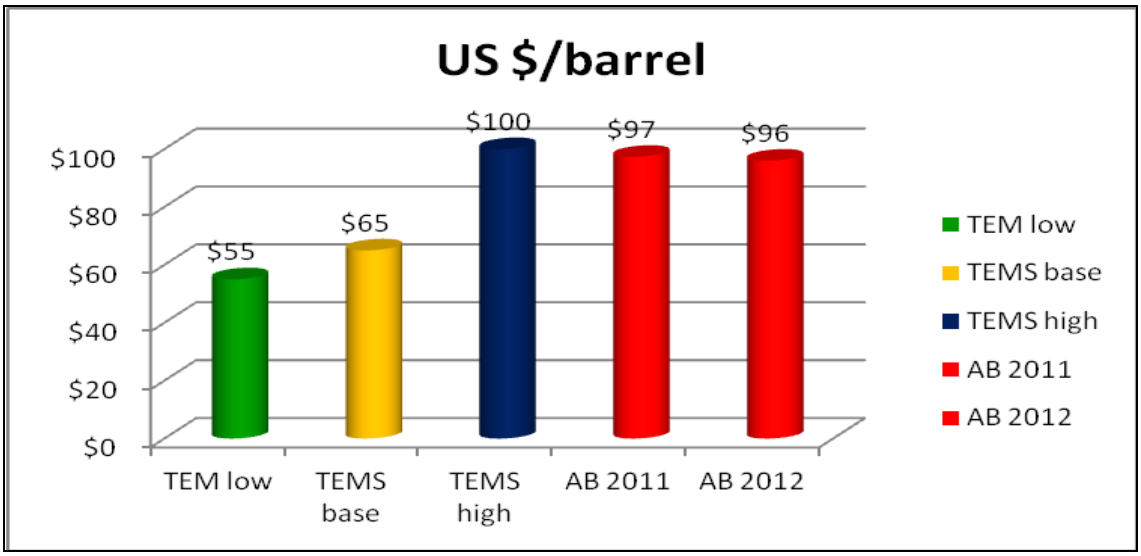
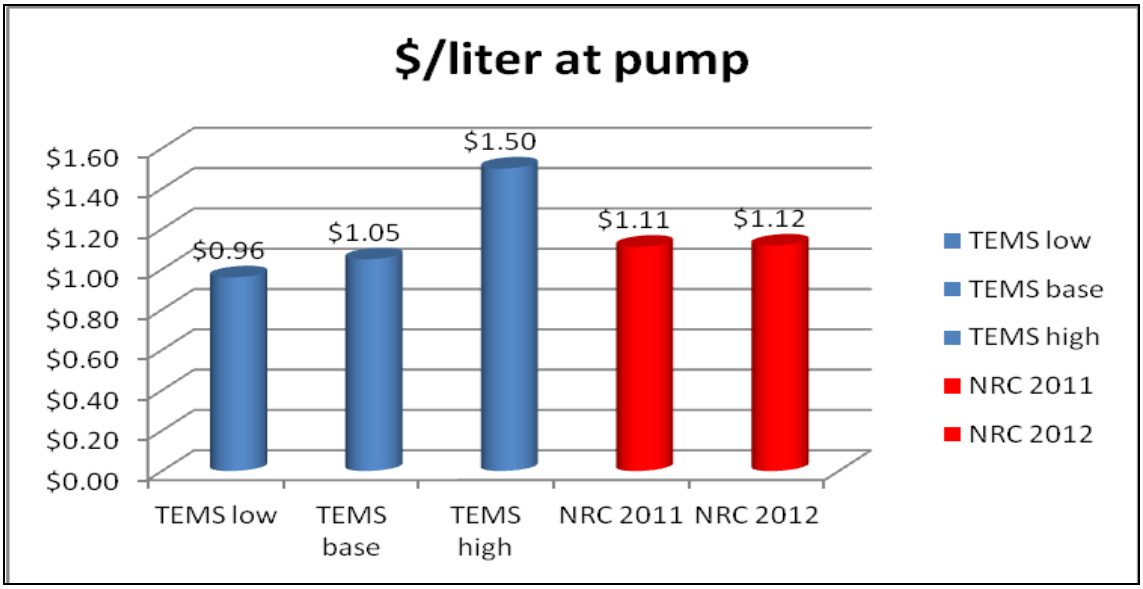


FIGURE 5 – GAS PUMP FUEL PRICE PER LITER



[5] Source: Natural Resources Canada, *2011 and 2012 Fuel Review*.

The comparisons indicate that recent fuel cost per barrel was nearer the TEMS high scenario. While average cost per liter at the gas pump was less than the high scenario level of $1.50 per liter, it was nevertheless slightly higher than the base scenario. Although fuel costs are subject to significant variability, current forecasts by Alberta Treasury and Finance and the US Energy Information Administration suggest that WTI per barrel cost will remain fairly stable for the next two years.

Traffic Congestion

The TEMS used three congestion growth rate assumptions for their simulations as follows:

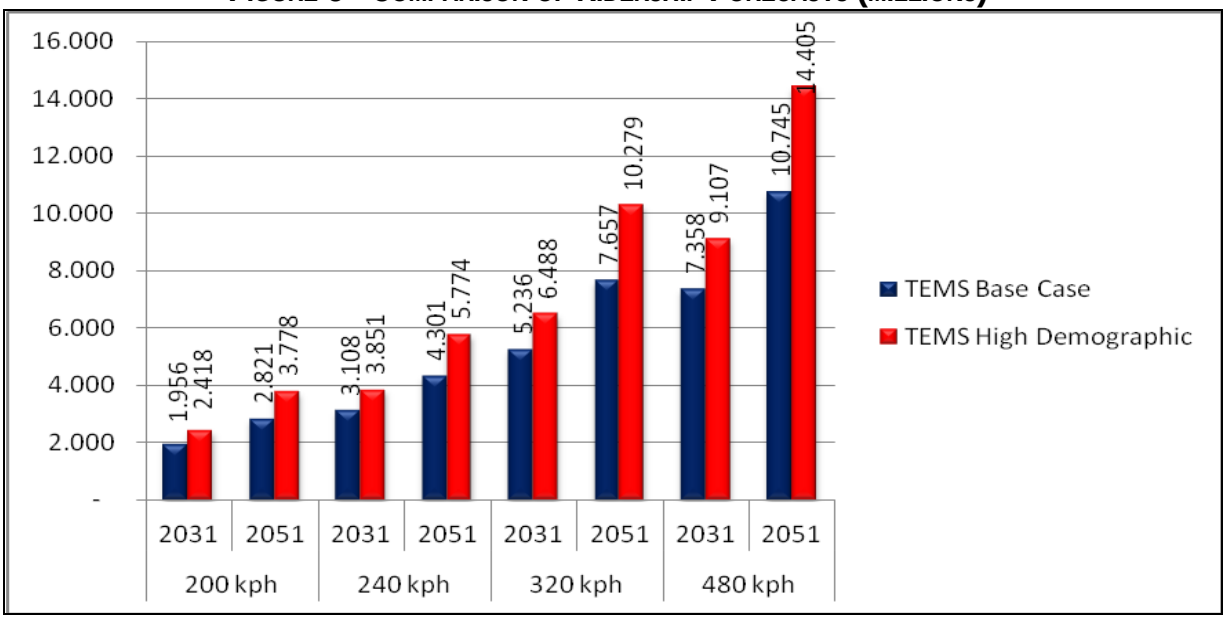
- Low Scenario – No change in travel time;
- Base Scenario –0.5% increase per year in travel time in urban areas; and,
- High Scenario – 1.0% increase per year in travel time in urban areas.

Although the simulation model is unavailable for this assignment, the scheduled time increase for bus and web based time for average car trip are both 5 minutes more than that assumed in the TEMS study. This increase equates to a 0.5% per annum increase in travel time that must be attributed to the urban areas that form part of the total trip and corresponds to the TEMS base scenario.

Ridership Estimate

Based on the update review of socio-economic and other factors influencing ridership in the TEMS model, the best fit is to the TEMS high demographic forecast without adjustment for fuel or traffic congestion.

FIGURE 6 - COMPARISON OF RIDERSHIP FORECASTS (MILLIONS)



Whereas the TEMS study certified the Base Case ridership estimate as the basis for future projections, the current update suggests that a higher estimate in line with TEMS high demographic forecast is more appropriate. This higher forecast is 24% to 34% higher than previously expected.

Revenue Estimate

The TEMS study proposed the following maximum one-way fares based on the stated preference travel surveys and service characteristics:

BASE CASE SERVICE & 2006 FARE CHARACTERISTICS

	200 kph	240 kph	320 kph	480 kph
Average travel time (h:min)	2:00	1:45	1:35	1:00
Frequency (round trips/day)	8	10	14	17
Fare (in cents per km)	$0.40	$0.56	$0.64	$0.96
Max. 1-way fare Calgary/Edmonton	$56	$80	$90	$120
Max. 1-way fare from Red Deer	$28	$40	$45	$60

The travel market between Calgary and Edmonton includes air service principally by Air Canada and WestJet, bus service offered by Greyhound and Red Arrow and car travel. The following table compares the service characteristics and fares of existing travel modes in the corridor in 2006 and 2012.

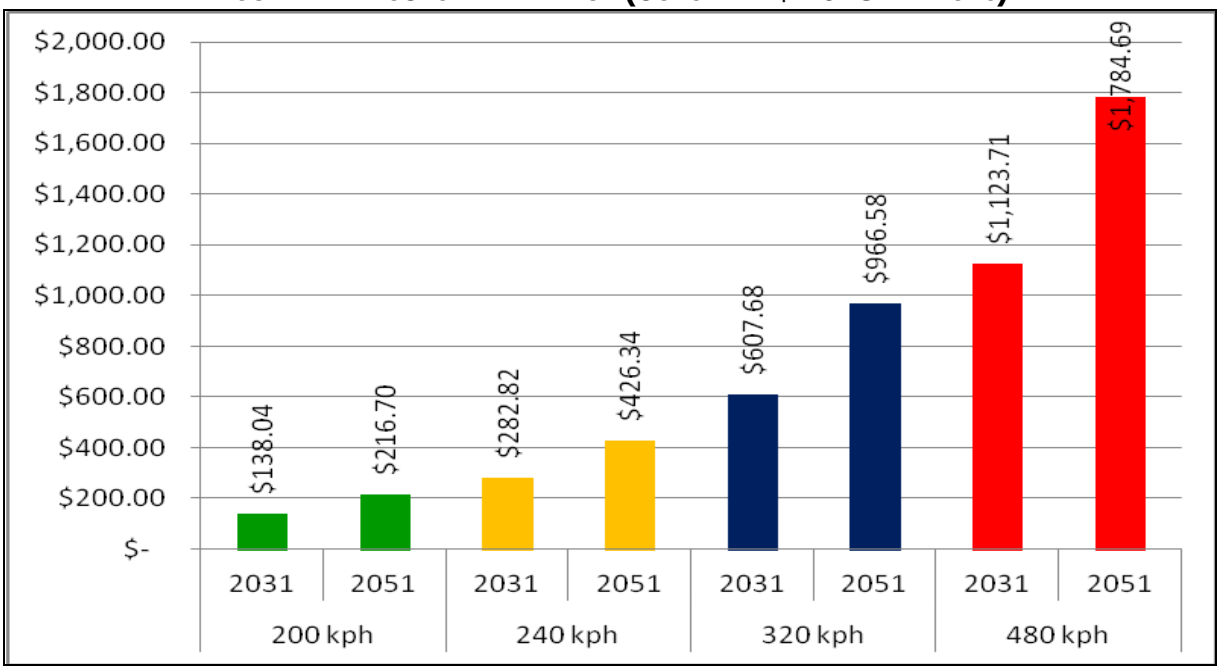
2006 VS 2012 TRAVEL MODE CHARACTERISTICS

	Avg. Travel Time (h:min)		Frequency (round trips/day)		Cost/Fare (cents/km)		Maximum 1-way Cost/Fare Calgary-Edmonton		Maximum 1-way Cost/Fare to/from Red Deer	
Year	2006	2012	2006	2012	2006	2012	2006	2012	2006	2012
Car[1]	3:00	3:05	N/A	N/A	$0.14	$0.15	$42	$45	$14	$22
Air	0:45	0:49	33	16-22	$1.01	$1.43	$300	$425	N/A	N/A
Greyhound	3:45	3:50	8	9-11	$0.16	$0.19	$48	$56	$33	$33
Red Arrow	3:15	3:20	6	6 - 8	$0.20	$0.24	$60	$71	$38	$47

1 - Car cost is based on operating costs only based on CAA annual average cost.

This comparison shows a small change in travel time (3% or 5 minutes for all modes) and more substantial changes in the travel cost ranging from 7% (car) to 42% (air) between Calgary and Edmonton. Assuming that HSR service and time travel characteristics remain the same and in the absence of updated stated preference surveys, revenue estimates were updated using the average fare derived from the TEMS base forecast updated to 2013 dollars using CPI and applying this new average fare amount to the revised ridership forecast.

FIGURE 7 – PROJECTED REVENUE (CONSTANT $ 2013 MILLIONS)



This results in a projected revenue forecast in 2031 that ranges from $138 to $1,124 million and from $217 to $1,785 million in 2051 depending on the technology used (i.e., train speed). In 2051, revenues are 58% higher than previously predicted. These estimates represent gross income in constant 2013 dollars.

Applying CPI to the TEMS fare structure used in their analysis, the following fares in 2013 dollars result and are compared to current maximum fares charged by the competing modes.

HSR FARES VS. CURRENT MAXIMUM FARE/COST BY MODE ($ 2013 MILLIONS)

	200 kph	240 kph	320 kph	480 kph	Air	Greyhound	Red Arrow	Car
Max. 1-way fare Calgary-Edmonton	$66	$94	$106	$142	$425	$56	$71	$45
Max. 1-way fare from Red Deer	$33	$47	$53	$71	N/A	$33	$47	$22

4. OPERATING COST UPDATE

Operating cost estimates in the VHI 2004 study were estimated by VIA Rail based on their current collective agreements and operating experience. At the time, it was acknowledged that, despite assumed crewing reductions for the Greenfield HSR operations based on train configuration for one engineer, other crewing numbers, work rule provisions, collective agreements and costs would apply. Furthermore, it

was noted that a "new company" operation would not be bound with similar restrictions and could both contract-out at minimum non-core functions and apply more economic and efficient work rules and compensation just as WestJet has compared to Air Canada in the provision of airline service.

With this caveat and for purpose of consistency, this update has applied appropriate increases based on the base VIA Rail model (ie., VIA wage rate increases). This is not to say that if operation of a new HSR service was put out to open competition that VIA Rail would necessarily quote its services on this basis as it could seek concessions from its unions to make its bid more competitive. Also, not all functions would necessarily be in-house or rail company-based at higher wage rates. For example, call centre, commissary, station maintenance, etc., could and would likely be contracted out at lower cost. In addition for conservatism, the 2004 VHI study assumed no cost recovery let alone profit for on-board products (ie., food and beverages) and this assumption remains the same in this update.

Both labour (VIA Rail) and fuel costs have increased more than inflation (CPI) by approximately 26% to 29% for labour (CAW and TCRC) and 87.9%[6] for diesel fuel. Electricity costs have increased by 4%. On board products (eg., food) were inflated by CPI and adjusted for TEMS high demographic ridership. Advertising and commissions were assumed also based on TEMS high demographic ridership pro-rated to 2013. The following table presents the update of operating costs based on the above assumptions.

ESTIMATED 2013 ANNUAL OPERATING COSTS ($ MILLIONS)

$ Millions (2013)	CPR	Greenfield Non-Electric	Greenfield Electric
Train Maintenance	$ 31.0	$ 36.7	$ 34.1
Track Maintenance	$ 3.2	$ 21.5	$ 25.7
Facility Maintenance	$ 4.4	$ 5.2	$ 5.1
Total Maintenance Costs	**$ 38.6**	**$ 63.4**	**$ 64.9**
Fuel/Electricity	$ 15.7	$ 16.8	$ 5.5
Train Crew	$ 5.7	$ 2.8	$ 2.2
On-Board services & product	$ 10.7	$ 14.4	$ 18.7
Stations services	$ 3.1	$ 3.9	$ 3.9
Commissary & call centre	$ 2.3	$ 3.3	$ 4.5
Training	$ 1.0	$ 1.0	$ 1.0
Insurance	$ 2.9	$ 5.1	$ 5.1
Ads & Commissions	$ 8.3	$ 8.3	$ 16.8
Total Operating Costs	**$ 49.5**	**$ 55.6**	**$ 57.6**
Admin & Other	$ 2.6	$ 3.6	$ 3.7
TOTAL O & M Costs	**$ 90.8**	**$ 122.6**	**$ 126.2**
Contingency 2%	$ 1.8	$ 2.5	$ 2.5
TOTAL w/ Contingency	**$ 92.6**	**$ 125.1**	**$ 128.7**

[6] Canadian average increase per litre from 2003 to 2010 derived from the Railway Association of Canada.

Not surprisingly, the cost per train mile estimated above is very comparable between VIA Rail's 2012 average of $95.06 and the Greenfield non-electric option calculated as $95.26. The estimated operating and maintenance cost per seat-km for the Greenfield Electric option ($0.10) also compares favourably with the low range for European HSR systems ($0.15).[7] Again, this is not surprising given the corridor's favourable geography, limited number of stations and operation size.

5. OTHER CONSIDERATIONS

The foregoing cost estimates, while based on work that is several years old and updated using a number of assumptions, nevertheless, appear to be reasonably comparable to existing European HSR construction and operation costs. However, there is no question that both capital and operating costs can be reduced from these estimates.

Cost Savings in HSR Train Options

Although Acela, the electric version of the *Jet*Train, continues to successfully operate in the US Northeast, the diesel version that was studied in the 2004 VHI study has effectively been mothballed. While Bombardier might be persuaded to reactivate the *Jet*Train, there is greater opportunity for supply competition in pursuing an electric HSR option.

Although infrastructure costs would be higher ($1.3 billion) for the Greenfield Electric option, this cost differential could be reduced if North American structural adaption of trains could be avoided (saving of $150 million)[8] and a tag-on order to another system's acquisition contract could be secured. European lighter weight trains would also allow higher speed option to be pursued with commensurately higher ridership and revenue potential as well as lower operating and maintenance costs due to less track wear and energy cost savings.

Potential Capital Cost Savings

In the case of capital cost estimates, the Greenfield options already embed land cost savings by using the CPR corridor approaches into Calgary and Edmonton. The CPR option illustrates potential costs savings through common freight and passenger rail use of a single corridor throughout. However, these savings result in trade-offs in terms of added cost to adapt trains to North American Standards, higher operating costs due to increased train weight, reduced operating speed in mixed operation as well as higher track maintenance costs. Regardless, some form of shared right-of-way or partnership agreement with CP Rail could be advantageous both in terms of right-of-way land requirements and capital costs.

[7] 2002 data for European HSR systems was derived from Global Mass Transit Report and updated to 2013 values.

[8] This presumes that the HSR service is a stand-alone operation that would not involve mixing or transitions with freight or standard North American train operations.

Partnerships with developers and public land owners, such as the Calgary International Airport Authority, in station development as well as commercial retailers in the construction and operation of stations, also offer opportunities to defray up to $39.1 million in estimated capital costs and $3.9 million in estimated annual operating costs. Furthermore, public land acquisition of the right-of-way would enable power of expropriation as well as permanent public ownership of the right-of-way that could result in a small reduction (the up to $82 million) in capital cost as well as interest costs on this expense (ie., 3% versus 5% would result in up to $1.2 million in interest cost savings over 30 years).

The advantages and disadvantages of each of these alternatives needs to be weighed in the context of the pros and cons of financial structure options for the project, expectations of investors and tax, time and other complications they bring.

Potential Operating Cost Savings

Operating costs can also be reduced through partnerships in station operation and competitive out-sourcing of train operation and maintenance functions. The formation of a new stand-alone company for HSR delivery, whether a shell corporation responsible for finance, policy, service design and planning, and marketing with multiple contracts for various service delivery functions to competitively contracted suppliers (eg., Nike corporation) or a more integrated service delivery company also affords a variety of cost and other economic advantages and disadvantages.

Ridership and Revenue Risk

Like most HSR rail projects, the highest financial risk is the ridership and revenue projection. With a commodity that has no precedence within a market prior to its introduction, this is difficult to predict, as prospective users of the service have no realistic concept of its utility, benefits and application to their current or prospective travel behaviour. It also typically takes a couple of years to develop a stable market as potential users of the system try the new service and transition from their previous travel habits.

Even in 2008/09 when the TEMS study was completed, ridership and revenue estimates were speculative, albeit based on extensive market research and modelling. However, apart from the demographic and other changes that have occurred, there have been other subsequent shifts in the travel market. This includes off-loading of "optional costs" in airline fares, such as baggage, seat selection, food and amenities that add to the actual cost of travel but are not included in published fares nor taken into account in this update. Not surprisingly, there appears to have been a decline in Calgary-Edmonton air passengers compared to 2004 (461,000[9] in 2012 compared to 600,000 in 2004) for

[9] Source: Edmonton Airport Authority

all these reasons that suggests a larger proportion of the total travel market between Calgary-Edmonton has shifted to cars, no doubt due to a lack of other desirable choices.

Regardless of the shifts that have occurred, "willingness to pay" is another issue. It appears from changes in the air travel market that this has not increased, while the cost of car travel has remained relatively the same and the increase in bus cost is lower than inflation. Another previously unconsidered factor is shifting lifestyles that favour HSR's attributes. In various cities across North America, declining car ownership and driver's licenses among young adults[10] is being observed with a positive shift to urban transit and growing use of alternatives such as "Car2Go" and other transport services. This combined with higher than expected population and income growth within the Calgary-Edmonton corridor bode well for HSR potential.

Additional Revenue Opportunities

The 2004 study and the current update purposely excluded any revenues from any source other than fares. This was done to ensure a conservative estimate. However, there is potential to generate other revenues from food and beverage services, newspaper, magazine and confectionary sales, advertising, merchandising of logo wear and products, parking and courier contracts. As an example, meal and concession sales equal 6% of passenger fare revenue system-wide[11] on BC Ferries, where most trips are less than one and half hours.

Financial Cost Savings

The 2004 HSR Feasibility Study examined two structural options to finance HSR construction and operation; an entirely publicly financed option and a shared public-private financing option over a 30-year period. For publicly funded debt, a rate of 5.2%[12] was assumed. For private financing, an interest rate of 7.2% was assumed for debt service and 13% for return on equity.

Under the publicly funded option, the 2004 financial analysis indicated that operating costs would be fully covered from year 1 and sufficient surplus revenue is generated to pay back debt and interest on the capital investment in 25 years for the CPR option and 36 years for the Greenfield Electric option. With a shared public-private finance option, operating costs are fully covered by the private sector and sufficient revenue is generated to pay back 34% to 66% of the total initial capital investment over 30 years.[13]

[10] For example, in Metro Vancouver, 50% and 80% of persons age 16 to 19 and 20 to 29 respectively had drivers' licenses in 2011 compared to 60% and 90% in 1999.
[11] BC Ferries Corporation, 2012-13 Annual Report.
[12] This was then the 30-year Government of Canada bond rate.
[13] This includes repayment of all of the private sector debt and recovery of 23% to 55% of the public debt through rental and tax payments.

As current interest rates and expected return on equity are at least 2% lower, savings in financing costs can be expected that would either reduce the pay-back period of the initial investment or lower required debt payment costs over the term of the investment. In addition, it has become more common for public investments in fixed infrastructure (eg., rapid transit lines) to seek debt repayment over longer periods than 30 years in keeping with their actual effective life[14], which improves the affordability and potential attractiveness of these projects for private investors

Financial modelling to take into account the previous or alternative HSR funding structures using the updated capital, operating and revenue estimates, taxation, depreciation and other factors was beyond the scope of this assignment. However, if one assumes the same annual debt payment required to pay-back an investment over 30 years, the 2% lower interest/return on equity could shave approximately 10 years from the pay-back period.[15]

6. CONCLUSIONS

The foregoing analysis indicates a 35% increase in capital costs and a 23% to 33% increase in operating costs compared to the 2004 study. However, these estimates do not take into account various opportunities to lower these cost as outlined in this report.

Ridership based on the TEMS high demographic scenario, which is more in keeping with actual growth over the past 5 to 6 years, results in revenues that are 58% higher than those previously predicted by 2051. Furthermore, additional revenues from other sources have not been estimated and included.

Finally, as interest rates are lower than those assumed in the 2004 study, the project can benefit either from lower debt service payments over a longer term of repayment or a reduced pay-back period regardless of the financing structure chosen for HSR.

[14] As examples, the P3 contract with InTransit BC, Vancouver's Canada Line constructor and operator is for a 35 year concession period. Amortization of debt for the Expo Rapid Transit lien was modified from 30 to 40 years. The effective life for rail infrastructure is considered to be 50 years.

[15] Calculation was based on 30 year repayment period of nominal debt only.