

Shifting Modes and Reducing Travel for Energy Conservation: Evidence from North America

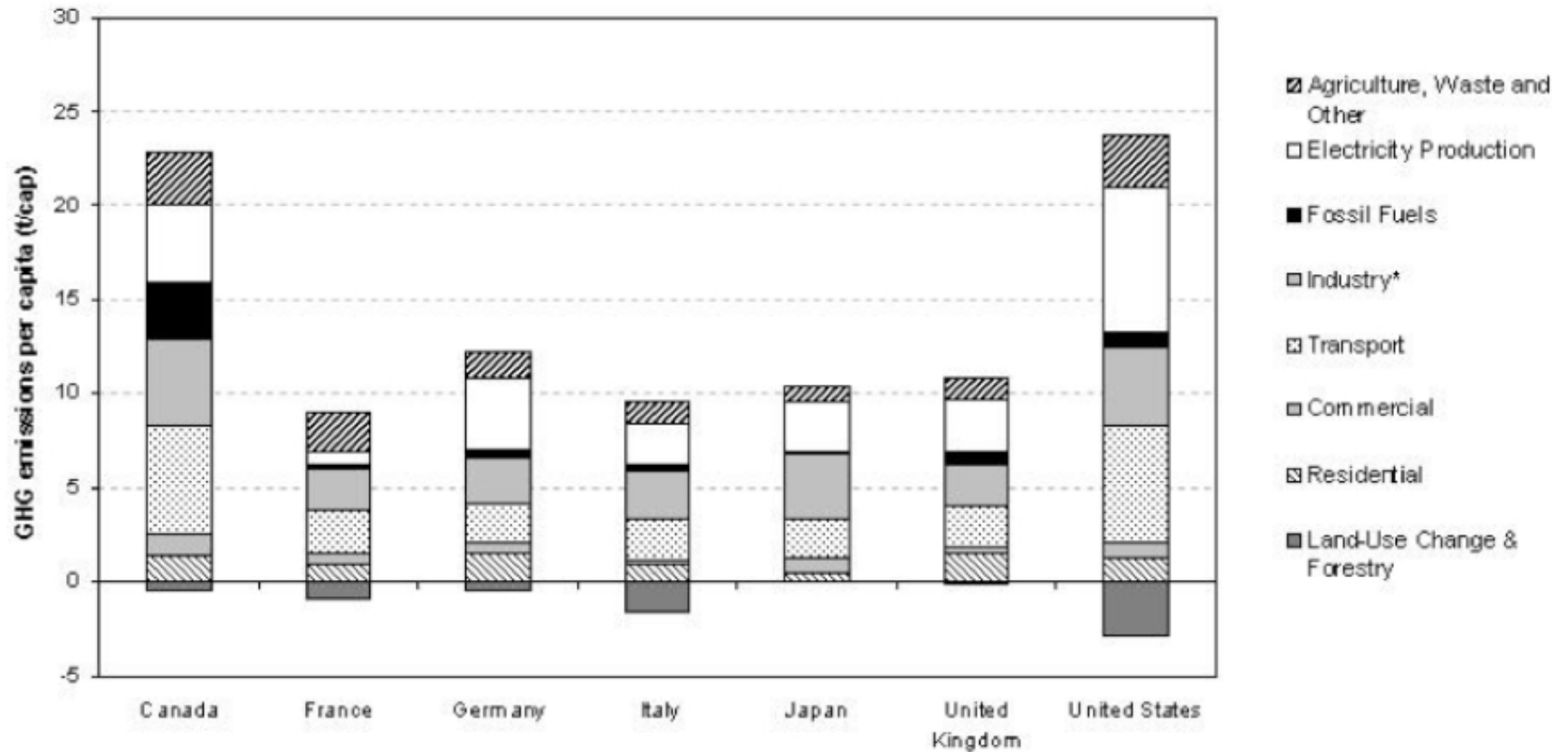
Asia Pacific Energy Research Center

Annual Conference

26 February 2013

Dr. Craig Townsend, Concordia University Montreal,
Quebec, Canada

Transport Accounts for a Lot of Energy Demand/GHG



Per-capita GHG emissions by sector

Passenger Transport Energy Use in Canada and the USA is high because:

1. High quantity of travel **activity** (trip length, frequency)
2. High share of travel by car (modal **share**)
3. Car fleet is proportionately heavy (pickups, SUVs, large cars) and uses internal combustion engines (**intensity**)
4. Carbon-based **fuel** (mainly gasoline) cheap and ubiquitous

Greene, D.L. (2004). "Transportation and Energy," in *The Geography of Urban Transportation*, S. Hanson and G. Giuliano, eds., The Guilford Press, New York.

Energy Consumption Per Vehicle Kilometer Travelled in the US

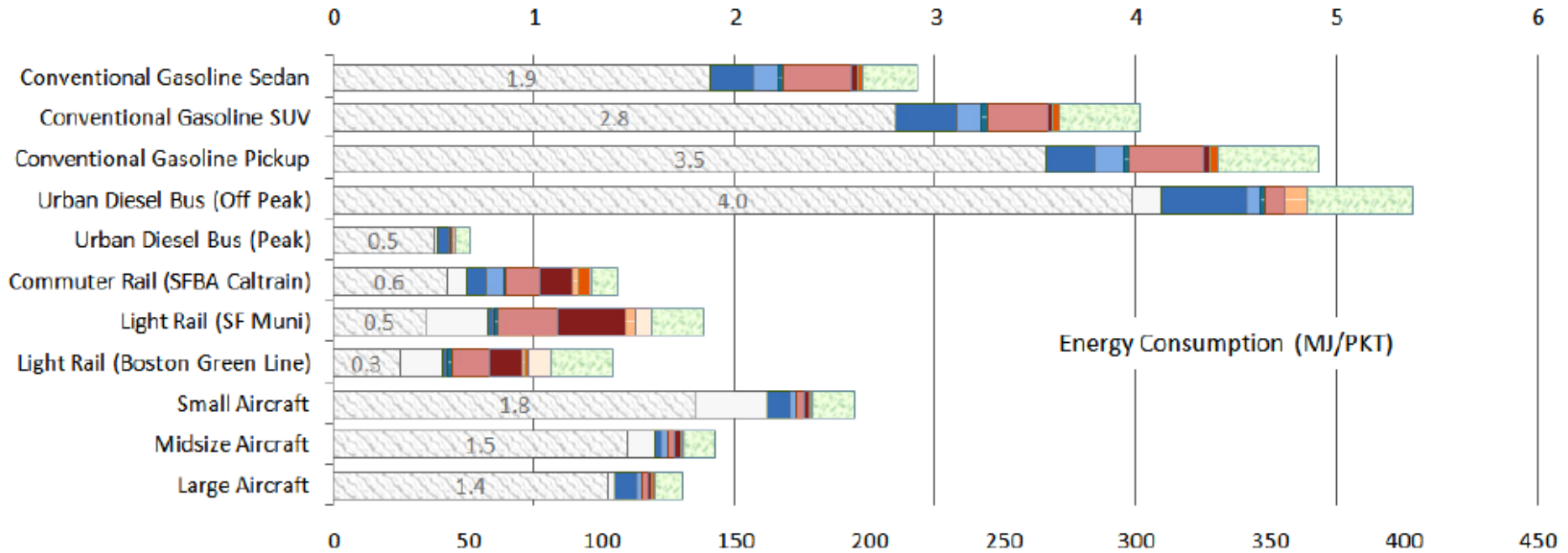


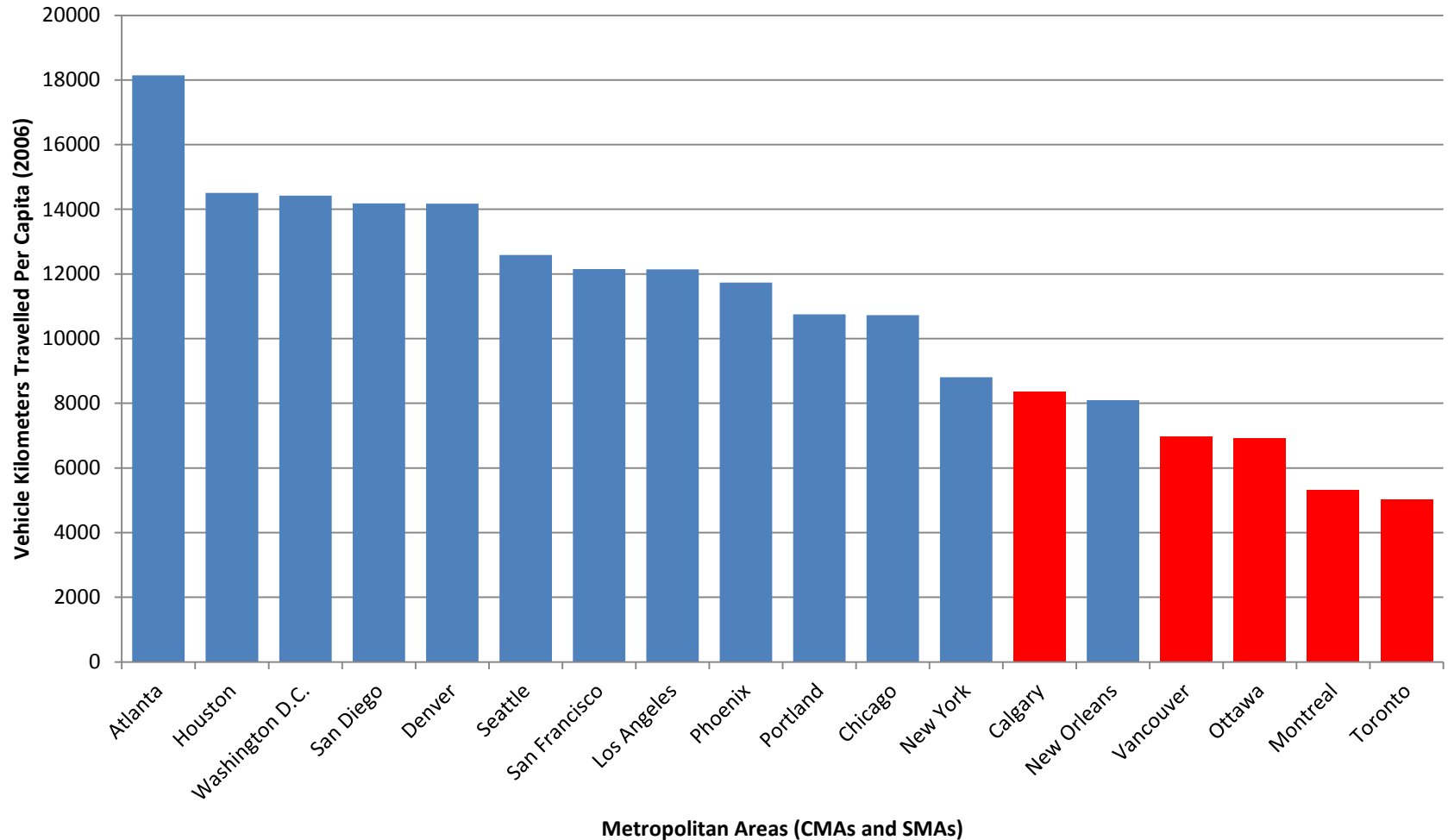
Figure 1. Energy consumption and GHG emissions per PKT (The vehicle operation components are shown with gray patterns. Other vehicle components are shown in shades of blue. Infrastructure components are shown in shades of red and orange. The fuel production component is shown in green. All components appear in the order they are shown in the legend.).

Transport Energy Reduction

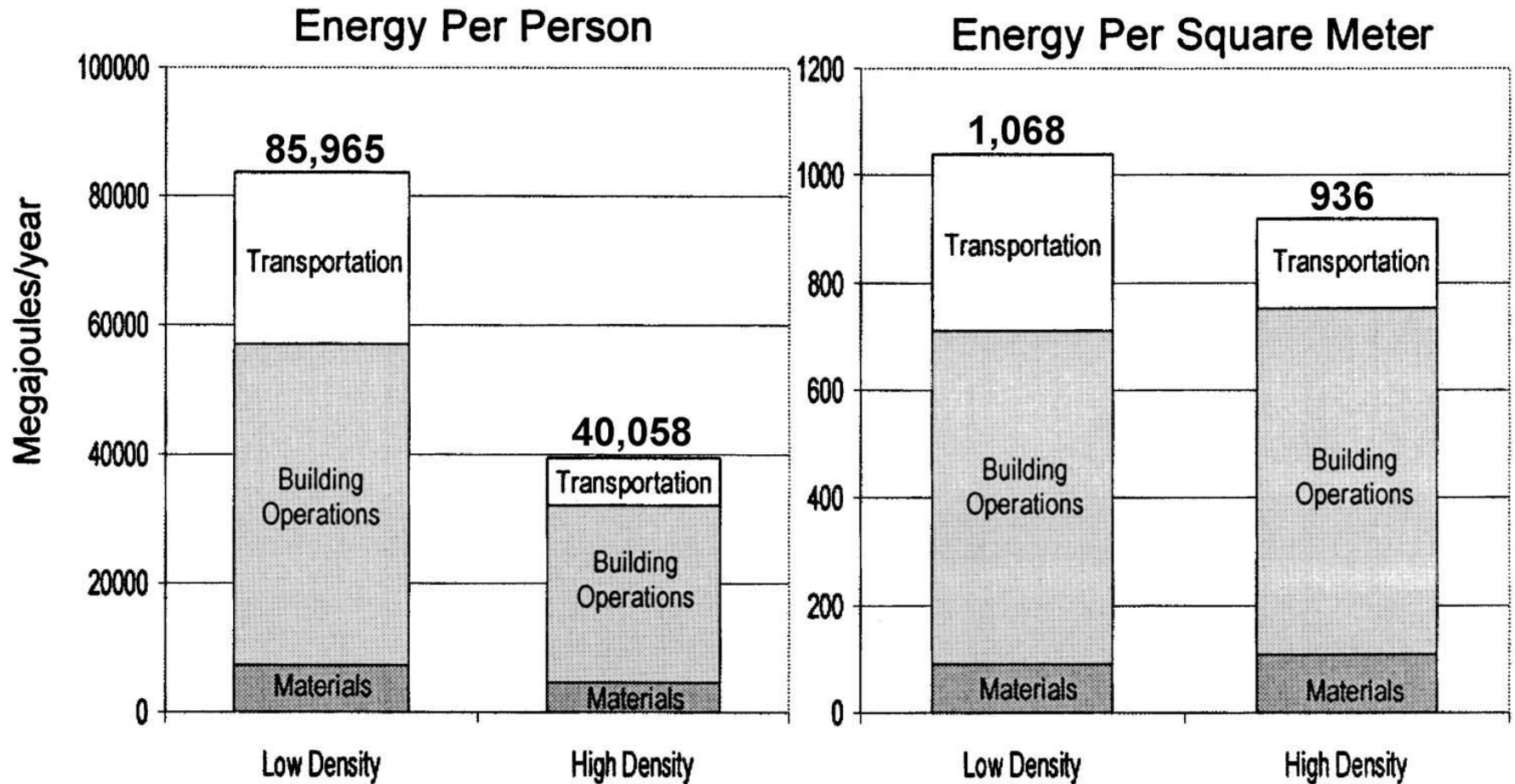
- Requires addressing at least one of 1. activity, 2. modes, 3. intensity, 4. fuels while holding the others constant
- Reducing intensity through vehicle improvements without restraints on demand will lead to increased activity and car share (Jevons paradox)

Quantity of Driving Varies by City

(reflecting differences in urban form, transport infrastructure, income, prices)



Annual Energy Use Associated with Low and High Density Development in Toronto



Source: Norman, Maclean and Kennedy, 2006

Car Travel May Have Peaked in High Income Cities

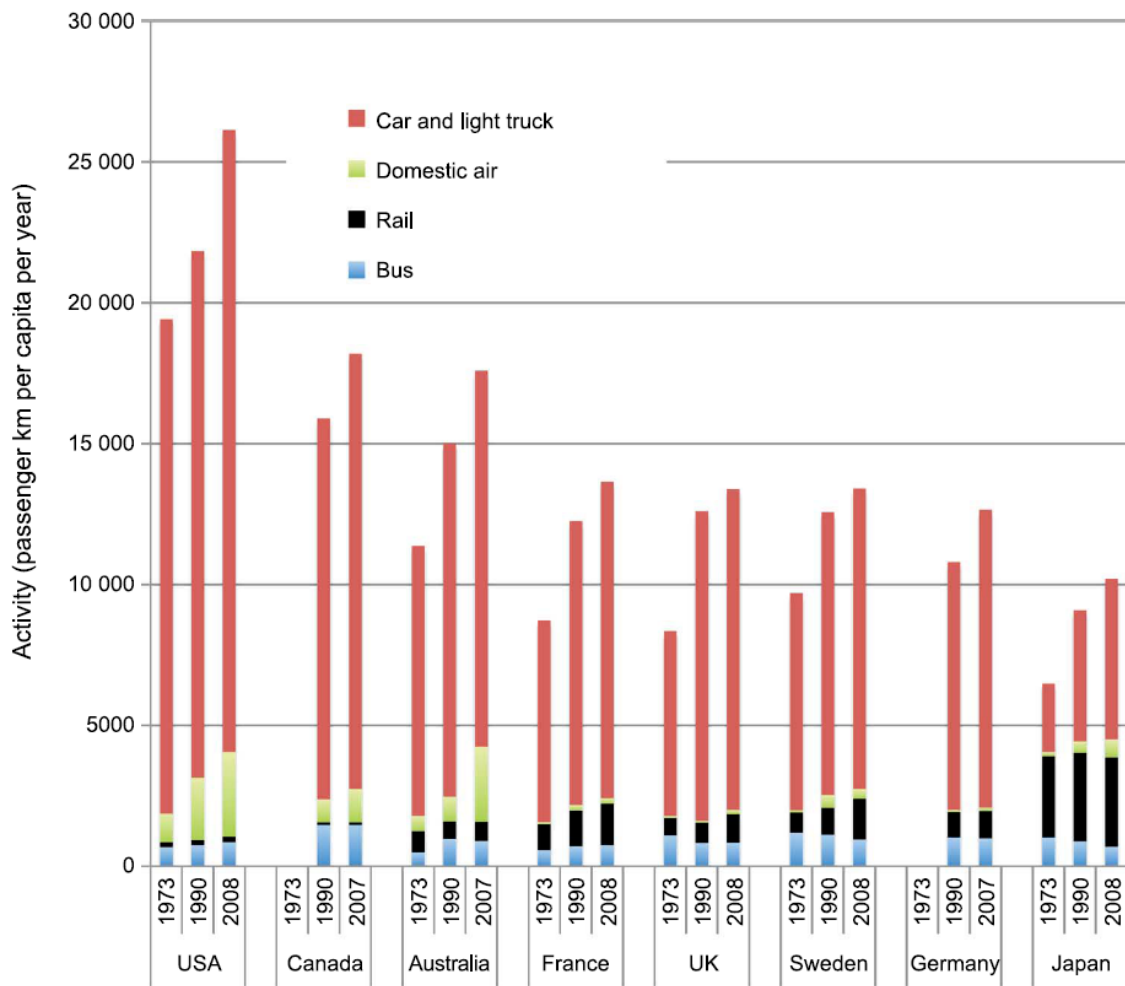
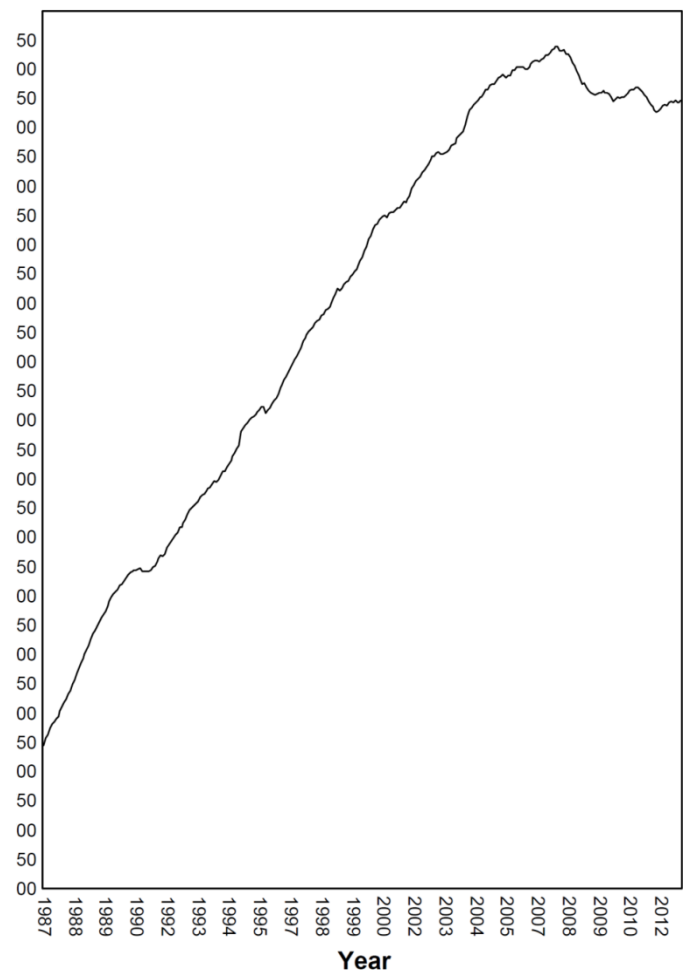


Figure 6. Passenger travel per capita by mode. Note: For Canada, metro and other local rail services are included in the 'bus' category.



Source: US-DOT, 2012

Source: Millard-Ball & Schipper, 2010

Decline in licensed drivers among younger population

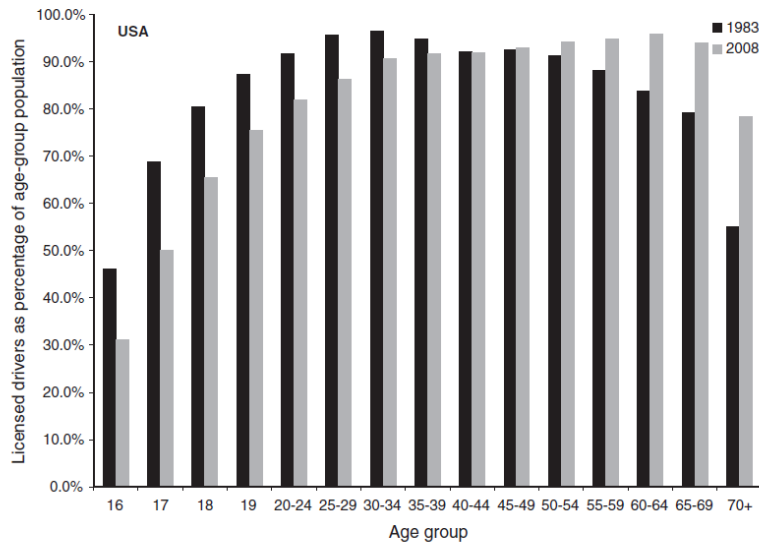


Figure 1 United States: Licensed drivers as a percentage of their age-group population (Federal Highway Administration [FHWA] 1984, 2009).

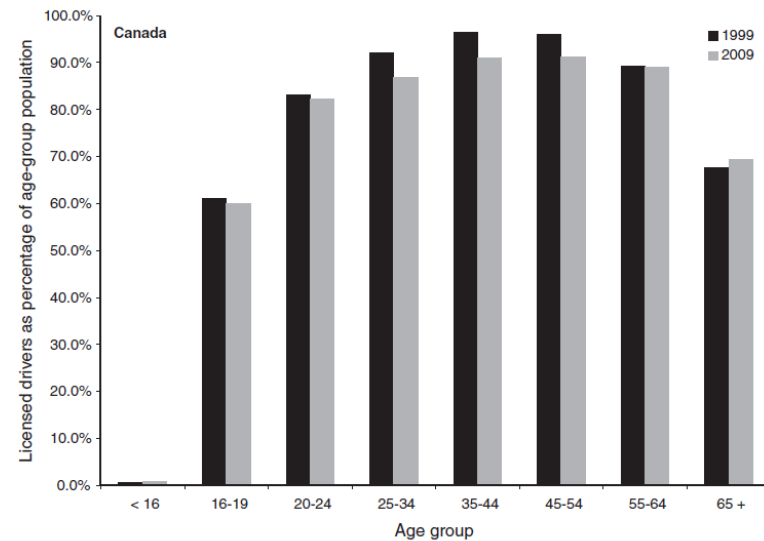


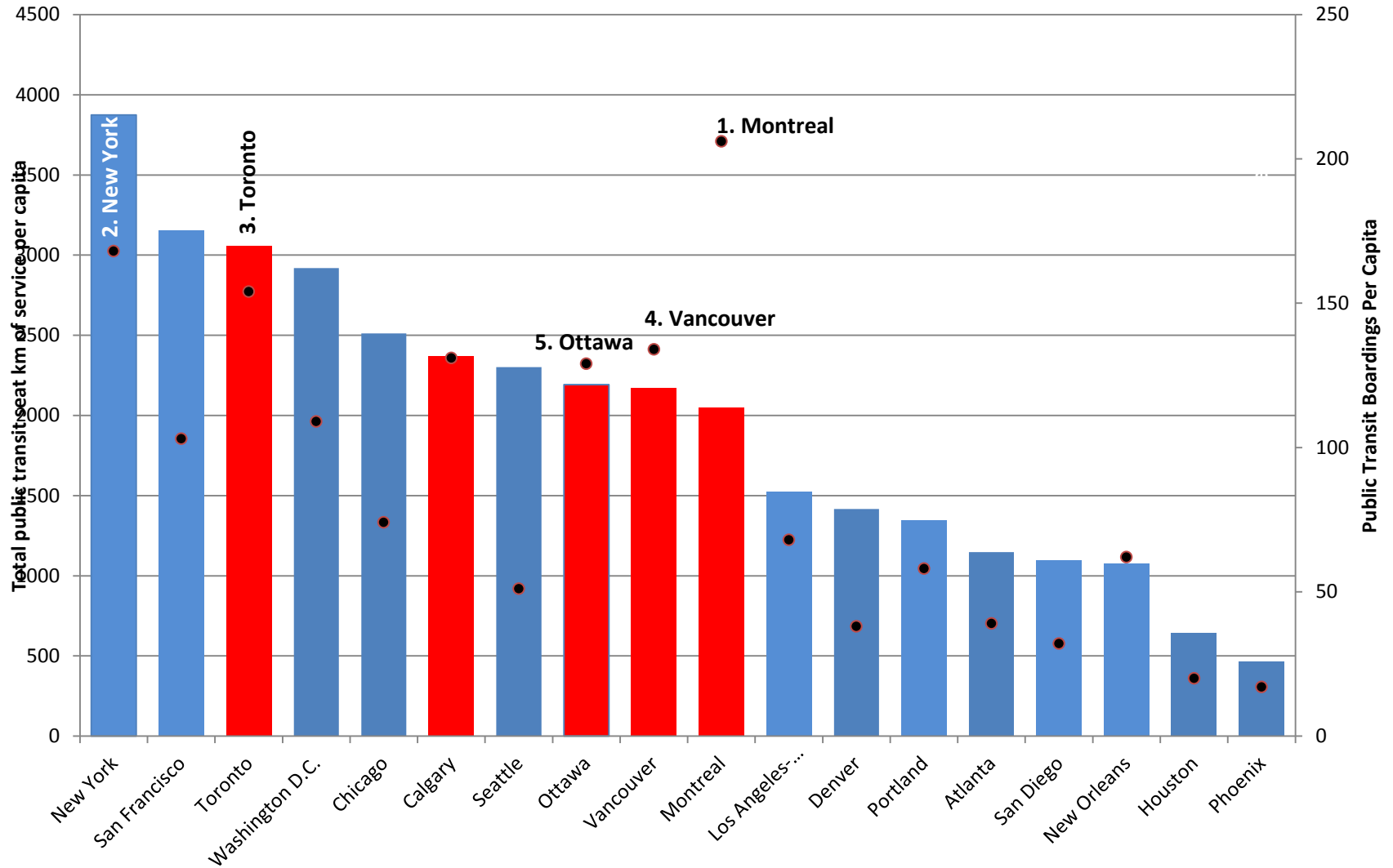
Figure 6 Canada: Licensed drivers as a percentage of their age-group population (Statistics Canada 2011; E. Cragg, personal communication, June 30, 2011).

Why is Driving Declining?

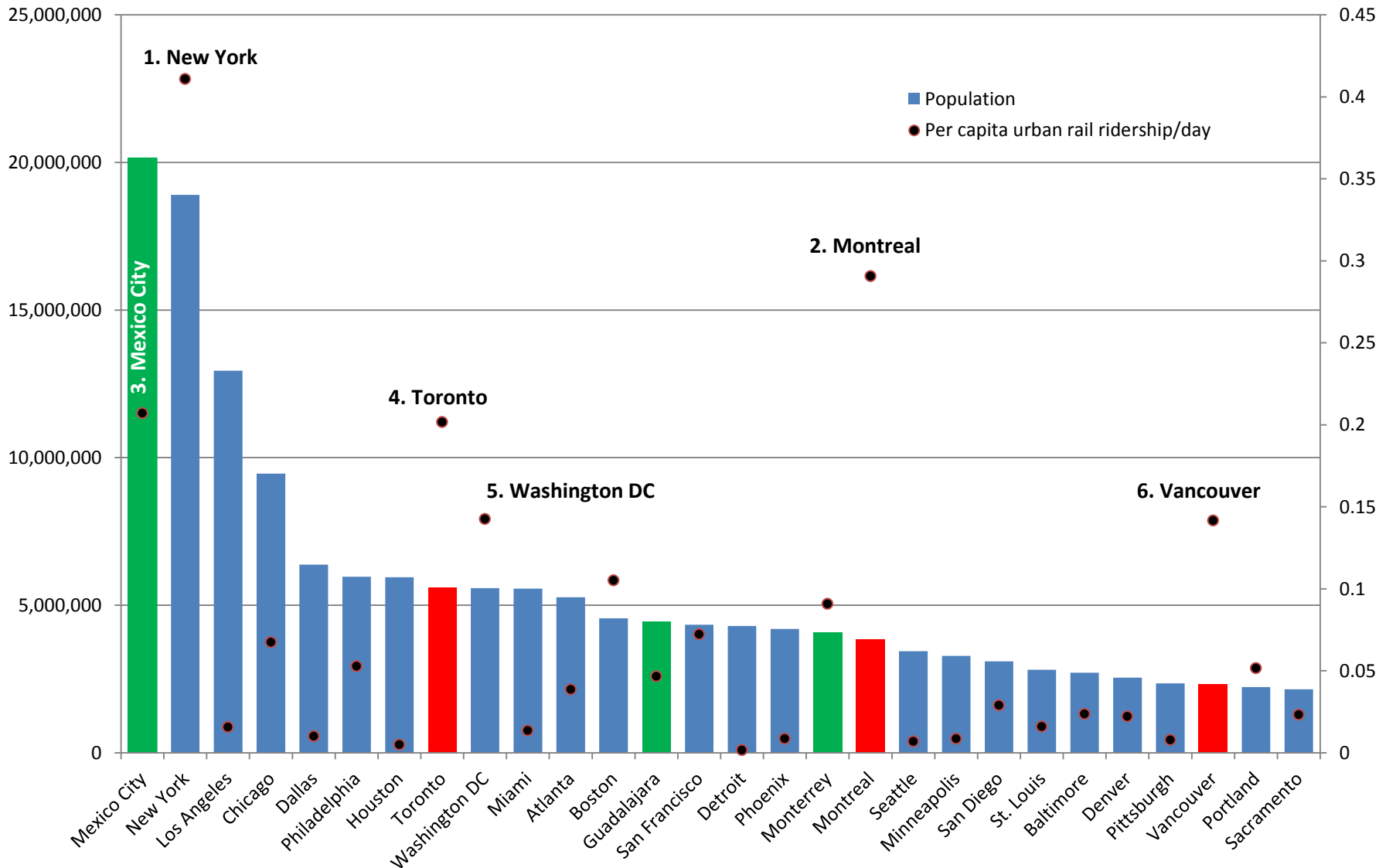
"They've grown up quite differently than me and you," Mark Reuss, president of GM North America said of millennials in January. "I cut lawns when I was young, and then I saved my money and bought a car. I don't know if that happens anymore...."

"From 2001-09, the average annual number of vehicle miles traveled by people ages 16-34 decreased from 10,300 miles [16,576 km] to 7,900 miles [12,714 km] per capita -- a drop of 23%, according to a study by Frontier Group released in April.

North America: Public Transit Supply and Demand, 2006



North America: Metropolitan Population and Per Capita Urban Rail Ridership, 2011/12

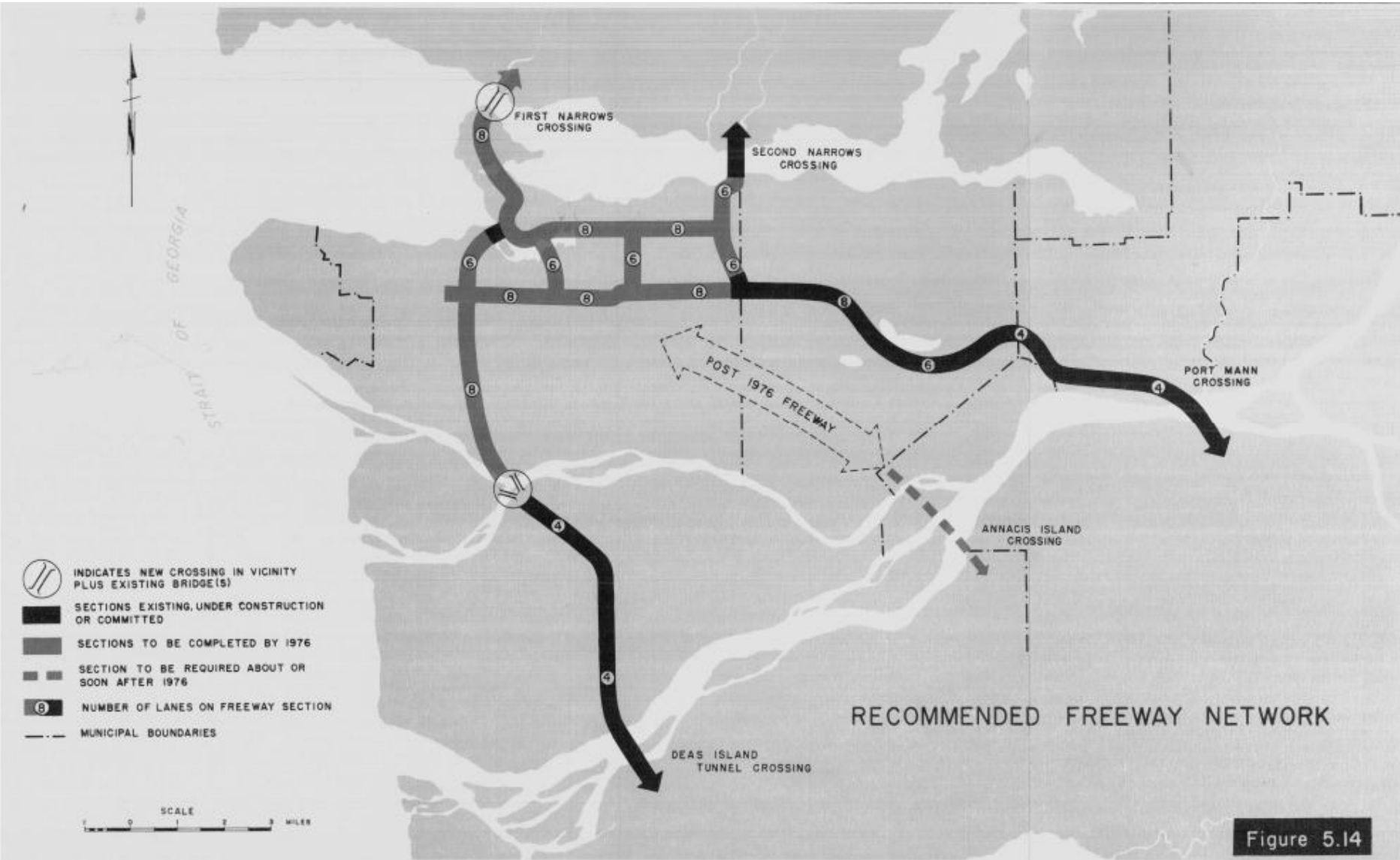


Note: Data from American Public Transit Association (2012) and Wikipedia

Vancouver: Background



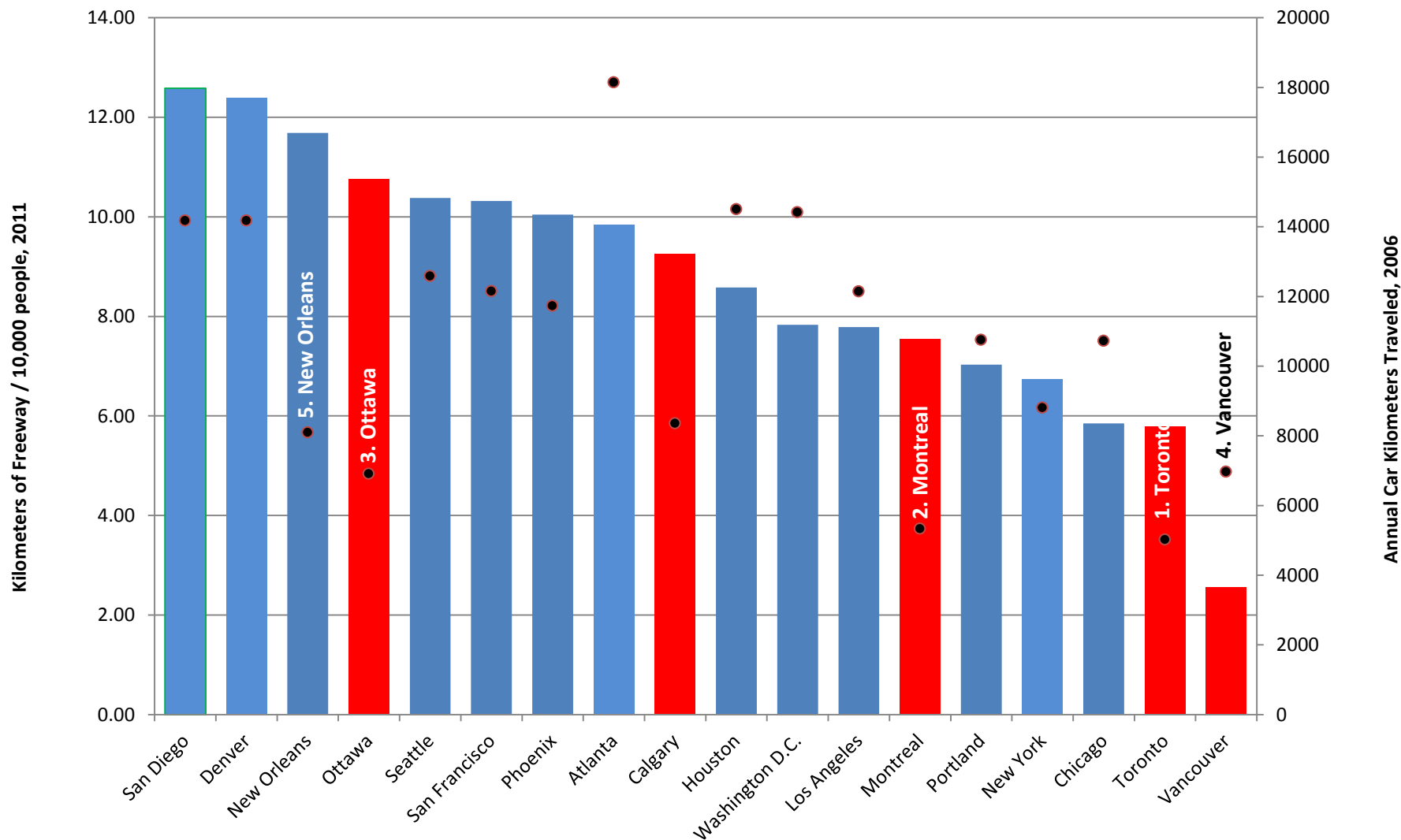
Proposed Metropolitan Freeways (1959)



Source: Technical Committee for Metropolitan Highway Planning, 1959

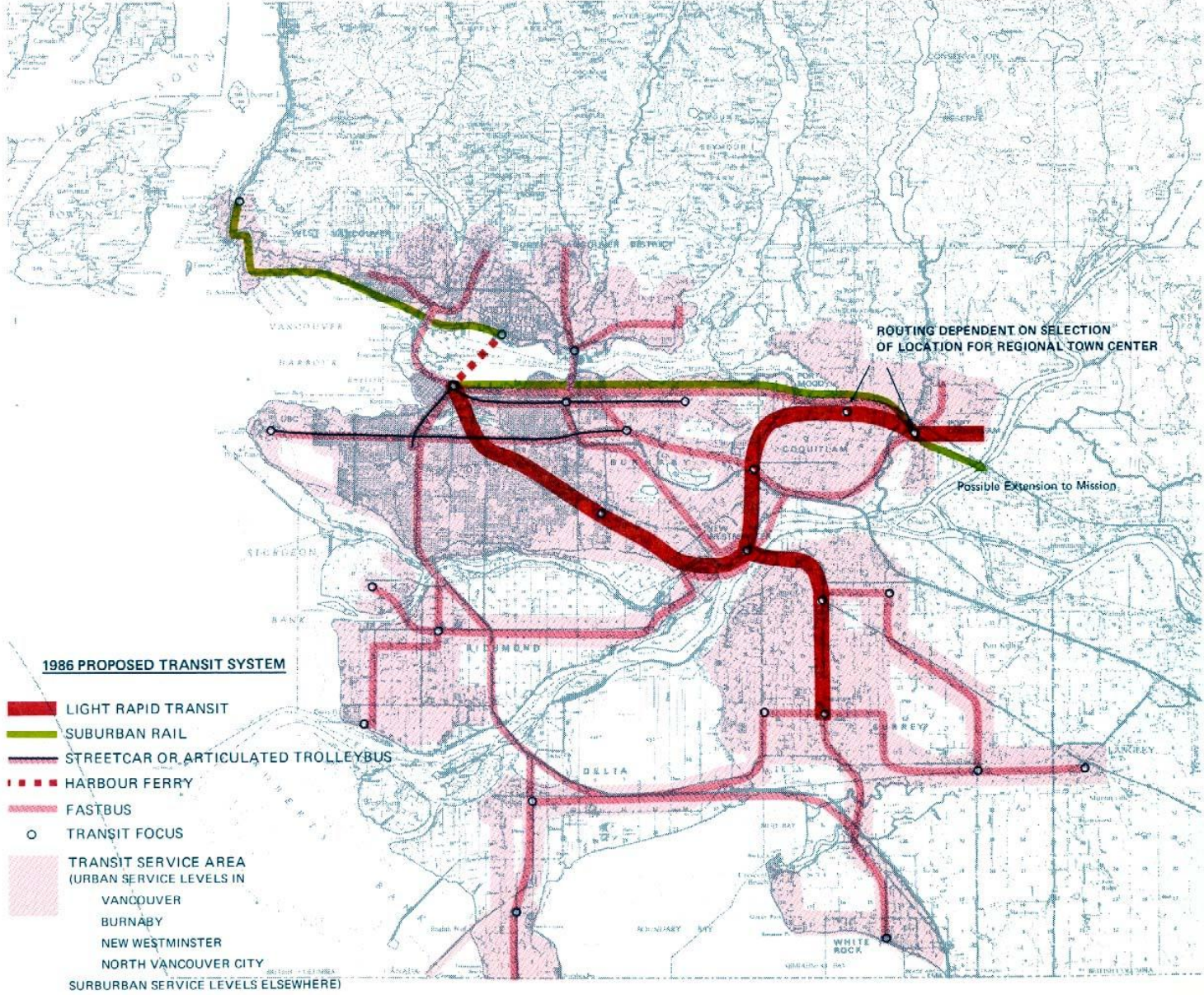


High Income North America: Freeways and Driving



Note: Freeway lane/capita data from 2011/12, calculated by Townsend and Durning; Annual Car Vehicle Kilometres travelled for 2006, calculated by Kenworthy.

Proposed Transit System (1975)



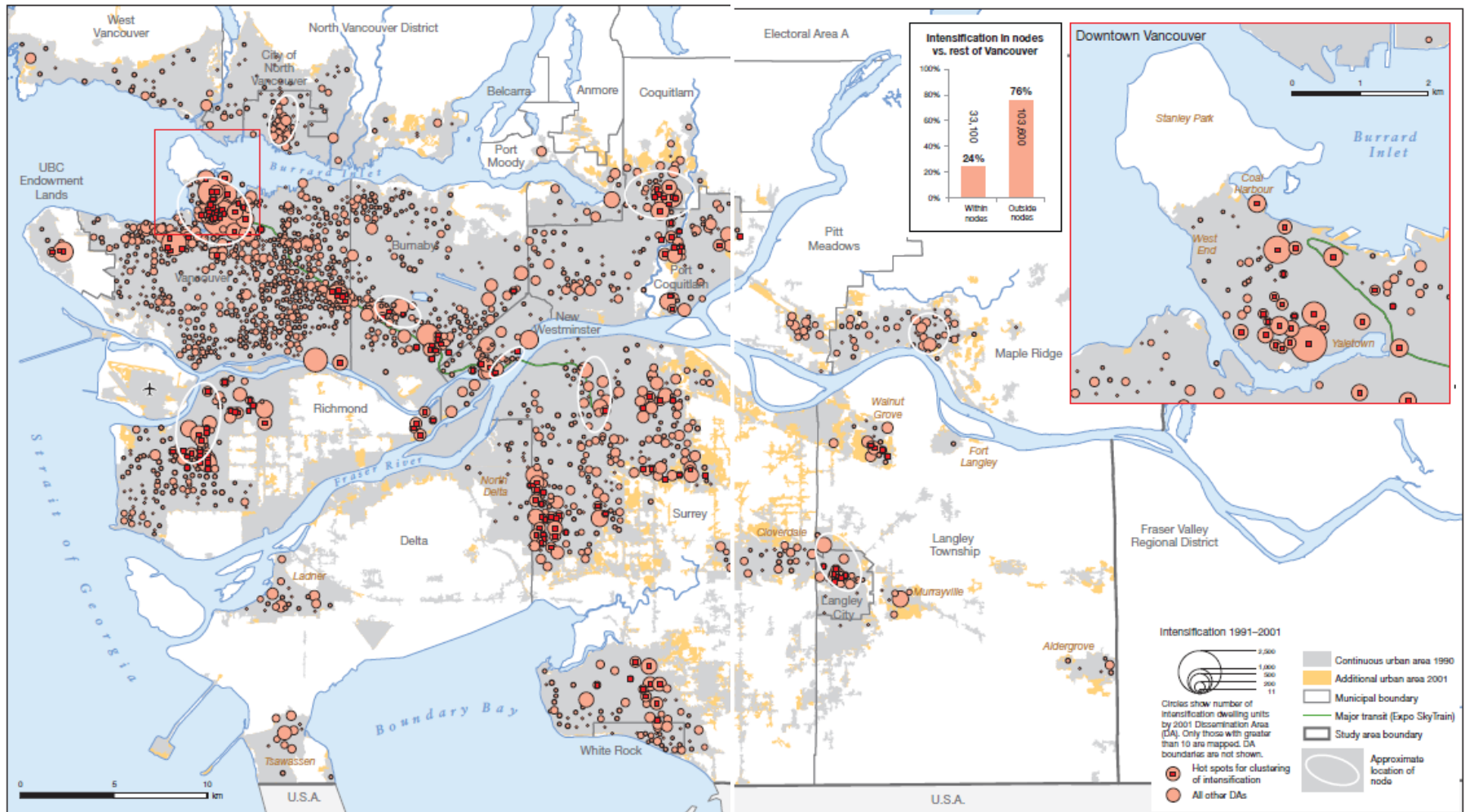
Source: Greater Vancouver Regional District, 1975

Steps Toward Reduced Travel and Modal Shift in Vancouver, 1970s

- Anti-freeway citizen protests followed by political change (late 1960s, early 1970s)
- Creation of agricultural land reserve by interventionist provincial government (1972)
- Livable Region Strategic Plan (first draft 1975) –
 - Protect green zone
 - Build complete communities
 - Achieve compact metropolitan region
 - Increase transport choice

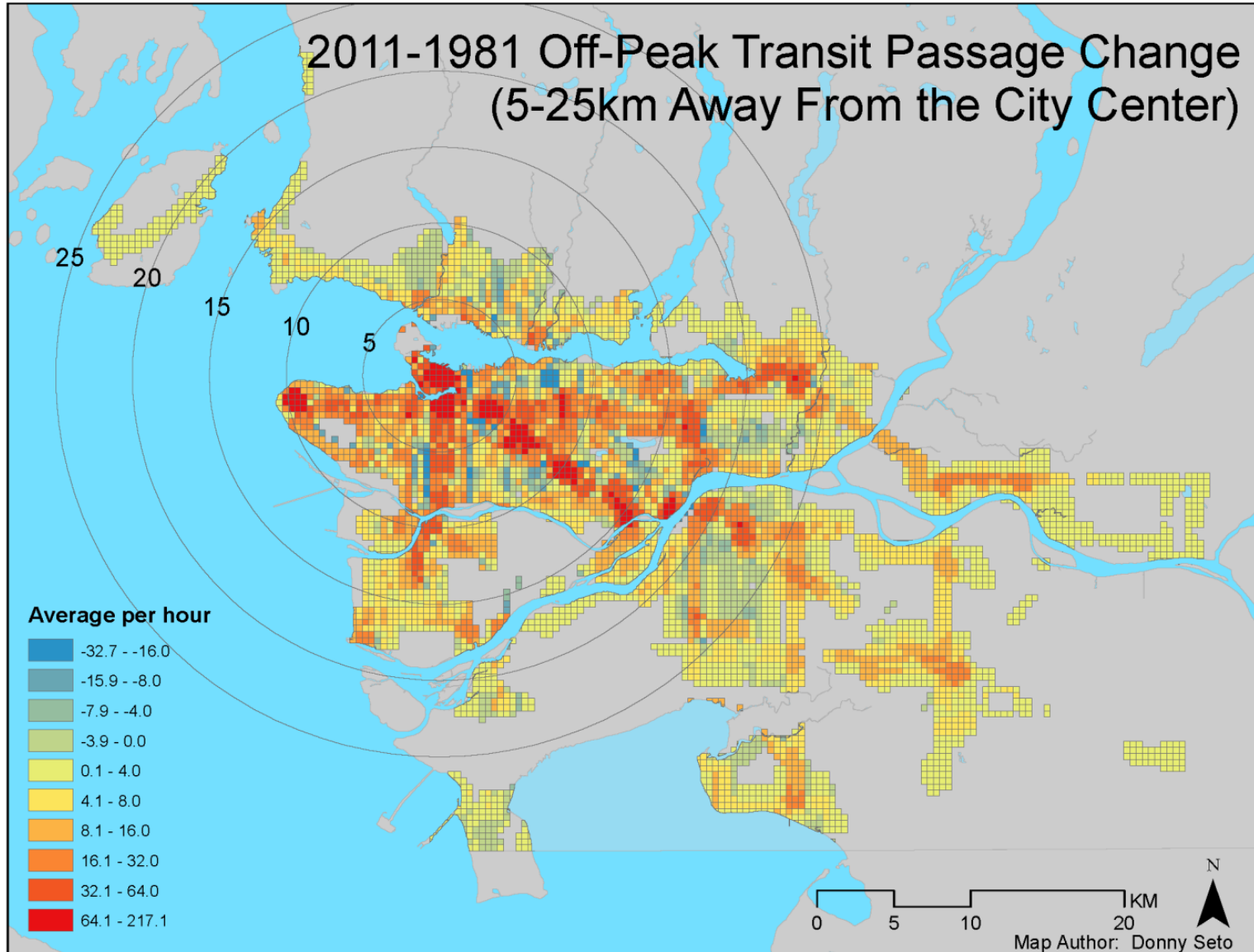
Residential Intensification, 1991-2001

Figure 3.5 The location of intensification in Vancouver



Source: Taylor & Burchfield (2010) *Growing Cities*, Neptis Foundation: Toronto

Public Transport Intensification in Vancouver







WEST COAST EXPRESS

148

098
Canada

Paying \$100 for a
\$35 wireless plan?
Something's off the rails.



Platform 2 - Release 1 min.
1st Arrive 2 min. 09:56 AM
Platform 1 - Release 1 min.

Information

NEWSPAPER ONLY

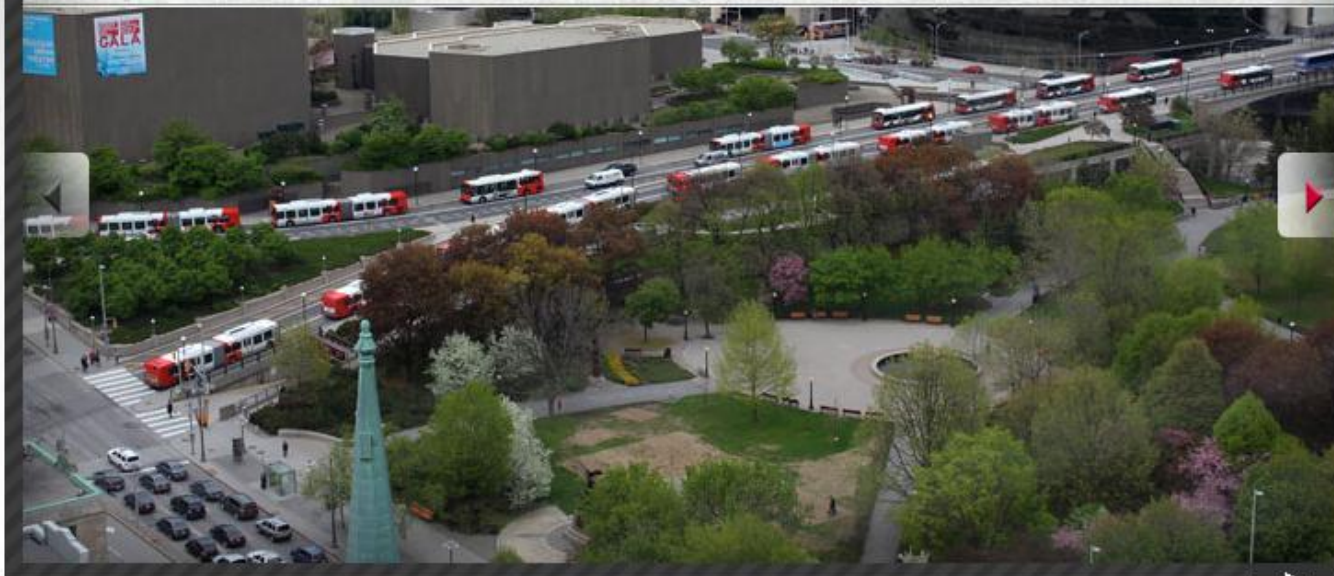
Steps Toward Reduced Travel and Modal Shift in Vancouver, 1980s-present

- Three lines of elevated/underground light metro (1986-2009), another under construction (2012-), small number of semi-rapid bus lines, commuter rail line (1996), community shuttle buses (late 2000s)
- Creation of TransLink (regional transport authority, late 1990s) and marginal gas tax increases
- Encouragement of Transit-Oriented high and mid-rise development around stations, prohibition and discouragement of parking
- Rapid population growth, rises in congestion and gasoline prices (1980s and 2000s)

TRANSIT CHALLENGE

- > Welcome
- > Team
- > Route and Tunnel
- > Vehicle
- > Stations
- > Mobility
- > Partnership

- CHALLENGE**
- SOLUTION
- PRINCIPLES
- NAME



Attend a public showcase

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December 5-19
Weekdays Only
11 am-7 pm
City Hall, Former Entrepreneurship Centre
110 Laurier Ave. West

December 6
3-9 pm
Rideau Centre (adjacent to escalators on 3rd floor)
50 Rideau St., Ottawa

December 7
5-9 pm
Ben Franklin Place, Atrium
101 Centrepointe Dr., Nepean

December 10
5-9 pm
John G. Mlacak Community Centre, Hall C
2500 Campeau, Kanata

December 11
3-9 pm
Gloucester Shopping Centre (adjacent to Food Court)
1980 Ogilvie Rd, Gloucester

December 11
5-9 pm
Hintonburg Community Centre, Wellington Room
1064 Wellington

December 12
5-9 pm
Walter Baker Sports Centre (Food Court)
100 Malvern Dr., Barrhaven

December 13
3-9 pm
Place d'Orleans Shopping Centre (adjacent to Guest Services)
110 Place d'Orleans Dr., Orleans



A Visionary Project That Moves People and Shapes Urban Form

[Shape our Community](#)



[Move People](#)



[Protect our Countryside](#)



[Better the Environment](#)



[Manage Urban Growth](#)



Rapid Transit News

We need your input!

Over the past few months, the Region of Waterloo has been working with Quarry Integrated Communications, a local marketing firm, to come up with a brand name for its new Rapid Transit service. We're n...

Region releases Request for Qualification

News Archive

February 2013 Events

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Video



TORONTO LIGHT RAIL TRANSIT PROJECTS



The Government of Ontario is moving forward on its \$8.4 billion commitment to deliver the largest light rail transit (LRT) expansion in the history of Toronto.

It features a network of 52 km of light rail transit - running underground and on the street that will connect Toronto with comfort, convenience, reliability and speed. It will keep our economy strong, ease congestion, and provide an easy connection to subways, buses and GO Transit.

The Toronto LRT Plan is part of *The Big Move*. *The Big Move* is a 25-year, \$50 billion plan that will transform regional transportation across the Greater Toronto and Hamilton Region.

Four New Lines = 52 Kilometres of New Transit

The Government of Ontario has committed \$8.4 billion in support of four LRT lines based on recommendations from Metrolinx:

- **The Eglinton–Scarborough Crosstown LRT** from Black Creek to Kennedy Station will be

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- [Benefits Case Analyses](#)
- [Planning, Design & Engineering](#)
- [Smart Commute](#)
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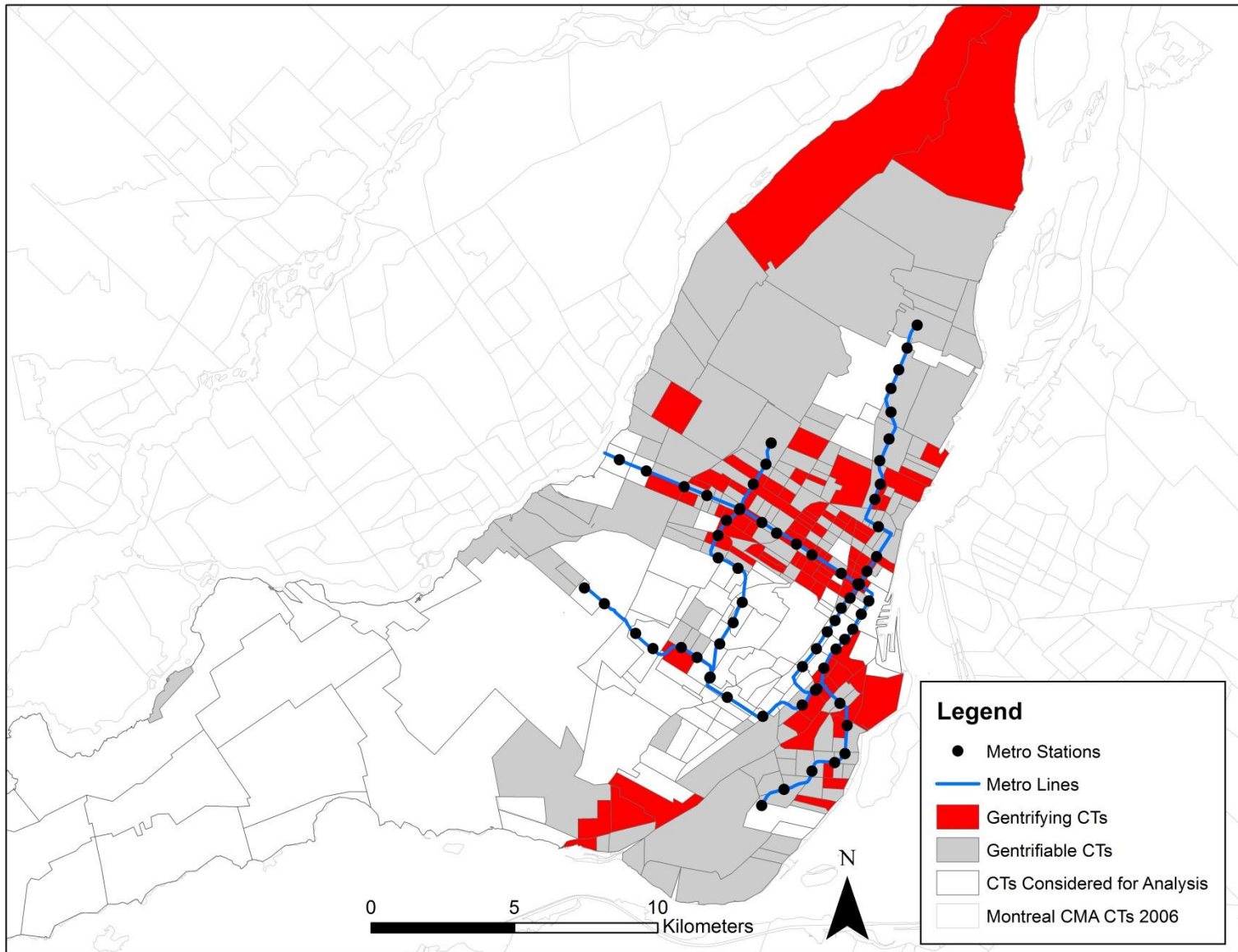


[Viva In York Region](#)



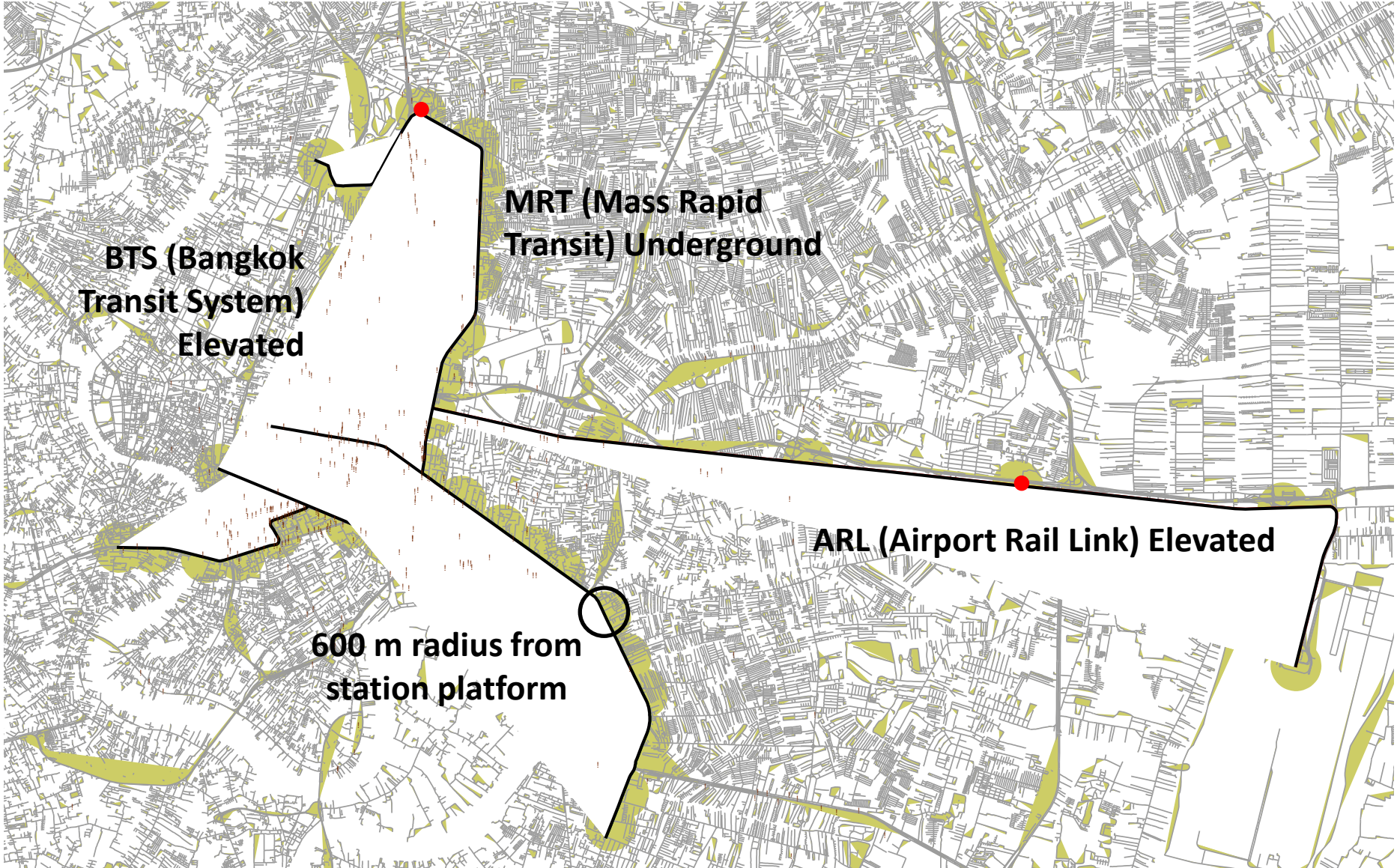
[Mobility Hubs](#)

Rail Rapid Transit and Social Equity Challenges



Source: Grube-Cavers & Patterson, 2012

Bangkok's mass rapid transit and road network, 2011



**BTS (Bangkok
Transit System)
Elevated**

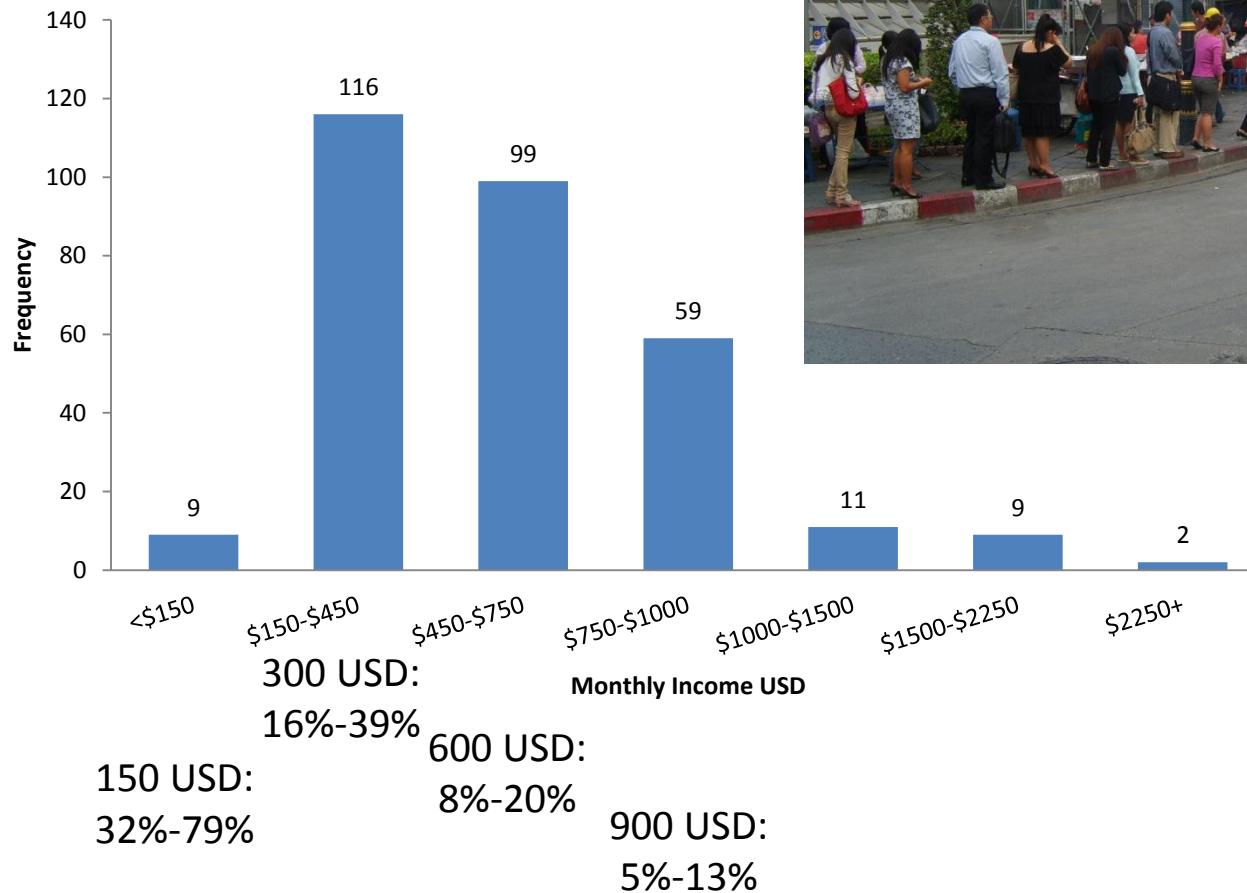
**MRT (Mass Rapid
Transit) Underground**

ARL (Airport Rail Link) Elevated

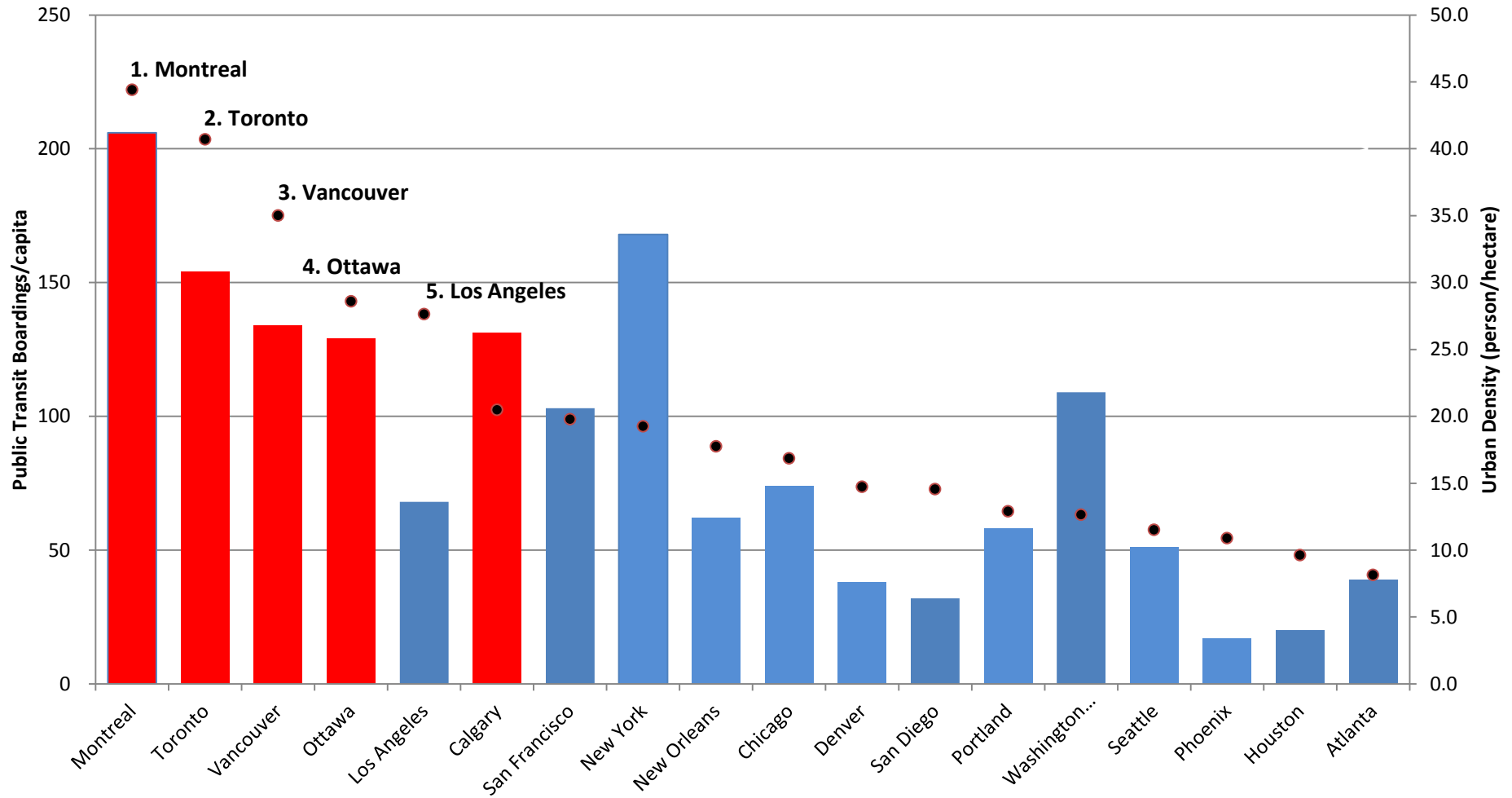
**600 m radius from
station platform**

ARL (Ban Tap Chang) to MRT (Phahonyothin) Cost 2.12 USD

Income of subway riders by income, Bangkok, 2011

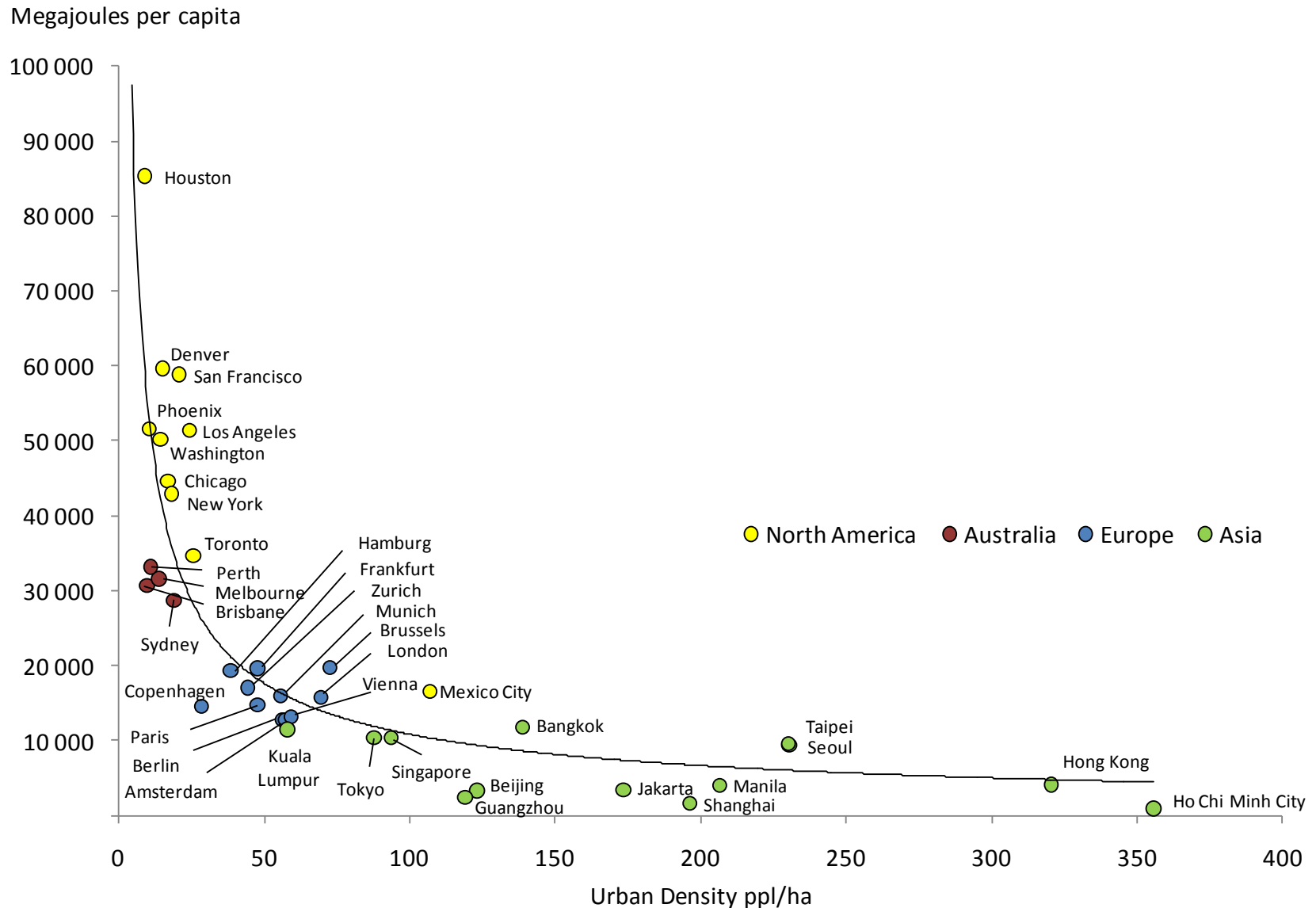


High Income North America: Public Transit and Density (top 5 ranked), 2006



Note: Canadian densities = median census tract density for 2011 calculated by Townsend using Statistics Canada 2011 Census d; US densities are 2005/6 metropolitan averages calculated by Kenworthy (2012)

Transport, Energy Use, and Urban Form are Linked



Note: The urban city statistical indicators shown here were collected on a common base year of 1995.

Source: Adapted from IUPI/ISTP (1995)