

CPCS Economic Impact Assessment Review for City of Ottawa

August 2011

1.1 Increase in Property Values

It is well known that a new public transit project can affect property values along the alignment. Values generally rise in proximity to stations, reflecting the improved, more accessible, character of the property.

In Ottawa, however, the presence of an existing BRT system could somewhat reduce the incremental uplift resulting from LRT. LRT will also tend to extend the benefit area around stations, according to the Metrolinx study on property values, from 400m to 600m. However, while properties nearest to new stations experience the most uplift, those generally within easy walking distance (which tends to be a 10 to 15 minute walk, or about 1.2 kilometres) also experience increases in demand and, consequently, value.

Industrial properties tend to benefit less, as accessibility is not generally as important a factor in determining property value. Further, industrial properties are not usually designed with pedestrian accessibility in mind and are thus less accessible, despite being near LRT stations, than adjacent non-industrial properties. Vacant land tends to experience greater uplift, reflecting the ease and lower cost of developing such property instead of redeveloping built-up properties.

1.1.1 Work to Date

In 2005, the City completed a study entitled *Strategic Assessment: North-South Light Rail Value Uplift and Capture* (Value-Uplift Study). This study examined development opportunities within a 400m radius around the (then) 15 stations proposed for the North-South LRT project. It estimated that the impact area would receive 5.3% of the city's annual 1 million square metres of new development, and that this share would increase by 20%, to around 6.4% with the presence of LRT. The estimated value of all properties in the impact area was \$4.8 billion, with \$1.7 billion in development likely in the Base Case (no LRT) and an additional \$766 million likely with an LRT. These figures are all presented over a 15-year analysis period. The study also noted that the city could potentially capture between \$80 million and \$125 million of this development through a combination of property tax surcharges, development charge premia, and direct participation in the projects as a partner, where appropriate and feasible.

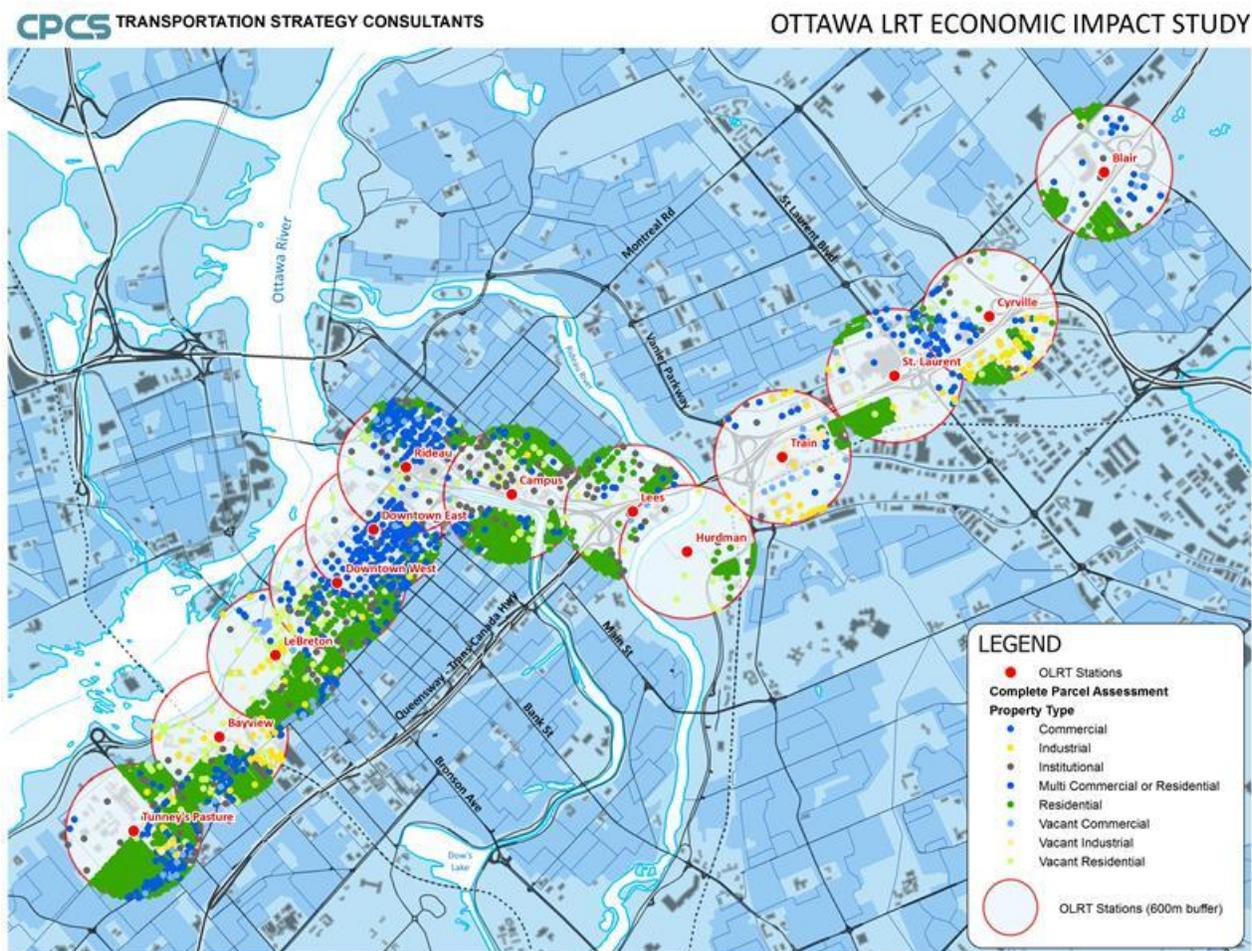
1.1.2 Approach

We propose an updated macro approach to complement the findings of the Value-Uplift Study. This approach involves a fairly straightforward application of property value uplift to all properties within 600m of an LRT station. Using the latest City of Ottawa property assessment values and tax rates, as well as the composition of the areas surrounding the planned LRT stations, we can estimate the total likely property value growth and potential tax revenue creation resulting from LRT station development, based on the experience in comparable cities/projects.

1.1.3 Area Assessment

An area of 12.7 million square metres falls within 600 metres of the planned OLRT stations and contains an estimated 14,727 separate properties. Figure 1-1 illustrates the distribution of properties, by type, around the stations. Notably, and predictably, commercial properties are largely concentrated in the downtown core with additions in Tunney's Pasture and around the St. Laurent shopping complex. Industrial properties are clustered chiefly around the Bayview, LeBreton, Train and Cyrville stations. Residential properties, for their part, are scattered throughout the area.

Figure 1-1: Land-Use Near Planned OLRT Stations



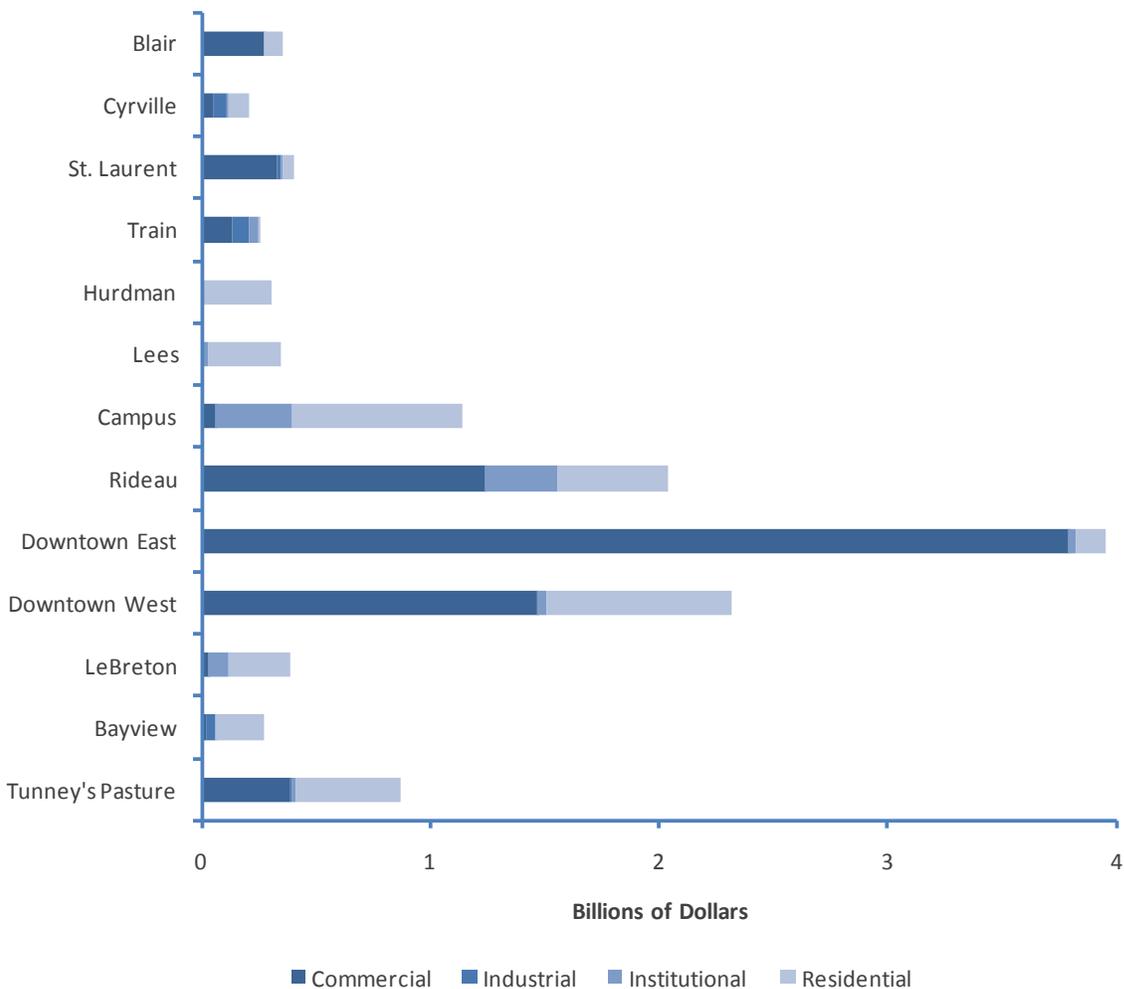
Currently, the land-use mix in the areas adjacent to the planned LRT route is dominated by Commercial properties (61% of the property values¹), with Residential (31%), Industrial (1%), and Institutional² (7%) properties making up the rest of the value. This breakdown, along with

¹ Based on City of Ottawa property tax assessment value data.

² For the purpose of this analysis, Institutional properties are considered those used for public purposes (parks, Parliament, museums, community centres, public transportation facilities, sports complexes, schools, places of worship, etc).

the data from Figure 1-2, shows that there is currently a heavy concentration of Commercial properties in Ottawa’s downtown, especially near to the planned Downtown East station. This suggests that there is a great deal of demand for Commercial in Ottawa’s downtown. By making travel between stations quick and effortless, the LRT would likely boost demand for Commercial space outside of downtown.

Figure 1-2: Assessed Property Values by Current Use and Closest Planned OLRT Station



1.1.4 Uplift Estimates

Using the Metrolinx estimates of property uplift ranges in response to grade-separated LRT stations for low and high values blended with international benchmarks to provide a medium range estimate, and using Ottawa’s current Commercial/Residential/Industrial/Institutional mix, Figure 1-3 illustrates the most likely range of property uplift as a result of the OLRT project. While the existing BRT could potentially moderate uplift values, this is unlikely to play a major role both due to the limited uplift potential of BRT, in terms of percentage, and its more limited impact range of 400 metres from BRT terminals.

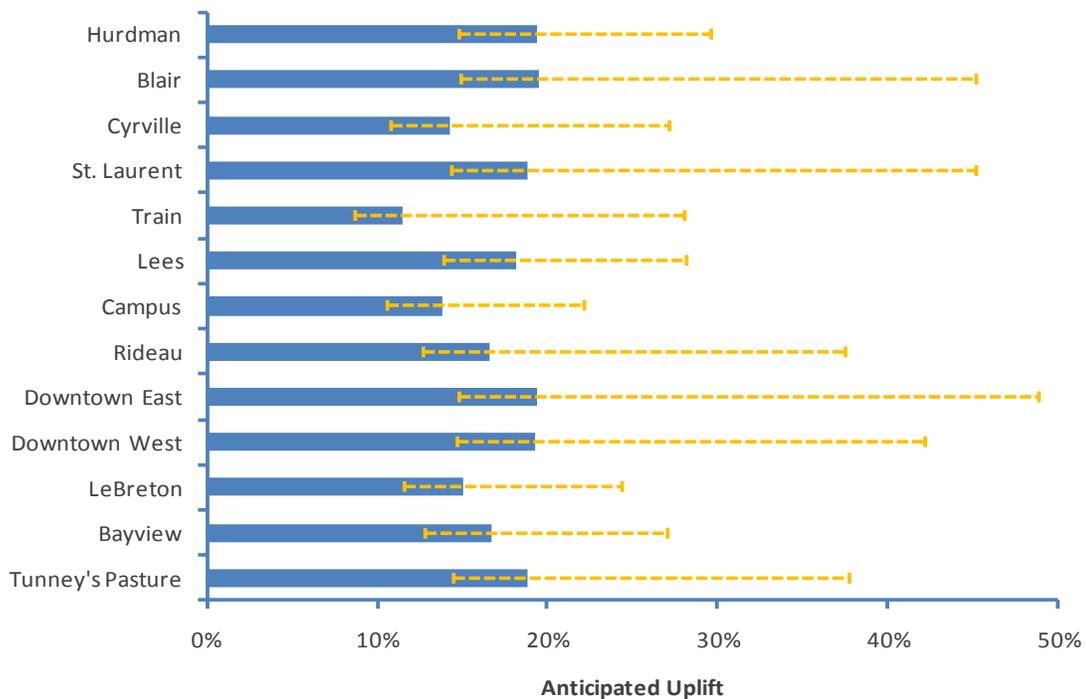
Figure 1-3: Estimated OLRT Uplift Rates by Property Type

Property Type	Low	Medium	High
Residential	15.0%	19.6%	30.0%
Commercial	15.0%	19.6%	50.0%
Industrial	1.0%	1.5%	2.0%

Given the above rates and Ottawa’s current geographic mix of properties,

Figure 1-4 illustrates the likely boost that each OLRT station’s surrounding area will experience³ in the Low, Medium, and High rate scenarios. The area that is likely to see the highest uplift is the Commercial-laden downtown core due to the high potential uplift rates seen on Commercial properties. This is mirrored in other areas which have large amounts of Commercial space present as a percentage of their current property value mix. Areas with little Commercial space, on the other hand, have a more moderate, though still substantial, uplift perspective.

Figure 1-4: Predicted Percentage Land Value Uplift by Nearest Planned OLRT Station

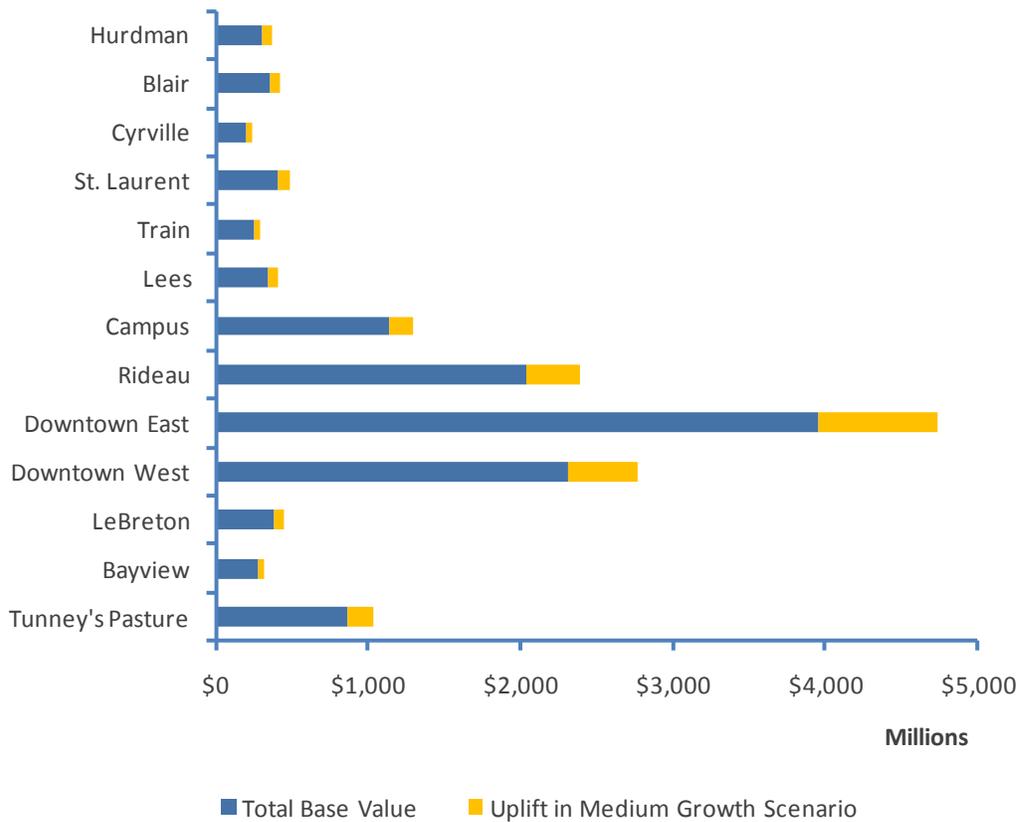


Blue bars represent Average Price Growth Scenario while error bars represent Low and High Price Growth Scenarios, respectively.

³ This analysis assumes no re-zoning or other significant change in current land-use patterns.

On the low uplift side, the area around the Train station, given its current mix of Commercial and Industrial use leaves it with the lowest perspectives in the Medium growth scenario, but nonetheless gives it respectable potential in the High growth scenario. LeBreton and Bayview, meanwhile, with a predominantly Residential and Industrial makeup, have respectable Medium scenario uplift, but a lower High scenario potential (due to the lack of growth potential represented by Commercial properties). Lastly, Campus, which contains a large number of Institutional and Residential properties, is limited in growth potential as Institutional properties were not considered to have uplift potential for the purposes of this analysis⁴. The total anticipated uplift, by nearest OLRT station, is shown in Figure 1-5.

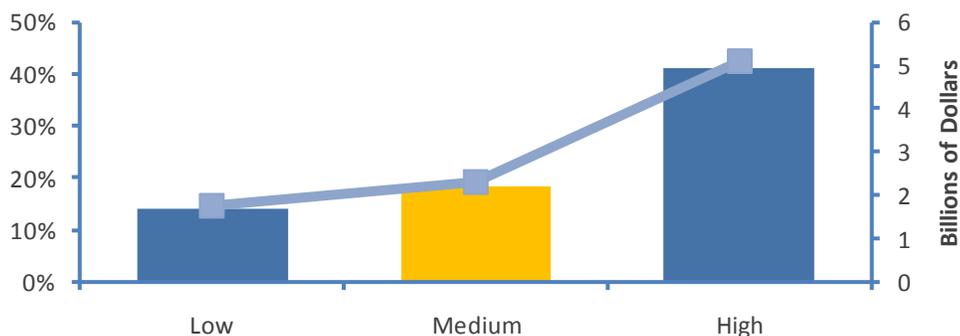
Figure 1-5: Predicted Total Land Value Uplift by Nearest Planned OLRT Station



Overall, as illustrated in Figure 1-6, the aggregate land value uplifts resulting from the OLRT are estimated to be 18.2%, using the medium scenario, corresponding to property value growth equivalent to \$2.3 billion.

⁴ Institutional lands and properties would certainly experience land value uplift and could, potentially, provide income to their respective owners in future years through sale or lease.

Figure 1-6: Total Estimated Land Value Uplift Resulting from the OLRT (Low, Medium, High Scenarios)



These uplift estimates would suggest that Ottawa's uplift, under the Medium growth scenario, would position it well within the ranges predicted and observed resulting from the comparable LRT projects analysed. Figure 1-8 illustrates Ottawa's standing and suggests that the likely property value uplift would be higher than the average 18.2% anticipated in the Medium growth scenario.

1.1.5 New Developments

There are currently a number of undeveloped lands which will fall within close proximity to the OLRT stations. The lands around Bayview, LeBreton, Lees and Hurdman have land which could serve as greenfield projects for current or perspective owners, including the City. Lees station, for example, would provide access to land which the University of Ottawa has expressed interest in developing. Other stations, such as Train, Cyrville and Blair currently border shopping complexes which have large parking lots. These lands could either serve as development land or act as a revenue source as future park-and-ride facilities.

Additionally, while some of the vacant land which surrounds the OLRT stations is currently listed as contaminated and may not be suitable for development, investment in cleanup and decontamination could render these lands viable for potential development. However, given the lack of detailed environmental assessments, it would be premature to attempt to calculate potential values of such developments as substantial funds may need to be invested by current owners or the City itself to make the land viable for development or attractive for investment. Thus, while there is a high amount of potential for these lands, there is also a great degree of uncertainty as to their prospects and detailed Environmental Assessments, in some cases already under way, would need to be concluded to calculate potential value uplift at a later time. The redevelopment of some of these lands would also be eligible for funding under the City's Brownfield Redevelopment Community Improvement Program.

1.1.6 Comparison to Other Cities

The impact of LRT on property values is among the most commonly explored economic impacts. The Metrolinx summary table reproduced as Figure 1-7 provides a range of impacts that this study believes are reasonable for Ottawa as well. For a grade-separated LRT, such as the OLRT, Metrolinx has estimated that property within a radius of 600m around each station will be affected. The impact varies by type of property:

- Residential: 15-30%
- Retail: 10-50%
- Office: 15-50%
- Industrial: 1-2%

Figure 1-7: Metrolinx Summary of Property Uplift of Various Transit Systems

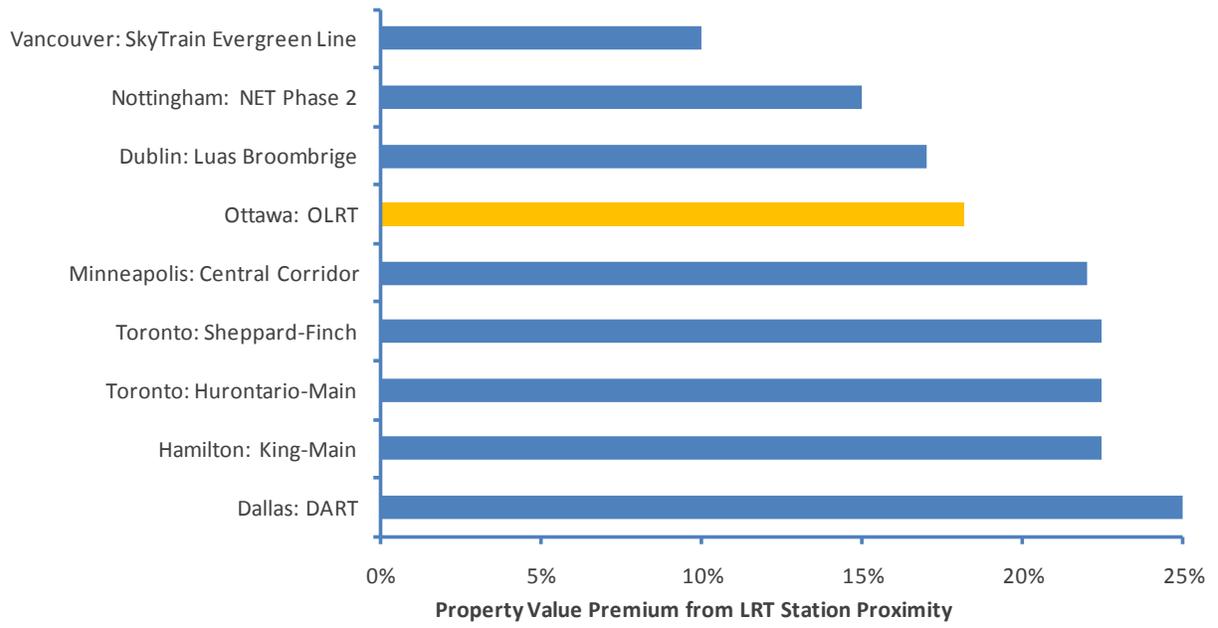
Technology		Bus	BRT	LRT: at-grade	LRT: grade separated	Subway	GO Rail
Station Impact Area (m)		100	400	500	600	800	800
Zoning		Premium %					
Residential	Low	1%	2%	10%	15%	20%	20%
	High	2%	4%	25%	30%	50%	50%
Office	Low	1%	2%	10%	15%	20%	20%
	High	2%	4%	50%	50%	50%	50%
Retail	Low	1%	1%	10%	10%	7%	7%
	High	2%	2%	50%	50%	15%	15%
Industrial	Low	0%	0%	1%	1%	5%	5%
	High	1%	2%	2%	2%	5%	5%

Source: Metrolinx, Sheppard Finch Rapid Transit Benefits Case, June 2009.

These findings were supported by the findings of the analyses carried out on the DART LRT network. These found consistent residential, commercial and retail property value appreciation that was considerably above the metropolitan averages. Lastly, it was also observed that vacant land would experience greater appreciation than occupied land as its potential for development allowed it to be considered for flexible use rather than for existing uses.

Lastly, the Ottawa Medium value growth scenario estimate of 18.2% places Ottawa squarely in the middle of the pack vis-à-vis comparable cities, as illustrated in Figure 1-8.

Figure 1-8: Property Value Uplift from Proximate LRT Stations



Appendix B: Comparable LRT Systems Statistics and Impacts

Dublin: Luas Broombridge LRT

Dublin: LUAS Broombridge LRT		 <p>Source: Railway Procurement Agency</p>
City GDP per Capita	44,300	
City Population	500k (city), 1,700k (metro)	
Length	6 km	
Number of Stations	13	
Power	750V DC overhead traction	
Train Length	40 metres (up to 53 m)	
Headway	3 min	
Underground Characteristics	None	
Projected Ridership	5,000 ppdph (up to 8,700 ppdph)	
Estimated construction cost	Not yet disclosed	
Opening years	2016	

The Luas Broombridge (line BXD) expansion is slated to be Dublin's next foray into light rail and will expand on its two existing lines. As part of Ireland's multi-billion euro *Transportation 21* initiative, the Broombridge project plays a key role in the development of Dublin's public transportation infrastructure.

Type of Impact	Findings
Production Impacts	
Direct Impacts	€250 million in construction costs (€EUR2002) (estimated, but not disclosed publicly)
Indirect Impacts	A total of 1,592 person-years of employment will be used in the construction of the BXD line. In addition to providing an economic boost, this will help reduce a currently high unemployment rate in local construction industry in Ireland.
Induced Impacts	A total of 2,700 indirect jobs resulting from supply-chain linkages and salary expenditure are expected.
Consumer Impacts	
Time Savings	The BXD line is expected to provide easier access to central employment locations and reduced journey times for workers. It will serve as a quicker means to travel than car or bus and will allow passengers to enjoy a single direct service (as opposed to mode-switching).
Cost Savings	Not assessed.
Comfort	Not assessed.
Property Values	Not assessed.
Retail Spending	Expansion of retail activity, as measured by an increased footfall ⁵ of up to 22% (based on previous Luas line data) will create vibrancy, and employment in retail/associated industries along the planned BXD route. This is not expected to negatively impact retailers outside of catchment area and is expected to create, rather than divert,

⁵ The number of people visiting a shop or a chain of shops in a period of time is called footfall (also foot traffic).

	spending.
Fiscal Impacts	Information not publicly disclosed, but operational revenues are predicted to “generate sufficient revenues to cover incremental operating costs” and that “operating surpluses should be sufficient to cover the renewal costs of the infrastructure over a 30-year operating timescale”. Demand would be required to fall by 22% below forecast over the lifetime of the project for this projection to fail.
Other Economic Impacts	
Business Attraction	The project is seen as a catalyst for urban regeneration and brownfield projects.
Tourism	Of Ireland’s top 20 national attractions, seven are located along the BXD line corridor. As city visitors prefer light rail rather than bus due to its greater ease of navigation and locational certainty with stops, the BXD line will help boost site visitation and ease of access. However, there will be some impact on tourism during construction due to noise and statutory/monument preservation measures.
Environmental Benefits	The line is expected to reduce the number of car trips by three million per annum.
Other	10 million additional passenger boardings to the Luas network will be incurred every year. However, this will partly be at the expense of other public transportation modes (bus, heavy rail, metro). The BXD project has an estimated benefit-cost ratio of 2.46 and an IRR of 12.6% with a total benefits NPV of €512m.

Hamilton: King-Main LRT

Hamilton: King-Main LRT	
City GDP per Capita	\$ 38,200
City Population	500k (city), 700k (metro)
Length	14 km
Number of Stations	17
Train Length	1-2 vehicles
Headway	2-4 min
Projected Ridership	1,950 (1 vehicle) / 3,900 (2 vehicles) per hr per direction peak period
Estimated construction cost	\$829 million (C\$2008)
Opening years	2015

Source: City of Hamilton

The King-Main LRT is one option recently studied by Metrolinx for improving transit service through the centre of Hamilton. There is currently a BRT-lite system connecting Eastgate Square in the east via downtown Hamilton to University Plaza west of McMaster University. This is the transit corridor in Hamilton with the highest ridership, with almost 850,000 passenger trips in 2008.

The base case for this assessment is articulated buses running in mixed traffic with no priority signals. The LRT option studied would provide a 14.2-km line with 17 stations. LRT would operate in the median of King Street. The economic impact of the LRT option was assessed relative to the base case.

Unless otherwise noted, all information is drawn from the Metrolinx Benefits Case and all dollar-figures are 2008 Canadian Dollars.

Type of Impact	Findings
Production Impacts	
Direct Impacts	<p>Construction: Estimated creation of 3,729 person-years of employment, \$129.6 million in wages and salaries, and \$313.8 million in GDP.</p> <p>O&M: 2021: Annual impact of 81 jobs, \$2.8 million in wages and salaries, \$6.9 million in GDP. 2031: Annual impact of 132 jobs, \$4.6 million in wages and salaries, \$11.2 million in GDP.</p>
Indirect Impacts	<p>Construction: Estimated creation of 2,064 person-years of employment, \$71.7 million in wages and salaries, and \$173.7 million in GDP.</p> <p>O&M: 2021: Annual impact of 35 jobs, \$1.2 million in wages and salaries, \$2.9 million in GDP. 2031: Annual impact of 55 jobs, \$1.9 million in wages and salaries, \$4.6 million in GDP.</p>
Induced Impacts	Not assessed.
Consumer Impacts	
Time Savings	Calculated for both transit and non-transit users. The value of time is estimated at \$647 million over the 2009-2038 period based on an average of \$13 per hour and growth in real terms by 1.6% per year over the period.
Cost Savings	<p>Estimated reductions in automobile-km travelled are 17 million in 2021 and 42 million in 2031. Corresponding automobile operating cost savings are estimated at \$187 million in present value terms over the period 2009-2038.</p> <p>Safety benefits from accident reduction are estimated at \$18 million in present value terms over the period 2009-2038. This estimate is based on a reduction in vehicle-km travelled and an accident cost reduction rate of \$0.07/vehicle-km travelled.</p>
Comfort	Not separately assessed.
Property Values	<p>Value uplift for properties within 500m of a station. Vacant residential properties within the catchment area would experience an increase in property value of 4-6%; Vacant commercial properties would experience an increase in value of 8-14%.</p> <p>The study estimated land value uplift in the middle of the ranges above: within the catchment area, "the average uplift is between 1.5% and 3.2%. It is estimated that the potential uplift in assessment value as a result ... may result in between \$50 million to \$144 million." [9, p. 44]</p>
Retail Spending	Largely included in long-term vehicle cost savings that are re-directed to other consumption.
Fiscal Impacts	Not assessed.
Other Economic Impacts	
Business Attraction	Transportation cost savings to area businesses captured in ongoing direct and indirect production impacts.
Tourism	Not separately assessed.
Environmental Benefits	With an estimated decline in automobile usage, the resulting reductions in CO ₂ emissions are 3,450 tonnes in 2021 and 8,500 tonnes in 2031. The present value of the reduction in CO ₂ emissions over the period 2009-2038, based on an average value of \$0.01 per km is estimated at \$2.6 million.

Other Impacts	Annual incremental (to base case) operating costs in 2031: \$12.5 million (C\$2008), for a total incremental operating cost of \$129 million over 2009-2038 NPV (C\$2008). NPV of capital costs is \$655 million (C\$2008). Projected incremental fare revenue of \$15.6 million. The benefit-cost ratio is 1.1.
---------------	---

The Metrolinx Benefits Case included two sensitivity analyses. One examined the sensitivity of some benefits to changing the LRT route to connect with the Hunter Street GO Station. Doing so would decrease the present value of travel time savings to \$367 million from \$647 million, of automobile cost savings to \$156 million from \$187 million, and of safety benefits to \$5 million from \$18 million.

Second, the benefits case assessed the sensitivity of the net present value (NPV) of the benefits to three different discount rates, 3%, 5%, and 7%. Under these rates respectively the NPV of the benefits of the project were \$338 million (1.4 BCR), \$69 million (1.1 BCR), and -\$91 million (0.9 BCR).

Minneapolis: Central Corridor LRT

Minneapolis: Central Corridor LRT	
City GDP per Capita	\$ 54,600
City Population	400k (city), 3,300 (metro)
Length	18 km
Number of Stations	15 (+5 existing to be incorporated)
Power	Electric
Train Length	3-car
Headway	7.5-min peak / 10-min off-peak
Projected Ridership	40,000 per weekday by 2030
Estimated construction cost	\$957 million (\$US2010)



Source: Twin Cities Metropolitan Council

The Central Corridor LRT project is an 18-km line covering downtown Minneapolis and St. Paul. It is currently under construction. When complete it will have 23 stations and an estimated average weekday ridership of 41,690 by 2030. It is scheduled to open in 2014. The estimated cost of construction is \$957 million (\$US2010). In the Final Economic Impact Statement (FEIS), economic effects were measured for the Minneapolis-St. Paul-Bloomington Metropolitan Statistical Area (MSA).

Type of Impact	Findings
Production Impacts	
Direct Impacts	Construction: Output impact of \$861 million. Earnings (wages and salaries) impact of \$285 million. 7,075 person-years of employment. Dollars are measures in the year of expenditure. O&M: Annual O&M costs of \$53.9 million (\$US2007). \$11.7 million (\$US2008) per year in additional earnings.
Indirect Impacts	Not separately presented from direct impacts.
Induced	

Impacts	
Consumer Impacts	
Time Savings	Only the distribution (e.g. across time of travel and origin of journey) of benefits is reported, no absolute dollar or time savings.
Cost Savings	Reduction of 6,850 vehicles on the region's roadways per day and 77,100 fewer VMT.
Comfort	Not assessed.
Property Values	The LRT "is not expected to have a substantial impact on development outside the influence area of most stations (line haul segments of the alignment) where market forces alone would continue to be the primary impetus for continued development. Most redevelopment will be focused in the immediate vicinity of the station area. Station-oriented development activities are not expected to extend outside the one-half mile station areas, especially where distance between stations is such that the two stations are within entirely different land use settings or districts." [10, p. 5-54] Also, "Increases in commercial and residential development densities is expected." [10, p. 5-13]
Retail Spending	Not assessed.
Fiscal Impacts	Annual loss of revenue to the municipal government of \$154,041 resulting from acquisition of tax-paying properties for construction. To be more than offset over time by taxes levied on the additional earnings generated by the project and by higher property taxes on properties that experience an increase in land value. These effects were not quantified.
Other Economic Impacts	
Business Attraction	"New transportation capacity could create competitive advantages for businesses located in the Central Corridor LRT Study Area". [10, p. 5-54]
Tourism	
Environmental Benefits	Not quantified in dollar terms.
Other	"The Central Corridor LRT Project would effectively link the six primary activity and employment centers in the region: downtown St. Paul and Minneapolis, the University of Minnesota (U of M), State Capitol Complex, Minneapolis-St. Paul International Airport, and Mall of America region (four directly and two through connection to the Hiawatha LRT line)." [10, p. 5-1]

Nottingham: Nottingham Express Transit (NET) Phase Two

Nottingham: Express Transit Phase Two	
City GDP per Capita	48,287
City Population	300k (city), 700k (area)
Length	18 km
Number of Stations	28
Power	Electric
Train Length	
Headway	7.5 min (8 per hour)
Underground Characteristics	None
Projected Ridership	13.2 million per year (at mature ridership)
Estimated construction cost	£600 (£GP2011)
Operational date:	2014



Source: Nottingham City

NET is one of the newest LRT systems to open in the United Kingdom. It opened in 2004 and comprises a 14 km route with 23 stations. A fleet of 15 electric trams are operated on the system. It offers 10-minute peak, 15-minute inter-peak, and 20-minute non-peak services. NET Line Two hopes to mirror these statistics into new, often-underprivileged neighbourhoods in Nottingham.

Type of Impact	Findings
Production Impacts	
Direct Impacts	£600 million
Indirect Impacts	3,120 person-years of employment
Induced Impacts	The project is estimated to have an employment multiplier of 1.05
Consumer Impacts	
Time Savings	<p>The new LRT line will provide direct access to industrial areas (Lenton) from residential areas (Beeston and Chilwell) and lower the cost and time of daily commutes for workers. In addition, the line will help provide for anticipated a “transportation gap” resulting from 12% increase in population and 20% increase in people movements in inner Nottingham.</p> <p>Both the new line and its feeder services will provide increased access for impoverished (“deprived”) areas and grant easier access to employment hubs. This will be coupled with linkages with Line One and will provide significantly improved access to jobs, education opportunities, healthcare, and affordable leisure across the city.</p>
Cost Savings	Not assessed.
Comfort	Over and above bus transport, LRTs increase the reliability and certainty of routes and journey times.
Property Values	Not assessed.
Retail Spending	Retail spending is likely to be boosted thanks to the greater penetration of the City Centre which will improve access to the heart of the city and northern and southern commercial areas
Fiscal Impacts	Not assessed.
Other Economic Impacts	
Business Attraction	Among other similar benefits, the line will provide direct access to the ng ² site (a major ongoing commercial and residential development).
Tourism	Not assessed.
Environmental Benefits	Over three million car journeys per annum are expected to be transferred away from the urban core as park-and-ride facilities will allow for modal switching outside the urban centre.
Other	<p>NET Line Two will have a large impact on the 38% of regional households with no automobile and will enhance access to employment opportunities for these households. This will particularly aid retirees and lone-parent households whose car ownership rates are at 41% and 51%, respectively.</p> <p>Overall, the NPV of the NET Line Two is estimated to be £736 with a benefit to cost ratio of 2.82:1. Operations of the line will create a total of 166 direct jobs and seven induced jobs.</p>

Interestingly, the NET Phase Two project was compared to a high-quality bus alternative which, although having a lower cost, also provided much fewer economic benefits (and a lower benefit to cost ratio). Additionally, it was estimated that the benefits of an LRT, which would have priority signalling (at crossings) could not be matched by buses which, while requiring a large number of vehicles, would also have to interact with local traffic. Buses also reduce the road space available for other vehicles and contribute to congestion.

Salt Lake City: Mid-Jordan Line

Salt Lake City: Mid-Jordan Corridor	
City GDP per Capita	\$ 48,200
City Population	200k (city), 1,100k (metro)
Length	17 km
Number of Stations	10
Power	Electric
Headway	15 minutes
Projected Ridership	19,000 riders per day
Estimated construction cost	\$554 million (\$US2007)
Operational date:	2011



Source: Ride UTA

The Mid-Jordan line, currently under construction in Salt Lake City, Utah is a new branch off the existing Salt Lake City LRT system. It is expected to be completed at the end of 2011 and will replace existing bus routes which, in 2000, were deemed to be unable to keep up with growing population and transit usage demands. It will provide an interconnection between several high population and employment centres in order to ease daily commutes.

Type of Impact	Findings
Production Impacts	
Direct Impacts	Construction will cost an estimated \$521 million
Indirect Impacts	Not assessed.
Induced Impacts	Not assessed.
Consumer Impacts	
Time Savings	Significant improvement (30% to 60%) in transit time using public transit and marginal improvement in auto transit time due to congestion alleviation. The Mid-Jordan line is anticipated to result in 3.9 (or \$22.01 per hour of benefit when factoring in system capital and operating costs) hours of user benefit on typical weekdays in 2030.
Cost Savings	Previous LRT (TRAX) brought huge operating cost savings. For the full first year of operation, 2000, operating cost per passenger-mile by TRAX plunged to \$0.15 USD, compared with \$1.04 USD for UTA's bus operations. By 2030, the cost per passenger-mile of the Salt Lake City transit system is expected to be \$0.58 per passenger-mile which is the same as the anticipated cost per passenger-mile from the Mid-Jordan line.
Comfort	All population groups along transit corridor will enjoy improved transportation benefits.
Property Values	Not assessed.
Retail Spending	Revitalizing of declining commercial areas (i.e. Redwood); station locations tend to concentrate transit activity and increase pedestrian activity in their immediate vicinity. Increases in pedestrian activity may result in increased localized business development

	opportunities near stations.
Fiscal Impacts	The Mid-Jordan line is expected to generate a 2% (3,760) improvement in daily transit ridership vs. no-build scenario and thus provide an additional \$2 million per year in new revenue in 2030 (at \$1.58 average fare). In addition, the new job opportunities related to the operation of the transit system will produce expendable income for workers and create new sales tax revenues.
Other Economic Impacts	
Business Attraction	Improved access will expand opportunities to work, recreate, or shop in areas previously inaccessible by those who do not own or operate vehicles, as well as those commuting by bus.
Tourism	The presence of LRT may have a positive impact to tourism, but this is not quantified.
Environmental Benefits	It is expected that there will be a general improvement of air quality vs. no-build alternative, but some localized increases near stations and during construction will occur.
Other	Availability of light rail and commuter rail believed to be a contributing factor for headquarters relocation from Portland, thus granting Salt Lake City a competitive locational advantage. The new line will also help boost to public transport usage by students. The construction of Mid-Jordan Line requires the acquisition of 15 city properties, six residential buildings and seven commercial buildings.

Toronto: Hurontario/Main Street LRT

Toronto: Hurontario/Main Street LRT	
City GDP per Capita	\$ 38,200
City Population	2,500k (city), 7,100k (metro)
Length	21 km
Number of Stations	28
Train Length	1-2
Headway	3 min
Projected Ridership	5,500/hr peak direction by 2031
Estimated construction cost	\$1.23 billion (C\$2010)
Opening years	2015



Source: Metrolinx

The Hurontario/Main Street LRT is one of three options assessed for improved transit service along this corridor that connects Port Credit to Downtown Brampton, via Mississauga City Centre Drive, in the western part of the Greater Toronto Area. The option assessed is an on-street segregated LRT with signal priority. This line would have 28 stations.

Type of Impact	Findings
Production Impacts	
Direct Impacts	Construction: Estimated creation of 4,506 person-years of employment, \$174 million in wages and salaries, and \$383 million in GDP. O&M: Annual impact of 406 jobs, \$15.1 million in wages and salaries, \$34.6 million in

	GDP.
Indirect Impacts	Construction: Estimated creation of 2,494 person-years of employment, \$96.3 million in wages and salaries, and \$213 million in GDP. O&M: Annual impact of 169 jobs, \$7.0 million in wages and salaries, \$14.4 million in GDP.
Induced Impacts	Not assessed.
Consumer Impacts	
Time Savings	"Travel time savings are included for both transit and non-transit users. With the improvement of transit services along the Main Street in Hurontario between Port Credit and Downtown Brampton, the analysis shows that the investment will generate significant time savings for existing transit users (those who currently travel on buses), new transit users and auto users. The value of time is estimated at an average of \$13 per hour and is expected to grow, in real terms, by 1.6% per year over the period. The present value of travel time savings for both transit and auto users over the evaluation period (2009-2038) ... estimated at \$1,154 million in present value terms." [26, p. 28]
Cost Savings	"Automobile operating costs savings are derived from a reduction in auto kilometres as a result of the transit investment. The analysis shows that the Hurontario/Main Street project will result in ... a reduction in auto kilometres by 2031 of more than 111 million kilometres" per year. "Translating these savings into monetary terms, the present value of the automobile operating cost savings over the period is \$569 million." [26, p. 28-29] "The reduction in collisions is based on fewer vehicle kilometres driven. The monetary savings resulting from a reduction in collisions is calculated based on an assumed value of 7 cents per kilometre in reduced road travel (see Appendix A). The present value of safety benefits over the period is \$56 million." [26, p. 29]
Comfort	Not quantified.
Property Values	Property values would be affected approximately for 500m around each station. Land value uplift was calculated by multiplying the percentage of value uplift typical for each land use by the total assessment of lands within station areas in each land use category. Within the land area impacted, the average uplift is between 1.5% and 3.1%. It is estimated that the potential uplift in assessment value could be approximately \$208 million to \$417 million.
Retail Spending	Not assessed.
Fiscal Impacts	Not assessed.
Other Economic Impacts	
Business Attraction	Not assessed.
Tourism	Not assessed.
Environmental Benefits	With an estimated decline in automobile usage of 65 million vehicle-km in 2021 and 111 million vehicle-km in 2031, the resulting reductions in CO ₂ emissions are 13,000 in 2021 and 22,000 tonnes in 2031. "The present value of the reduction in CO ₂ emissions over the period 2009-2038, based on an average value of \$0.01 per km is estimated at \$8.0 million." [26, p. 34]
Other	The three-year construction period of 2011 to 2014 is expected to generate costs of \$1.345 billion (C\$2008). Annual operational costs, on the other hand, are to be \$15.8 million (C\$2008) in 2021, \$19.2 million (C\$2008) in 2031, as the number of LRT vehicles is increased.

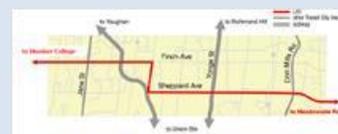
The total NPV of capital costs is estimated to be \$1.022 billion while operating costs are \$185 million.

In addition to the analysis presented above, the Benefits Case report also included a sensitivity analysis of the Hurontario/Main Street LRT project. The sensitivity of the NPV of the benefits was assessed using three different discount rates, 3%, 5%, and 7%. Under these rates respectively the NPV of the benefits of the project were \$1.141 billion (1.8 Benefit Cost Ratio - BCR), \$572 million (1.5 BCR), and \$220 million (1.2 BCR).

Toronto: Sheppard-Finch LRT

Toronto: Finch-Sheppard LRT

City GDP per Capita	\$ 38,200
City Population	2,500k (city), 7,100k (metro)
Length	39 km
Number of Stations	68 stations including 5 underground
Train Length	3 car
Headway	3 min in 2031
Underground Characteristics	5 stations, existing Sheppard Line
Projected Ridership	7,600 per hour per direction peak
Estimated construction cost:	\$3.6 billion (C\$2008)
Opening years	2015



Source: Metrolinx

The Sheppard-Finch LRT is designed to provide high-quality, rapid transit service to the north-east and north-west areas of the City of Toronto in an affordable way, and provide connections to the subway system. The system would be in-street LRT with frequent stops and a partial-exclusive right-of-way. The Metrolinx Benefit Case assessment considered five options. The most relevant to Ottawa is Option 2, in which the LRT runs continuously from Humber College (near Highway 27) to Meadowvale Road in the east end of Toronto. All information is drawn from the Metrolinx Benefits Case unless otherwise noted. All impacts are measured relative to a base case which involves increasing bus service along both Sheppard and Finch Avenues.

Type of Impact	Findings
Production Impacts	
Direct Impacts	Construction: Estimated creation of 12,500 person-years of employment, \$465 million in wages and salaries, and \$1.24 billion in GDP. O&M: Annual impact of 270 jobs, \$10 million in wages and salaries, \$27 million in GDP.
Indirect Impacts	Construction: Estimated creation of 6,900 person-years of employment, \$255 million in wages and salaries, and \$690 million in GDP. O&M: Annual impact of 100 jobs, \$4 million in wages and salaries, \$10 million in GDP.
Induced Impacts	Not assessed.
Consumer Impacts	
Time Savings	The value of time is estimated at \$857 million over the 2009-2038 period based on an

	average of \$13 per hour and growth in real terms by 1.6% per year over the period.
Cost Savings	Automobile operating cost savings are estimated at \$819 million in present value terms over the period 2009-2038. Safety benefits from accident reduction are estimated at \$87 million in present value terms of over the period 2009-2038. This estimate is based on a reduction in vehicle-km travelled and an accident cost reduction rate of \$0.07/vehicle-km travelled.
Comfort	Not separately assessed.
Property Values	Area of value uplift is 3,600 hectares. Average premium uplift is between 5.5% and 15.7%. Total potential uplift is \$1.59 billion to \$4.75 billion.
Retail Spending	Largely included in long-term vehicle cost savings that are re-directed to other consumption.
Fiscal Impacts	Not assessed.
Other Economic Impacts	
Business Attraction	Transportation cost savings to area businesses captured in ongoing direct and indirect production impacts.
Tourism	Not separately assessed.
Environmental Benefits	With an estimated decline in automobile usage, the resulting reductions in CO ₂ emissions are 32,707 tonnes in 2021 and 10,750 tonnes in 2031. ⁶ The present value of the reduction in CO ₂ emissions over the period 2009-2038, based on an average value of \$0.01 per km is estimated at \$12.5 million. Because the Sheppard Subway line would be shut down during LRT construction, there would be an increase in (replacement) bus traffic, and associated pollution, during construction.

The Metrolinx Benefits Case included two sensitivity analyses. One examined the sensitivity of some benefits to extending the LRT further west to the Toronto Pearson International Airport. Doing so would increase the present value of travel time savings by \$20 million, of automobile cost savings by \$85 million, and of safety benefits by \$9 million.

Secondly the benefits case assessed the sensitivity of the NPV of the benefits to three different discount rates, 3%, 5%, and 7%. Under these rates, respectively, the NPV of the benefits of the project were \$1.338 billion (0.6 BCR), \$1.545 billion (0.5 BCR), and \$1.645 billion (0.4 BCR).

Vancouver: SkyTrain Canada Line

Vancouver: Canada Line		
City GDP per Capita	\$ 37,600	
City Population	600k (city), 2,100k (metro)	
Length	15 km	
Number of Stations	17	
Power	Electric	

⁶ The reduction in greenhouse gas emission declines over time, relative to the base case, because as congestion builds in the base case and travel patterns change, base case emissions are reduced.

Train Length	2-5 vehicles/train	Source: Translink
Headway	2.7 minutes	
Underground Characteristics	Elevated and underground sections	
Projected Ridership	Daily boardings 104,000	
Estimated construction cost	\$1.6 billion (C\$2010) excluding vehicles	
Operational date	2010	

The Canada Line is an extension to the Vancouver SkyTrain urban rail system. It connects downtown Vancouver with the suburb of Richmond and Vancouver International Airport, a length of 19.2 km incorporating 16 stations. The project had an estimated capital cost of \$2 billion (all figures are C\$2010 in this section unless otherwise noted).

The information below is drawn from the Richmond/Airport-Vancouver (RAV) Line Multiple Account Evaluation. It should be noted that this study is now somewhat dated, as it was conducted in 2001 and the RAV Line (now Canada Line) has been in service for two years. Nonetheless, for the purposes of the present study, the age of the evaluation is not overly important, because benchmarks can be constructed against internally consistent parameters, such as travel time savings per dollar of capital cost.

The base case assumes a high-quality, bus-based transit service in the corridor. Impacts were evaluated over the period 2001 to 2050 and deflated to \$2001 using a 5% discount rate.

Type of Impact	Findings
Production Impacts	
Direct Impacts	Not assessed.
Indirect Impacts	Not assessed.
Induced Impacts	Not assessed.
Consumer Impacts	
Time Savings	(Estimated in conjunction with vehicle operating cost savings) NPV of \$544 million on the basis of a value of travel time of \$14/hr, which the consultants derived from their own willingness-to-pay analysis and is consistent with US Federal Transit Administration suggested rate of 80% of the average wage rate. The evaluation determined that transit users and auto users share equally in the travel time cost savings benefits and that truck users receive 2-3% of the benefit.
Cost Savings	Reduced accident risk: cost savings of \$32-\$41 million NPV. Parking savings of \$51 million NPV.
Comfort	Not separately assessed.
Property Values	Focused on stations areas with a radius of 300m. "Impacts for lands beyond that radius were assumed to be minimal and were not examined." [27, p. 48] Base case assumed an increase in commercial and residential land values of 1.5% per year excluding inflation. With LRT in place, commercial land values were forecast to increase at 3.5% per year and residential land values were forecast to increase at 3.0% per year, excluding inflation. The resulting projected increase in land values is \$75 million NPV. These increases assumed no change in zoning. The consultant noted that should zoning changes occur to allow higher value and higher density development, "significantly higher" land value

	would result, but no further details were provided.
Retail Spending	Not assessed.
Fiscal Impacts	<p>Only construction impacts were estimated as operational impacts were considered not to vary from the base case. The NPV of federal and provincial taxes (income, GST, PST) was \$116 million. The federal government would realize roughly 65% of this value.</p> <p>The evaluation also assumes a loss of \$15 million to governments from decreased fuel taxes. These decreased fuel taxes result from a reduction in fuel consumption of 3-4 million litres per year and fuel taxes of roughly \$0.30 per litre.</p> <p>The NPV of incremental potential property taxes raised with the LRT system is \$28 million. The consultant states that "this property tax revenue relates to real estate that the rapid transit system would attract around the stations, that would likely occur elsewhere in the region if there were no rapid transit line constructed." [27, p. 53]</p>
Other Economic Impacts	
Business Attraction	Not assessed.
Tourism	Not assessed.
Environmental Benefits	NPV of vehicle emissions reductions: \$16.5 million resulting from 18,000 fewer car trips per day. Corresponding reduction of 600 tonnes in local air pollutants each year. This includes CO ₂ equivalent, carbon monoxide, volatile organic compounds, nitrous oxide, sulphur oxides, particulate matter, and sulphates. The study is not clear on the values assigned to these pollutants to obtain the dollar-value emissions reduction figure.
Other	<p>This study also calculated productivity impacts. Based on research from the US Federal Transit Administration (FTA), the consultant estimated an impact on regional GDP of \$2.85 billion in NPV terms.</p> <p>This estimate was calculated on the basis of "FTA estimates that, for a 1% increase in 'transit presence', the region will experience a 0.04% increase in annual productivity gain (value added per employee), and a 0.004% economic growth per year. This research was based on examining growth in some 100 U.S. cities where mass transit systems exist." The consultant applied this methodology by defining change in transit presence "as change in transit travel demand and change in transit passenger kilometres of travel." [27, p. 53-54]</p> <p>The consultant further notes that "while these benefits may be considered high, and may include other benefits presented earlier, particularly value of time saved, this transit presence measure is another indicator of the importance of good-quality rapid transit, and the benefits of constructing the system earlier, rather than later. The beneficiaries, while region-wide, will largely accrue to labour force and employers in the corridor who will benefit from the improved accessibility afforded by the rapid transit service." [27, p. 54]</p>

Vancouver: SkyTrain Evergreen Line

Vancouver: Evergreen Line		
City GDP per Capita	\$ 37,600	
City Population	600k (city), 2,100k (metro)	
Length	11 km	

Number of Stations	6	Source: Evergreen Line Project Website
Power	Electric	
Underground Characteristics	Partly underground	
Projected Ridership	70,000 per day by 2021	
Estimated construction cost	\$1.4 billion (C\$2010)	

The Evergreen Line is a planned extension to Vancouver's SkyTrain urban rail system. It would connect downtown Vancouver with the suburb of Coquitlam via Port Moody, a length of 11 km incorporating six stations. The project has an estimated capital cost of \$1.4 billion (C\$2010 all figures in this section unless otherwise noted).

Type of Impact	Findings
Production Impacts	
Direct Impacts	Construction to generate approximately 4,000 direct person-years of employment and \$268.4 million in GDP. During the operation of the line, 30 jobs would be created, with a direct impact of \$2.2 million per year in GDP.
Indirect Impacts Induced Impacts	Construction to generate 5,531 indirect and induced person-years of employment. Construction to generate indirect GDP of \$292.6 million and induced GDP of \$99.5 million. During operation of the line the indirect impact will be 17 jobs, and the induced impact will be eight jobs. Indirect GDP generated will be \$1.2 million per year, and induced GDP will be \$0.5 million per year.
Consumer Impacts	
Time Savings	The Project Assessment report notes that time savings would be generated for existing transit users, new public transit users and motor vehicles users travelling in a corridor that would be otherwise more congested. It estimates that by the year 2021, ridership on the proposed project would result in annual time savings benefits of \$73.2 million with approximately 70% of annual benefits accruing to transit riders and 30% to road users.
Cost Savings	"Vehicle and accident cost savings from reduced fatalities and injuries and reduced property damage due to improved safety". [29, p. 58] Not quantified.
Comfort	Not considered separately.
Property Values	A 10% increase in residential property values within a three to five block radius of stations and 15 to 40% increase in residential rents for station-oriented apartments.
Retail Spending	Not separately identified.
Fiscal Impacts	From construction, provincial revenues to be \$74.9 million from commodity, personal income and corporate taxes; municipal revenues to be \$6.2 million; federal tax revenues to be \$75.2 million. The Environmental Assessment report state that during the operation of the line, the 47 people directly and indirectly employed would pay income and other taxes. The EA notes that while sales taxes and corporate income taxes would be generated by the operation of the line, that these would be offset by reductions in taxes paid on fuel, vehicles and other purchases. No quantitative estimates have been made.
Other Economic Impacts	

Business Attraction	The project assessment report found that the project would “support local municipal and regional strategic development plans including positive impacts to the tourism sector by providing rapid transit to the affected communities”. [29, p. 58] No quantification in dollars was provided.
Tourism	“During operations, the Proponent reports that the proposed Project would have potential positive impacts to recreation and tourism, as it would provide increased opportunities for day-trippers to access events, tourism and recreation facilities in each of the municipalities”. [29, p. 63] Not quantified.
Environmental Benefits	The following environmental benefits were identified: a small decrease in CAC and GHG emissions during the operation of the project; no significant residual adverse noise and vibration effects; no adverse residual effects to human health from electromagnetic field exposure, contaminated sites, or drinking water. No quantification in dollars was provided.

Dallas DART LRT

Dallas: DART Light Rail	
City GDP per Capita	\$ 53,000
City Population	1,200k (city), 6,500k (metro)
Length	116 km
Number of Stations	54
Power	Electric
Underground Characteristics	Partly underground
Projected Ridership	57,700 unlinked passenger trips per day
Estimated construction cost	\$2.4 billion (\$US2009)

The map displays the Dallas DART Light Rail network. It features three primary lines: the Green Line, the Orange Line, and the Blue Line. The Green Line runs north-south through the city center. The Orange Line runs east-west, connecting the city center to the airport and beyond. The Blue Line runs north-south, primarily in the eastern part of the city. The map also shows various station locations and transfer points between lines.

Source: Urban Rail

The Dallas DART LRT is not a single line, but rather a system of three existing lines, with a fourth currently under construction (though not included in this analysis). Overall, the Dallas DART provides insight into the operational impact of a more-established, though relatively recent LRT network in the urban landscape of a major North American city. In addition, the DART LRT has been the subject of several academic studies on its impacts on local retail spending and property values that are not available for many other LRT projects.

Type of Impact	Findings
Production Impacts	
Direct Impacts	Green line: \$868 million from construction
	Orange Line: \$1.2 billion from construction
	Blue Line: \$289 million from construction
Indirect Impacts	Green Line: \$1.5 billion in regional economic activity; support almost 11,900 person-years of employment
	Orange Line: \$2.0 billion in regional economic activity and 16,200 person-years of employment
	Blue Line: \$502 million in regional economic activity and 4,000 person-years of employment
Induced Impacts	Green Line: Increased tax income will bring in over \$37 million dollars to government coffers on a \$160 million boost in local income.

	Orange Line: \$50 million new tax revenue on \$218 million new property income.
	Blue Line: \$12 million in indirect business taxes on \$53 million new property income.
Consumer Impacts	
Time Savings	Not assessed.
Cost Savings	Not assessed.
Comfort	Access to public areas/events such as zoo, circus, concerts and downtown has increased visitation rates and area vibrancy.
Property Values	A 25% (1994 to 1998) and 13% (1997 to 2001) improvement in real estate valuation around stations for residential and office properties (vs. control group); a 11% decline in industrial property values in the same area (vs. control group).
Retail Spending	36.2% jump in retail sales vs. 3.6% in other areas; new retail areas around stations;
Fiscal Impacts	Sizable increase in tax revenues for state and local jurisdictions from increased property values.
Other Economic Impacts	
Business Attraction	Value of development projects near stations increases substantially; consists of many new retailers; LRT has become driver for regional economic development; total value of projects that are attributable to the presence of a DART station since 1999 is \$4.26 billion.
Tourism	Not assessed.
Environmental Benefits	Reduction in congestion and thereby reduce emissions from cars and trucks.
Other	Wide citizen support for LRT development; LRT has acted as catalyst for other development and resulted in inter-neighbourhood cooperation on transit issues.