Global Transit Investments and Ridership

Assessing Canadian Cities' Challenges and Opportunities

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Summary

Earlier this month, the Pembina Institute produced a report that examined the level of investment in "fast transit" – higher-order transit operated on either fully or longitudinally separated rights of way – in major Canadian cities: Calgary, Montreal, Ottawa, Toronto, and Vancouver. The key findings from the Pembina study were that Canadian cities perform very well in terms of ridership per capita, with Toronto producing the highest results at 133 rides per person per year; and that significant differences are evident across Canadian cities in terms of the level of investment in new infrastructure.

The Waterloo Public Transportation Initiative – a research group housed in the University of Waterloo's Department of Civil and Environmental Engineering and the School of Planning – extended the Pembina Institute's research to compare Canadian cities' ridership and investment levels to US and international cities. The results of these comparisons are presented here.

To identify peer US cities, we used two criteria: similar service area population and similar economic activity, as measured by GDP. For each Canadian city and its peers, we calculated the system lengths; the change in system length between 1996 and 2012; the annual number of rides per person; and the change in per person ridership in period 1996 to 2012. The results are summarized in Table ES1.

Table ES 1 Comparison of Canadian Cities with Peer US Cities

City	2012 System length (km)	Growth in system length 1996-2012		2012 rides per person	Change in annual rides per person 1996-2012
		(km)	%[1]		
Toronto	83	18	21.7	133	25
Dallas	125	106	84.8	11	10
Miami	47	6	12.8	11	1
Philadelphia	60	0	0.0	31	8
Montreal	69	5	7.2	93[2]	-51
Baltimore	70	11	15.7	11	2
Denver	57	48	84.2	8	6
Minneapolis	20	20	100.0	6	6
Calgary	56	26	46.4	74	29
Vancouver	68	44	64.7	52	29
Portland	60	36	60.0	29	19
St. Louis	73	46	63.0	11	5
Salt Lake City	57	57	100.0	8	8
Ottawa	43	23	53.5	104	28
Charlotte	15	15	100.0	6	6
Canadian Averages	63.8	23.2	36.4	91.2	12.0[3]
US Averages	58.4	34.5	59.0	13.2	7.1

Notes: [1]The values presented in this column are the % of the 2012 system built between 1996 and 2012; [2]2012 represents an anomaly in Montreal transit usage – the 2011 and 2013 values are 162.9 and 188.0 respectively. [3]This value includes the anomaly in Montreal transit usage. Without Montreal, the average change is 27.8.

We interpret these results as follows:

1. **Canadian cities have much higher transit usage than their American counterparts.** In every case, the Canadian cities' annual rides per capita exceed their American peers. In some cases, such as Toronto and Montreal, the difference is remarkable – 12 and 8 times the ridership in these cities respectively. While Canadian cities are far denser than their American counterparts (see data below) which may explain some of the differences, the Canadian ridership values demonstrate that transit plays a more important role in urban transportation in these Canadian cities than in American cities.
2. **In both countries, a wide range of transit investments can be observed.** In the US, older cities like Philadelphia, Baltimore and Miami have made very few and in some cases no additions to their networks. In contrast, some cities have made major investments. Most notable is Dallas, where more than 100km of LRT have been built in the past 16 years. Many other cities in the United States have invested heavily in their transit networks.
   Our interpretation of the US network growth is that these cities are making conscious efforts **to improve transportation choice and sustainability and reverse the (North) American trend of auto dependence**. The low rides per capita in these cities reflect the complex challenge of not only introducing new service, but convincing travelers to first consider transit as a viable alternative and, ultimately, change their travel behavior. **The modest growth in per capita ridership, however, suggests that additions to the network have enormous potential to grow ridership, even in places where current ridership levels indicate that transit is less ingrained in personal travel patterns.**
   In Canada, most of the growth in urban transit networks has occurred in the west – in Calgary and Vancouver. Calgary and Vancouver have added 70km of service in the past two decades. In contrast, Toronto and Montreal have added only 23km. **The impacts of the growth in system length are manifest in the rides per capita data; Calgary, Vancouver and Ottawa each grew ridership faster than Toronto despite not having less population growth and lower densities.**
   Our interpretation of these results is that **Toronto and Montreal have both missed opportunities to vastly expand the role of transit in promoting sustainable, reliable, and economically-supportive transportation networks. Given the observed growth in usage in other cities where investments have been made, our expectation is that investments in Canada's two largest metropolitan areas will produce greater returns on investment than in other cities due to the existing roles that transit plays in contemporary travel patterns. Failure to make these investments presents the risk that these metropolitan regions will experience decreased global economic competitiveness and quality of life for residents, as well as poorer environmental conditions.**

We also compared Toronto and Montreal to similar international cities: Los Angeles, New York, Chicago, Washington DC, San Francisco, Madrid and Singapore. These cities were chosen to place Canada's two largest metropolitan areas in context with similar areas in terms of population, density, or GDP values. In addition to the comparisons made above, for this comparison we also calculated km of transit network per million residents. This metric indicates the level of supply of transit relative to total population. The results are shown Table ES2.

Table ES 2 Comparison of Toronto and Montreal to International Cities

City	2012 System length (km)	2012 System length (km / million residents)	Growth in system length 1996-2012		2012 rides per person	Change in annual rides per person 1996-2012
			(km)	%		
Toronto	83	32	18	21.7	133	25
Montreal	69	37	5	7.2	93	-51
Los Angeles	164	19	93	56.7	13	10
New York	392	49	0	0.0	321	136
Chicago	166	49	1	0.6	67	29
Washington DC	170	46	27	15.9	77	12
San Francisco	52	64	12	23.0	54	3
Madrid	293	91	172	58.7	186	48
Singapore	178	33	95	53.4	182	97

We interpret the data in Table ES 2 as follows:

3. Toronto and Montreal have smaller higher order transit networks on a per capita basis than all cities except for Los Angeles, and Singapore which currently is constructing several new lines of metro. Los Angeles also has been investing in public transport with 93km of higher order transport built in the last 16 years.
4. Major investment is taking place in metro networks outside of North America. Singapore's network has grown by 95km; Madrid's network has tripled in the past 16 years. The results in these two cities are massive growth in annual rides per capita. Both these cities have overtaken Toronto in terms of annual rides per person over the study period.
5. In terms of population density (see below), Montreal and Toronto are most similar to Chicago. But, in terms of transit networks, both cities lag considerably behind Chicago's 166 km of higher order network. Despite being slightly less dense and having less transit infrastructure, annual per capita ridership is higher in the Canadian cities than in Chicago. This once again reinforces the important role that transit is playing in Canadian cities and, as an extension, the propensity for investments in transit to grow ridership in Canada.

City-by-City Comparisons with American Peers

Toronto

Table 1 City Characteristics of Toronto and its American Peers

City	Service Area (square kilometres)	Service Population	Density (ppl / sq. km.)	GDP ($ M)
Toronto	630	2,615,060	4,150	228,204
Dallas	1,800	2,423,480	1,346	192,545
Miami	793	2,496,435	3,150	217,693
Philadelphia	2,204	3,320,234	1,506	198,369

Figure 1 Rapid Transit System Length for Toronto and its Peers

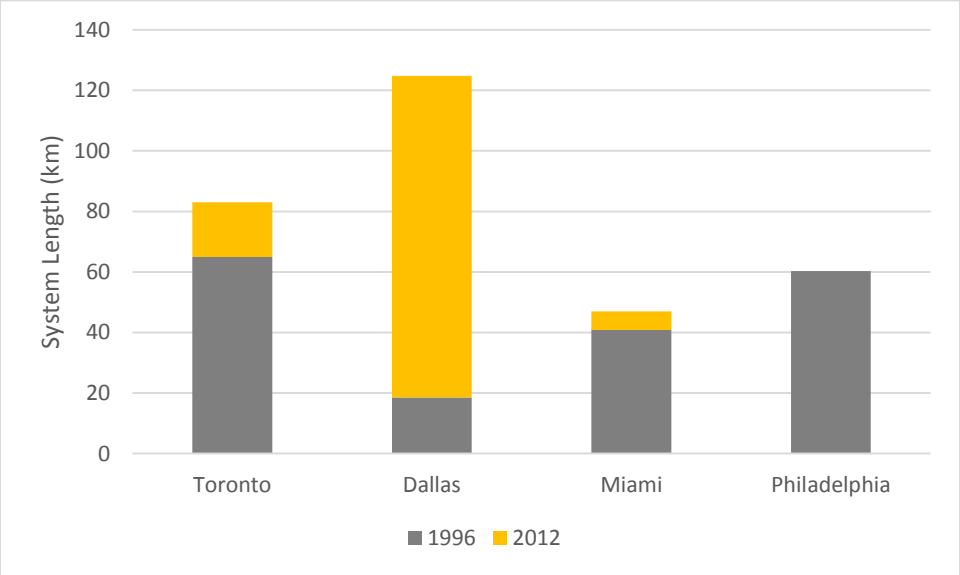


Figure 2 Rapid Transit System Length per Capita for Toronto and its Peers

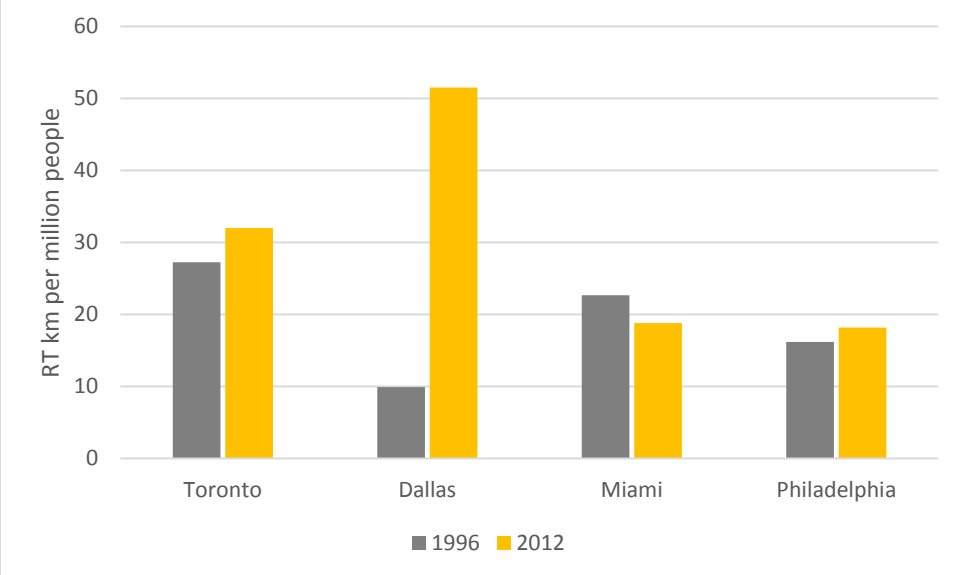


Figure 3 Rapid Transit Ridership per Capita for Toronto and its Peers

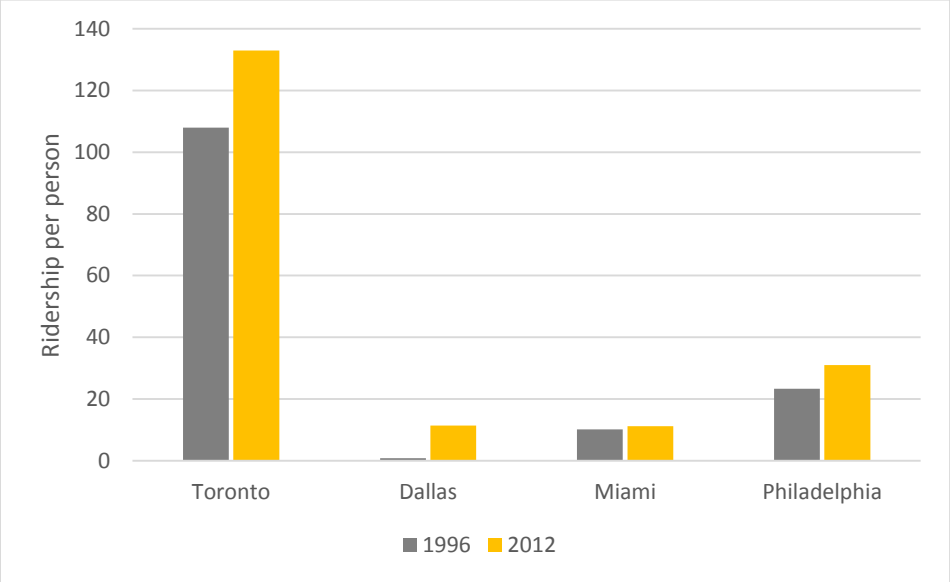
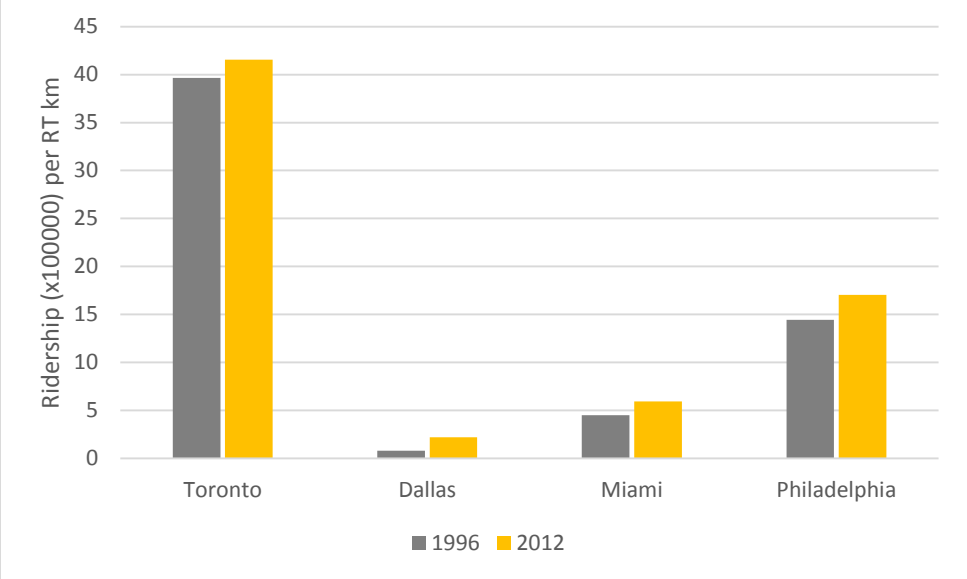


Figure 4 Rapid Transit Ridership per Kilometre of Rapid Transit Infrastructure for Toronto and its Peers



Montreal

Table 2 City Characteristics of Montreal and its American Peers

City	Service Area (square kilometres)	Service Population	Density (ppl / sq. km.)	GDP ($ M)
Montreal	499	1,886,481	3,779	129,444
Baltimore	4,649	2,203,663	474	123,594
Denver	6,024	2,619,000	435	121,607
Minneapolis	1,572	1,805,940	1,149	148,717

Figure 5 Rapid Transit System Length for Montreal and its Peers

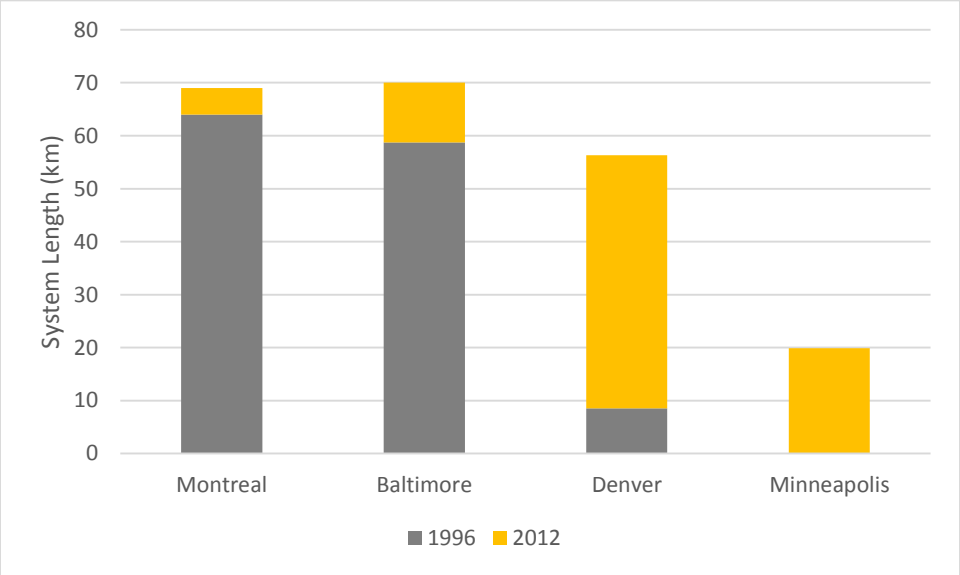


Figure 6 Rapid Transit System Length per Capita for Montreal and its Peers

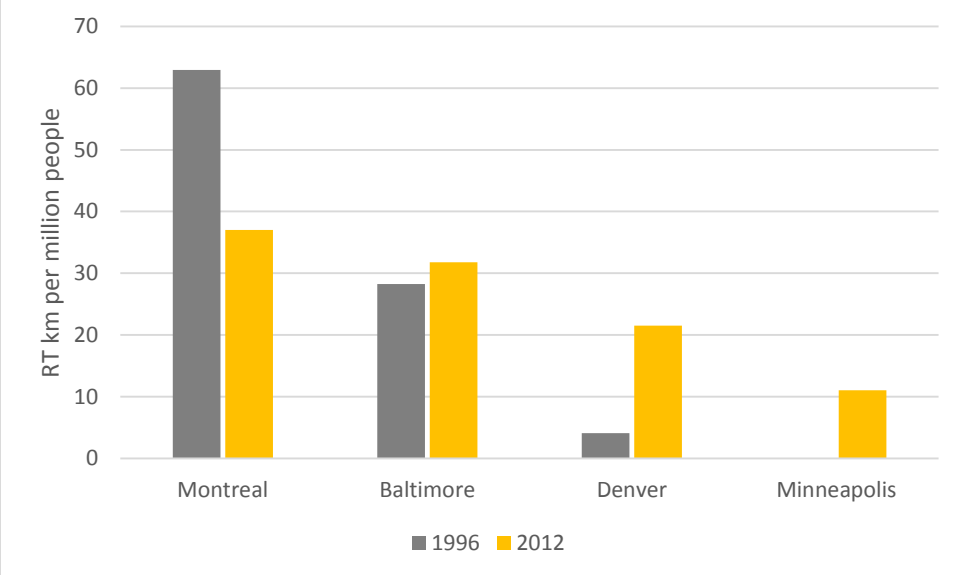


Figure 7 Rapid Transit Ridership per Capita for Montreal and its Peers

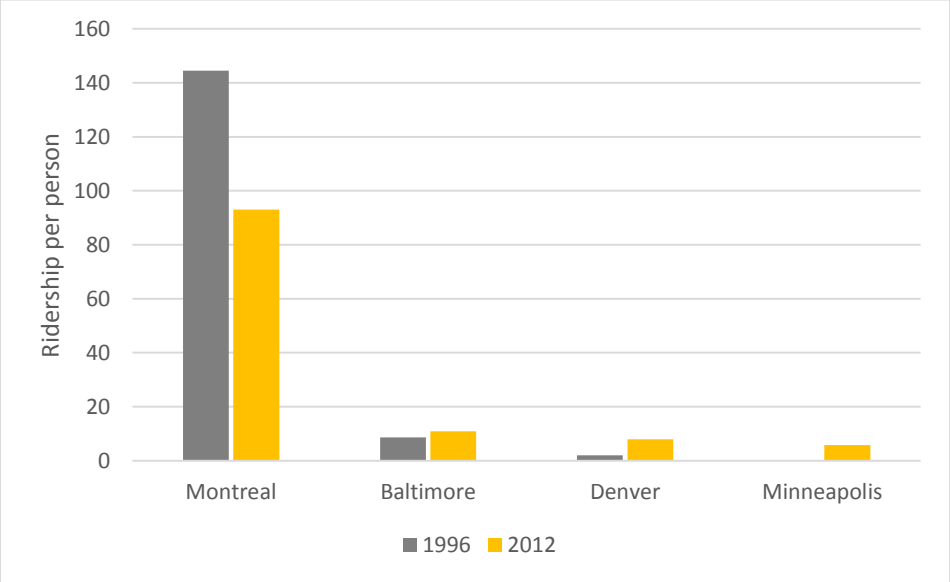
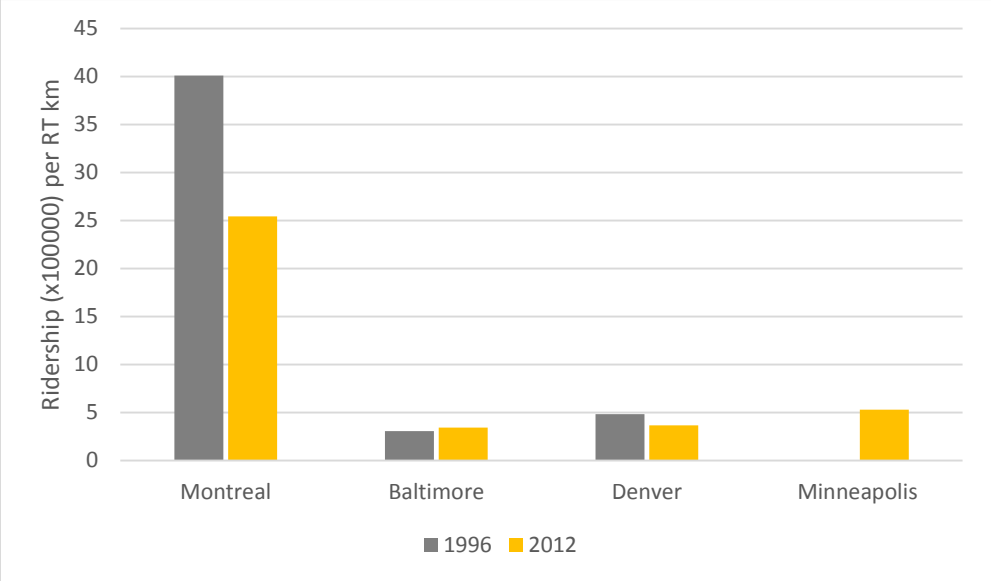


Figure 8 Rapid Transit Ridership per Kilometre of Rapid Transit Infrastructure for Montreal and its Peers



Calgary and Vancouver

Table 3 City Characteristics of Calgary, Vancouver and its American Peers

City	Service Area (sq. km.)	Service Population	Density (ppl / sq. km.)	GDP ($ M)
Calgary	825	1,096,833	1,329	70,967
Vancouver	2,883	2,313,328	803	81,613
Portland	1,476	1,489,796	1,009	100,453
St. Louis	1,445	1,540,000	1,066	99,107
Salt Lake City	1,945	2,165,290	1,113	47,701

Figure 9 Rapid Transit System Length for Calgary, Vancouver and its Peers

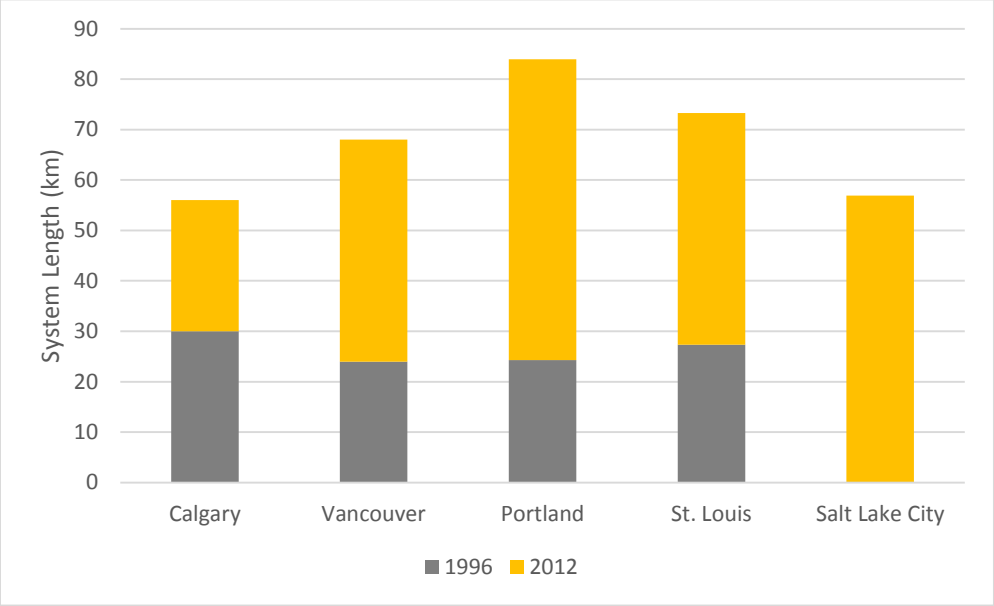


Figure 10 Rapid Transit System Length per Capita for Calgary, Vancouver and its Peers

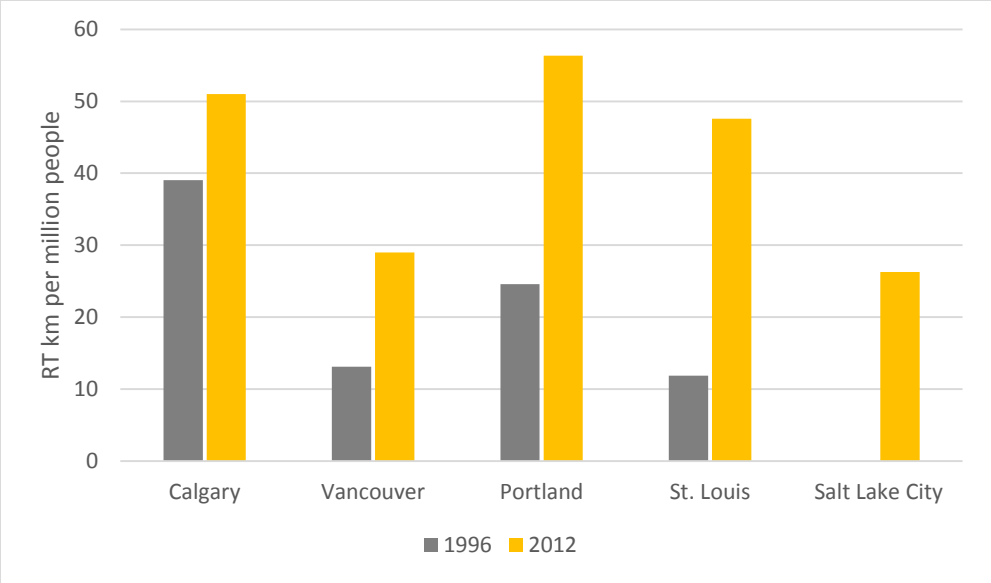


Figure 11 Rapid Transit Ridership per Capita for Calgary, Vancouver and its Peers

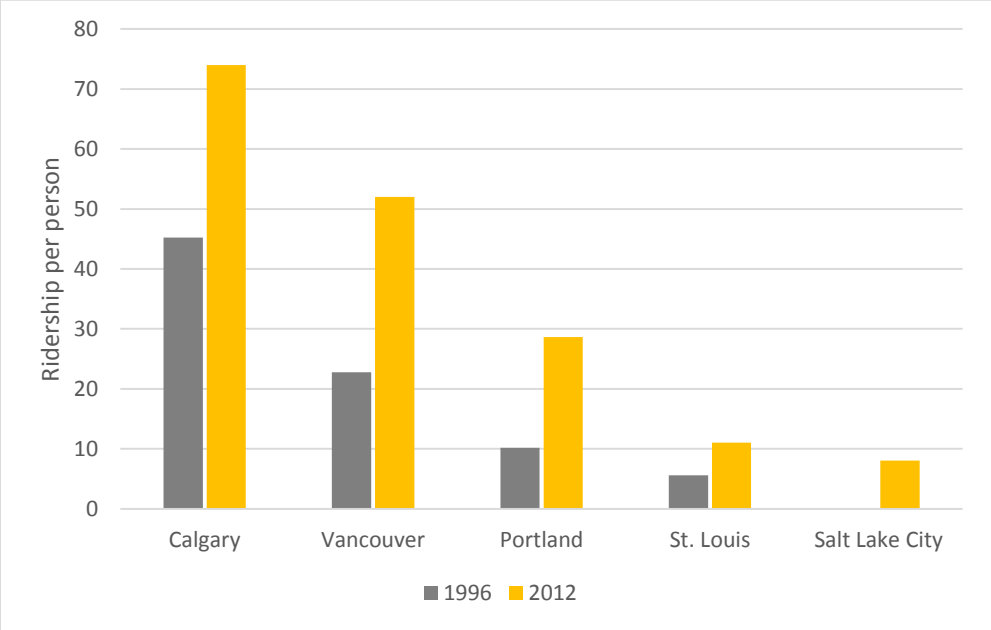
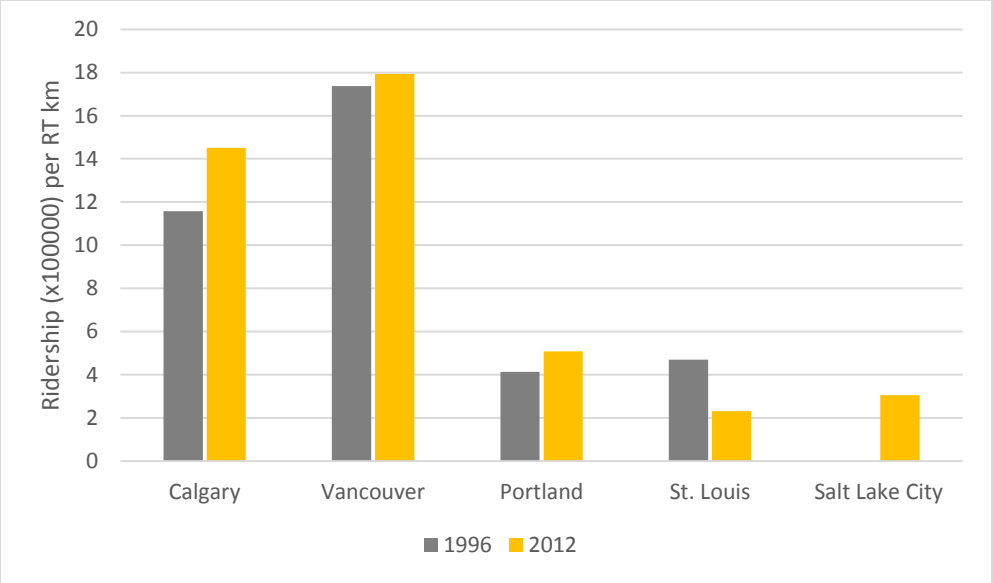


Figure 12 Rapid Transit Ridership per Kilometre of Rapid Transit Infrastructure for Calgary, Vancouver and its Peers


20
18
16
14
12
10
8
6
4
2
0
Ridership (x100000) per RT km
Calgary
Vancouver
Portland
St. Louis
Salt Lake City
1996
2012

Ottawa

Table 4 City Characteristics of Ottawa and its Peer

City	Service Area (sq. km.)	Service Population	Density (ppl / sq. km.)	GDP ($ M)
Ottawa	2,790	883,391	317	47,761
Charlotte, NC	1,153	758,927	658	48,682

Figure 13 Rapid Transit System Length for Ottawa and its Peer

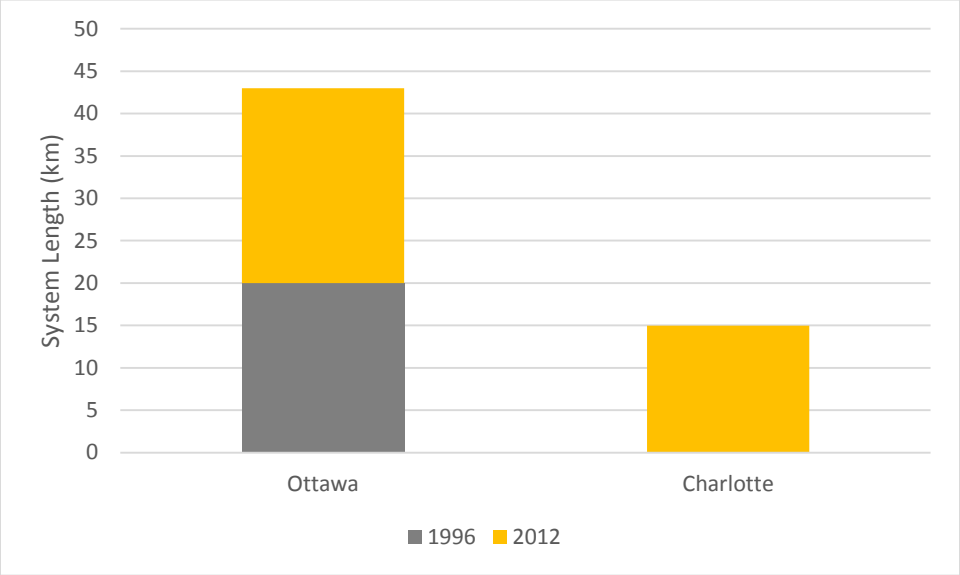


Figure 14 Rapid Transit System Length per Capita for Ottawa and its Peer

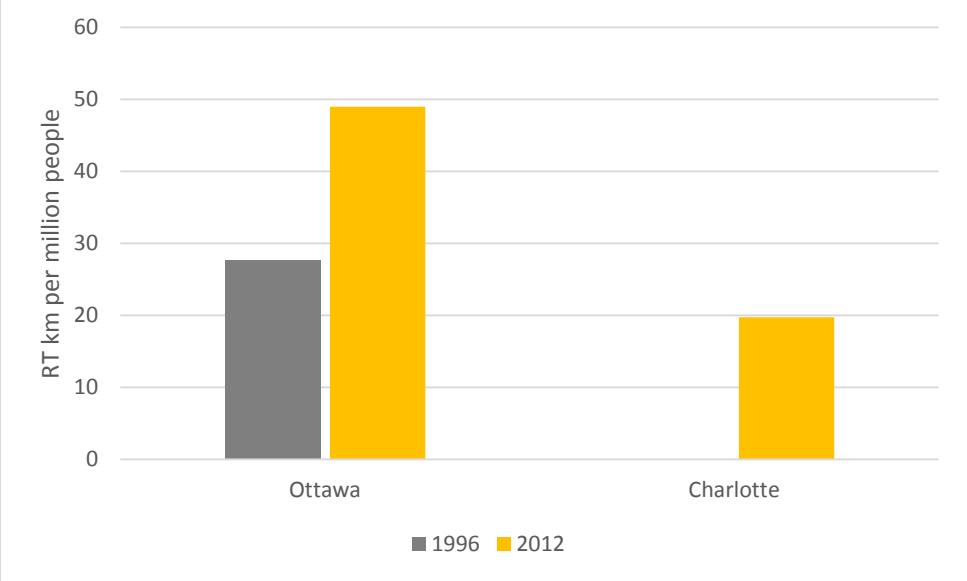


Figure 15 Rapid Transit Ridership per Capita for Ottawa and its Peer

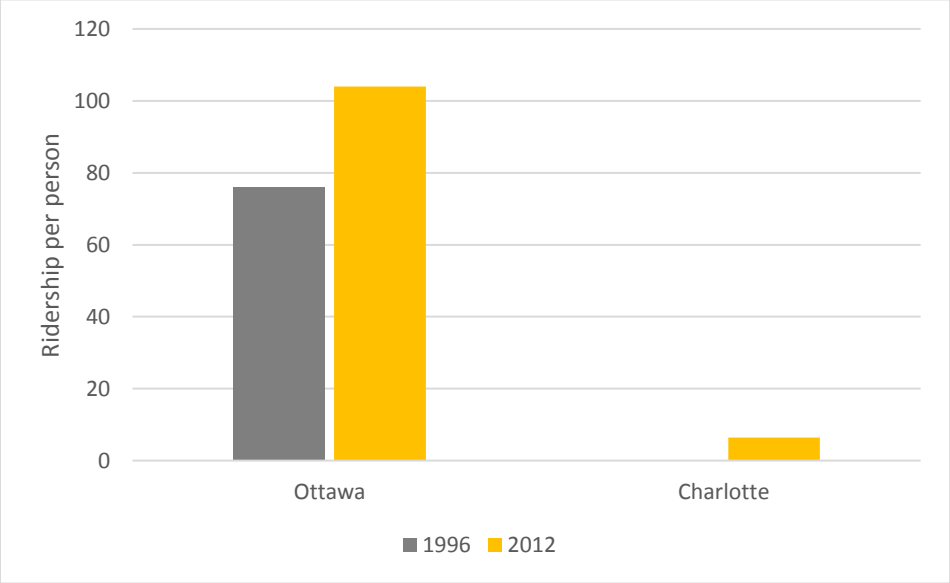
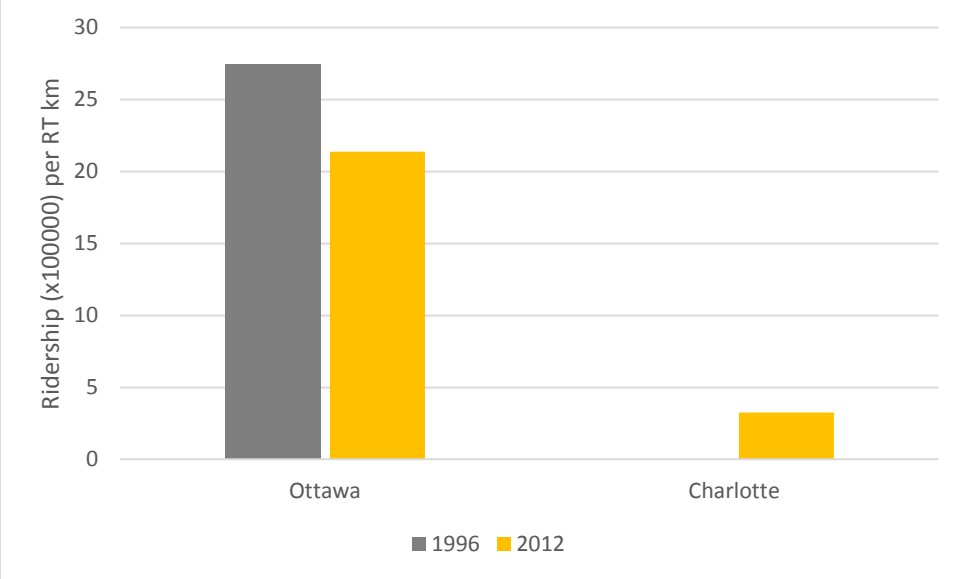


Figure 16 Rapid Transit Ridership per Kilometre of Rapid Transit Infrastructure for Ottawa and its Peer



Comparison of Cities from around the World

System Length and Expansion

- New York City is a leader in absolute rapid transit system length.
- Madrid is a leader in rapid transit infrastructure per million people.
- Rapid transit expansion: Madrid, Singapore and Los Angeles have each at least doubled their rapid transit system length over the past twenty years.
- Relatively minimal rapid transit implementation has occurred in Toronto, Montreal, Chicago and New York City
- Consider Toronto and its international peers – in terms of GDP - Singapore and Madrid:
    - Toronto has not kept pace its peers in terms of rapid transit implementation
    - Toronto has similar existing rapid transit system lengths per capita (service population) to Singapore; however, the system in Singapore serves a higher population density
        - Potential reason is that Singapore requires less KM of rapid transit to serve the population
- Consider Toronto and its international peer - in terms of density – Chicago:
    - Toronto has added more rapid transit infrastructure over the past 20 years than Chicago
    - However: Chicago has double the rapid transit system length in comparison to Toronto
    - Chicago also has more rapid transit infrastructure per million people

Ridership

- In terms of ridership per person: Toronto outperforms Chicago, Washington, San Francisco, and Los Angeles, but lags behind New York City, as well as its GDP peers, Madrid and Singapore
- In terms of ridership efficiency: Toronto is third behind New York City and Singapore

Table 4 City Characteristics from Around the World

City	Service Area (sq. km.)	Service Population	Density (ppl / sq. km.)	GDP ($ M)
Toronto	630	2,593,750	4,150	228,204
Montreal	499	1,886,481	3,779	129,444
Los Angeles	3,919	8,626,817	2,201	726,314
New York City	831	8,008,278	9,632	951,585
Chicago	813	3,431,053	4,219	449,897
Washington	2,460	3,719,567	1,512	300,412
San Francisco	127	805,235	6,345	391,899
Madrid	606	3,233,500	5,338	226,040
Singapore	716	5,312,400	7,422	236,420

Figure 17 International Comparison of Rapid Transit System Length

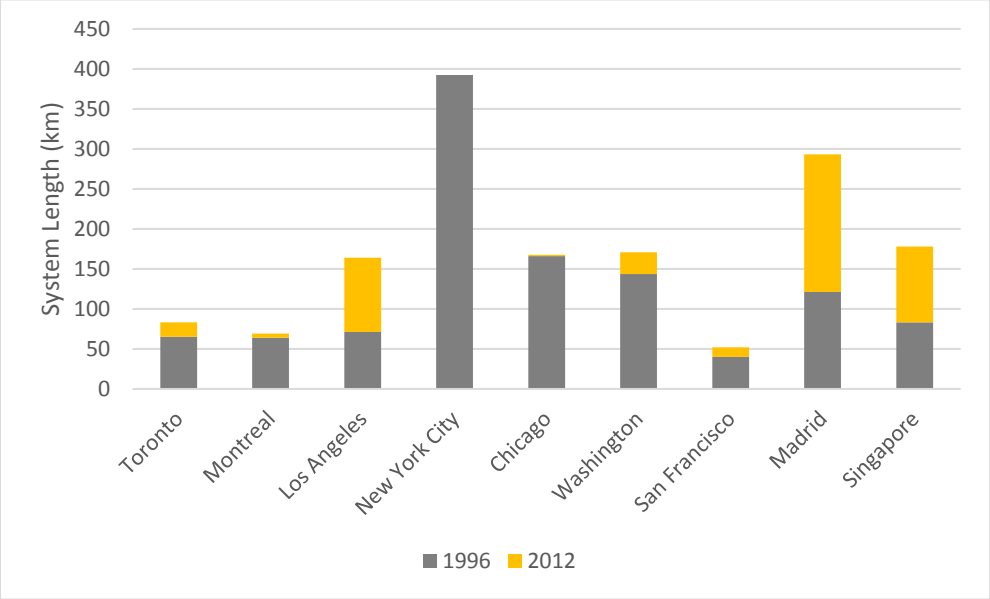


Figure 18 International Comparison of Rapid Transit System Length per Capita

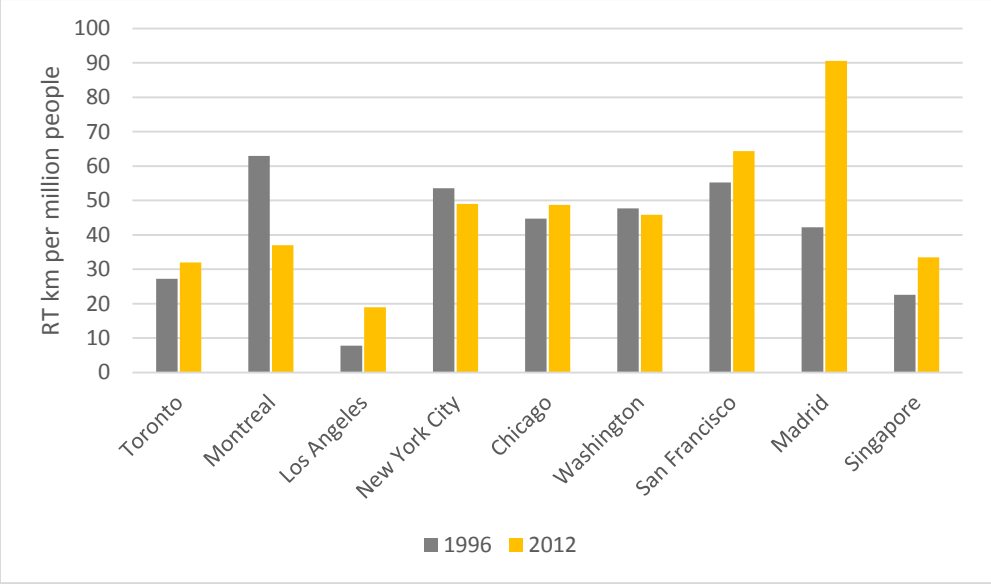


Figure 19 International Comparison of Rapid Transit Ridership per Capita

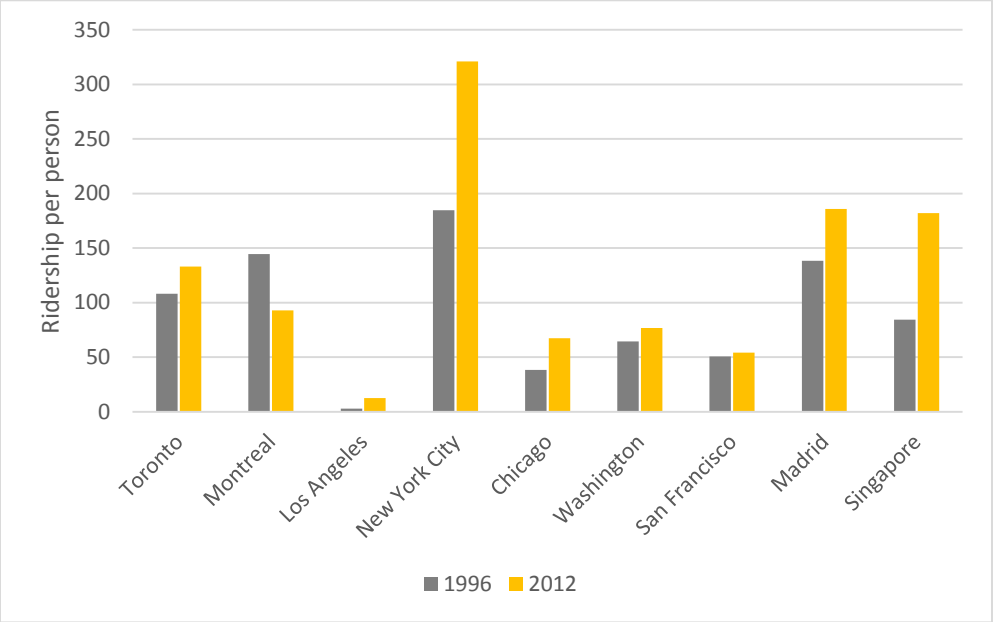
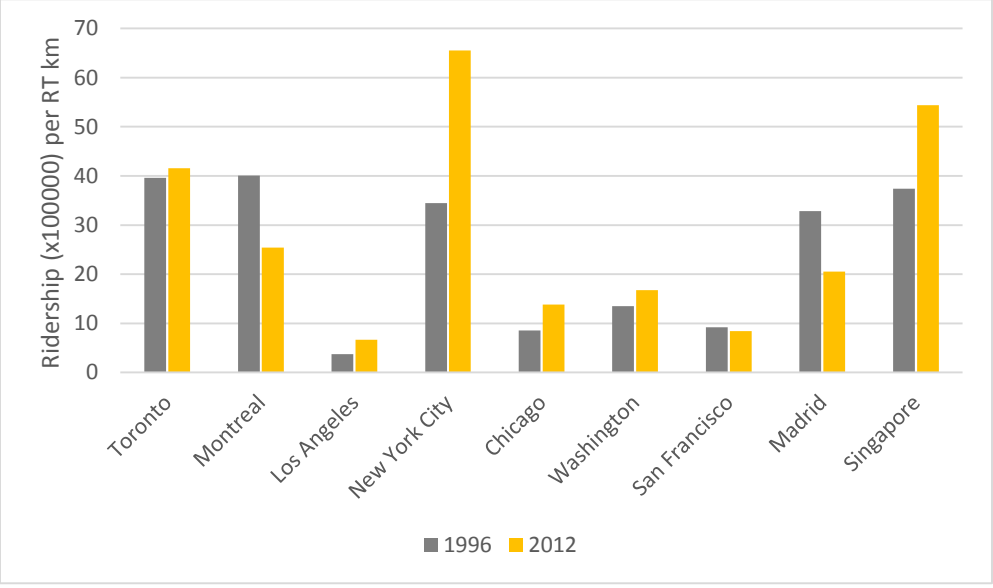


Figure 20 International Comparison of Rapid Transit Ridership per Kilometre of Rapid Transit Infrastructure



Methodology

- Selected peers to compare with Canadian cities; peer cities were determined by service population and city economic output.
    - Service Population for Canadian Cities: Statistics Canada (1996 and 2011).
    - Service Population for American Cities: National Transit Database (2014b).
    - Population of Madrid: Instituto Nacional de Estadistica (2013).
    - Population of Singapore: World Bank (2014).
    - City Economic Output (GDP): Organization for Economic Cooperation and Development (2014)
- Data Collected includes:
    - Existing Rapid Transit and Annual Rapid Transit Ridership in 1996 and in 2012
        - Source for Canadian Cities: As collected by the Pembina Report and from the American Public Transit Association (1996).
        - Source for American Cities: National Transit Database (2014a).
            - Includes: bus rapid transit, light rail transit, heavy rail
            - Does not include: bus, commuter rail
            - Data from Directional Route Miles in NTD (which does not include non-revenue track infrastructure). Divided by 2 and multiplied by 1.6 to convert to kilometres
        - Source for Madrid: Metro de Madrid (2014).
        - Source for Singapore: Land Transport Authority (2013a and 2013b).
- Data Calculated includes:
    - Existing Rapid Transit per capita = Existing Rapid Transit / Service Population (in millions)
    - Ridership per capita = Annual Ridership / Service Population
    - Rapid Transit Built per capita = Rapid Transit Built Over the Past 20 years / Service Population

Bibliography

American Public Transit Association (1996). *Fourth Quarter Ridership Report.* Available from http://www.apta.com/resources/statistics/Pages/RidershipArchives.aspx

Instituto Nacional de Estadistica (2013). *Demography and population.* Retrieved from http://www.ine.es/en/welcome_en.htm

Metro de Madrid (2014). *Metro de Madrid en cifras.* Retrieved from http://www.metromadrid.es/es/conocenos/infraestructuras/red/index.html

Land Transport Authority (2013a). *Rail Length* [Data file]. Available from http://www.lta.gov.sg/content/ltaweb/en/publications-and-research.html

Land Transport Authority (2013b). *Average Public Transport Ridership* [Data file]. Available from http://www.lta.gov.sg/content/ltaweb/en/publications-and-research.html

National Transit Database. (2014a). *Annual Databases* [Data file]. Available from http://www.ntdprogram.gov/ntdprogram/data.htm.

National Transit Database. (2014b). *Transit Agency Profiles* [Data file]. Available from http://www.ntdprogram.gov/ntdprogram/profiles.htm.

Organization for Economic Cooperation and Development (2014). *Metropolitan areas database* [Data file]. Retrieved from http://stats.oecd.org/Index.aspx?Datasetcode=CITIES

Statistics Canada (2011). *Census of Population* [Data file]. Available from http://www12.statcan.gc.ca/census-recensement/index-eng.cfm?HPA

Statistics Canada (1996). *Census of Population* [Data file]. Available from http://www12.statcan.gc.ca/english/census01/info/census96.cfm

World Bank (2014). *Population, total* [Data file].. Available from http://data.worldbank.org/indicator/SP.POP.TOTL

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About the Waterloo Public Transportation Initiative

The Waterloo Public Transportation Initiative (WPTI) is a research group, housed in the School of Planning and the Department of Civil and Environmental Engineering at the University of Waterloo, which is committed to providing expertise in the fields of transit planning and transportation engineering to address the challenges relevant to Canadian public transportation agencies. We are dedicated to promoting and improving public transit by executing an integrative approach to research in: improving transit operations; attracting riders; and capturing the regional benefits from transit agencies.

For more information of our current projects and research, please contact Professor Jeff Casello or visit us online at: http://www.civil.uwaterloo.ca/WPTI.