Interaction between Land Use and Urban Transport

27 October 2012
Wendell Cox
Demographia
OUTLINE

• Perspective
• The Evolving Urban Form
• Transport and the City
• Realities and Challenges
Introduction

Why do cities exist?

Background: Cities and transport through history

Survey of modern world urbanization

Recent evolution

Population

Land Area

Density

Centralized and dispersed commercial development

Examples (Addis Ababa and others)

Transport in the modern era

Transport, economic growth and affluence

The roles of various transport modes

Differences between cities

Trends

Measuring performance

Planning in the modern era

Public policy goals

Differing planning perspectives

Impact on the quality of life and cost of living

The challenges ahead
PERSPECTIVE & RESOURCES
Demographia World Urban Areas
(World Agglomerations)

8th Annual Edition: Version 2
July 2012
RESOURCES

• DEMOGRAPHIA WORLD URBAN AREAS (9TH EDITION 2013)

• THE EVOLVING URBAN FORM
  – http://www.newgeography.com/category/story-topics/evolving-urban-form

• THE NEW GEOGRAPHY
  – http://www.newgeography.com/

• DEMOGRAPHIA INTERNATIONAL HOUSING AFFORDABILITY SURVEY (9TH EDITION 2013)

• WEBSITE
  – http://demographia.com/
Economist Steven Landsburg (2007):

- Modern humans first emerged about 100,000 years ago. For the next 99,800 years or so, nothing happened. Well, not quite nothing. There were wars, political intrigue, the invention or agriculture – but none of that stuff had much effect on the quality of people’s lives. Almost everyone lived on the modern equivalent of $400 to $600 a year, just above the subsistence level. True there were always aristocracies who lived far better, but numerically, they were quite insignificant …

- [http://online.wsj.com/article/SB118134633403829656.html](http://online.wsj.com/article/SB118134633403829656.html)
Highest National GDPs: 1500-2000
650 BC TO PRESENT

From Maddison (OECD)

PRINCIPAL MODE ➔ Walking Mass Transit Auto

GDP/Capita: Richest Nation: 2000$

Figure 9
World’s Largest Cities (Urban Areas)
650 BC TO PRESENT

Figure 10

From Chandler
<table>
<thead>
<tr>
<th>Year</th>
<th>1,000,000 &amp; Over</th>
<th>6,000,000 &amp; Over</th>
<th>10,000,000 &amp; Over (Megacities)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1750</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1800</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1900</td>
<td>16</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>449</td>
<td>53</td>
<td>26</td>
</tr>
</tbody>
</table>

Sources: Chandler (1987) and Demographia (2012)
Urban Areas: Densities from 17th Century
PARIS, LONDON, NEW YORK & LOS ANGELES

Data Points 2000, 1950, 1900, 1850, 1800 London 1700 (1680), Paris 1650

Population per Square Kilometer

- Paris
- London
- New York
- Los Angeles
THE PURPOSE OF CITIES
Why Cities (Urban Areas) Exist

The purpose of cities

Urban areas exist because of the economic opportunities they provide.

The purpose of urban areas is to improve the affluence of their residents.
Purpose of Cities is Economic
PEOPLE MOVE THERE FOR BETTER LIVES
The raison d’être of large cities is the increasing return to scale inherent to large labor markets. The cities’ economic efficiency requires, therefore, avoiding any spatial fragmentation of labor markets.
Global Scaling Research

Double city size, 15% productivity improvement
THE EVOLVING URBAN FORM
City
(Urban Organism)

Metropolitan Area or Labor Market (Functional Expanse)

Urban Area or Agglomeration (Physical Expanse)
Definition of Urban Terms

PARIS METROPOLITAN AREA (AIRE URBAINE)

Eurouban Area (Rural)

PARIS URBAN AREA

PARIS METROPOLITAN AREA

Goussainville Urban Area (Exurb)

Ville de Paris (Core Municipality)

Exurban Area (Rural)
Table 2
Comparison of Kinshasa & Paris
Ville, Urban Area & Metropolitan Area

<table>
<thead>
<tr>
<th></th>
<th>Kinshasa</th>
<th>Paris</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VILLE (MUNICIPALITY)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area (SKM)</td>
<td>9,965</td>
<td>105</td>
</tr>
<tr>
<td>Population</td>
<td>10,500,000</td>
<td>2,200,000</td>
</tr>
<tr>
<td>Density</td>
<td>1,100</td>
<td>21,000</td>
</tr>
<tr>
<td><strong>URBAN AREA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area (SKM)</td>
<td>583</td>
<td>2,845</td>
</tr>
<tr>
<td>Population</td>
<td>9,100,000</td>
<td>10,300,000</td>
</tr>
<tr>
<td>Density</td>
<td>15,600</td>
<td>3,600</td>
</tr>
<tr>
<td><strong>METROPOLITAN AREA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area (SKM)</td>
<td>NA</td>
<td>17,145</td>
</tr>
<tr>
<td>Population</td>
<td>NA</td>
<td>12,100,000</td>
</tr>
<tr>
<td>Density</td>
<td>NA</td>
<td>700</td>
</tr>
</tbody>
</table>

Sources: Census Authorities & *Demographia World Urban Areas* (2012) & author's estimates
Largest Urban Areas in the World

POPULATION: 2012

Tokyo-Yokohama
Jakarta
Seoul-Incheon
Delhi, DL-HR-UP
Shanghai, SHG
Manila
New York, NY-NJ-CT
Sao Paulo
Karachi
Mexico City
Beijing, BJ
Guangzhou-Foshan, GD
Osaka-Kobe-Kyoto
Mumbai, MAH
Moscow
Los Angeles, CA
Cairo
Dhaka
Kolkata, WB
Buenos Aires

Millions
<table>
<thead>
<tr>
<th>Country</th>
<th>Cases</th>
<th>Population</th>
<th>Density (Population per KM2)</th>
<th>Traffic Congestion Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>5</td>
<td>1,679,000</td>
<td>3,042</td>
<td>18.8</td>
</tr>
<tr>
<td>Europe</td>
<td>82</td>
<td>2,834,000</td>
<td>2,081</td>
<td>17.6</td>
</tr>
<tr>
<td>United States</td>
<td>100</td>
<td>2,015,000</td>
<td>1,009</td>
<td>8.8</td>
</tr>
</tbody>
</table>
Most Dense World Urban Areas
OVER 2.5 MILLION POPULATION: 2012

- Dhaka, Bangladesh
- Mumbai, India
- Surat, India
- Chittagong, Bangladesh
- Hong Kong, China
- Ahmadabad, India
- Bogota, Colombia
- Medellin, Colombia
- Jaipur, India
- Karachi, Pakistan

Population per Square Kilometer

Figure 26
Density Profiles at the Same Scale
7 METROPOLITAN AREAS: BERTAUD, 2003
Neighborhood Densities: Examples (WITHIN CITIES)

Population per KM²

- Kowloon Walled City 1990
- Dhaka-Ward 28
- Hong Kong: Tsueng Wan Centre
- New York: Highest 1910
- Mumbai Marine Lines
- Paris 11 Arr.
Average Population Densities: 2012
URBAN AREAS OVER 2.5 MILLION: SUB-SAHARAN AFRICA

Calculated from data in Demographia World Urban Areas

Figure 32
Coming to Terms with Global Urban Expansion
As Cities Become Larger They Become Less Dense
Addis Abeba Urban Area: Evolution
1972-2010
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagos</td>
<td>11.6</td>
<td>907</td>
<td>12,900</td>
<td>25.5</td>
<td>119%</td>
</tr>
<tr>
<td>Kinshasa</td>
<td>9.1</td>
<td>583</td>
<td>15,500</td>
<td>14.9</td>
<td>64%</td>
</tr>
<tr>
<td>Luanda</td>
<td>5.2</td>
<td>767</td>
<td>6,800</td>
<td>12.4</td>
<td>139%</td>
</tr>
<tr>
<td>Khartoum</td>
<td>4.8</td>
<td>930</td>
<td>5,100</td>
<td>9.0</td>
<td>88%</td>
</tr>
<tr>
<td>Abidjan</td>
<td>4.4</td>
<td>324</td>
<td>13,700</td>
<td>9.2</td>
<td>107%</td>
</tr>
<tr>
<td>Nairobi</td>
<td>4.3</td>
<td>557</td>
<td>7,700</td>
<td>8.6</td>
<td>102%</td>
</tr>
<tr>
<td>Accra</td>
<td>3.8</td>
<td>945</td>
<td>4,000</td>
<td>7.1</td>
<td>86%</td>
</tr>
<tr>
<td>Dar es Salaam</td>
<td>3.5</td>
<td>570</td>
<td>6,200</td>
<td>10.9</td>
<td>208%</td>
</tr>
<tr>
<td>Kano</td>
<td>3.5</td>
<td>251</td>
<td>14,000</td>
<td>7.7</td>
<td>119%</td>
</tr>
<tr>
<td>Dakar</td>
<td>3.2</td>
<td>194</td>
<td>16,200</td>
<td>6.8</td>
<td>116%</td>
</tr>
<tr>
<td>Addis Abeba</td>
<td>3.1</td>
<td>337</td>
<td>9,200</td>
<td>6.1</td>
<td>95%</td>
</tr>
<tr>
<td>Ibadan</td>
<td>3.1</td>
<td>389</td>
<td>7,900</td>
<td>6.8</td>
<td>121%</td>
</tr>
<tr>
<td>Kumasi</td>
<td>2.9</td>
<td>337</td>
<td>8,600</td>
<td>6.9</td>
<td>139%</td>
</tr>
<tr>
<td>Maputo</td>
<td>2.6</td>
<td>414</td>
<td>6,300</td>
<td>5.4</td>
<td>107%</td>
</tr>
<tr>
<td>Douala</td>
<td>2.5</td>
<td>205</td>
<td>12,300</td>
<td>5.3</td>
<td>110%</td>
</tr>
<tr>
<td>Yaounde</td>
<td>2.5</td>
<td>231</td>
<td>10,800</td>
<td>5.3</td>
<td>114%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>70.1</strong></td>
<td><strong>7,940</strong></td>
<td><strong>8,800</strong></td>
<td><strong>147.8</strong></td>
<td><strong>111%</strong></td>
</tr>
</tbody>
</table>

Sources: Demographia World Urban Areas & UN Urban Growth Rates
Cairo Urban Area: Evolution
1972-2010
Cairo Population by Governate: 1937-2012

CAIRO METROPOLITAN AREA

Population in Millions

Cairo
Giza
Kalyoubia

Figure 39
Guangzhou-Foshan Population
2000-2010: SHARE OF METROPOLITAN GROWTH

- Core Districts: 23%
- Inner Suburbs: 39%
- Outer Suburbs & Exurbs: 38%
Shanghai Population by Sector

CHANGE: 2000-2010

Source: Census of India

Figure 42
Shanghai Population Density by Sector

CHANGE: 2000-2010

Figure 43

- **Inner Core**: 60,000 population per square km (2000), 45,000 population per square km (2010)
- **Outer Core**: 22,000 population per square km (2000), 20,000 population per square km (2010)
- **Suburban**: 4,000 population per square km (2000), 3,000 population per square km (2010)
Beijing: Population Growth by Sector
2000-2010

- Inner City: 1%
- Outer: 3%
- Second Ring Suburbs: 43%
- First Ring Suburbs: 53%

Figure 1
Shenzhen Inner & Outer Area Population
1982 - 2010

Figure 45
Jakarta: Population: 1971-2010

CORE & SUBURBAN POPULATION

Population in Millions

- JAKARTA (CORE)
- INNER SUBURBS
- SUBURBS & EXURBS
- OUTER SUBURBS & EXURBS

Inner suburb data not available before 2000

Figure 46
Jakarta: Growth by Sector
2000-2010

- Jakarta: 16%
- Inner Suburbs & Exurbs: 31%
- Outer Suburbs & Exurbs: 53%
Delhi Urban Area Population by Sector

CHANGE: 2001-2011

Source: Census of India

Figure 49
Population by District: 1901-2011
MUMBAI METROPOLITAN REGION

RAIGAHR
THANE
OUTER MUMBAI
INNER MUMBAI
Kolkata Urban Area: 1901-2011
CORE & SUBURBAN POPULATION

Figure 51
Core & Suburban Population: 1950-2010
MANILA URBAN AREA

Figure 52
Manila Urban Area Population by Sector
ESTIMATED : 2010

Manila 8%
Outer Suburbs 41%
Inner Suburbs 51%
Moscow Area Population Growth by Sector
2002-2010

- Inner Moscow: 3%
- Suburban: 27%
- Outer Moscow: 70%

Figure 54
Ho Chi Minh City Population by Sector

PAST AND PROJECTED

Outside
Ho Chi Minh City

Urban Fringe

Outer Core

Inner Core

Suburban

Source: Derived from Asian Development Bank data
Istanbul: Population by Sector

1985, 2000 & 2012

Figure 58
### Quanzhou (Fujian) Population Trend by Sector

<table>
<thead>
<tr>
<th>Sector</th>
<th>2000</th>
<th>2010</th>
<th>Change</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Jurisdictions with Substantial Urbanization</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Historic Core: Licheng &amp; Fengze</td>
<td>690,000</td>
<td>898,000</td>
<td>208,000</td>
<td>30%</td>
</tr>
<tr>
<td>Near Urban (Jin Jiang &amp; Shi Shi)</td>
<td>1,978,000</td>
<td>2,660,000</td>
<td>682,000</td>
<td>34%</td>
</tr>
<tr>
<td>Outer Urban &amp; Exurban</td>
<td>2,785,000</td>
<td>2,864,000</td>
<td>79,000</td>
<td>3%</td>
</tr>
<tr>
<td>Balance of Prefecture (Principally Rural)</td>
<td>1,830,000</td>
<td>1,719,000</td>
<td>(111,000)</td>
<td>-6%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>7,283,000</td>
<td>8,141,000</td>
<td>858,000</td>
<td>12%</td>
</tr>
</tbody>
</table>

Note: Urban extent estimated at over 4.5 million in 2010.
High Income World: 1960s-2000s
NEARLY ALL URBAN GROWTH IN SUBURBS: 35+YEARS

Australia: 97%
Canada: 94%
United States: 93%
Western Europe: 114%
Japan: 92%

Moscow
New York Urban Area Expansion

POPULATION & URBAN LAND AREA 1950 - 2010

Figure 62
New York Urban Area Population Growth
1950 - 2010

Figure 63
Seattle Metropolitan Region: 1950-2010
POPULATION (COMBINED STATISTICAL AREA)

Data from US Census Bureau

City of Seattle
Inner Suburbs
Outer Suburbs
Exurban

Figure 64
Paris Urban Area Expansion
1954 - 1999
Paris Urban Area Population Growth
1950 - 2010

Figure 66
Barcelona: Growth By Sector
2001-2011

City of Barcelona: 112,000
Balance of Urban Area: 401,000
Balance of Metropolitan Area: 210,000

Figure 67
Seoul Metropolitan Area: 1960-2010
POPULATION BY PROVINCIAL LEVEL JURISDICTION

MUNICIPALITY OF SEOUL

GYEONGGI

MUNICIPALITY OF INCHEON
Tokyo Core & Suburban Population
1920-2010

Data: Japan Statistics Bureau

- 23-Wards (Core)
- Suburban

Figure 69
Tokyo: Detached Housing Share: 2006
BY DISTANCE FROM CENTRAL TOKYO: 2006

Data: Japan Statistics Bureau

Detached Housing 44.3% (Region)

Figure 70
Hong Kong Population by Sector
1961-2011

- New Territories
- Kowloon
- Hong Kong Island

Figure 71
Zürich Urban Area Population Growth
CITY & SUBURBAN RINGS: 1950-2010

Source: Statistik Stadt Zürich & FSO

Figure 72
Why Urban Expansion Happens

- Natural growth & migration
- Migrants are lower income
- Price of land on periphery is less
- Transport improvements
Population, Households & Employment


- Population
- Employment
- Households

0% 20% 40% 60% 80% 100% 120% 140% 160%
US: Age 25-34 in 2000: Change by 2010

MAJOR METROPOLITAN AREAS: CORE & SUBURBAN

35-44 Population in 2010 Compared to 25-34 in 2000
Source: US Census Data
US: Age 55-64 in 2000: Change by 2010

MAJOR METROPOLITAN AREAS: CORE & SUBURBAN

- Historic Core Cities
- Suburbs
- Other

Change in Population: 2000-2010

55-64 Population in 2010 Compared to 45-54 in 2000
Source: US Census Data
Largest Employment Centre in Canada
PEARSON AIRPORT AREA

355,000 Employees, 120 KM² (<10% Transit)
Downtown Toronto: 325,000 - 6 KM² (67% Transit)
Downtown Montreal 240,000 - 5 KM² (59% Transit)
Difficult for Public Transport To Compete With Auto To Such Locations

Luis Berini Center (Peripheral Center)

Sao Paulo: Edge City
TRANSPORT AND THE CITY
Democratization of Prosperity

ASSOCIATION BETWEEN MOBILITY & AFFLUENCE

“Time is Money”

Reduced Minority Unemployment With Cars
   U. of California

PRUD’HOMME
Mobility Improves Productivity
   U. Of Paris

HARTGEN-FIELDS
Mobility Improves Productivity

Chicago
Daily Motorized Trips & GDP/Capita

1995 DATA

R² = 0.71
(1% Conf. Level)

- United States
- Australia-NZ
- Canada
- Western Europe
- Japan
- High-Income Asia
- Eastern Europe
- Middle-Income Asia
- Latin America
- Low Income Asia
- Africa

1995$ (OECD)
Mass Transit Service Densities
MILLENNIUM CITIES DATABASE: 1995

Vehicle Kilometers per Square Kilometers

Manila
Hong Kong
Dakar
Singapore
Zurich
Vienna
Tokyo
Paris
Toronto
New York
Vancouver
Denver

Calculated from data in Millennium Cities Database (UITP)

Figure 82
Why are all these people in cars?
Transit: Strong Downtown: Weak Elsewhere
SEATTLE URBAN AREA: 2000

**EMPLOYMENT**
- Downtown: 13%
- Elsewhere: 87%

**# OF TRANSIT COMMUTERS**
- Downtown: 57%
- Elsewhere: 43%
Transit & Auto Access: 30 Minutes
FROM CENTRAL VANCOUVER
Travel by Transit Takes Longer
6 MAJOR METROPOLITAN AREAS: CANADA

One Way Work Trip Minutes

- All: 30
- Car: 27
- Transit: 44
Table 4

Motorized Urban Transport in 8 Cities of Developing Africa

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>More Formal: Collective (Generally Large Bus)</td>
<td>13%</td>
</tr>
<tr>
<td>Less Formal</td>
<td>87%</td>
</tr>
<tr>
<td>Collective (Generally Smaller Vehicle)</td>
<td>64%</td>
</tr>
<tr>
<td>Minibus</td>
<td>51%</td>
</tr>
<tr>
<td>Taxi</td>
<td>13%</td>
</tr>
<tr>
<td>Private</td>
<td>23%</td>
</tr>
<tr>
<td>Car</td>
<td>8%</td>
</tr>
<tr>
<td>2-Wheeler</td>
<td>15%</td>
</tr>
</tbody>
</table>

Abidjan, Accra, Addis Ababa, Dakar, Dar es Salaam, Douala, Lagos, Nairobi

2-Wheeler shown as personal, though there is collective use of an unknown volume

Western Europe, United States & the West

There is no practical mass transit for most trips
Capability of Transit: 45 Minute Job Access

METROPOLITAN AREAS OVER 2,000,000: 2008

- Accessible by Transit
- Not Accessible by Transit

Average Transit Job Access: 5.6%
(NYC: 9.8%)
Public Transport: 7 US Largest Markets

ACCESS TO TRANSIT STOPS/ACCESS TO JOBS

- **90.3%** Public Transport within Walking Distance
- **8.1%** 45 Minute Job Access

NY, CHI, LA, WDC, SF, BOS, PHI

Average work trip travel time:
- Car alone: 24.0 minutes
- Public transport: 47.4 minutes
Paris Suburbs: Cars Provide Quicker Travel

FROM MAJOR SUBURBAN RAIL STATIONS: 1 HR TO JOBS

Jobs Accessible: 84%
Not Accessible: 16%

Auto: Jobs Accessible 59%
Not Accessible 41%

Transit:
Jobs Accessible 41%
Not Accessible 59%
Public Transport & Auto Market Shares

Paris Metropolitan Area

Public Transport

Car
Transit’s “Last Kilometer” Problem
ELSEWHERE TRANSIT IS SLOWER FOR MORE TRIPS

Annual Cost:
More than gross annual income of metropolitan area

An auto competitive system for Portland?
800 Meter Metro Grid Required
<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
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<tbody>
<tr>
<td>LOW INCOME</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cairo</td>
<td>$5,600</td>
<td>$3,700</td>
<td>1.44</td>
<td>0.95</td>
</tr>
<tr>
<td>Delhi</td>
<td>$5,100</td>
<td>$3,400</td>
<td>1.55</td>
<td>1.03</td>
</tr>
<tr>
<td>Dhaka</td>
<td>$2,900</td>
<td>$1,900</td>
<td>1.38</td>
<td>0.90</td>
</tr>
<tr>
<td>Jakarta</td>
<td>$9,700</td>
<td>$6,400</td>
<td>2.69</td>
<td>1.78</td>
</tr>
<tr>
<td>Karachi</td>
<td>$4,800</td>
<td>$3,200</td>
<td>2.00</td>
<td>1.33</td>
</tr>
<tr>
<td>Kolkata</td>
<td>$4,500</td>
<td>$2,900</td>
<td>1.36</td>
<td>0.88</td>
</tr>
<tr>
<td>Lagos</td>
<td>$4,800</td>
<td>$3,200</td>
<td>3.43</td>
<td>2.29</td>
</tr>
<tr>
<td>Mumbai</td>
<td>$2,100</td>
<td>$1,400</td>
<td>0.64</td>
<td>0.42</td>
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<tr>
<td>MIDDLE INCOME</td>
<td>$10,000</td>
<td>$6,700</td>
<td>1.18</td>
<td>0.79</td>
</tr>
<tr>
<td>Beijing</td>
<td>$15,700</td>
<td>$10,300</td>
<td>2.31</td>
<td>1.51</td>
</tr>
<tr>
<td>Buenos Aires</td>
<td>$13,400</td>
<td>$8,800</td>
<td>1.02</td>
<td>0.67</td>
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<tr>
<td>Istanbul</td>
<td>$8,000</td>
<td>$6,800</td>
<td>0.98</td>
<td>0.83</td>
</tr>
<tr>
<td>Manila</td>
<td>$4,700</td>
<td>$3,100</td>
<td>0.92</td>
<td>0.61</td>
</tr>
<tr>
<td>Mexico City</td>
<td>$7,900</td>
<td>$5,200</td>
<td>0.79</td>
<td>0.52</td>
</tr>
<tr>
<td>Moscow</td>
<td>$15,900</td>
<td>$10,400</td>
<td>1.43</td>
<td>0.94</td>
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<tr>
<td>Rio de Janeiro</td>
<td>$8,200</td>
<td>$5,400</td>
<td>0.98</td>
<td>0.64</td>
</tr>
<tr>
<td>Sao Paulo</td>
<td>$6,300</td>
<td>$4,300</td>
<td>0.75</td>
<td>0.51</td>
</tr>
<tr>
<td>Shanghai</td>
<td>$12,600</td>
<td>$8,300</td>
<td>1.85</td>
<td>1.22</td>
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<tr>
<td>Shenzhen</td>
<td>$6,800</td>
<td>$4,500</td>
<td>1.00</td>
<td>0.66</td>
</tr>
<tr>
<td>HIGH INCOME</td>
<td>$17,400</td>
<td>$11,500</td>
<td>0.53</td>
<td>0.35</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>$24,000</td>
<td>$15,800</td>
<td>0.57</td>
<td>0.38</td>
</tr>
<tr>
<td>New York</td>
<td>$33,200</td>
<td>$21,800</td>
<td>0.79</td>
<td>0.52</td>
</tr>
<tr>
<td>Osaka-Kobe-Kyoto</td>
<td>$11,600</td>
<td>$7,700</td>
<td>0.37</td>
<td>0.24</td>
</tr>
<tr>
<td>Paris</td>
<td>$16,800</td>
<td>$11,100</td>
<td>0.56</td>
<td>0.37</td>
</tr>
<tr>
<td>Seoul-Incheon</td>
<td>$5,600</td>
<td>$3,700</td>
<td>0.27</td>
<td>0.18</td>
</tr>
<tr>
<td>Tokyo-Yokohama</td>
<td>$13,100</td>
<td>$8,600</td>
<td>0.42</td>
<td>0.27</td>
</tr>
<tr>
<td>ALL</td>
<td>$9,700</td>
<td>$6,700</td>
<td>0.76</td>
<td>0.53</td>
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</tbody>
</table>
Ho Chi Minh City Area: Travel Share
2007

Source: Derived from Asian Development Bank data

Motorcycle: 91%
Automobile: 1%
Transit: 8%
Density & Roadway Travel
ROAD VEHICLES: MAJOR METROPOLITAN COUNTIES

\[ y = 14.142x + 8699.1 \]

\[ R^2 = 0.7198 \]


Daily Vehicle Travel (KMs) per Square KM

R² = 0.705
99% confidence level

422 Counties in 51 Metropolitan Areas Over 1,000,000
Higher Density Means More Traffic Congestion

DENSITY & TRAFFIC VOLUMES: INTERNATIONAL

- Vehicle Hours/KM²
- Population/KM²

Hong Kong
## Automobile Market Penetration

0.75 AUTOS PER HOUSEHOLD

<table>
<thead>
<tr>
<th>Nation</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>1930</td>
</tr>
<tr>
<td>Canada</td>
<td>1955</td>
</tr>
<tr>
<td>Australia</td>
<td>1965</td>
</tr>
<tr>
<td>France</td>
<td>1970</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1980</td>
</tr>
<tr>
<td>Japan</td>
<td>1985</td>
</tr>
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</table>
## Comparing Toronto & Dallas-Fort Worth

**URBAN AREAS COMPARED (2010 & 2011)**

<table>
<thead>
<tr>
<th></th>
<th>Toronto</th>
<th>Dallas-Ft. Worth</th>
<th>Toronto/DFW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (Population Centre/Urban Area)</td>
<td>5,132,794</td>
<td>5,121,892</td>
<td>0.2%</td>
</tr>
<tr>
<td>Land Area (KM²)</td>
<td>1,751</td>
<td>4,606</td>
<td>-62.0%</td>
</tr>
<tr>
<td>Density</td>
<td>2,931</td>
<td>1,112</td>
<td>163.6%</td>
</tr>
<tr>
<td>One Way Work Trip</td>
<td>33</td>
<td>26</td>
<td>26.9%</td>
</tr>
<tr>
<td>Reach Work in 30 Minutes</td>
<td>48%</td>
<td>59%</td>
<td>-18.6%</td>
</tr>
<tr>
<td>Median Multiple (House Price/Household Income)</td>
<td>5.5</td>
<td>2.9</td>
<td>89.7%</td>
</tr>
<tr>
<td>Transit Work Trip Share</td>
<td>21%</td>
<td>2%</td>
<td>935.0%</td>
</tr>
</tbody>
</table>
A well governed city delivers:

Mobility & economic growth

Lower cost of living (housing affordability)
REALITY & CHALLENGES (CONCLUSION)
Prosperity is not Guaranteed
ECONOMIC POLICIES MATTER

Economic growth comparison over time for the United States, Japan, Germany, and Argentina, with Manila's economic data included.
Increasing Motorization
Evolution of Urban Growth

Curitiba and Metropolitan Region

<table>
<thead>
<tr>
<th>YEAR</th>
<th>POPULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955</td>
<td>360,000</td>
</tr>
<tr>
<td>1965</td>
<td>550,000</td>
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<tr>
<td>1975</td>
<td>1,140,000</td>
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<tr>
<td>1985</td>
<td>1,700,000</td>
</tr>
<tr>
<td>2000</td>
<td>2,700,000</td>
</tr>
<tr>
<td>2010</td>
<td>3,224,286</td>
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<tr>
<td>2020</td>
<td>3,758,358</td>
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</table>
ECONOMIC GROWTH: REQUIRED FOR SOCIAL COHESION