World Resources Institute

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The new Chinese city clusters:

would the current urban transport technology be able to serve these very large urban labor markets?

By Alain Bertaud
NYU – Stern Urbanization Project / Marron Institute

ABertaud@Stern.NYU.edu
http://alainbertaud.com

Summary

1. Large urban labor markets are more productive than smaller ones; but the integration of large labor markets depends on transport systems performance, not solely on the size of the labor force
2. Chinese urban clusters are unique because of their size
3. In cities all over the world, jobs are dispersing into lower density suburban areas; Chinese clusters are just an extreme form of this trend
4. Transport mode splits adjust to income and urban spatial structures
5. The traditional transport mode split, individual cars, freight trucks, and transit seems to have reached its limits in serving large labor markets
6. Could shared individual urban vehicles used as feeders to very rapid transit networks allows labor markets to expands to the size of Chinese urban clusters?

1- Large urban labor markets are more productive than smaller ones

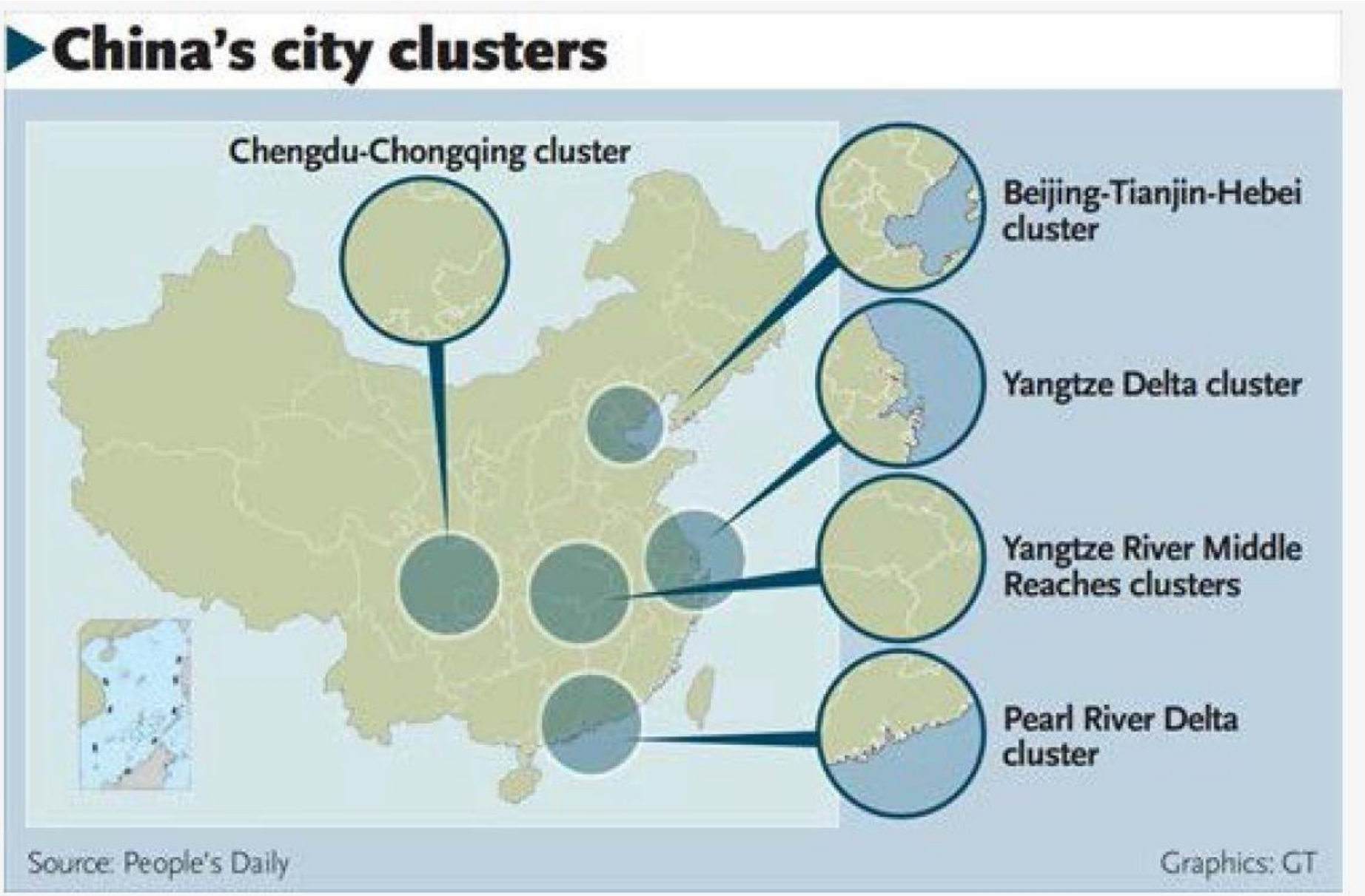
- Urban productivity and creativity increase with the size of labor markets.
- However, the number of workers in an urban area indicates only the potential size of the labor market.
  - The effective size of an urban labor market is defined by the average number of jobs accessible per worker in less than one hour commute.
- Beyond a one hour commuting time, productivity decreases.

2 - Chinese urban clusters are unique because of their size

The Chinese Government has recently decided to focus urban development on urban clusters rather than on discrete municipalities

- China's National Development and Reform Commission' s National Plan on New Urbanization (2014-2020) has identified 11 existing urban clusters where investments in infrastructure will be concentrated.
- The size of the 5 larger clusters range from 60 to 110 million people.
- **Those clusters already exists**, but the limitations of the transport system fragment their potential labor market into smaller less efficient ones

China's city cluster policy



China's unprecedented large urban clusters have already the potential to open a new era of high urban productivity and creativity

- The size of China's urban clusters is unprecedented (Beijing Tianjin Hebei cluster will eventually include about 100 million people)
- The spatial pattern of population densities and job distribution is already very different in clusters than in more traditional forms of urbanization
- The efficient supply chains that gives China a competitive advantage in manufacturing probably created this new urban form

Components of Jing-Jin-Ji

Jurisdiction	Total Population (2013)	Density (per KM2)	Principal Urban Area Population (2015)	Urban Density (per KM2)
Beijing	21.2	1,300	20.2	5,100
Tianjin	14.7	1,200	10.9	5,400
Jing-Jin-Ji Core	35.9	1,300	31.1	5,200
Baoding	10.2	500	1.3	5,900
Langfang	4.4	700	0.5	3,800
Canzhou	7.2	500	0.5	3,800
Tangshan	7.5	600	2.4	8,700
Zhangzhiakow	4.6	100	1.2	9,200
Qinhuangdao	2.9	400	1.0	6,500
Chengde	3.7	100	0.1	4,300
Inner Jing-Jin-Ji	40.5	300	7.0	6,600
Shijiazhuang	10.4	700	3.4	17,000
Handan	9.2	800	2.0	11,900
Xingtai	7.1	600	0.7	6,000
Henshui	4.3	500	0.4	11,800
Outer Jing-Jin-Ji	31.0	600	6.5	12,500
Jng-Jin-Ji	109.2	500	44.6	5,900

Population in millions.
Jurisdition population from government sources
Urban area population from Demographia World Urban Areas

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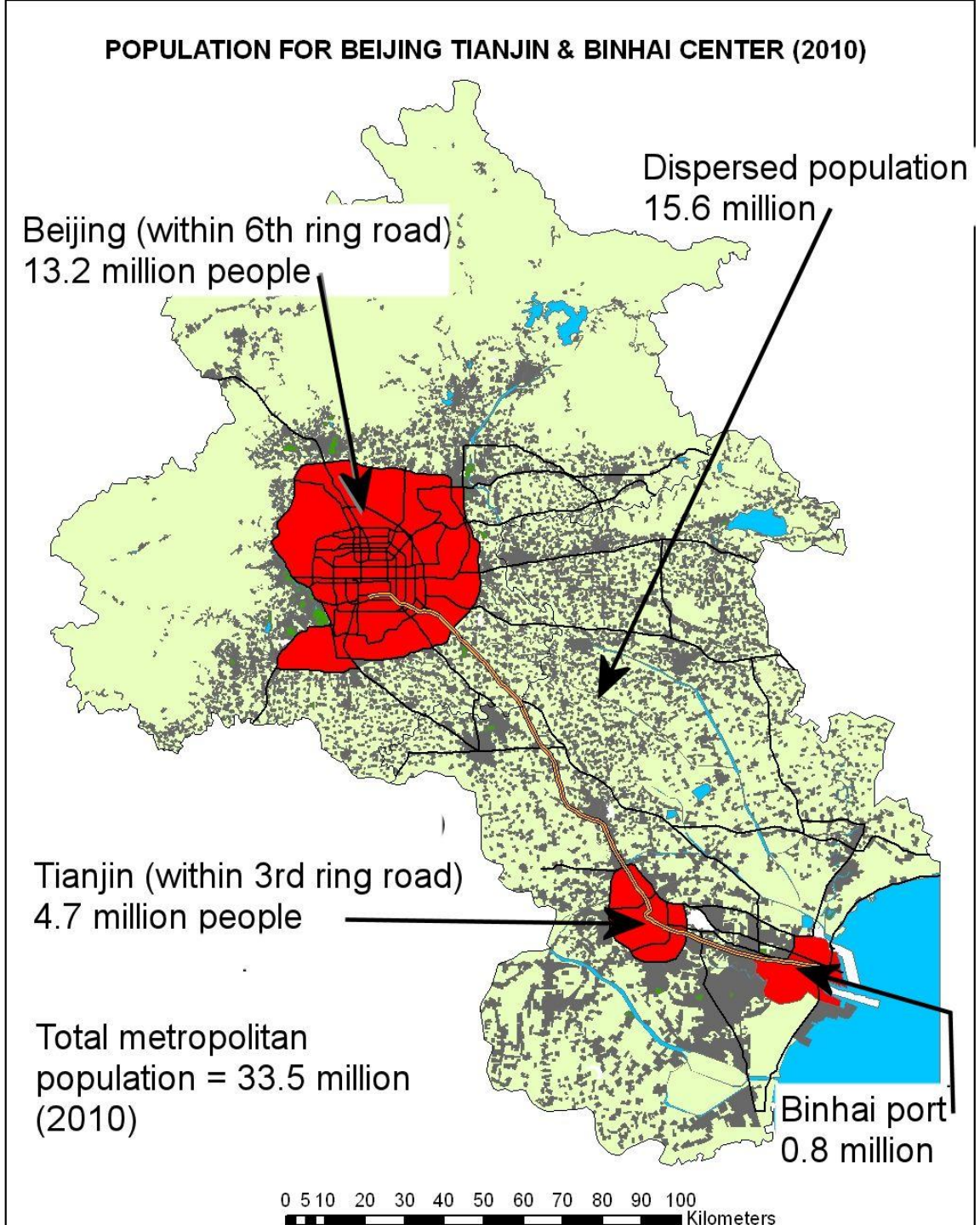


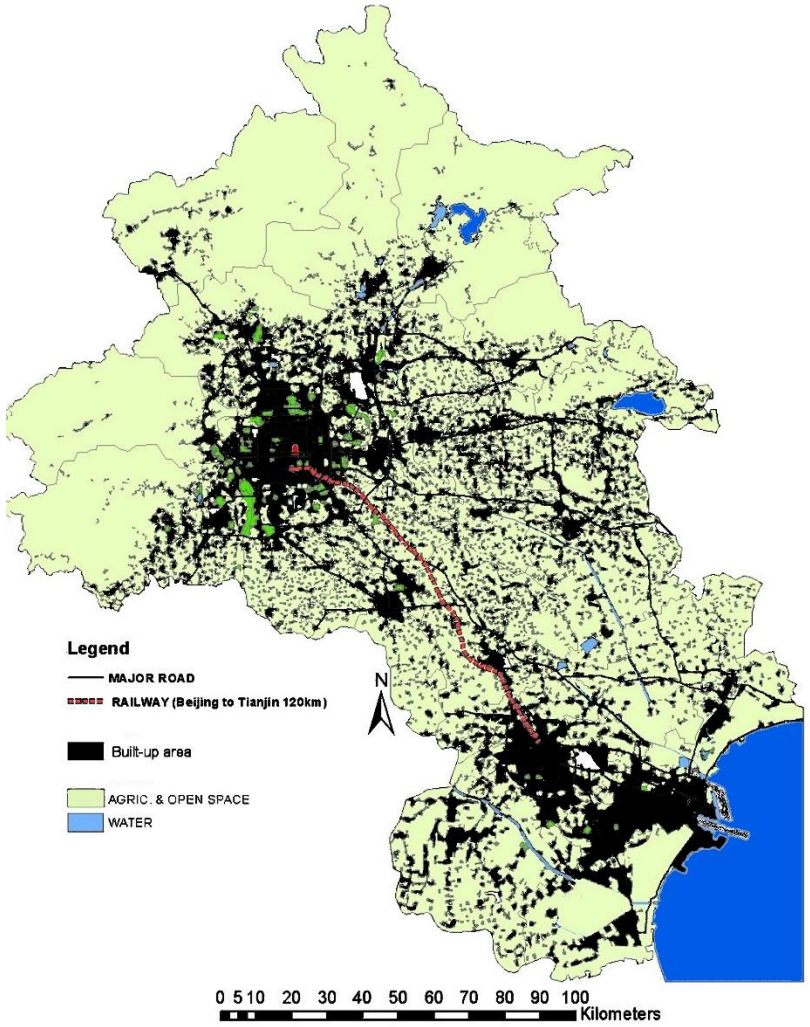
Map of Beijing Tianjin (32.5 million people) conurbation, about a third of the urban cluster Beijing Tianjin Hebei (110 million people)

China's urban clusters are dwarfing traditional existing megacities

Beijing-Tianjin shown at the same scale as Seoul and Paris metropolitan areas

BEIJING & TIANJIN BUILTUP AREA - 2013 -

Total population in areas shown on map: 36.5 million (2010 census)



Seoul Metropolitan Region

Built-up area 2009 : 3,028 km2

Population : 24.8 million

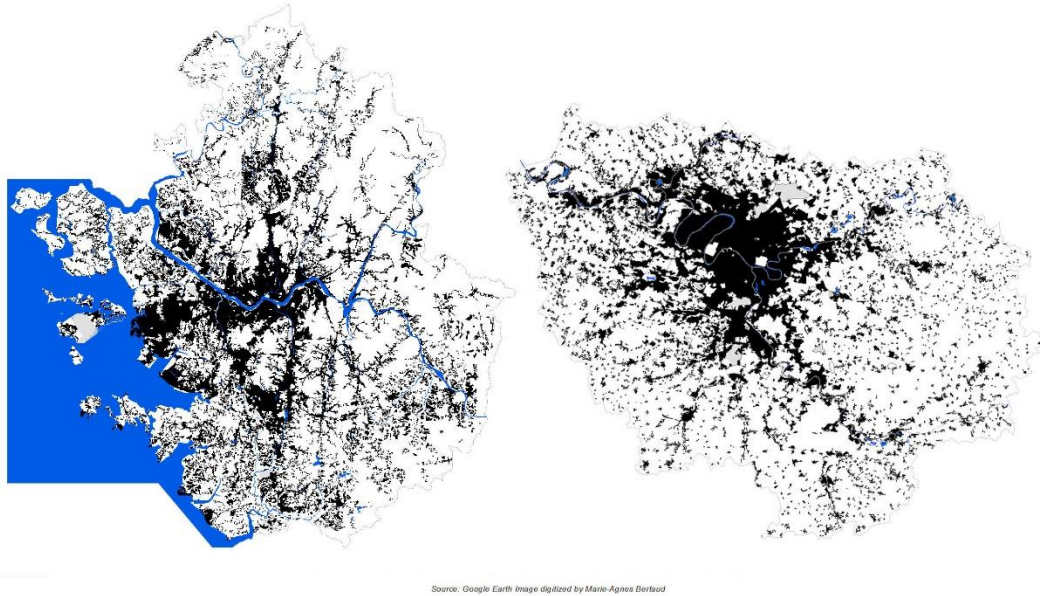
Built-up density : 82 p/ha

Paris - Ile de France Region

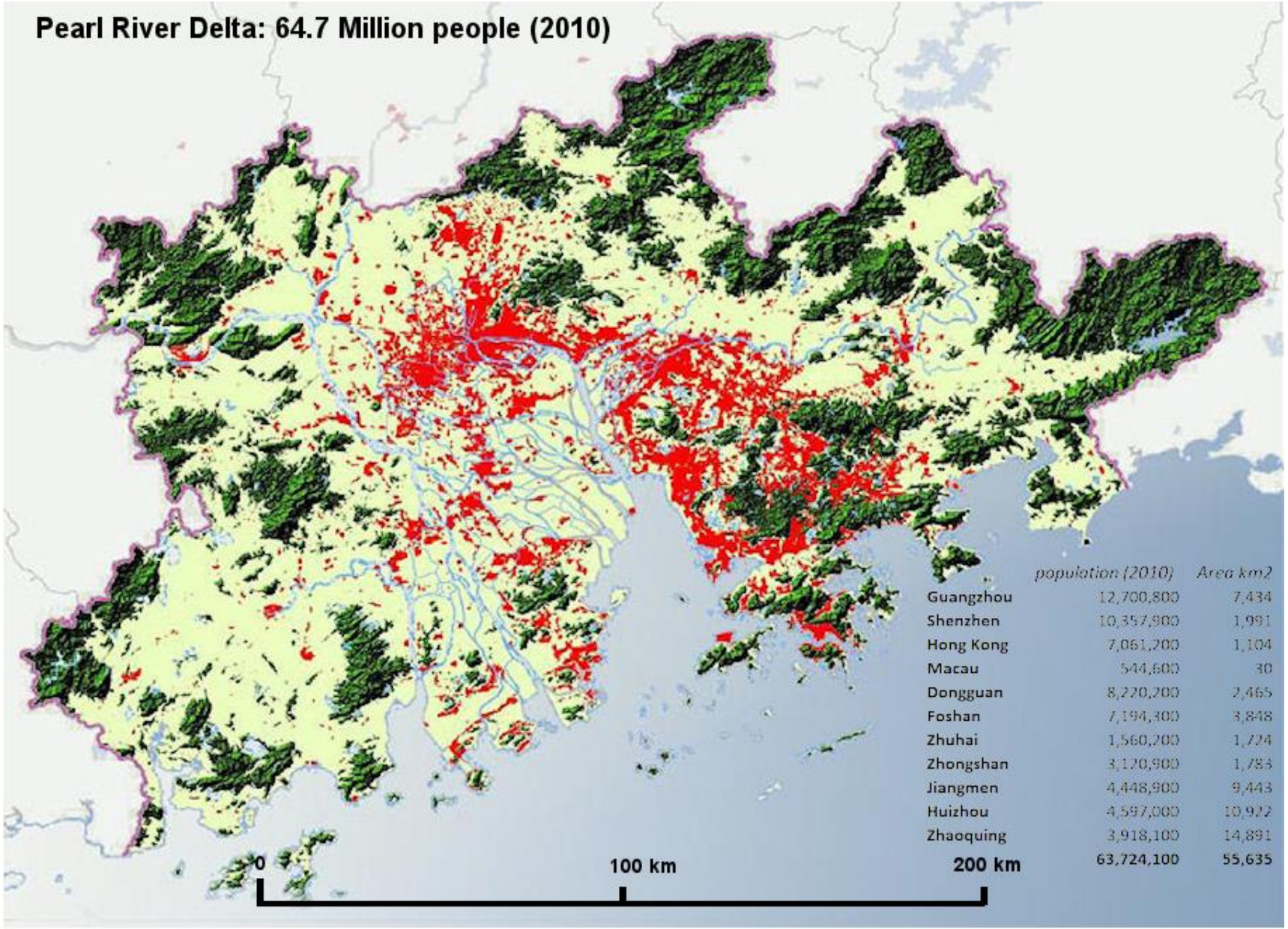
Built-up area 2006 : 2,871 km2

Population : 11.66 million

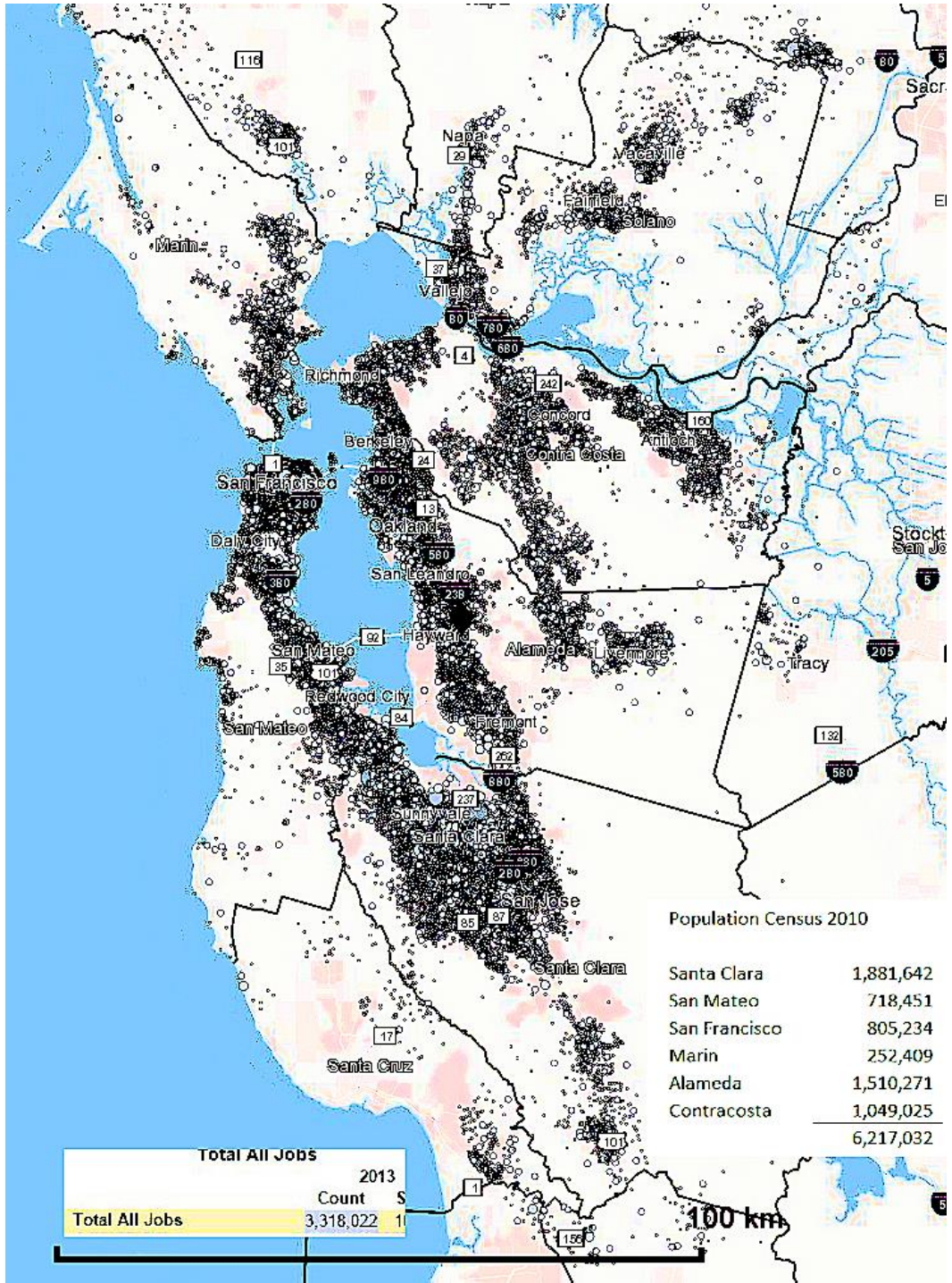
Built-up density : 41 p/ha



Guangzhou, Shenzhen and Hong Kong have high density core but are surrounded by a lower density hinterland.



	population (2010)	Area km2
Guangzhou	12,700,800	7,434
Shenzhen	10,357,900	1,991
Hong Kong	7,061,200	1,104
Macau	544,600	30
Dongguan	8,220,200	2,465
Foshan	7,194,300	3,848
Zhuhai	1,560,200	1,724
Zhongshan	3,120,900	1,783
Jiangmen	4,448,900	9,443
Huizhou	4,597,000	10,922
Zhaoquing	3,918,100	14,891
	63,724,100	55,635



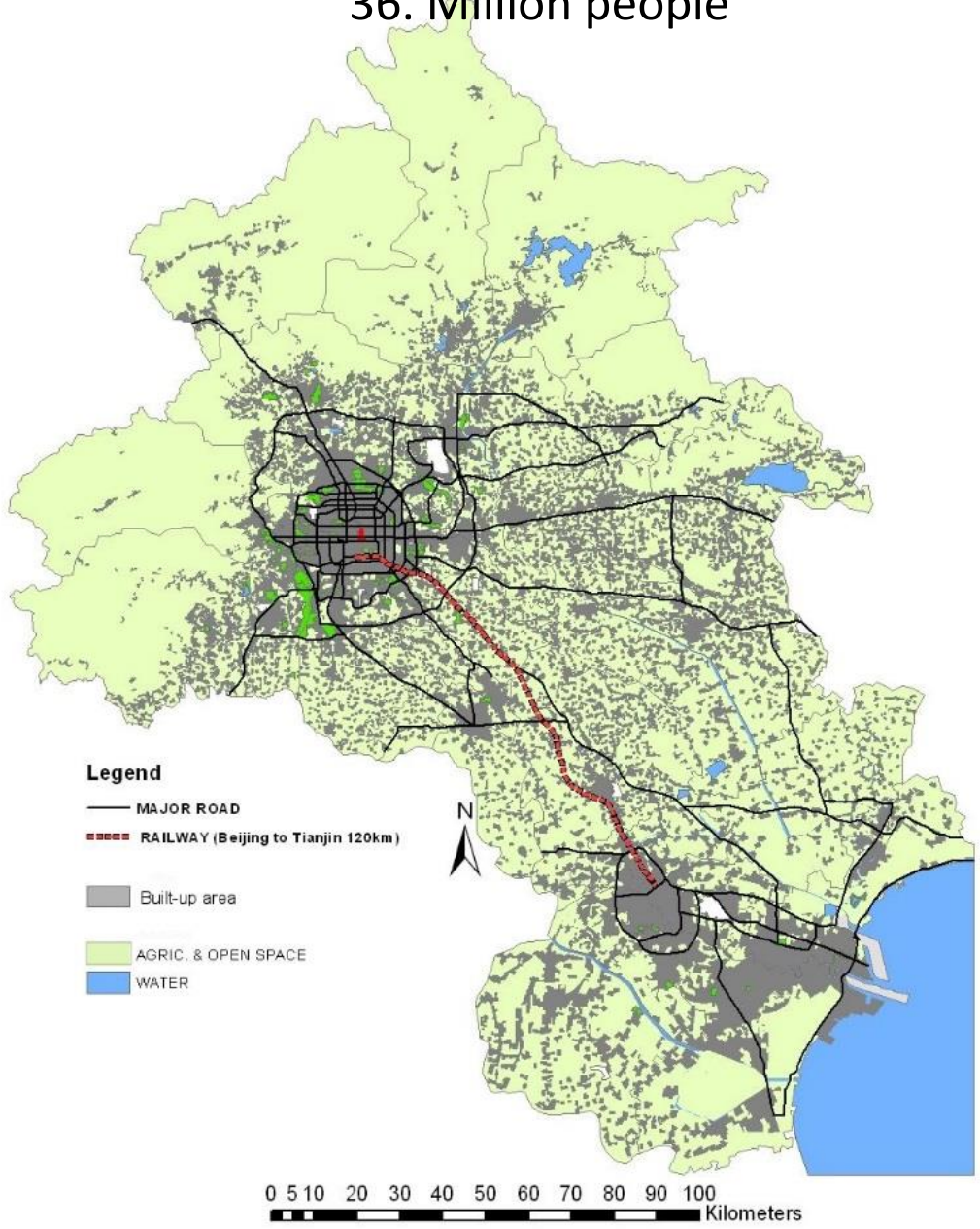
The Bay Area is a “dwarf cluster”, compared to China’s clusters.

Silicon Valley and the San Francisco Bay Area: 6.2 million people, and 3.3 million jobs spread over a distance of 150 km

BEIJING & TIANJIN BUILTUP AREA - 2013 -

Total population in areas shown on map: 36.5 million (2010 census)

36. Million people

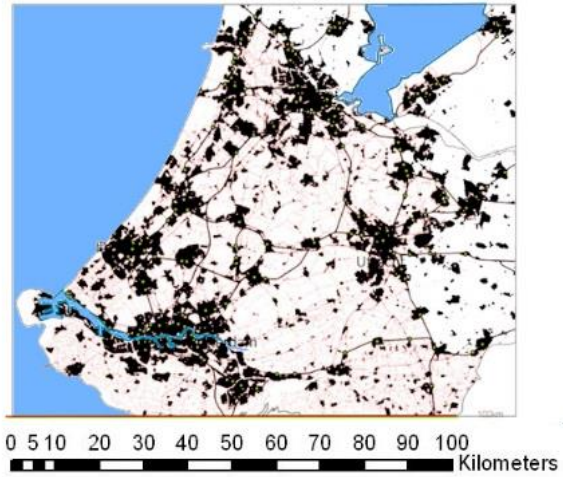


The Randstad

7.1 Million people

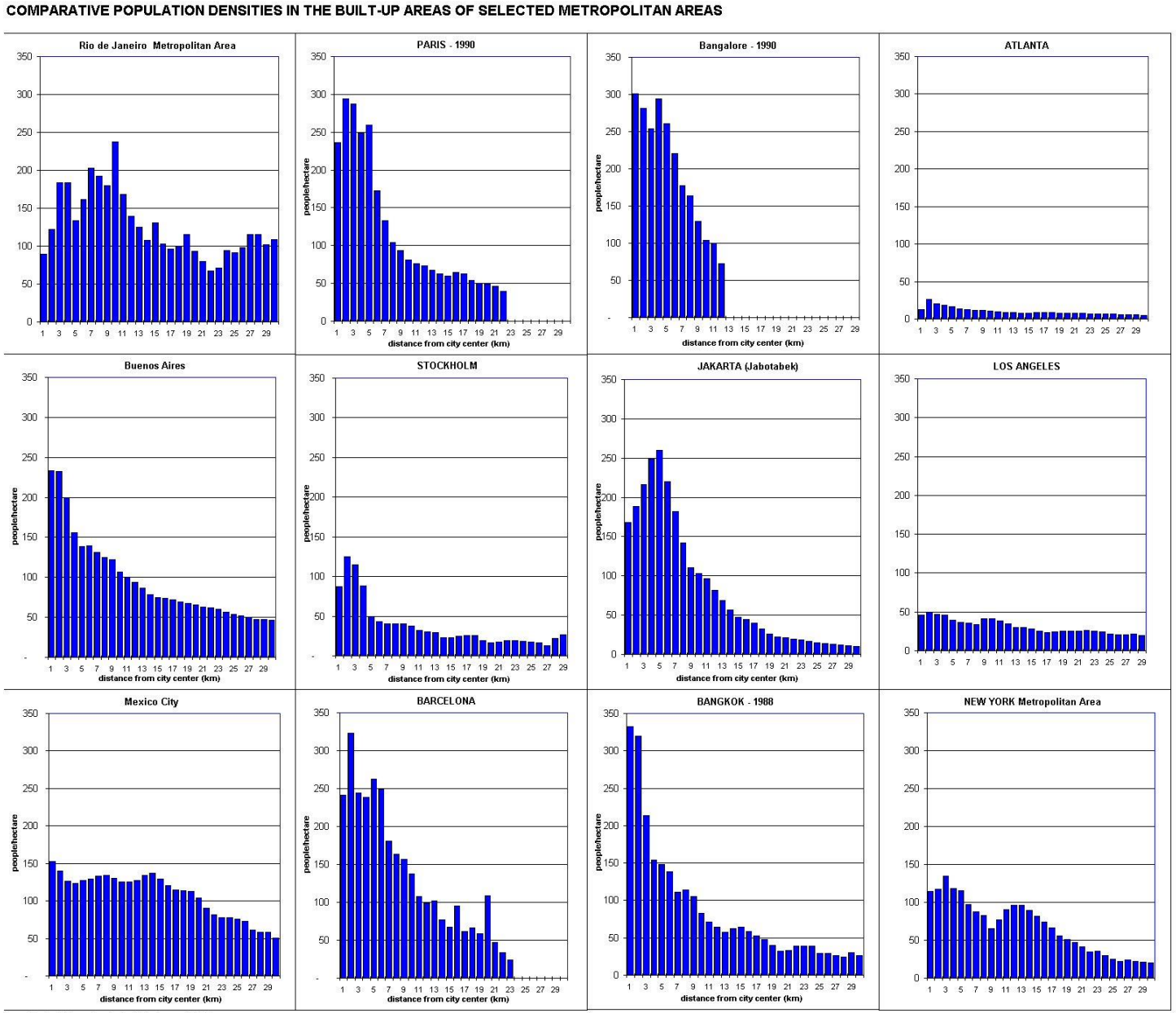
Total Randstad Population (2008)

Amsterdam	**0.8**	**million People**
Rotterdam	**0.6**	
The Hague	**0.5**	
Utrecht	**0.3**	
	2.2	
Other urban	**4.4**	
Rural	**0.5**	
Total Randstad	**7.1**	**million People**

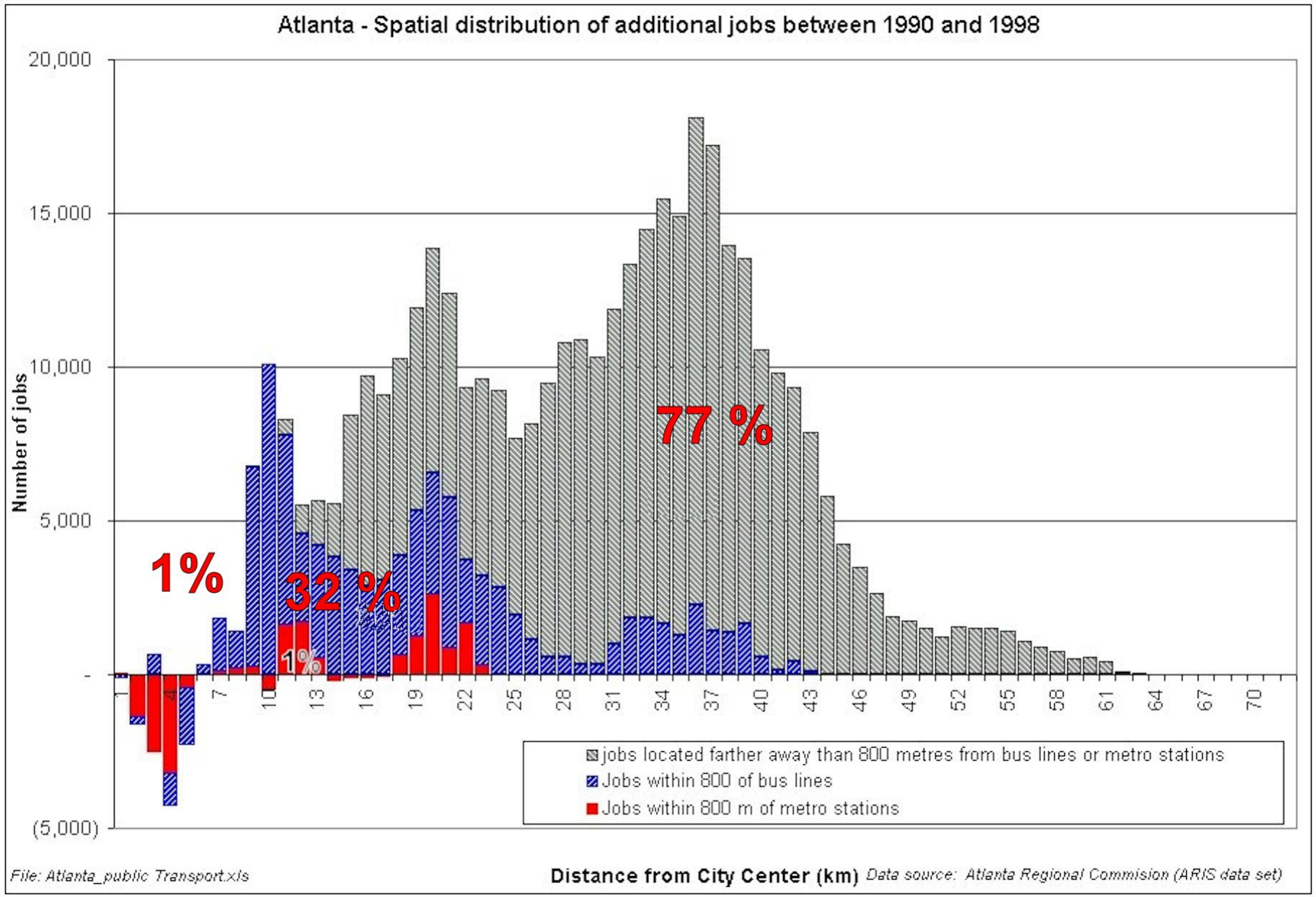


3 – In cities all over the world, jobs are dispersing into lower density suburban areas; Chinese clusters are just an extreme form of this trend

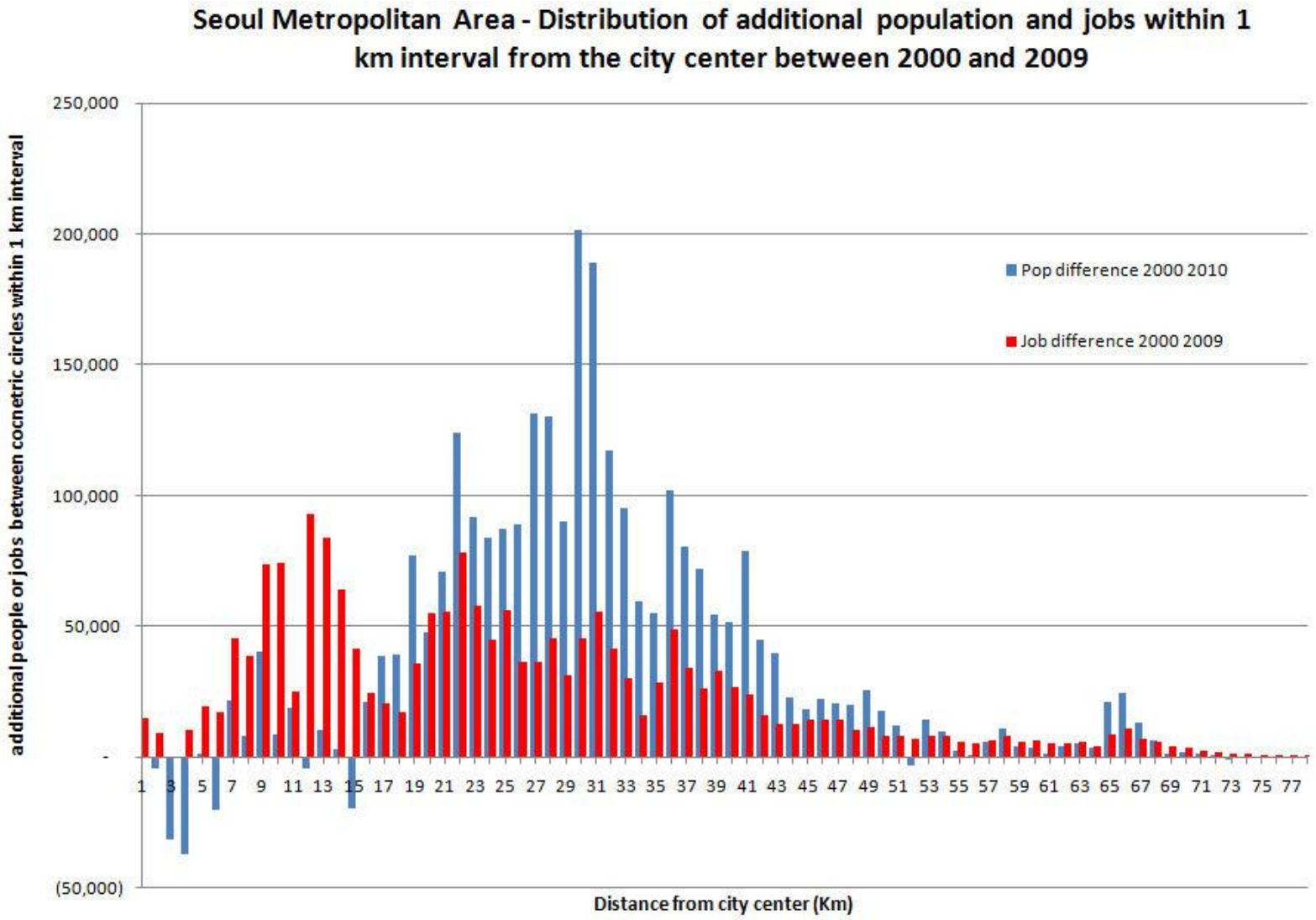
The profile of densities decreases with distance from the center independently of culture, history, or economy



Jobs are dispersing into suburbs in low density Atlanta, out of reach of the limited transit system



Jobs and population are also dispersing into remote suburban areas in Seoul with its very dense municipal area and superb transit system



The build-up area of Seoul (25 million p.)and Paris (11.6) represented at the same scale

Seoul Metropolitan Region
Built-up area 2009 : 3,028 km2
Population : 24.8 million
Built-up density : 82 p/ha

Paris - Ile de France Region
Built-up area 2006 : 2,871 km2
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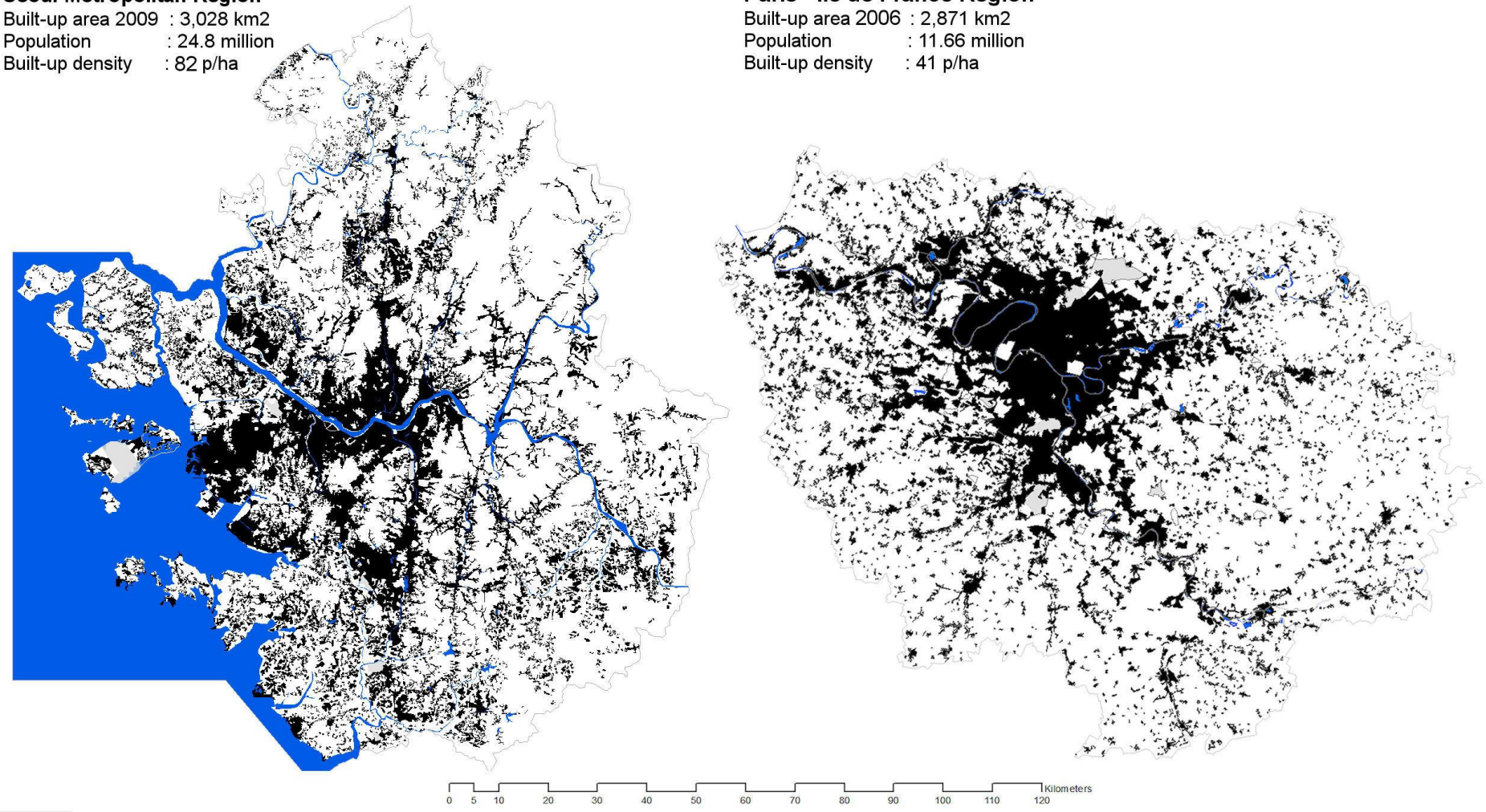
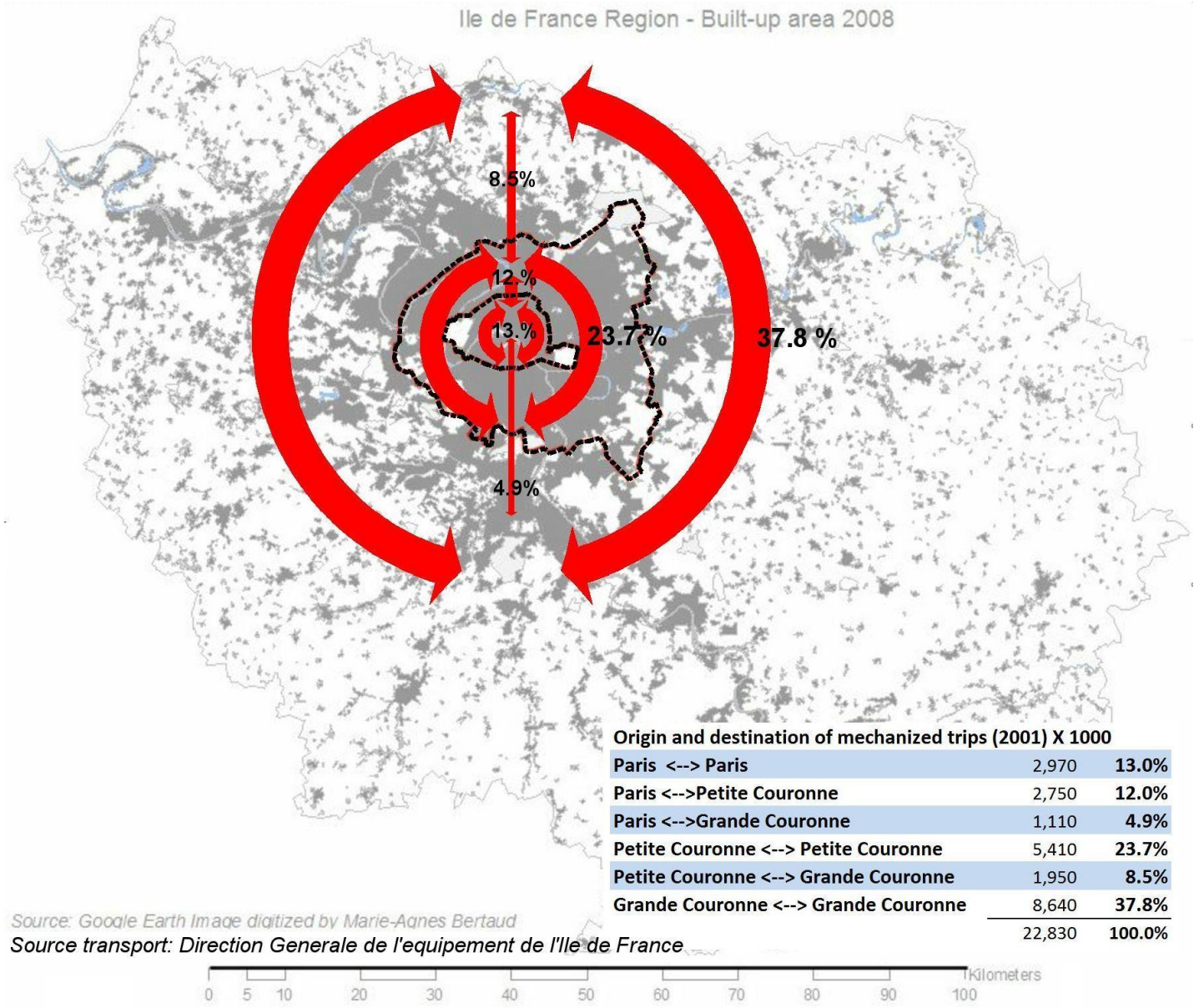


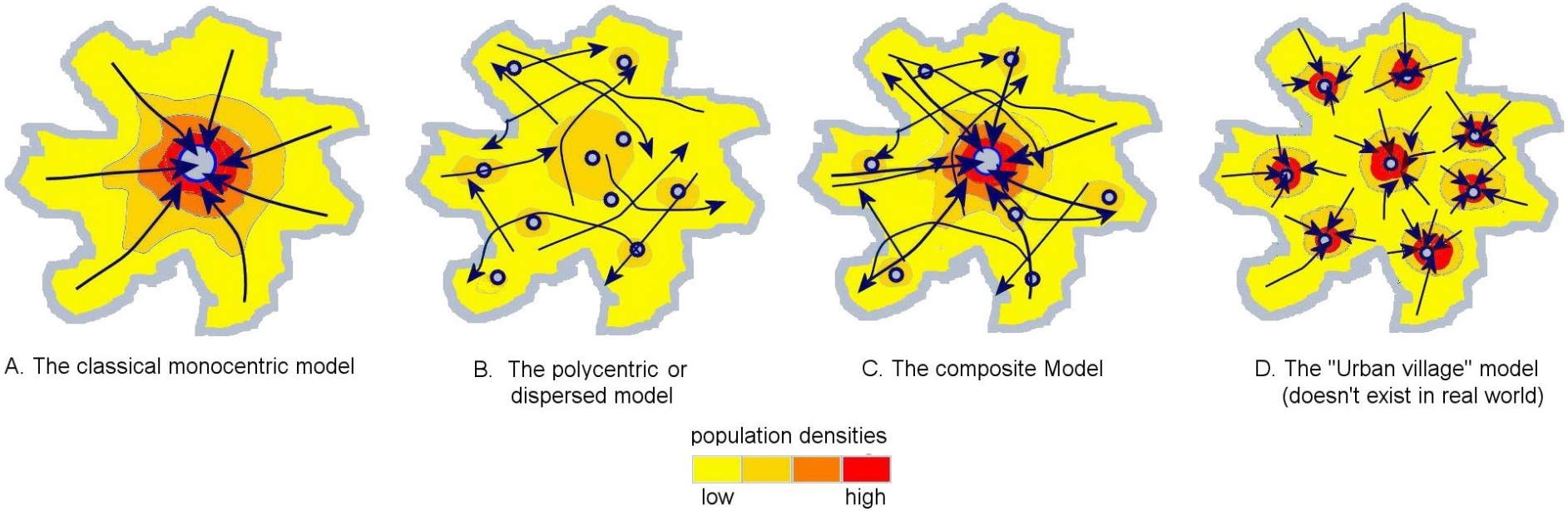
Source: Google Earth Image digitized by Marie-Agnes Bertaud

In Paris Metropolitan area 70 % of commuting trips are from suburbs to suburbs



Origin and destination of mechanized trips (2001) X 1000		
Paris <--> Paris	2,970	13.0%
Paris <-->Petite Couronne	2,750	12.0%
Paris <-->Grande Couronne	1,110	4.9%
Petite Couronne <--> Petite Couronne	5,410	23.7%
Petite Couronne <--> Grande Couronne	1,950	8.5%
Grande Couronne <--> Grande Couronne	8,640	37.8%
	22,830	100.0%

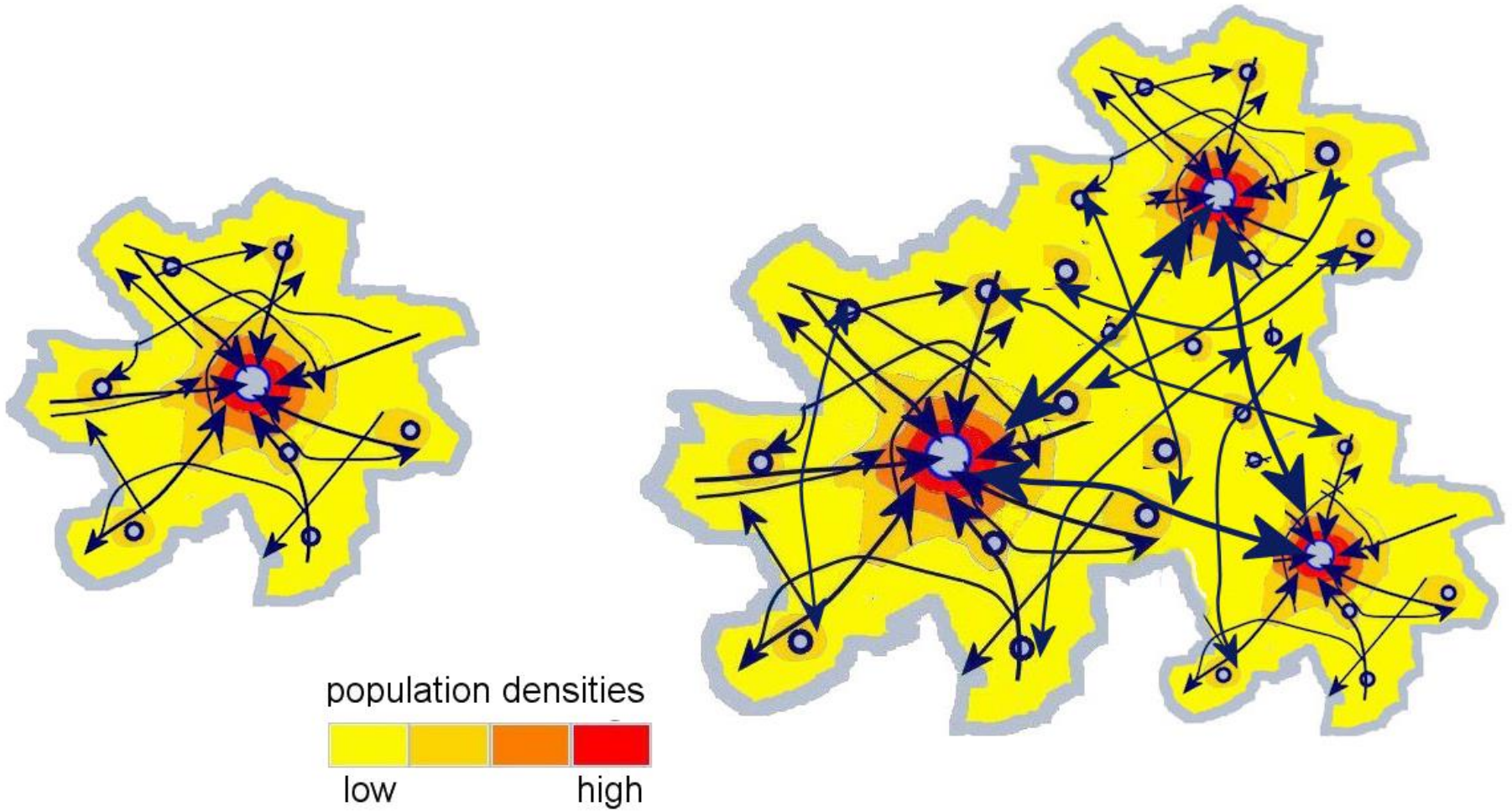
The pattern of commuting trips corresponding to various urban structures



The dispersion of trips origin and destination will increase in China's large urban clusters

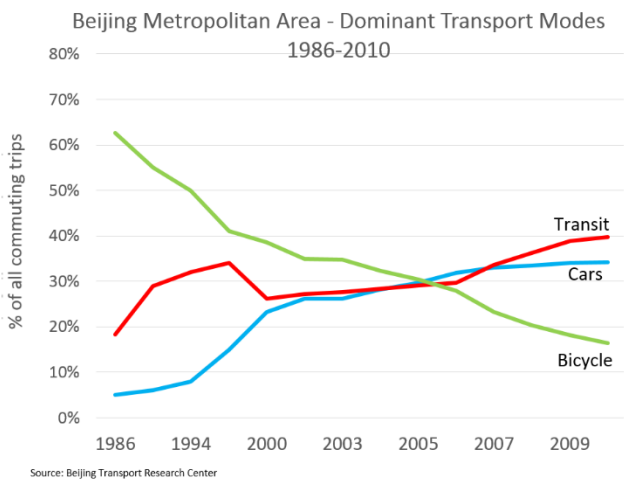
Typical trips pattern in a metropolitan area

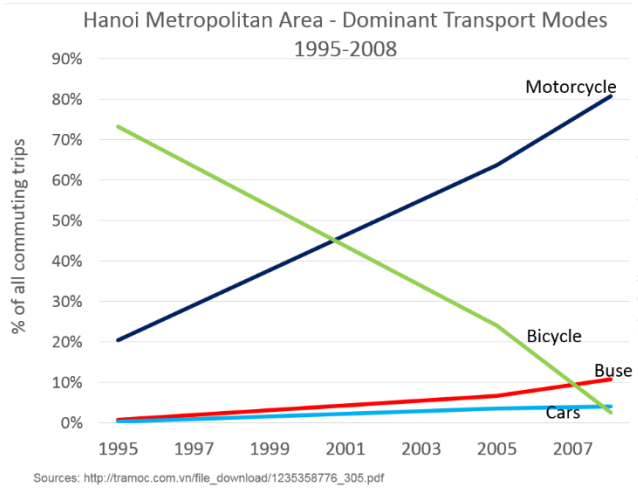
Expected trips pattern in an urban cluster

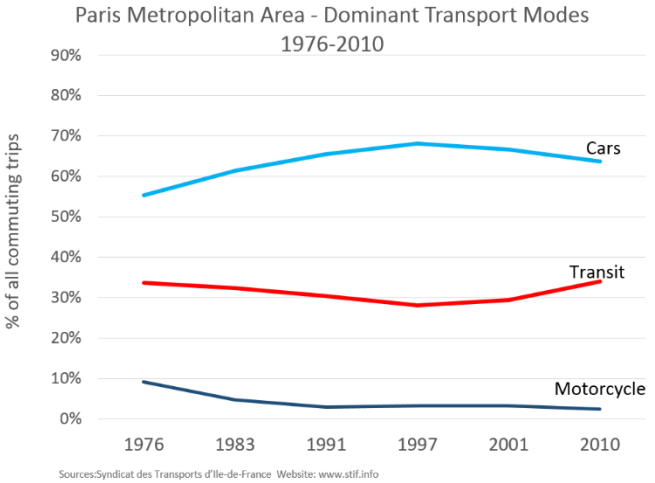


4 - Transport mode splits adjust to income and urban spatial structures

Transport mode splits changes in Beijing, Hanoi and Paris





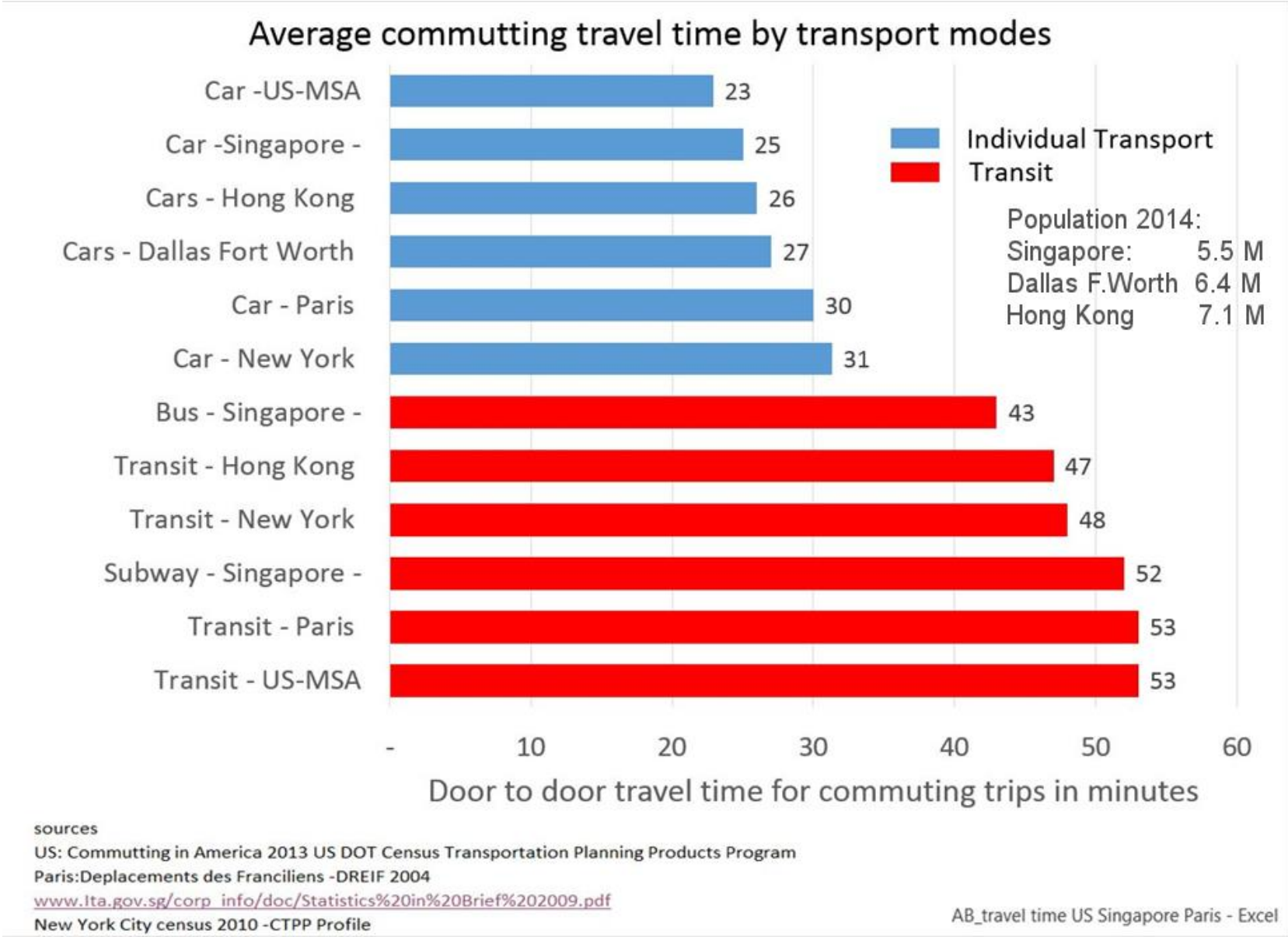


5 - The traditional transport mode split, between individual cars, freight trucks, and transit, seems to have reached its limits in serving large labor markets

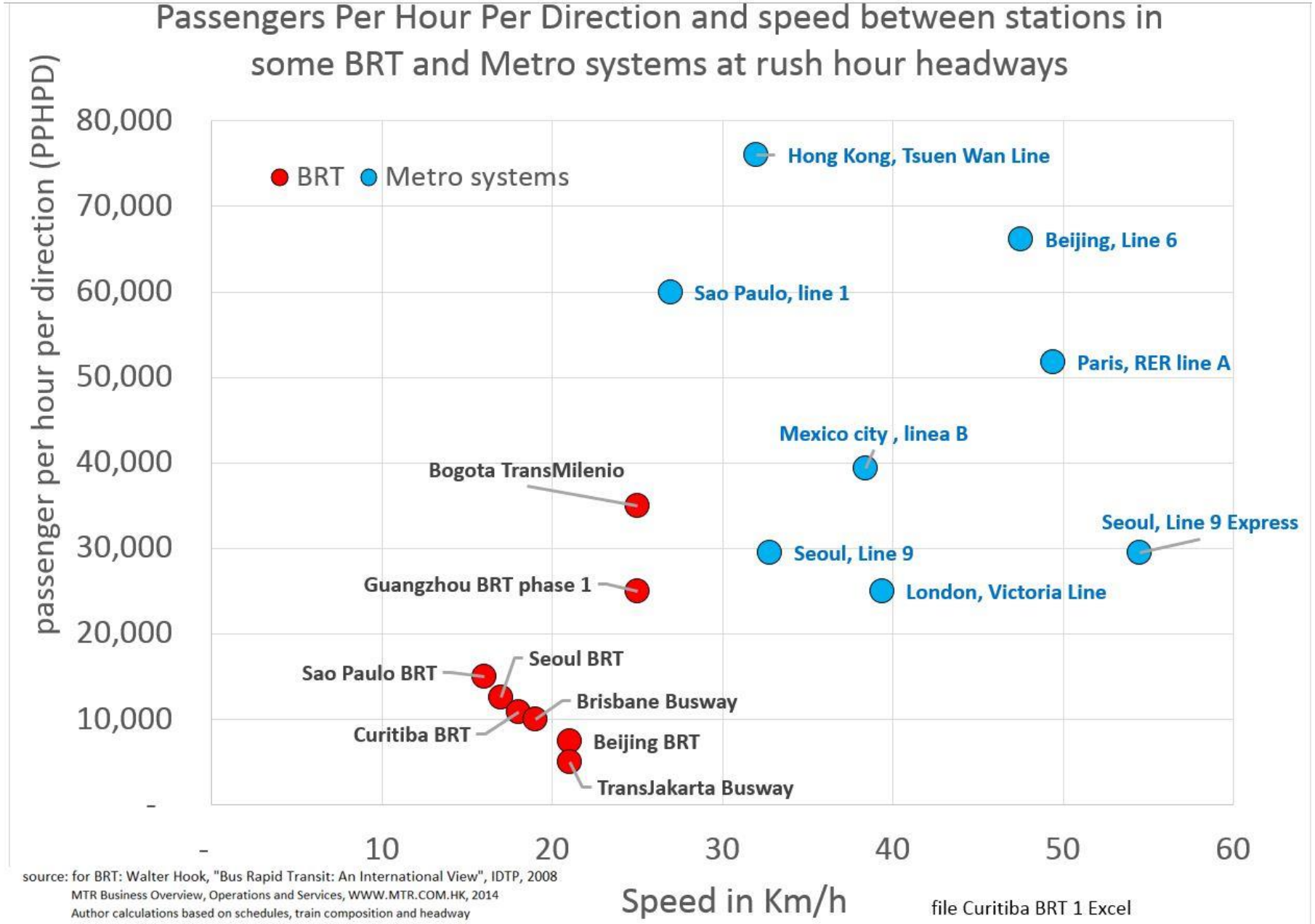
Different modes of transport serve different trip patterns: dispersed origins-> concentrated destinations, dispersed origins-> dispersed destinations

	Individual transport	Shared individual transport	Collective transport transit
area served:	*Entire road network*	*Entire road network*	*Limited network*
Schedule:	*On demand*	*On demand*	*Fixed schedule*
From where to where:	*Door to door*	*Door to door*	*Station to station*
	Walk	Taxi	Bus
	Bicycle	Carpool	Light rail, tram
	Electric scooter	Uber, Lyft	Collective taxi
	Motorcycle	Uber pool	Bus Rapid Transit (BRT)
	Car drive alone	self driving car	Subway
		I-Road Toyota at stations	Suburban rail

Transit provides high capacity but slow door to door speed current cars have higher speed but low road capacity



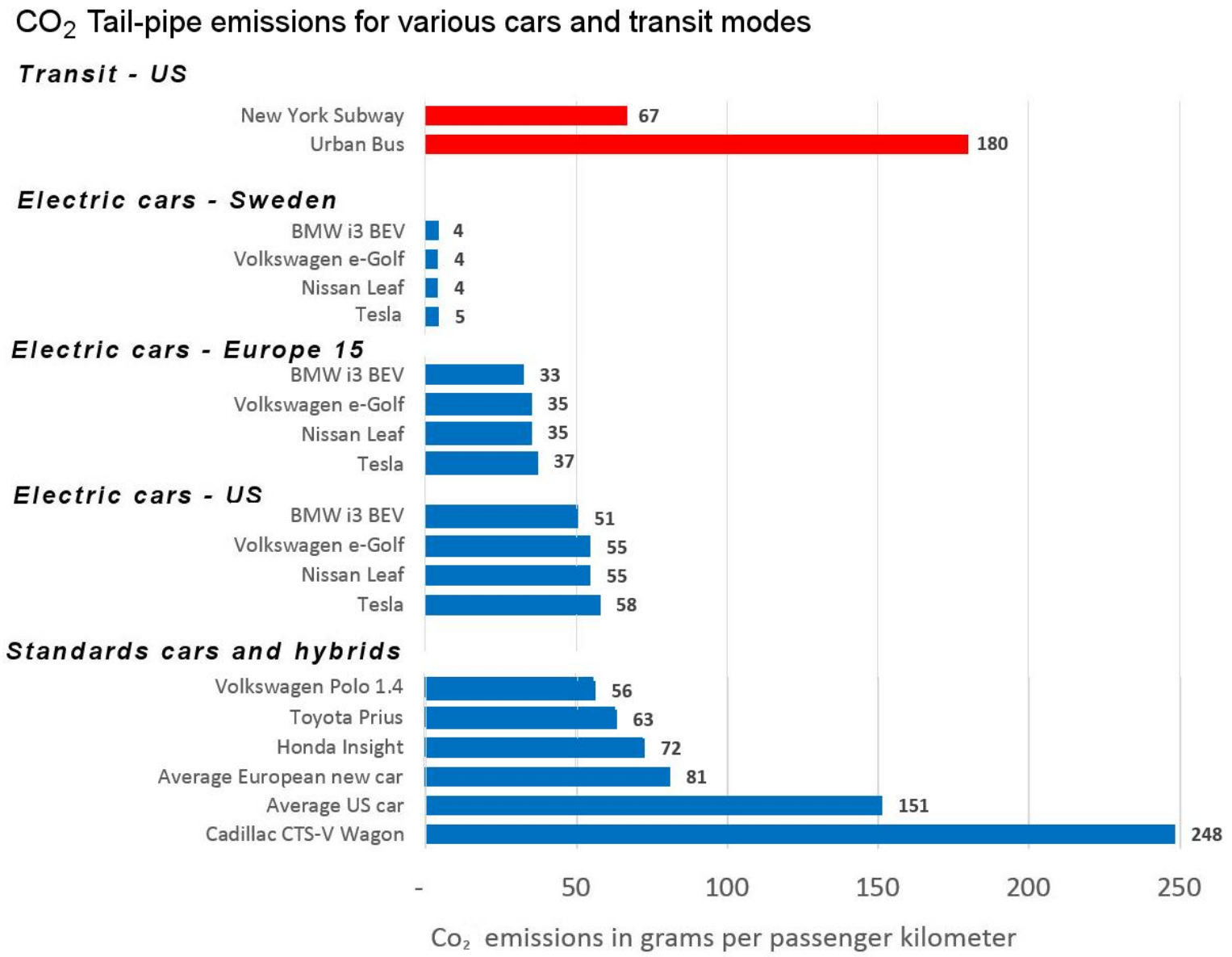
The faster transit systems seem to have difficulties breaching the 50km/h speed barrier



Beijing subway system, one of the largest in the world is already saturated at rush hour

Source: Beijing Transport Research Center (2015)

CO2e emission for various type of transport vehicles in different countries



6 -Could shared individual urban vehicles, used as feeders to very rapid transit networks, allows labor markets to expands to the size of Chinese urban clusters?

The shared door-to-station, station-to-door light electric vehicles might replace most feeders buses

Toyota i-Road individual mobility vehicle

The informal precursor of the Toyota i-Road serving the suburban Beijing subway stations

Toyota i-Road electric two seater

Three-wheeler on demand vehicle available at Beijing suburban subway stations

Self driving cars, when fully operational, would be perfect for the first and last 5 km to and from stations in very large urban clusters

The transport infrastructure that could accommodate urban clusters with high density core and low density suburbs:

A combination of transport modes:

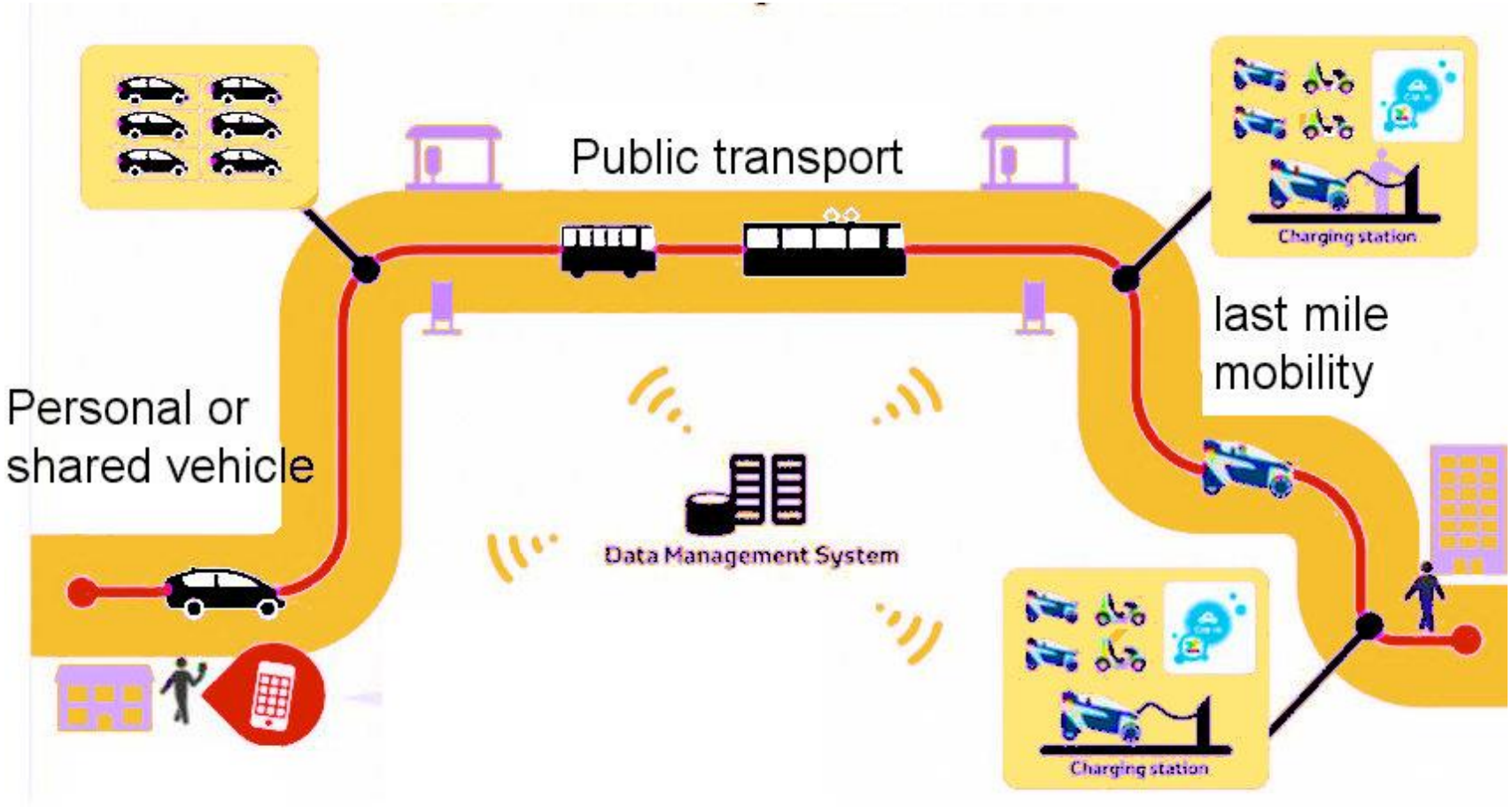
- Rapid rail transit for cross metropolitan trips
- Individual shared transport like Toyota i-road
- Freight self-driving vehicles

A small scale real life experiment in Grenoble

Toyota i-Road personal mobility vehicles parked near rail urban transport station in Grenoble

http://www.toyota-global.com/innovation/personal_mobility/i-road/

The Grenoble new transport system combining individual vehicles with transit



Toyota supplies 70 COMS and i-Road electric vehicles and "Last Mile Mobility Management System" to manage interconnection between users, vehicles, charging stations and the web-based Station Mobile trip planner