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*An examination of alternatives to
an underground extension of the
Millenium line to UBC.*

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The Case for the Tram: Learning from Portland.

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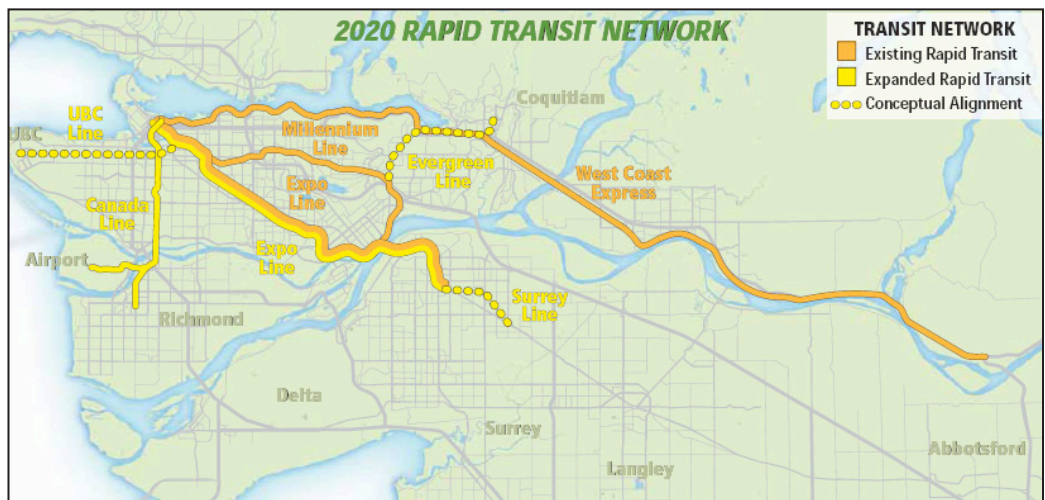
I. Introduction

On January 14th 2008, the Province of British Columbia publicly announced a \$14 billion Provincial Transit Plan for the greater Vancouver region. Of that total, \$2.8 billion would be dedicated to the development of an underground extension of the Millennium Skytrain line to UBC, connecting the University of British Columbia with the Commercial Drive station, running through central Broadway's business district.¹ This connection has been considered in various studies since 1993 and identified as a high-priority corridor by 2004. Translink, the regional transportation agency, continues to study the Broadway corridor with the final publication of the Rapid Transit Alternatives study, which is due out in 2009 and may or may not recommend a subway tunnel. Nevertheless the Province, by committing approximately 233 million dollars per kilometer for the project, is anticipating that the final technological choice for the corridor will be deep tunnel subway technology, by far the most expensive option.

If our common objective is to maximize the public benefit from tax dollars, the question could be asked: Is a subway system the best option for meeting the needs of citizens to access UBC from other parts of the region? Indeed, is accessing UBC alone worthy of a 2.8 billion dollar public investment? Are there more affordable options?

This study examines this question through exploring one alternative way to expend such a large sum. It reveals how the overlapping benefits which might accrue from a transit investment - in intensified land use, improved access for the elderly, and improved quality of life for the city - might be maximized. To this end, we will compare the current plans for the UBC line to the recent development of the Portland tram system, and analyse the costs and benefits consequent to that choice.

Figure 6-1: Map extracted from the Provincial Transit Plan.² The left hand dotted yellow line shows the conceptual extension of the Millennium line to UBC.



II. Historical Context: The City of Vancouver as a Classic Streetcar City

The opening of an electric streetcar railway system in Vancouver on June 27th 1890 brought excitement and convenience to many, and instigated a significant development boom in the city. The streetcar system reached its maximum extent in 1928 (figure 6-3). Originally built and managed by the Vancouver Electric Railway & Light Company, there were several shifts in ownership before its final takeover by the UK-owned British Columbia Electric Railway Company (BCER).

Once completed the system extended as far as North Vancouver's Lynn Valley and deep into Burnaby along the Hastings Street corridor. The longest line southward extended down Oak Street, crossing the North Arm of the Fraser River. Both residential and commercial development quickly spread along the streetcar corridors. The ease of transportation afforded by the streetcar established the pattern of commercial arterials and adjacent neighbourhoods that still define the City of Vancouver.

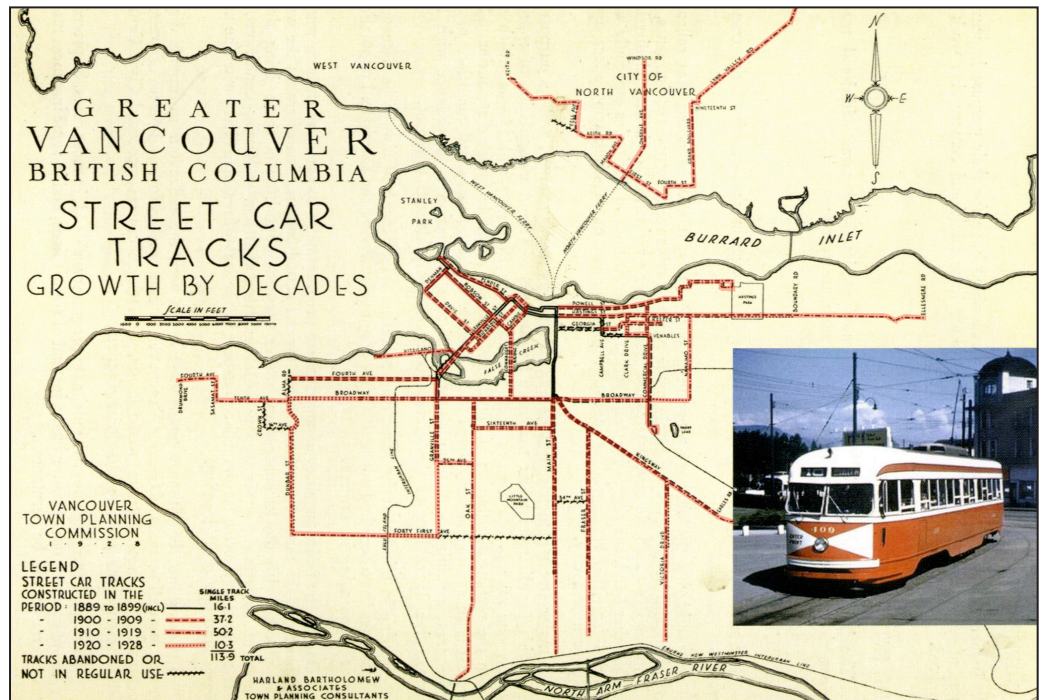
Figure 6-2: Historic photograph of a streetcar in Vancouver, ca.1900. ³



Streetcar ridership began to decrease with the advent of the automobile in the late 1920s. Gradually streetcars were replaced by busses and by the electric trolley. Vancouver streetcars made their last trip on April 24th, 1955. All the rails were quickly ripped out. The locations of most of the original streetcar lines are still marked by the overhead electrical catenary lines used by today's trolley busses. ⁴

Given the importance of this original system to the creation of Vancouver and its public realm, it is worth considering the value of a reinvestment along these key arterials as an alternative or as a supplement to the proposed UBC line. Consequently we compare the Vancouver proposal to Portland, OR, where they chose to reinstall trams on streets where they had been removed. A detailed analysis of the Portland experience begins below.

Figure 6-3: Historic map from 1928 showing the streetcar routes in Vancouver, highlighted in red. ⁴



III. Portland Case Study

It is important to first accurately quantify the characteristics of the city of Portland and its new tram system before comparing it to Vancouver and its current transit strategy. The two cities are remarkably similar, making them ideal for comparison. Both have:

- populations of approximately 600,000 within a metro region of 2,000,000;
- comparable mild temperatures and average annual rainfall;
- higher densities of jobs, housing and commercial services along arterial streets - a legacy of the streetcar era;
- similar arterial streets with approximately 90 feet of available ROW.



Figure 6-4: Portland Streetcar.⁵

When the city of Portland opted for their tram system they did so for compelling reasons: it was inexpensive and the areas to be served were not dense enough to justify the more expensive MAX light rail system or an even more expensive subway system.⁶

This decision was provoked by the electoral defeat of the bond initiative that would have expanded the more conventional and more expensive MAX light rail technology. When the measure was defeated the city was left with only two options: forget transit or build it with their own money. Their newly critical focus on cost efficiency led them to a solution they would not otherwise have found: the modern streetcar, or tram, technology. The costs for the tram technology chosen by Portland were less than one-third that of light rail and only a tenth of many modern subway systems. Costs for the new Portland tram system were only \$25.8 million per two way mile, or approximately \$16 million per two-way kilometer.

A. Effects of Portland Streetcar on real-estate

Portland city officials hoped that the introduction of the modern streetcar would spur high density development along the new line, and thus would help them recoup the cost of investment through increased tax revenues. Their expectations were substantially exceeded. During the formative years of streetcar construction (between 1997 and 2004), the amount of development adjacent to the new streetcar line increased exponentially, especially with increased proximity to the line. *Figure 6-5* below compares the density of development along the line before and after 1997 (expressed in terms of floor area ratio [FAR], which is the standard measure of development intensity expressed as a ratio between total floor area of all floors and the total surface area of the land parcel). Taking a closer look at the “post 1997 development”, the realized floor area ratio potential within one block of the streetcar line is 90% higher than in blocks farther away. The run of this curve shows that the further the distance from the streetcar (one to three+ blocks), the lower the realized FAR. Thus the percentage of FAR potential realized drops from 90% (one block distance) to 43% (three+ block distance). *Figure 6-6* shows the development activity that occurred along the streetcar alignment on a Taxlot basis⁷. It shows that after 1997, 55% of all new development took place within a one-block distance from the streetcar alignment.⁸

Figure 6-5: FAR realized with distance from streetcar.⁸

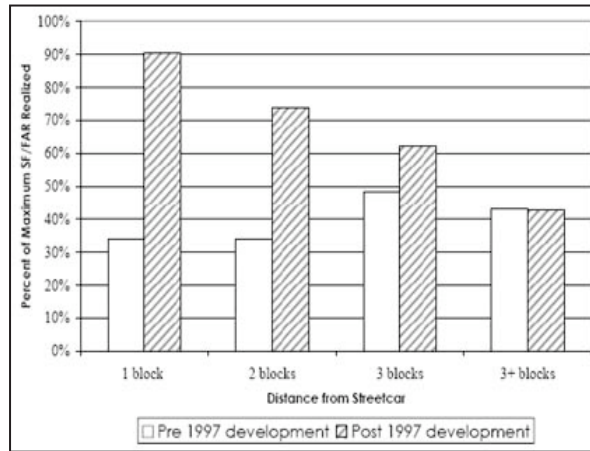
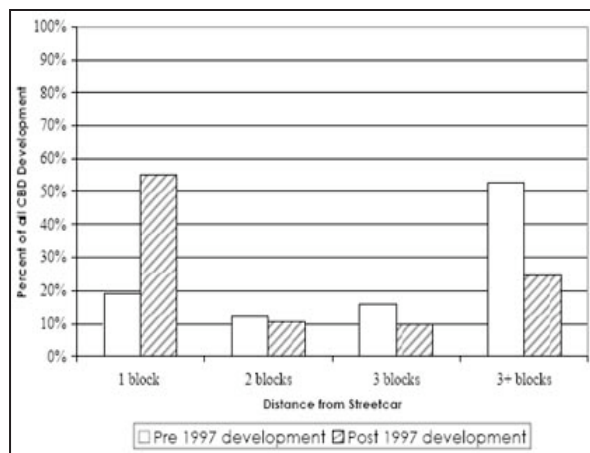


Figure 6-6: Development activity along the streetcar alignment.⁸



The table below (figure 6-7) displays the annual average percentage of growth in building stock within each measure of distance. It is striking that within a one-block distance from the streetcar, new net development increased more than three times as rapidly as in any other block-distance.

Figure 6-7: Annual average percentage growth in building stock.⁸

Distance from streetcar	Existing Building SF (Prior to 1997)	New Building SF (1997-2004)	New as Percent of Existing	Average Annual Increase
1 block	9,029,000	4,172,000	46%	5.8%
2 blocks	5,734,000	794,000	14%	1.7%
3 blocks	7,465,000	733,000	10%	1.2%
3+ blocks	24,706,000	1,886,000	8%	1.0%
Total	46,934,000	7,584,000	16%	2.0%

For a better visualization, the map on the next page (figure 6-8) shows the development activity that occurred along the streetcar alignment.

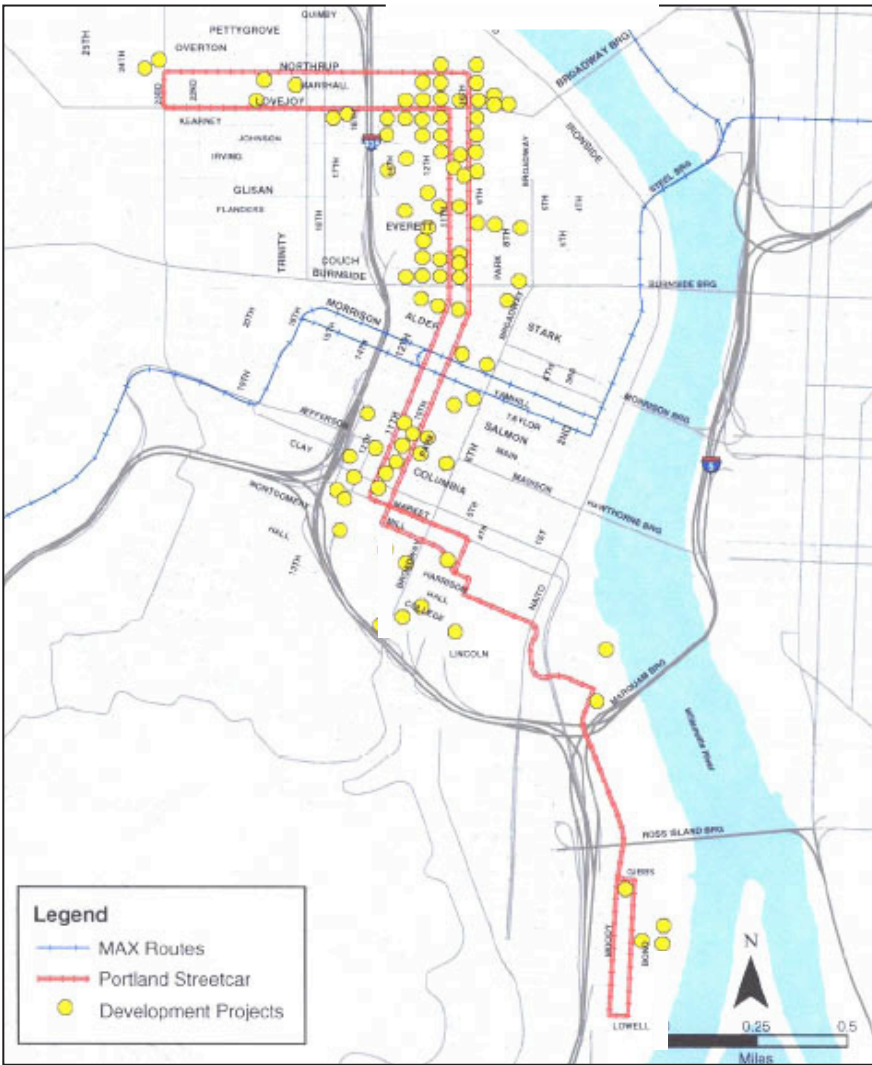


Figure 6-8: Development projects along the streetcar alignment.⁹ The map suggests that the lighter streetcar/tram technology was a far greater spur to development than the heavier MAX light rail technology.

B. Costs and Speed

It is often said that the more a system costs the faster it can travel. This is only true to a point. Many different factors contribute to travel speeds including the number of stops, wait times at stations and track engineering. The accompanying chart suggests that low cost systems like trams can

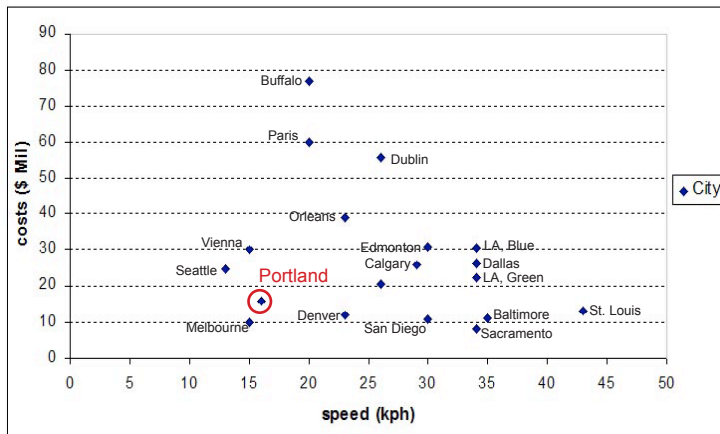



Figure 6-9: Comparison of various streetcar costs (in \$ million per km double-track) and average speed (kph).

compete with more expensive systems where necessary, largely through the provision of dedicated and protected rights-of-way through low demand areas. It relates the cost and speed figures of 13 North American, 4 European and 1 Australian city, shown in the table below (figure 6-10). Cost data are given in cost per kilometer double-track^a (\$ million), whereas speed refers to approximate system average speed (kph).

Figure 6-10: Key figures for various streetcar systems worldwide.

Sacramento RT LRT^{b,10}	
cost 8 Mil/km speed 34 kph	
Melbourne Streetcar¹⁰	
cost 10 Mil/km speed 15 kph	
San Diego Trolley¹⁰	
cost 11 Mil/km speed 30 kph	
Baltimore^{b,10}	
cost 11 Mil/km speed 35 kph	
Denver, RTD LRT¹⁰	
cost 12 Mil/km speed 23 kph	
St. Louis, MetroLink¹⁰	
cost 13 Mil/km speed 43 kph	
Portland Streetcar¹¹	
cost 16 Mil/km speed 16 kph	
Pittsburgh¹⁰	
cost 20 Mil/km speed 26 kph	
Los Angeles, Green¹⁰	
cost 22 Mil/km speed 34 kph	
Seattle Streetcar¹²	
cost 25 Mil/km speed 13 kph	
Dallas DART LRT¹⁰	
cost 26 Mil/km speed 34 kph	
Calgary C-Train¹⁰	
cost 26 Mil/km speed 29 kph	
Vienna Streetcar¹³	
cost 30 Mil/km speed 15 kph	
Los Angeles, Blue¹⁰	
cost 31 Mil/km speed 34 kph	
Edmonton LRT¹⁰	
cost 31 Mil/km speed 30 kph	
Orleans Streetcar¹⁴	
cost 39 Mil/km speed 23 kph	
Dublin Streetcar¹⁵	
cost 56 Mil/km speed 26 kph	
Paris T3 Streetcar¹⁶	
cost 60 Mil/km speed 20 kph	
Buffalo MetroRail¹⁰	
cost 77 Mil/km speed 20 kph	
Vancouver Skytrain¹⁷	
Millenium Line	
cost 60 Mil/km speed 40 kph	
Canada Line	
cost 100 Mil/km speed 40 kph	

^a 'Double-track' does not mean that every meter of the system consists of two tracks. Almost all of these systems have short sections (across a bridge for example) of single-track. However, those sections do not have much impact on scheduling or operations.

^b Sacramento and Baltimore didn't have a full double-track system.

As noted, Portland's streetcar system is one of the slowest and cheapest in this comparison. However, this technology is capable of much higher operational speeds if there is signalization priority at all intersections, a more precisely engineered trackbed, and stretches where the train has a dedicated right of way.

The question of operational speed conjures up a larger issue: who exactly are the intended beneficiaries of enhanced mobility? A high speed system is best if the main intention is to move riders quickly from one side of the region to the other. Lower operational speeds are better if your intention is to best serve city districts with easy access within them and to support a long term objective to create more complete communities, less dependent on twice-daily cross-region transit trips.

C. Trams vs. Subways in Other Cities

A survey of recent transit expenditures made in larger European cities is instructive in this respect. Cities such as Berlin, Vienna, Paris or Dublin¹⁸ have balanced expenditures between high speed trains, subways and light rail, and cheaper and lighter tram systems to serve more complete urban districts. This balanced expenditure helps satisfy a dual objective to enhance mobility within urban districts while also accommodating the commuting needs for people in surrounding areas. Of even greater interest, Europe's smaller cities such as Strasbourg (252,000 inhabitants¹⁹), are spending most of their funds expanding their tram system. In these jurisdictions it appears that the low-floor modern tram technology provides the main armature for a system supported by an adequate bus network.

IV. The tram option for the UBC Line

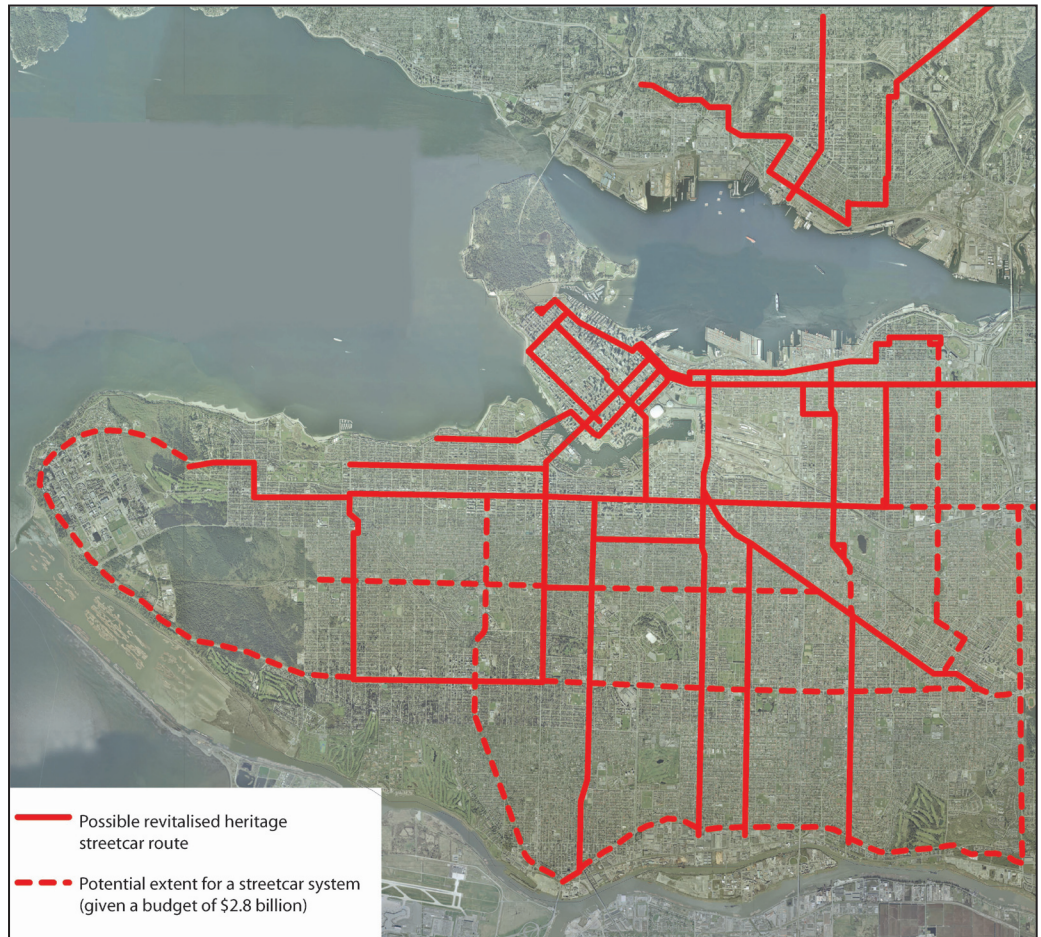
A tram to UBC from the terminus of the Millennium line would be approximately 15 times cheaper than an extended Skytrain system (based on Portland's average cost per km). For the same \$2.8 billion that the Province proposes to spend on a single 12 km Skytrain subway line extension to UBC, it could install and equip 175 km of modern tram. 175 km is far longer than Vancouver's original streetcar system at its most extensive, which was approximately 116 km in 1928.

The following two maps compare the current 2.8 billion dollar 12 km subway plan to one diagrammatic concept for a 175 km tram system, purchasable at the same cost.



Figure 6-11: Indicated in red: the proposed 12km extension of the Skytrain Millennium Line to UBC.

Figure 6-12: The potential extent for a 175km streetcar system in Vancouver, given a budget of \$2.8 billion (red: revitalised heritage streetcar route; red dashed: potential extension).



V. Conclusion

This study exposes one potential option to what would be a very large investment in subway technology. Alternative transit strategies have their costs and benefits. This study demonstrates that the money needed for one 12 km subway line would be more than enough to rebuild and substantially expand the region's entire historic streetcar system. There is no doubt that such a system would not be as fast as a subway. However based on the Portland experience, the benefits may be an improved quality of life in many neighbourhoods, an improved investment climate for higher density homes and job sites, enhanced access for citizens within their own districts and to other parts of the city (especially for the rapidly expanding seniors' demographic) and a substantially reduced cost per ride. As our region pushes towards a goal of 80 percent reduction in per capita greenhouse gas production, it behooves public officials to look carefully at how taxpayer dollars can be most effectively used towards the creation of a very different pattern of transportation than the one we know today. A return to a pattern known before the rise of the automobile may merit a careful re-examination.

Notes

- ¹ *BC Ministry of Transportation*: www.th.gov.bc.ca/Transit_Plan/index.htm (07/04/08)
- ² BC Ministry of Transportation (2008). *The Provincial Transit Plan*. p.9 (25/04/08)
- ³ *Vancouver Historical Society*: www.vancouver-historical-society.ca/images/VPL/6675.jpg (02/04/08)
- ⁴ Hayes, Derek (2005). *Historical Atlas of Vancouver and the Lower Fraser Valley*. Vancouver: Douglas and McIntyre Ltd., pgs. 64-65
- ⁵ *Midtown Community Works*: www.midtowncommunityworks.org/Images/Photo3-sidewalkstation.jpg (03/03/08)
- ⁶ *Personal Communication* Kay Dannen, Portland Streetcar (28/02/2008)
- ⁷ A Taxlot is a legal parcel.
- ⁸ *Portland Streetcar Development Impacts*. Final Draft. E.D. Hovee & Company, LLC. November 2005, pgs.ii-v
- ⁹ *Portland Streetcar Development Oriented Transit*. January 2006, p.7
- ¹⁰ Schumann, John, LTK Engineering Services (2003). *Status of North American Light Rail Transit Systems*, Year 2003 Update, p.18
source for images: images.google.ca
general sources: LightRailNow Group (www.lightrailnow.org), Railway Technology (www.railway-technology.com/projects), Bombardier (www.bombardier.com), February 08
- ¹¹ *Personal Communication* Kay Dannen, Portland Streetcar (28/02/2008)
Portland Streetcar: www.portlandstreetcar.org (01/04/08)
- ¹² *Seattle Streetcar*: www.seattlestreetcar.org (01/04/08)
- ¹³ *Wienerlinien*: www.wienerlinien.at/WienerStadtWerke/DOWNLOAD/Linie44_8.pdf (04/04/08)
Public Transport: <http://publictransport.net/bim/Austria/Wien/Ulf/ulf.html> (04/04/08)
Siemens: www.siemens.at/transportation/index.htm (03/04/08)
- ¹⁴ *Alstom Transport*: www.transport.alstom.com (February 08)
- ¹⁵ *Alstom Transport*: www.transport.alstom.com (February 08)
Light Rail Smackdown: <http://kfarr.com/2007/11/23/light-rail-smackdown-dublins-luasvs-sf-munis-t-third/> (February 08)
Luas: www.luas.ie (February 08)
- ¹⁶ *Alstom Transport*: www.transport.alstom.com (February 08)
Spiegel: www.spiegel.de/international/0,1518,454517,00.html (February 08)
- ¹⁷ *APTA Skytrain - The Smart Choice for Greater Vancouver*: www.apta.com/services/intnatl/intfocus/skytrain2.cfm (23/04/08)
Canada Line: www.canadalineline.ca/aboutFAQ.asp (23/04/08)
Canada Line Fact Sheet: www.richmond.ca/_shared/assets/2007-12-14_Canada_Line_Vehicle_FactSheet18994.pdf (23/04/08) and personal communication Alan Dever, Canada Line (06/05/08)
Millenium Line: www.cyburbia.org/forums/showthread.php?t=7759 and http://en.wikipedia.org/wiki/Millennium_Line (23/04/08)
- ¹⁸ *Personal Communication* with Rainer Doege (Berliner Verkehrsbetriebe, March 2008), Gregor Stratil-Sauer and Andreas Nuss (both MA18, Stadtentwicklung und Stadtplanung Wien, March 2008)
Berliner Verkehrsbetriebe: www.bvg.de and www.bvg.de/index.php/de/Bvg/Index/folder/207/name/Stra%DFenbahn (03/03/08)
Bombardier: www.bombardier.com/index.jsp?id=1_0&lang=en&file=/en/1_0/1_0.jsp (03/03/08)
Moderne Strassenbahn und Verkehrsplanung: www.tramway.at/projekt_basics/index.html (03/03/08)

Railway Procurement Agency Ireland: www.rpa.ie (27/03/08)

Statistik Berlin: www.statistik-berlin.de/umwelt/umw-01.htm (03/03/08)

Tram Metro Bus Airplane: <http://public-transport.net/bim/Austria/Wien/Ulf/ulfl.html> and <http://public-transport.net/bim/Paris.htm> (03/03/08)

¹⁹ Tramway in Strasbourg France: <http://public-transport.net/bim/Strasbourg.htm> and <http://www.eaue.de/winuwd/76.htm> (28/03/08)

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