

79th ITPS Colloquium 24 February 2006

*Study to Identify the Special Transport
Policies in Asian Megacities*

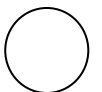
アジアの大都市特有の都市交通政策に関する研究

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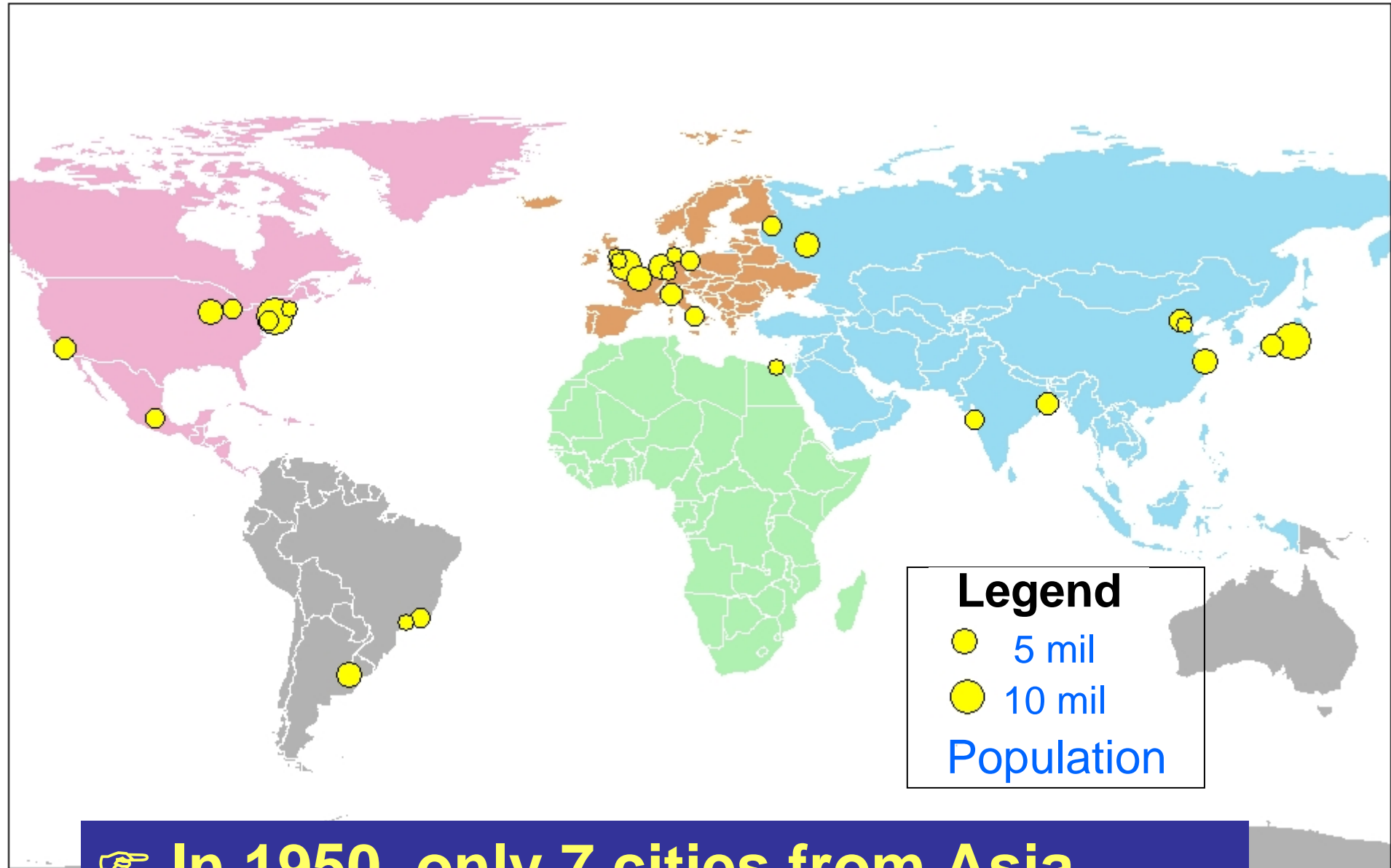
24 Feb 2006



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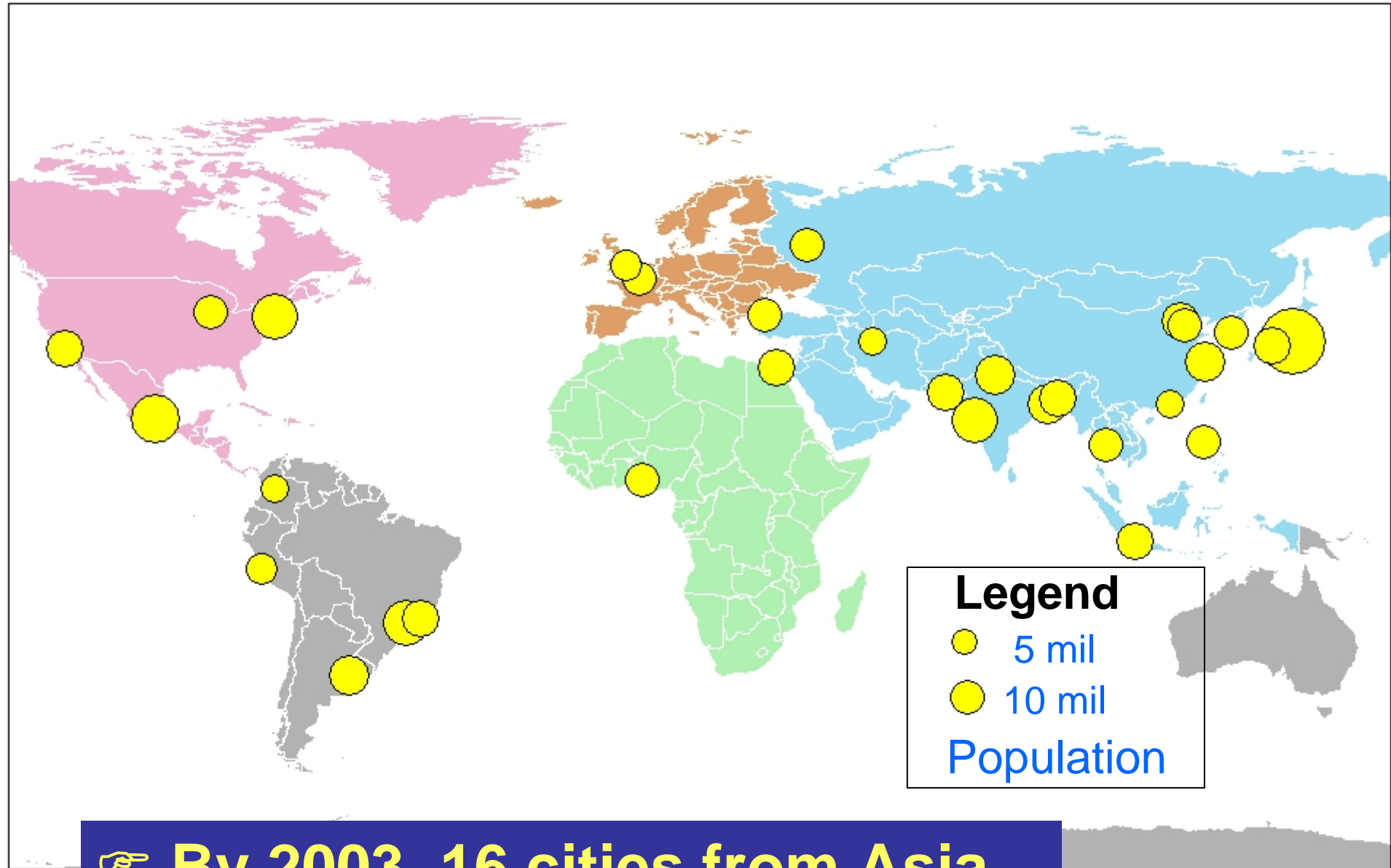
- **Background:** Features and Problems of Asian Megacities
- **STREAM Study:** Objectives; Framework and Perspectives
- **Comparative Examples from Seoul and Bangkok**
 - Urban form and Land-use
 - Urban roads and motorization
 - Public transport and urban rails
- **Policy Implication and further works**

World 30 Largest Metropolitan Areas (1950)



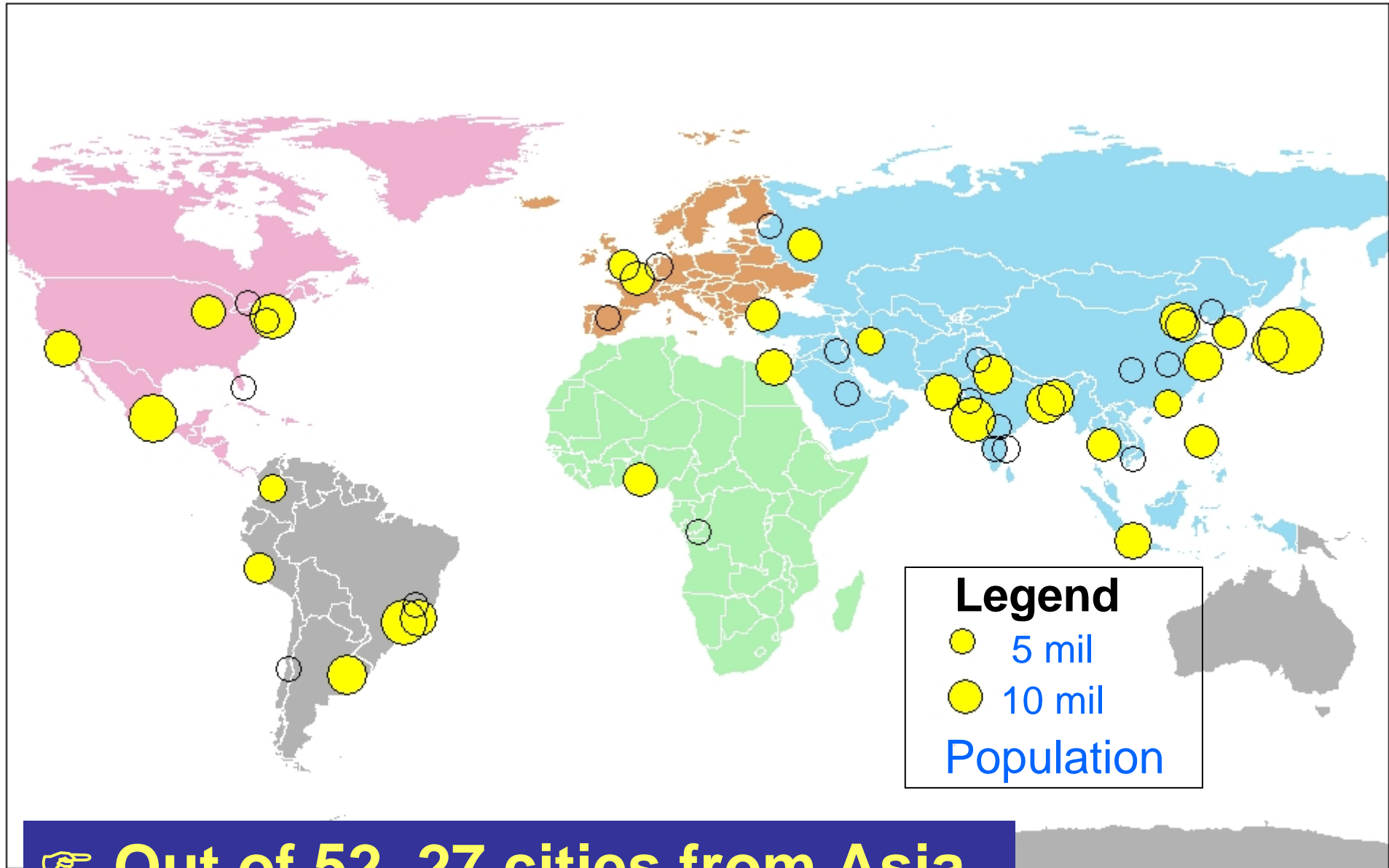
👉 **In 1950, only 7 cities from Asia...**

World 30 Largest Metropolitan Areas (2003)

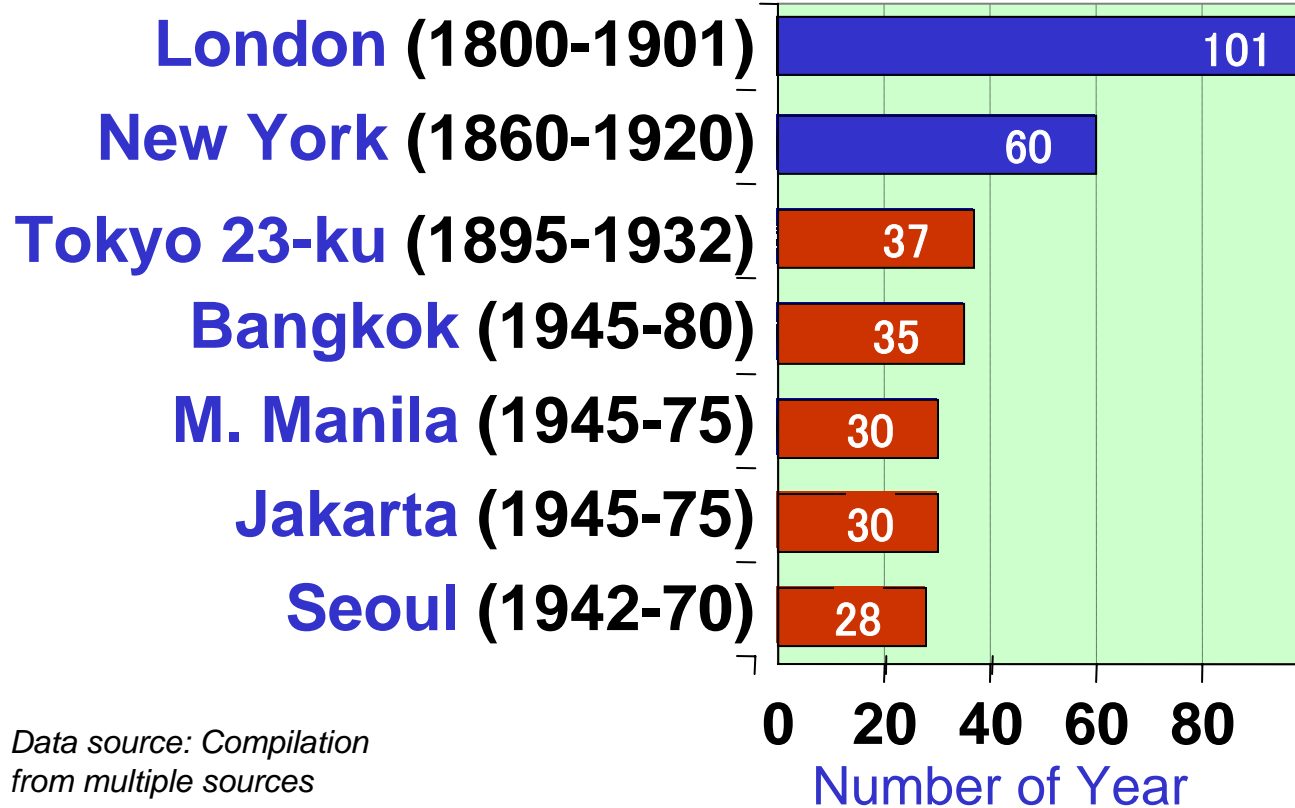


👉 **By 2003, 16 cities from Asia..**

Metropolitan Areas: Population >5 mil (2003)



Years taken to increase city* population from 1 mil. to 5 millions

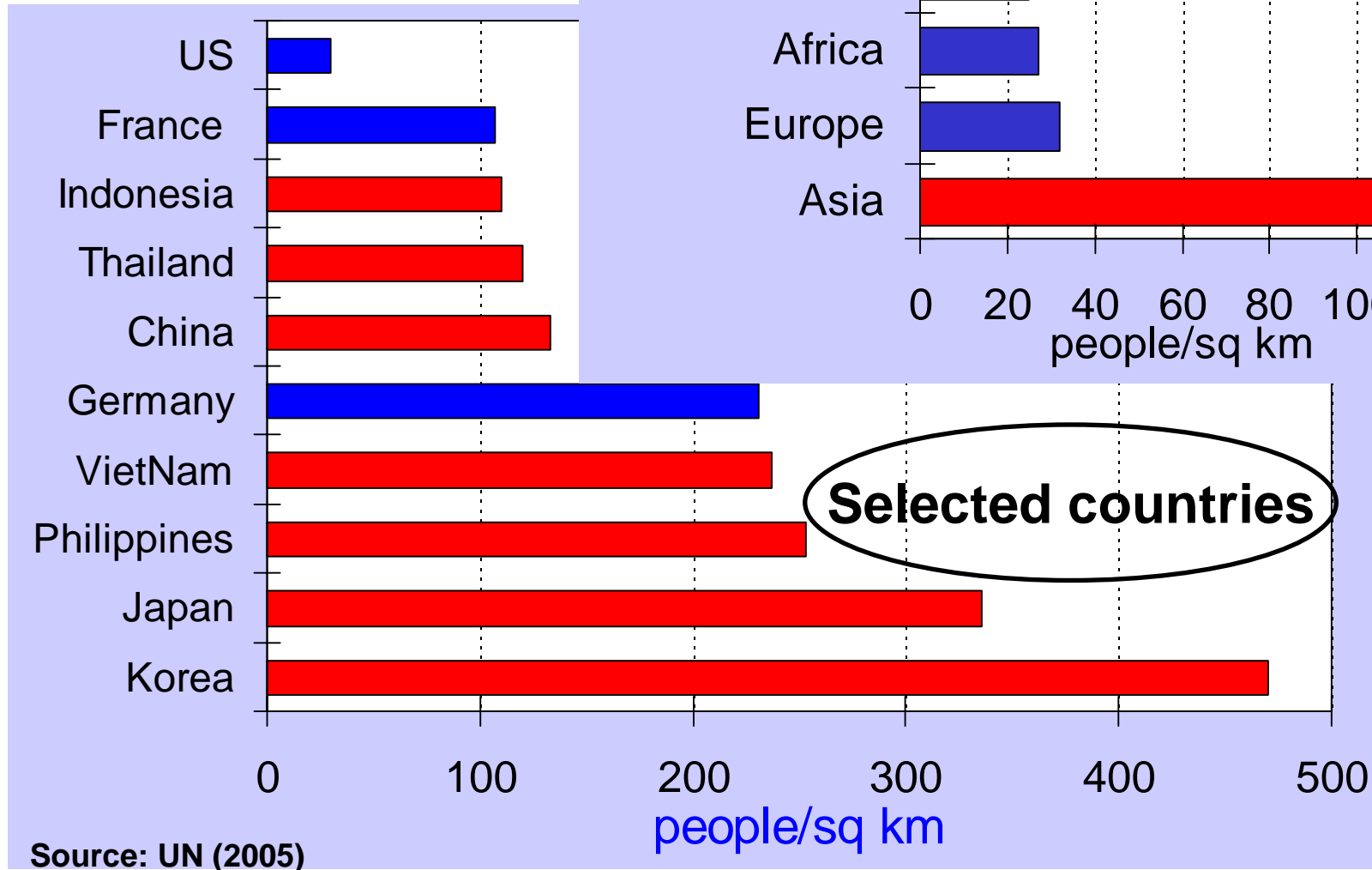


Area Km ²	First Subway
1580	1863
835	1904
621	1927
1577	2004
637	-
661	-
606	1974

* City proper (not extended metropolitan area)

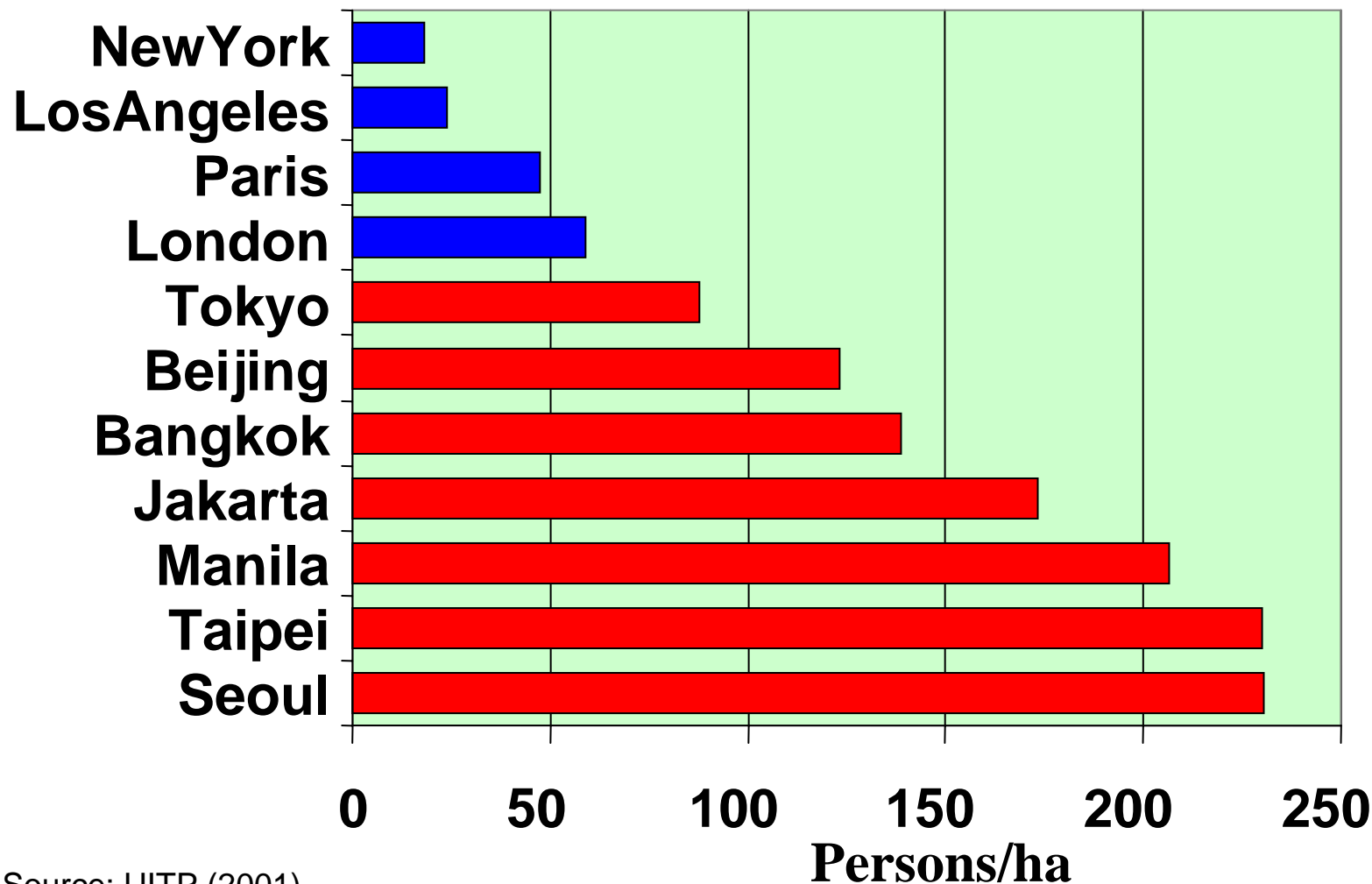
- Rapid urban growth in Asian megacities
- Challenge of managing rapid urban growth
- Late development of important infrastructure (subway)

Population Density



➡ Higher population density in Asia

Urban density in Selected Metropolitan Areas 1995



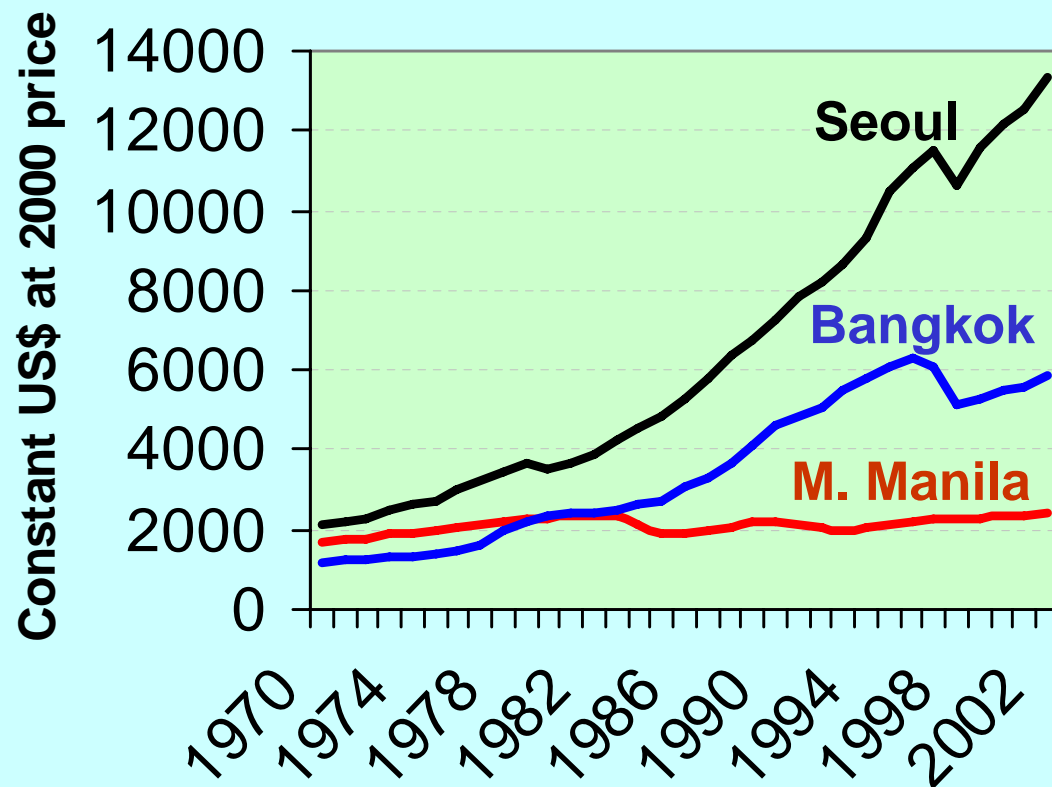
Source: UITP (2001)

* Data year for Bangkok 2000, Source NSO (2004)

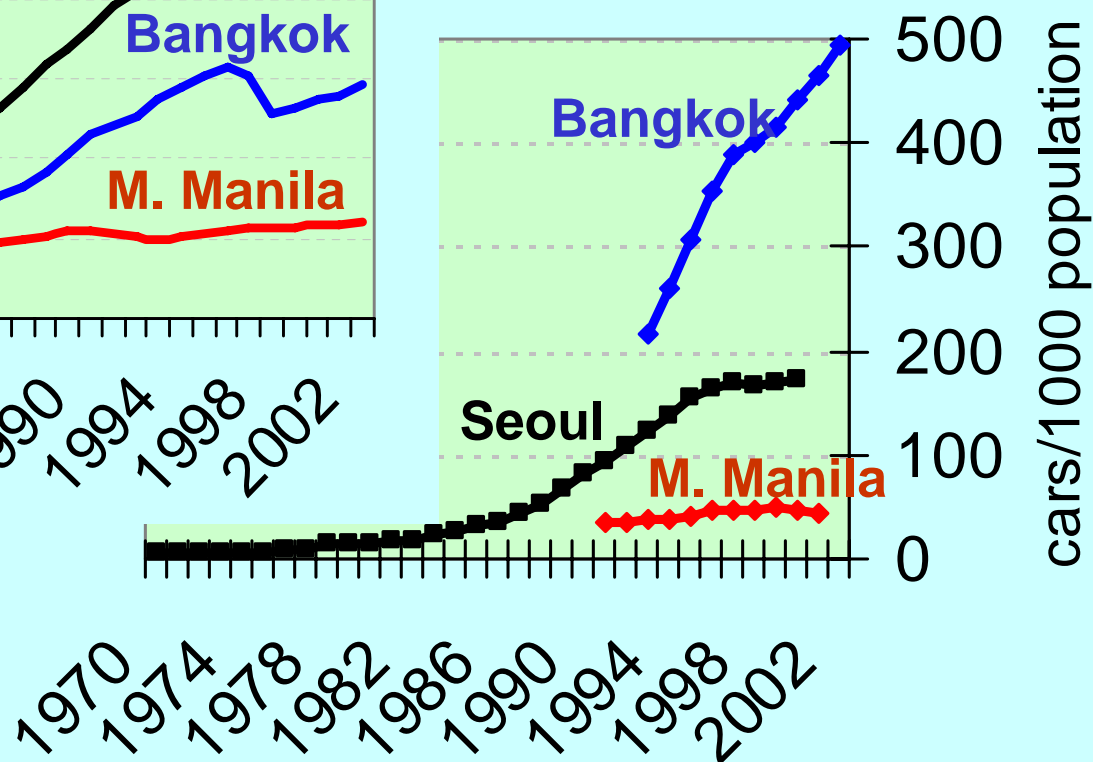
Urban density: Only urbanized area is considered

➡ Higher urban density in Asian megacities

Trend of city's per capita income

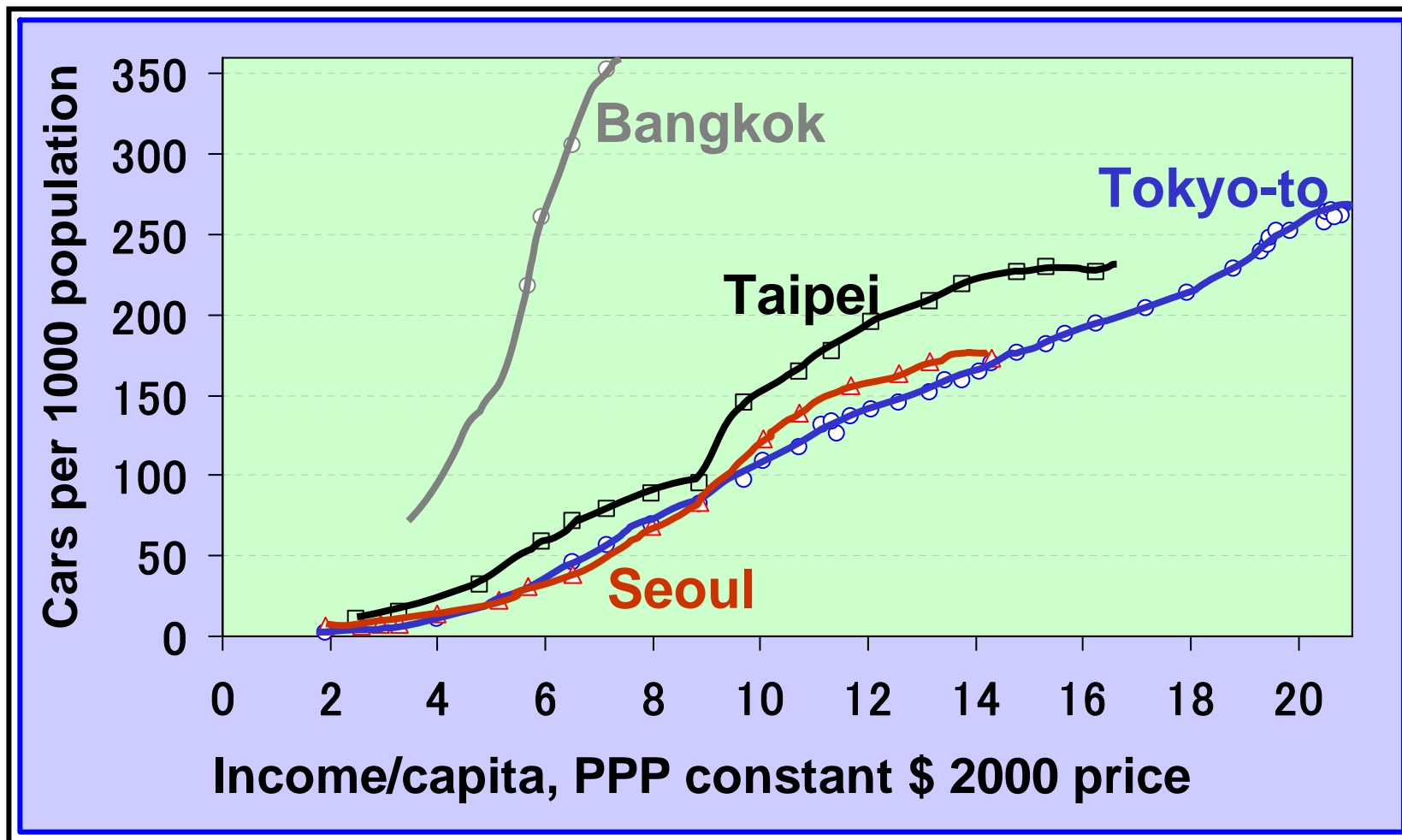


Trend of car ownership

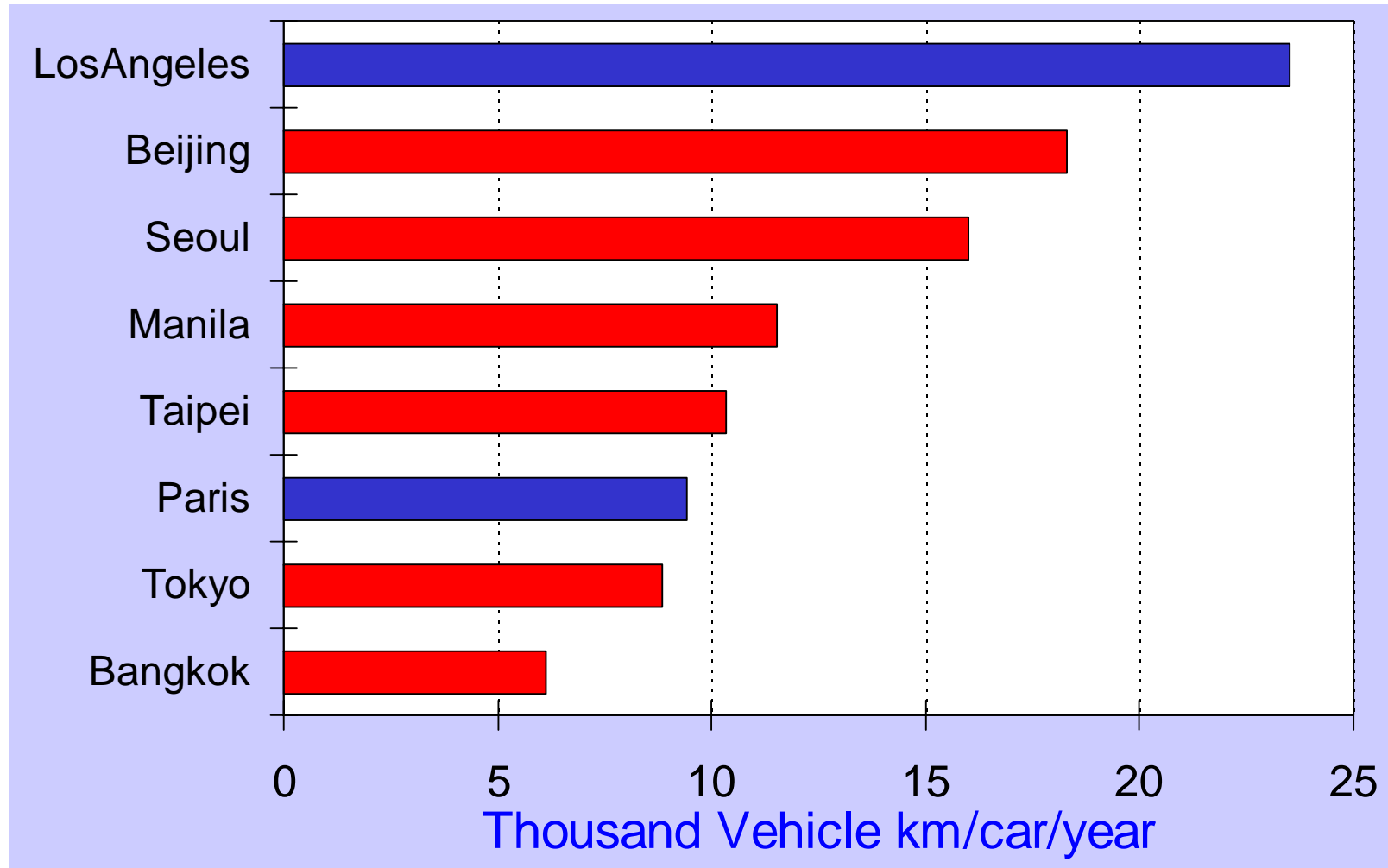


➡ Rapid increase of income and car ownership in Asian megacities

Income Vs Car Ownership



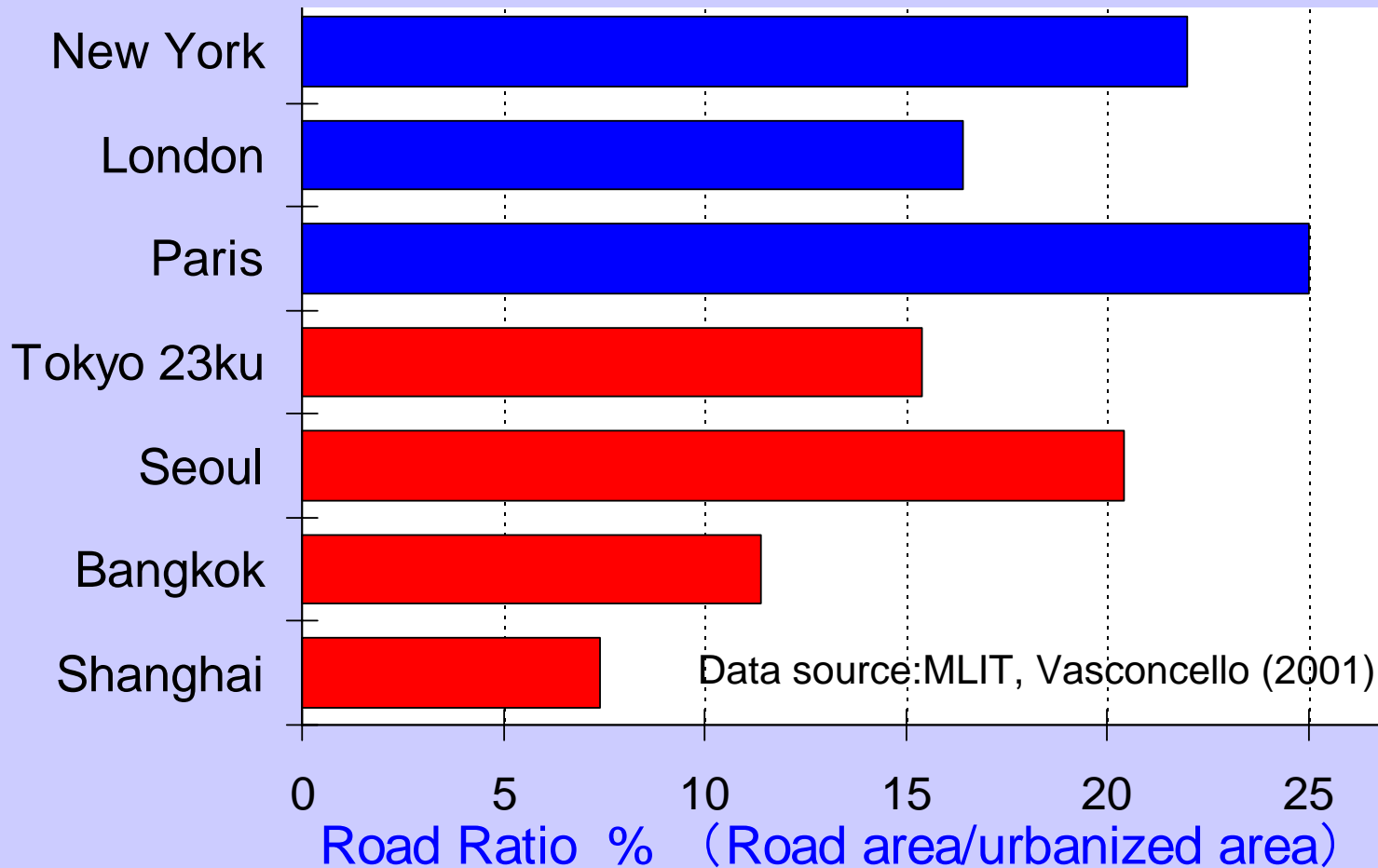
Car usages rate



👉 Not only ownership, but car usage rates are also higher...

Urban Roads

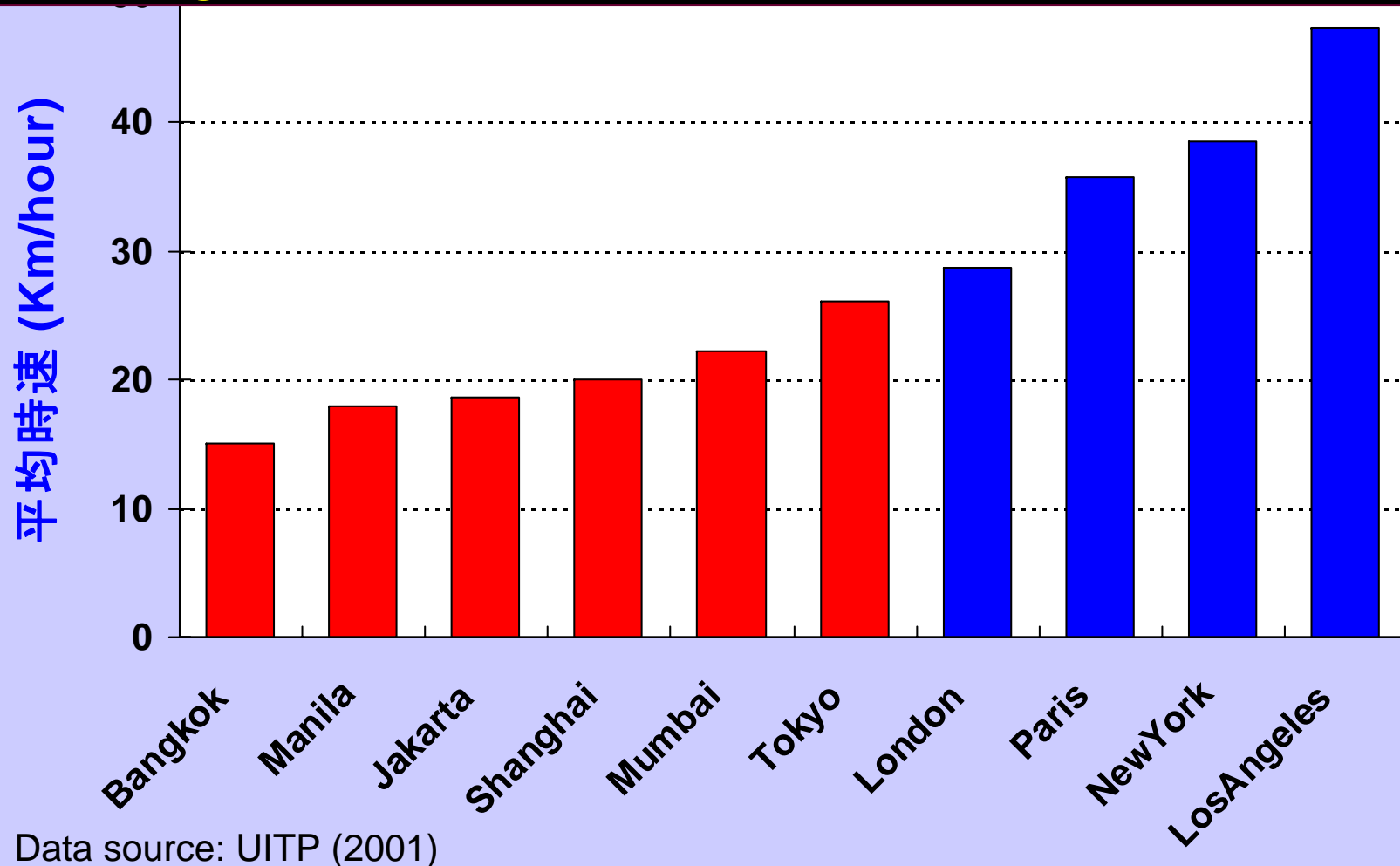
Road space ratio in selected cities



👉 Inadequate road in mega-cities of Asian developing countries

Traffic Congestion

Average speed of road traffic 1995

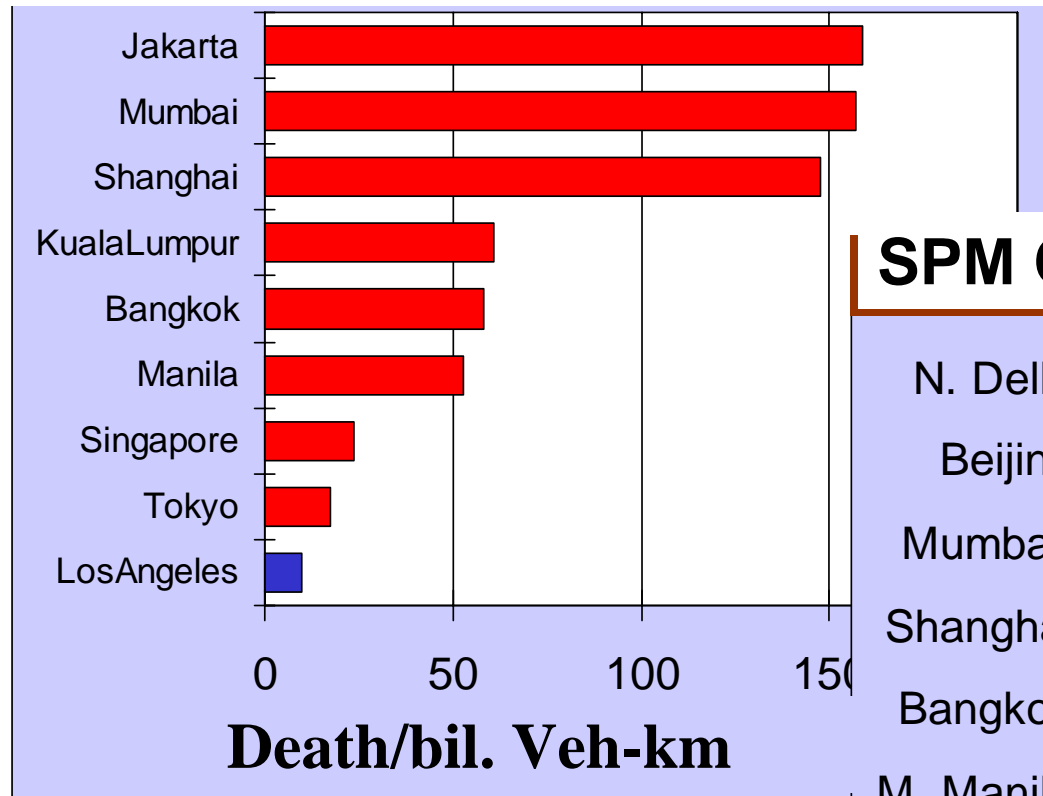


☞ Severe Road traffic congestion in Asian megacities

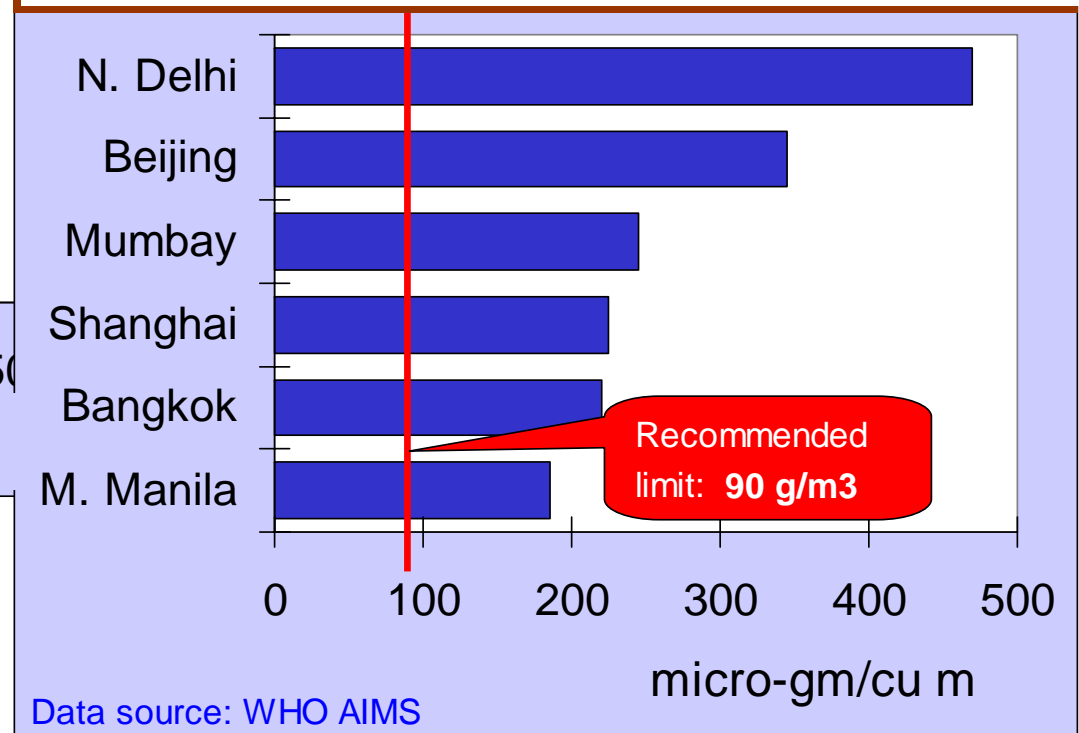
(C) Dr. Surya Raj ACHARYA, Institute for Transport Policy Studies, 2006

Traffic accident and Pollution

Traffic accident rate (1996)

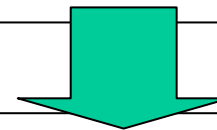


SPM Concentration (1998)



Background: summary

- Specific features of Asian megacities
→ Special urban transport problems
- Research on Urban Transport in EU and US
 - Does not focus on the specialties of Asian megacities
 - Mostly focused on the problems of developed cities
 - Suggestions for Asian cities: direct lessons without context?
 - Project oriented studies: short-term focus
 - Value biased perspectives
 - Pro-car vs anti-car
 - Road vs rail (BRT vs LRT)
 - Environment vs Economic growth



Need of policy-oriented research focusing on the Asian contexts maintaining a balanced perspective

Sustainable TRansport for East Asian Megacities (STREAM)

**An International Collaborative Research Study
(2005~2007)**

Objectives of STREAM Study

Generate policy insights to address special problems of urban transport in Asian megacities at different level of policy making:

- Vision**

- **What are the long-term desirable scenarios?**

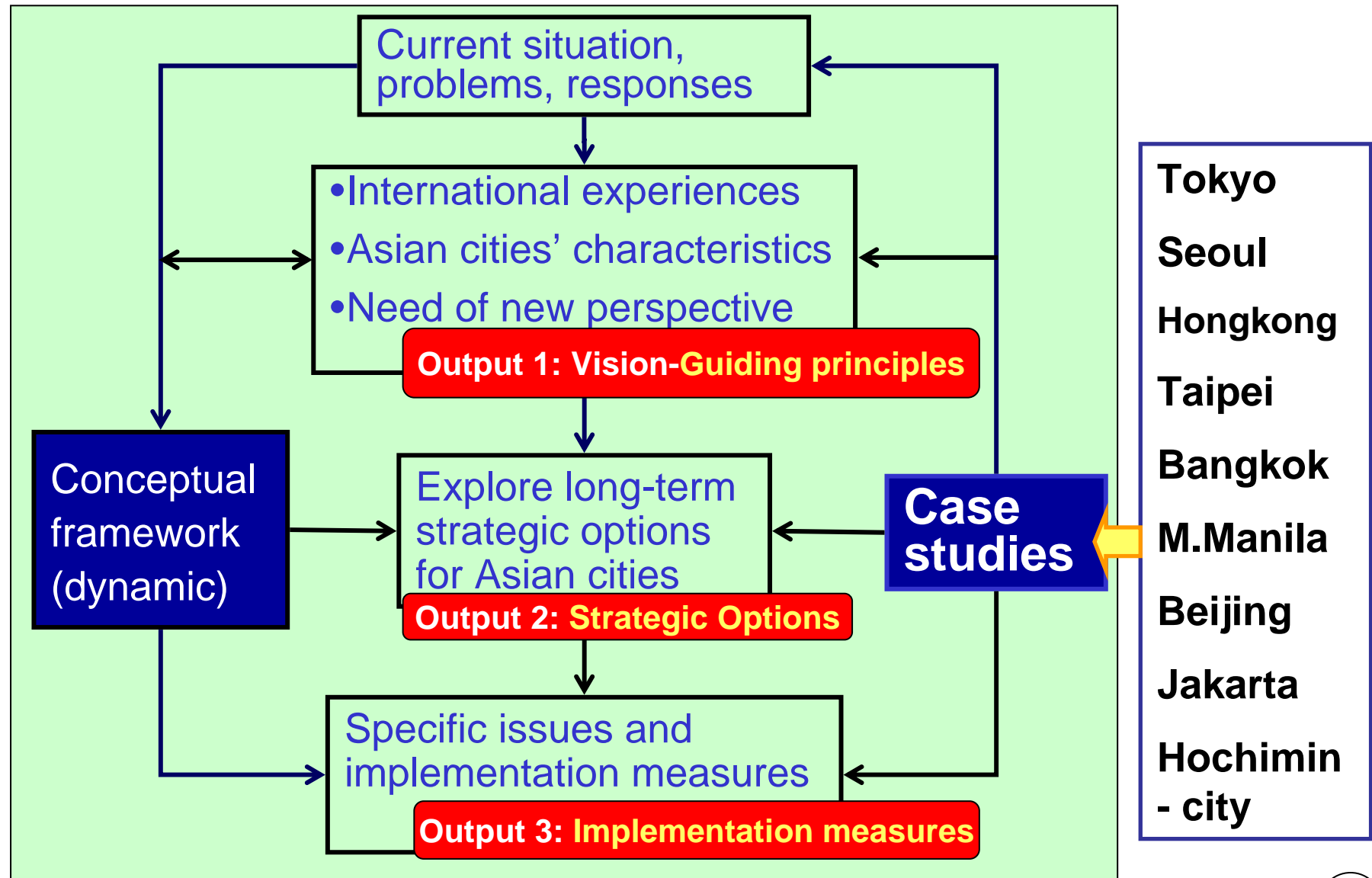
- Policy Strategies**

- **What are the strategic options to realize the Vision?**

- Policy measures**

- **What are the measures to implement policy strategies?**

Research Approach



To workout solutions for the special problems of Asian megacities, we may need some new perspectives...

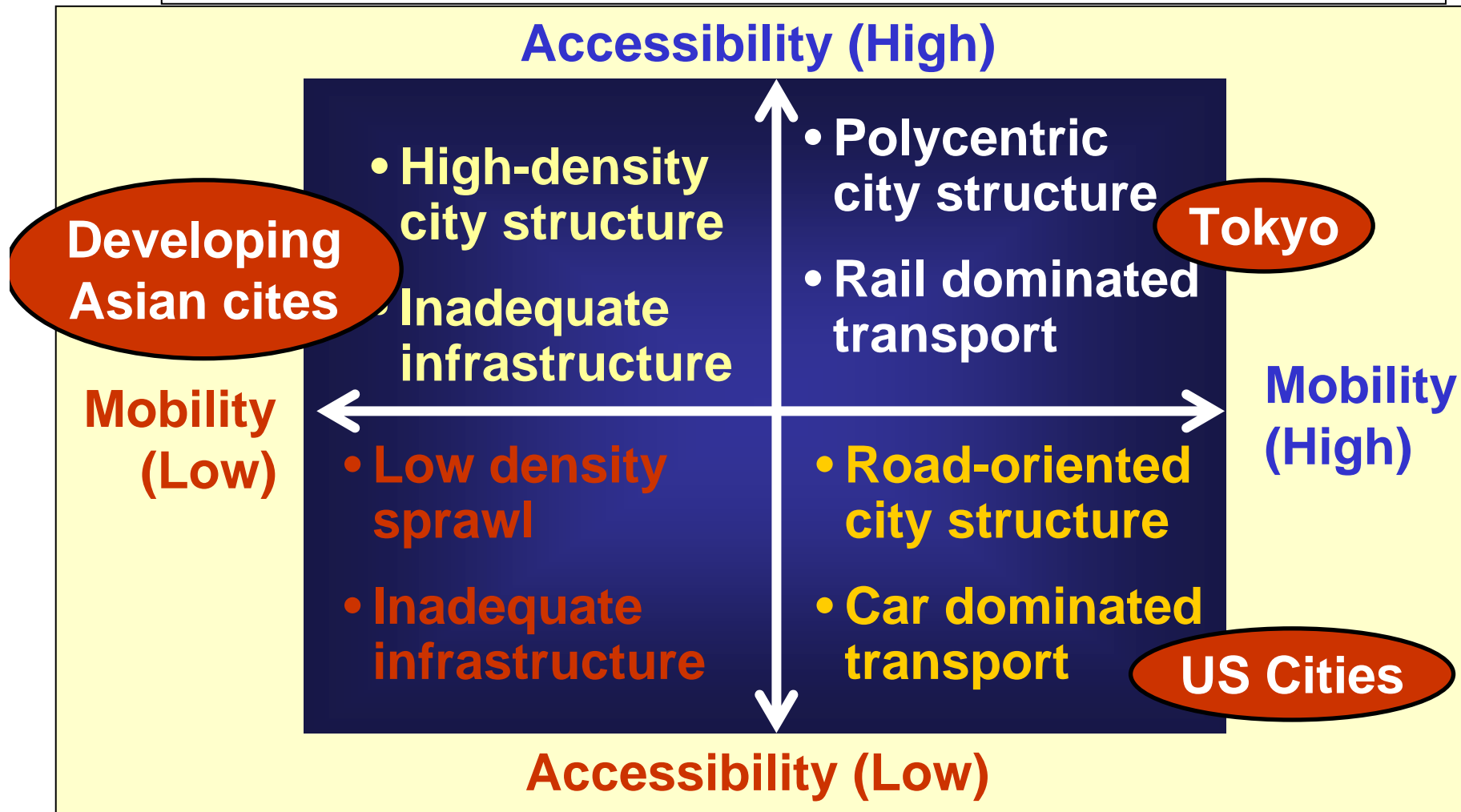
Mobility or Accessibility ?

Definition

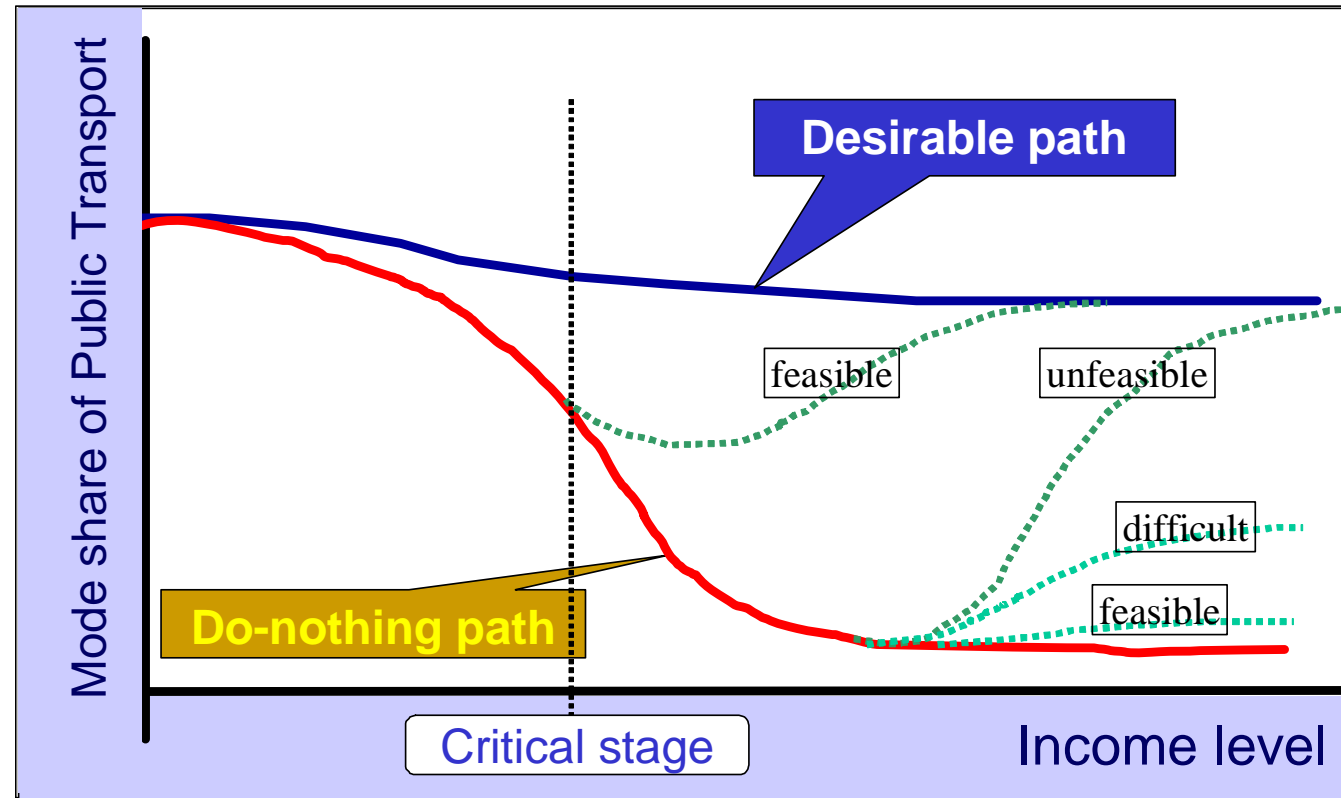
Mobility: *Quality of being mobile (Level-of-Service)*

Accessibility: *Potential for interactions*

ECMT (2002)



The dynamics of Motorization and Suburbanization → declining of Public Transport modal share

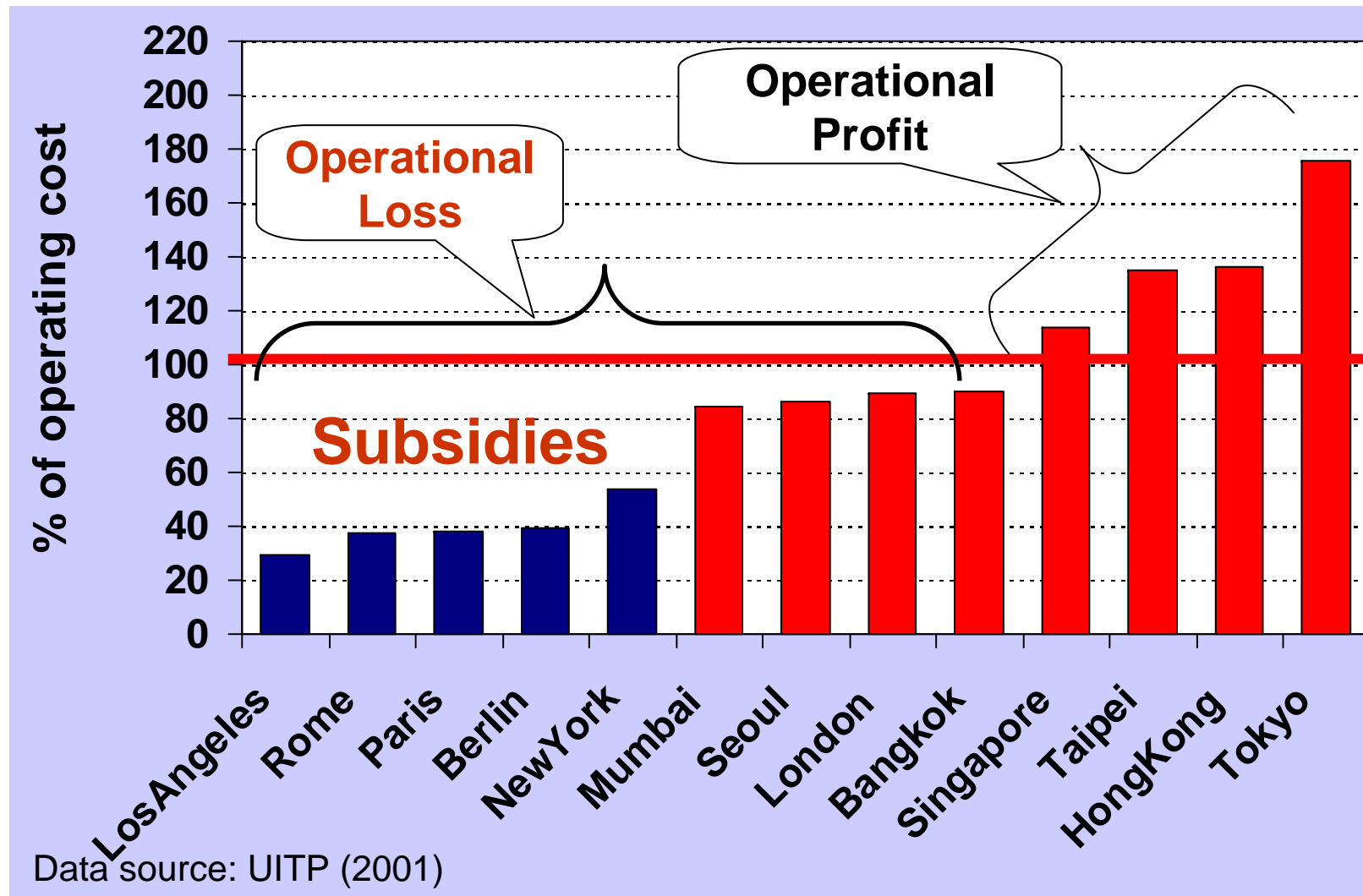


Role of Mass Transit System (MRT)

- Too early: financially difficult
- Too late: Unfavorable land-use

Operation Revenue of Public Transport

(% of operating cost)



....issue is not only about how to make provision of public transport, but also how to sustain it.....

Comparative Examples from selected cities

Seoul and Bangkok

- **Urban form and Land Use**
- **Urban Roads and motorization**
- **Public transport and urban rails**

Seoul



Seoul Metropolitan Area (% Share in Korea total)

Area	11.8 %
Population	45.6 %
GRP	46.4 %
Business	43.7 %
Manufacturing	48.8 %
Universities	42.3 %

Seoul city

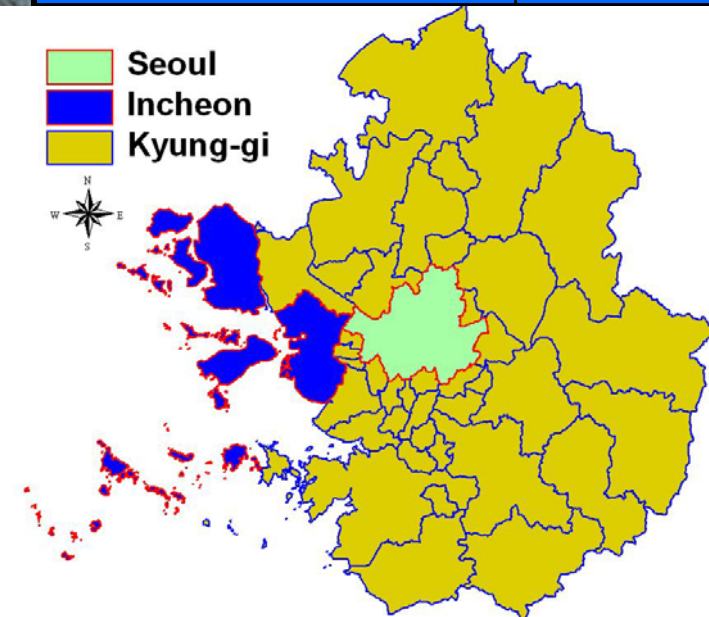
Area: 606 sq km

Population: 10.3 million

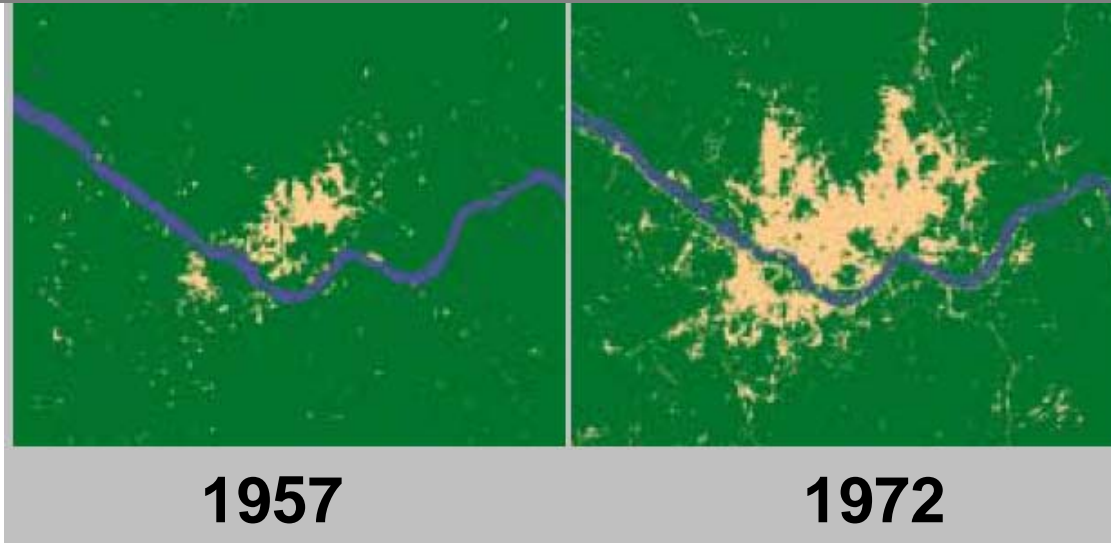
Seoul Metropolitan Area

Area: 11,748 sq km

Population: 21.4 million

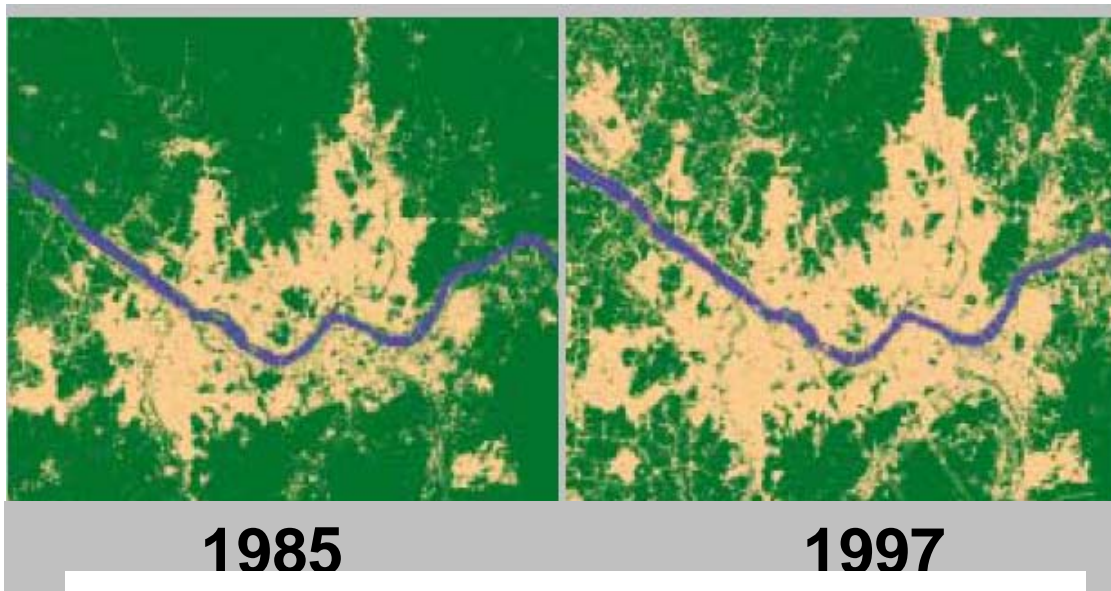


Urban form and Land Use



Urban Expansion in Seoul MA

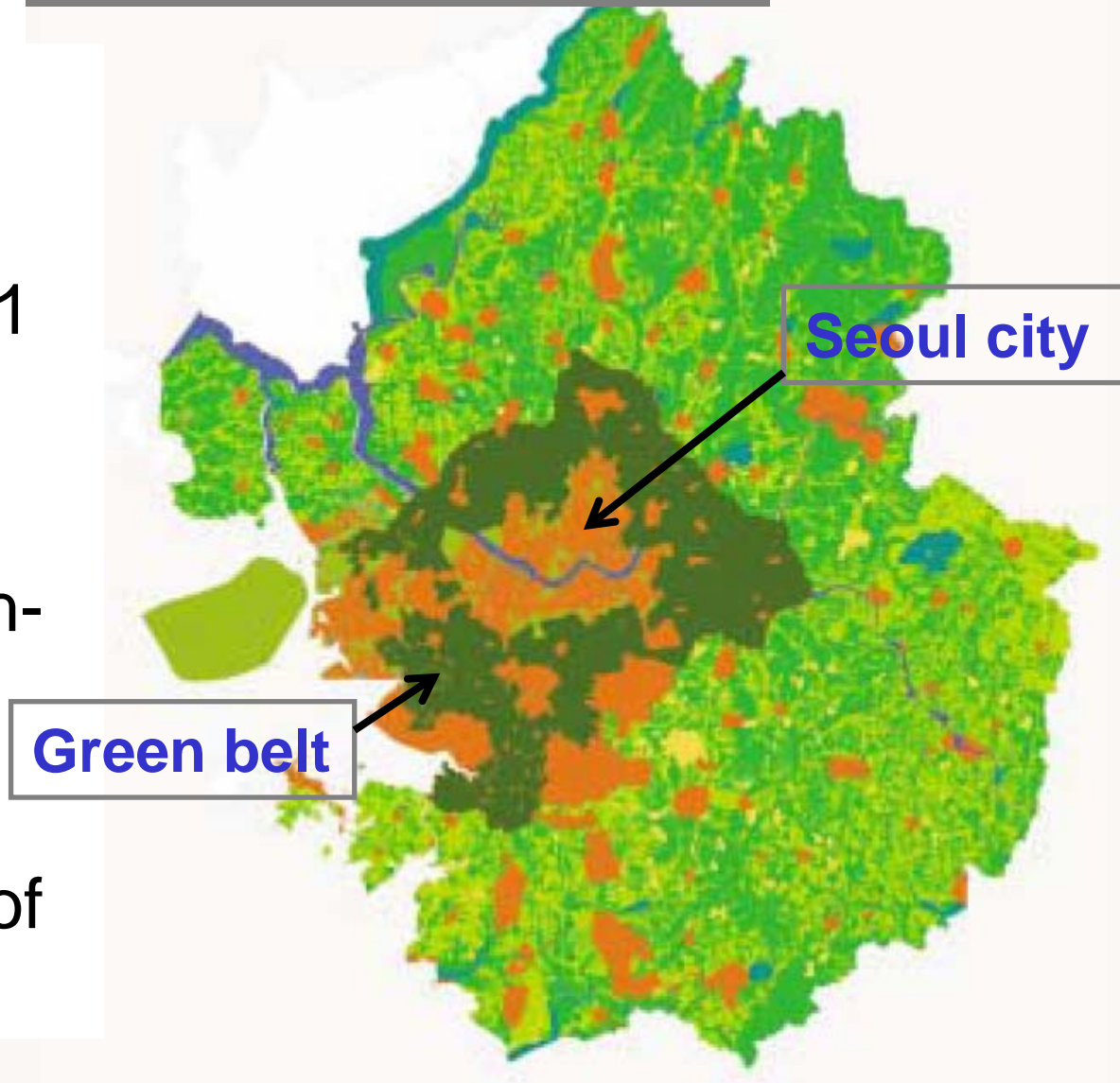
- Concentrated urbanization
- Leap-frog suburbanization



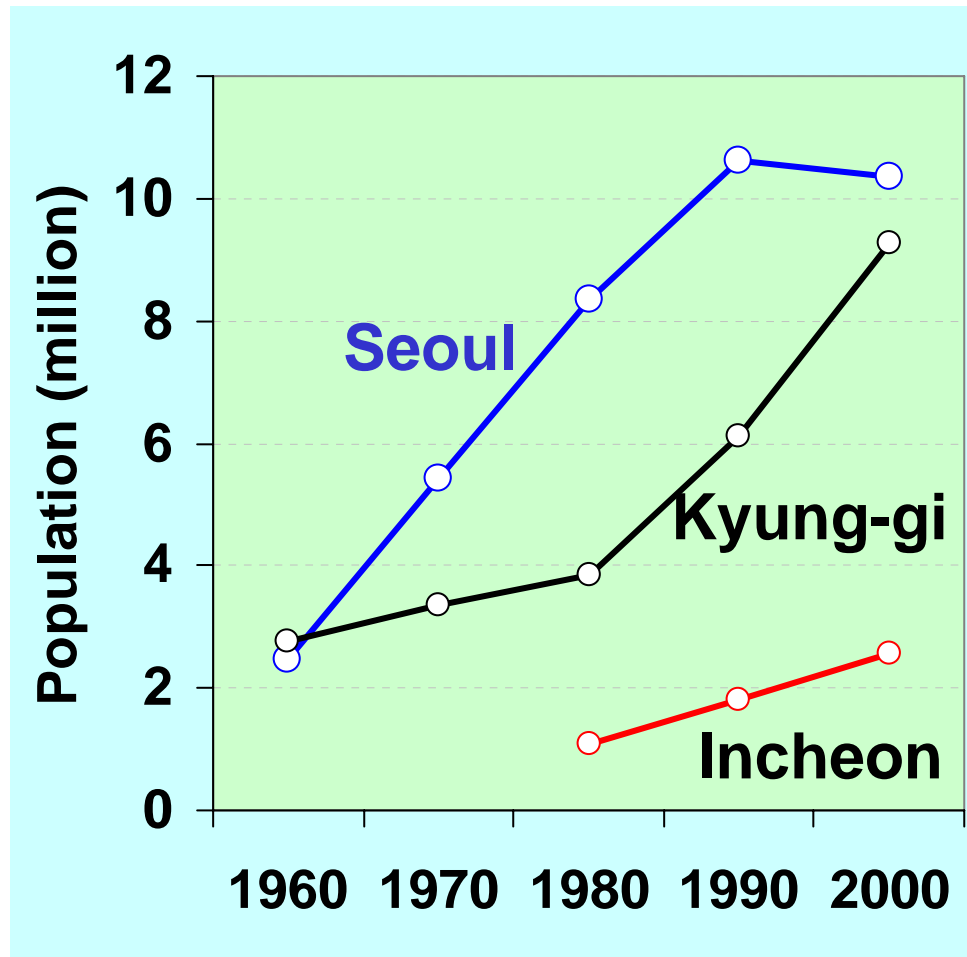
Source: Seoul Metropolitan Government

Seoul Metropolitan Area: Land Use

- Strong land use control
- Green-belt in 1971 to control urban sprawl
- Compact and high-density city development
- Severe shortage of land for housing

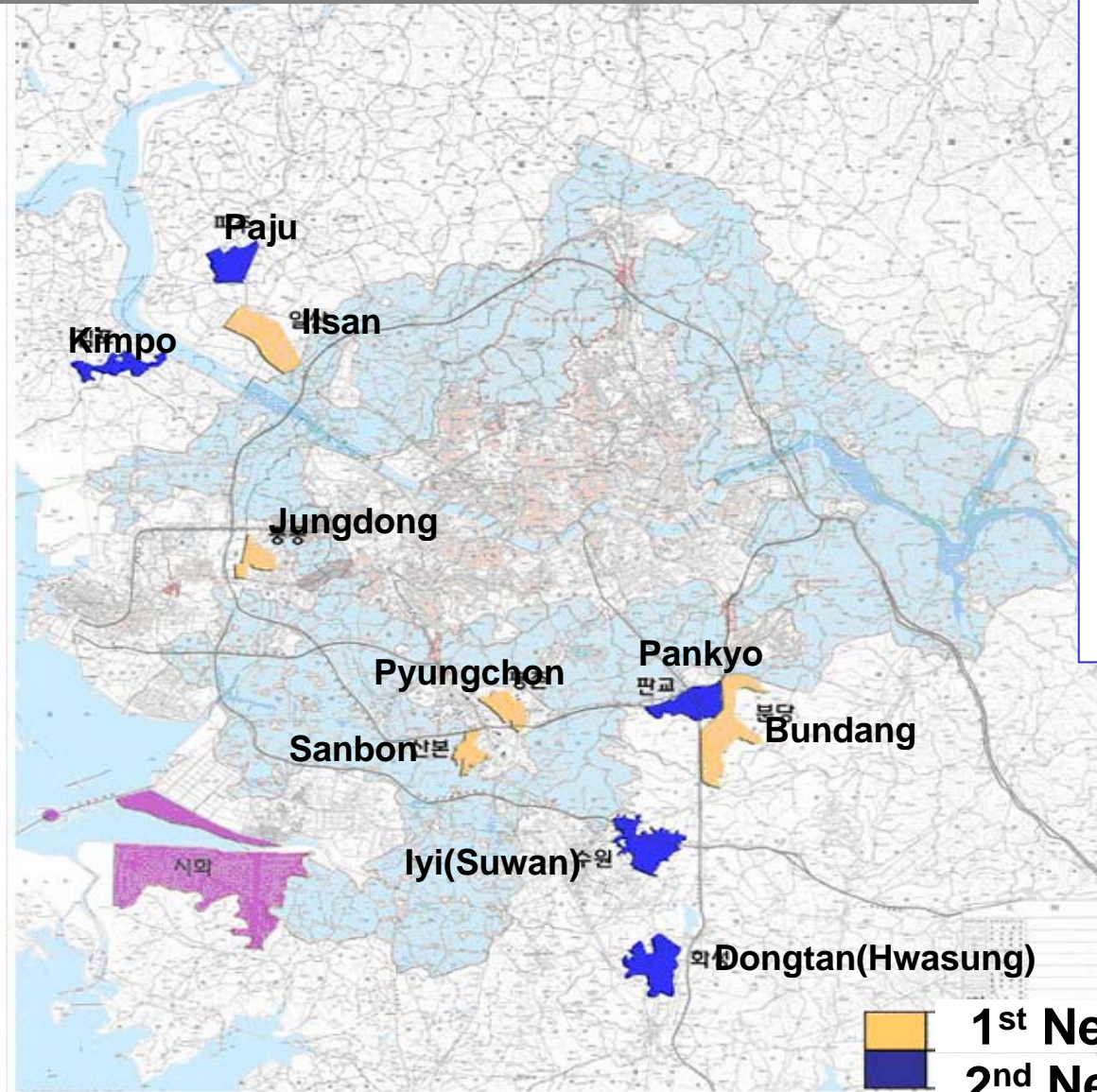


Trend of Population growth in Seoul Metropolitan Area (Seoul city, Incheon city and Kyonggi) 1960-2000

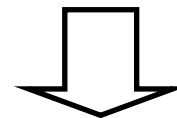


- Until 1990: population concentration in the Seoul city
- Since 1990: population decentralized to suburban area

New Town Development



- New town development plan in 1989
- Rapid development of 5 new towns
- Plan for second stage new towns



**New Towns only
for Housing?**

Seoul Metropolitan Area: New Towns

(C) Dr. Surya Raj ACHARYA, Institute for Transport Policy Studies, 2006

Trip Patterns in Seoul Metropolitan Area

Total daily trips:

1970 → 5.7 million

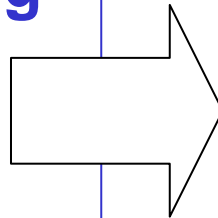
1995 → 27 million

Average commuting distance

1991 → 9.7 km

1996 → 11.3 km

2002 → 12.9 km



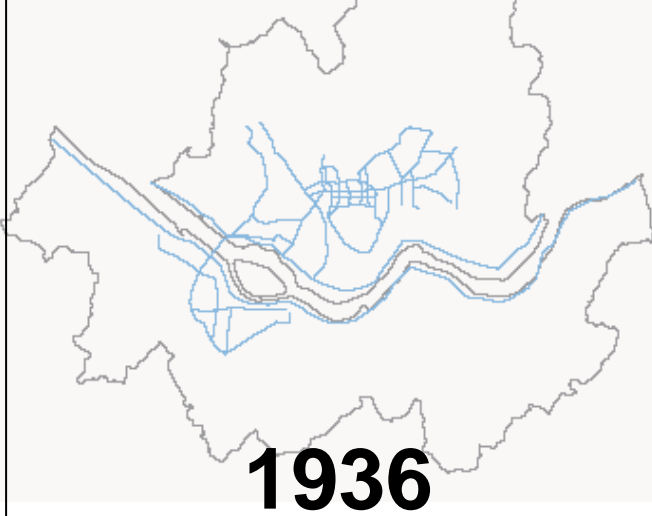
Decentralization of population but concentration of jobs in the city center caused increase in,

→ Total number of trips

→ Average commuting distance

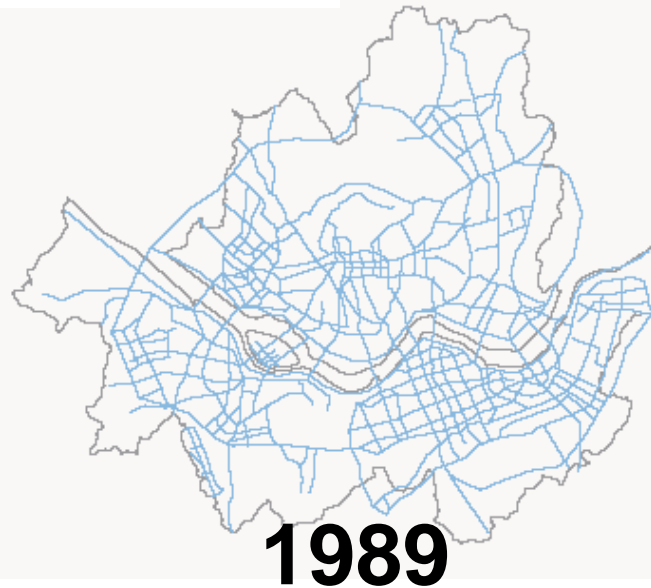
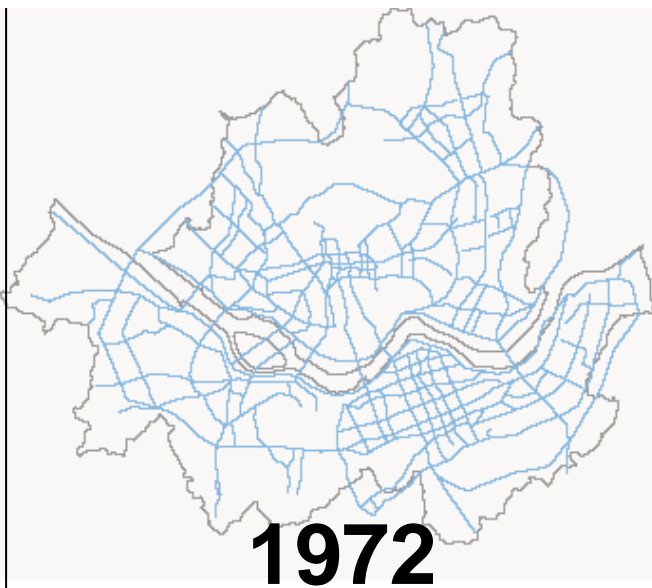
Urban Roads and Motorization

Urban Roads



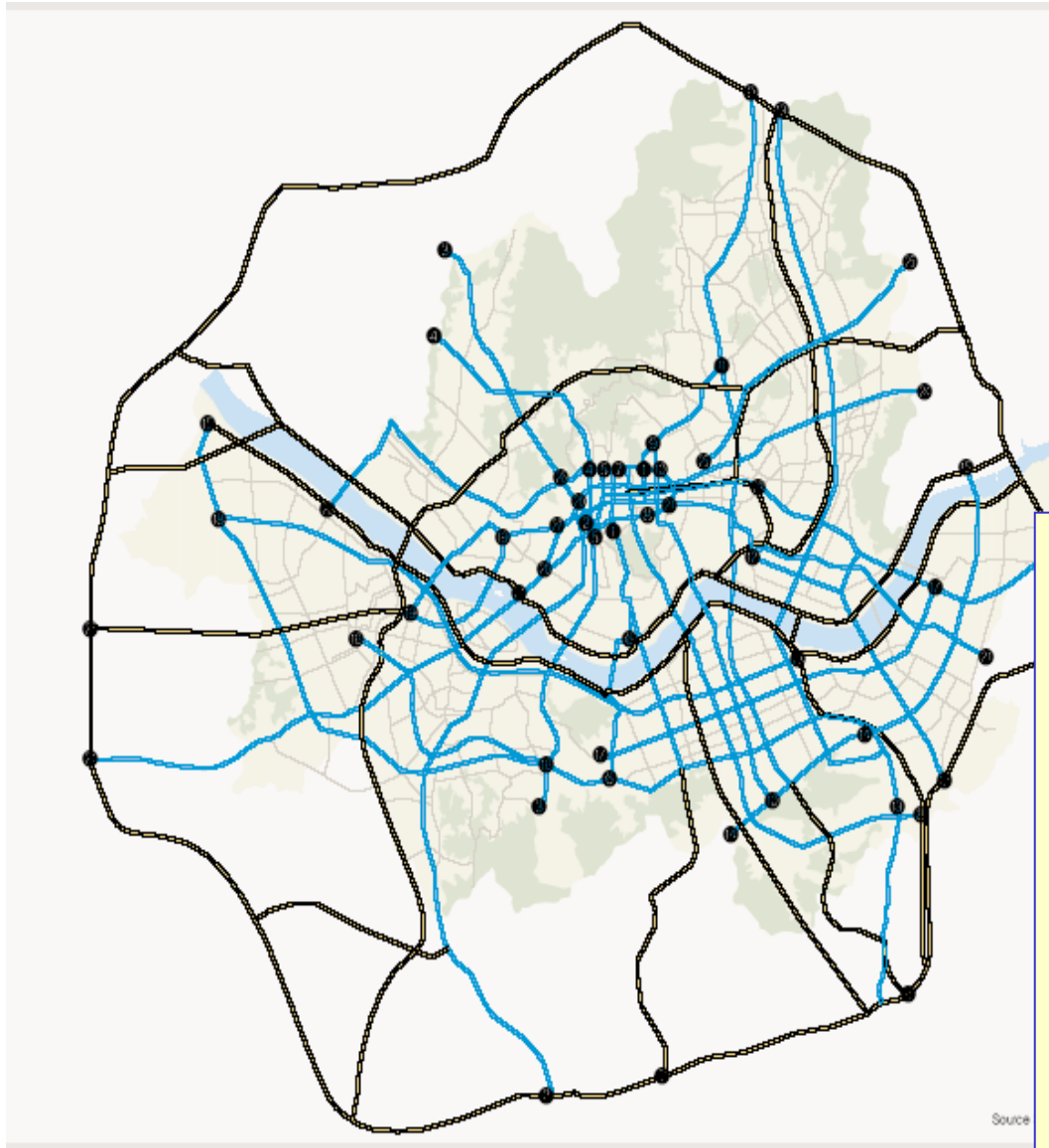
**Expansion
of Road
Network in
Seoul City**

Source: Seoul Metropolitan Government



**Priority to
road
building:
1960s
through
1980s**

Road Network in Seoul City 2000



Road length in 2000 km

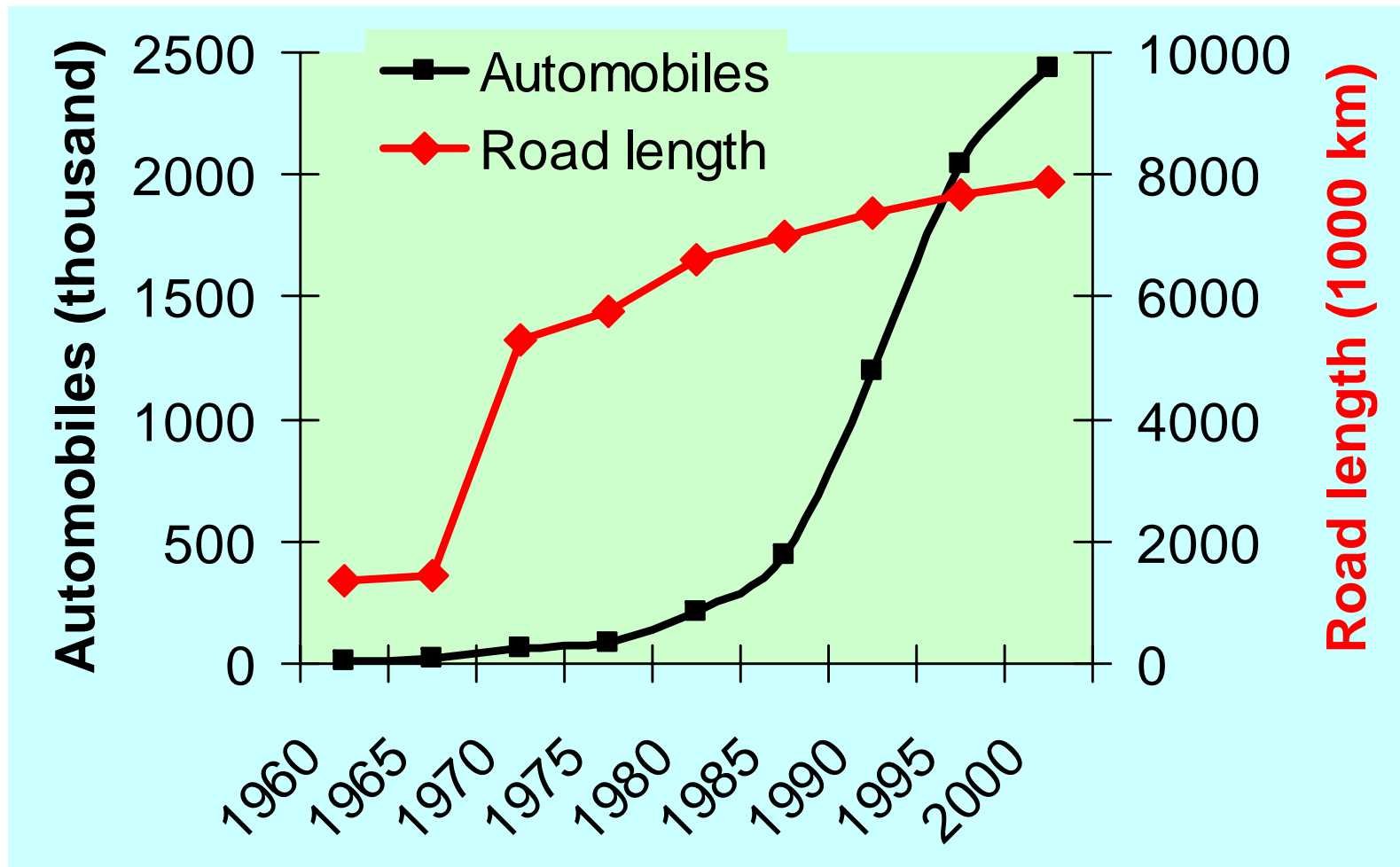
Expressways: 23

Highways 169

Metrop. Roads 7,697

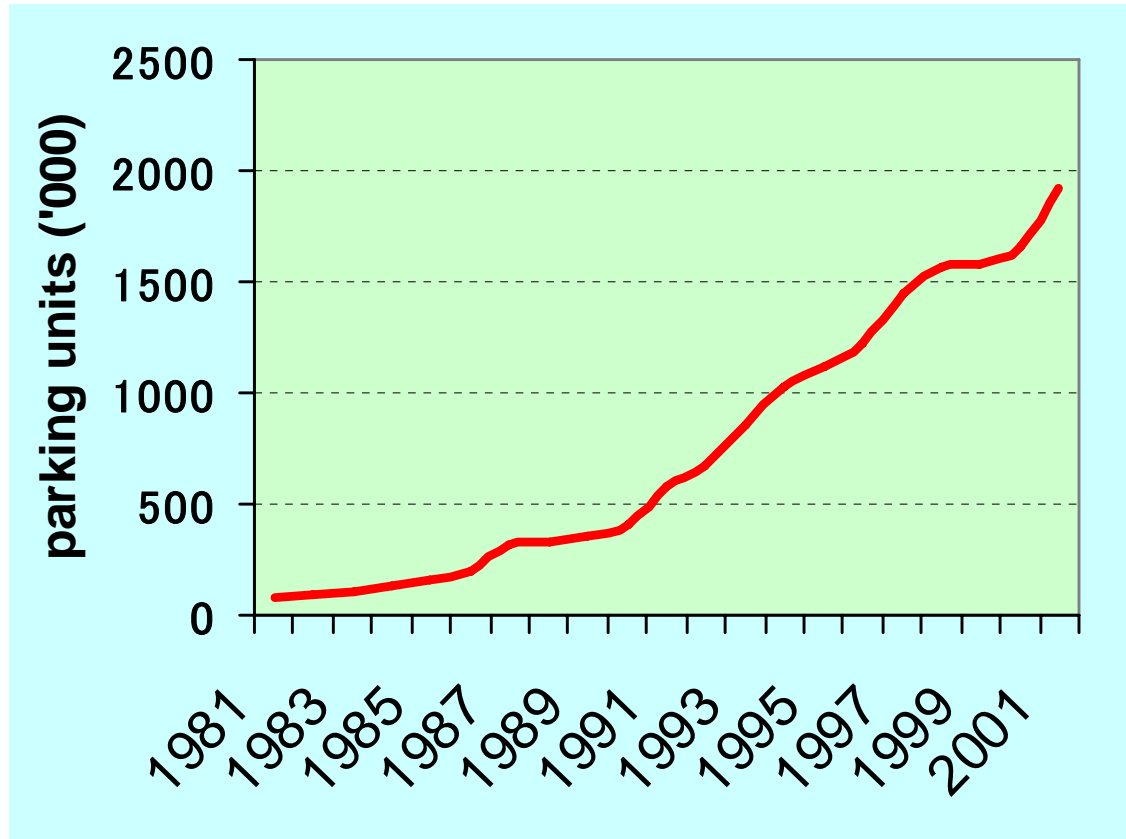
- Expressways (tolled) are section of intercity expressways
- Highways are toll-free
Freeways (expressways)
- Metropolitan road includes other general roads

Trend of Automobile population and Road length in Seoul 1960-2000



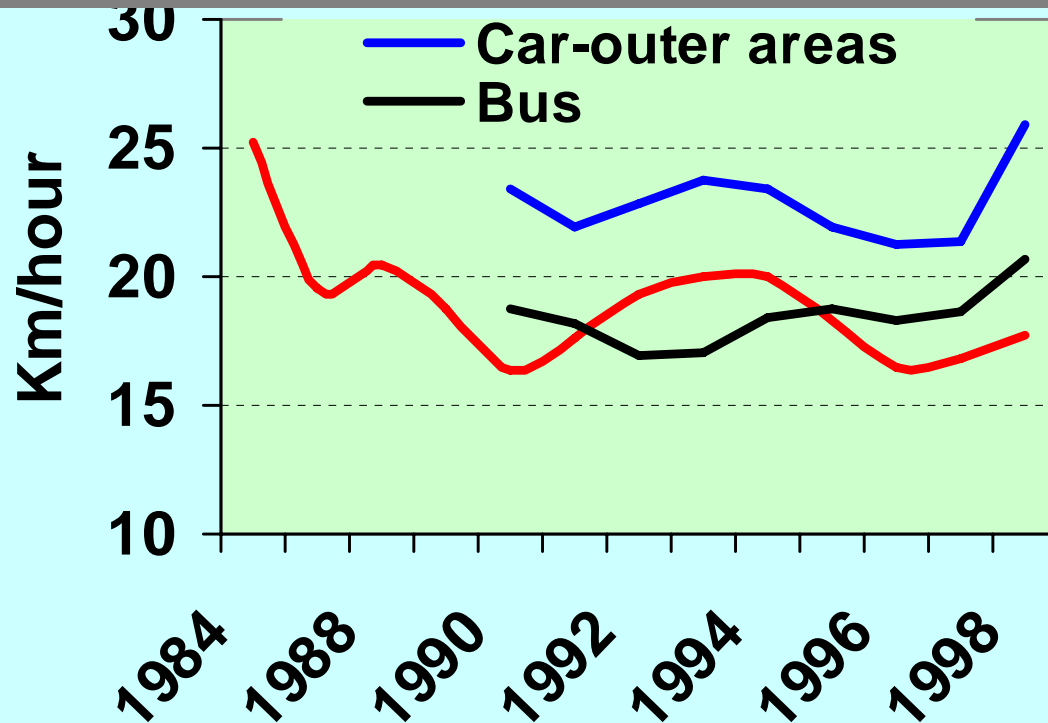
👉 **Rate of motorization is even faster than the rate of road expansion...**

Trend of public parking in Seoul 1981-2001



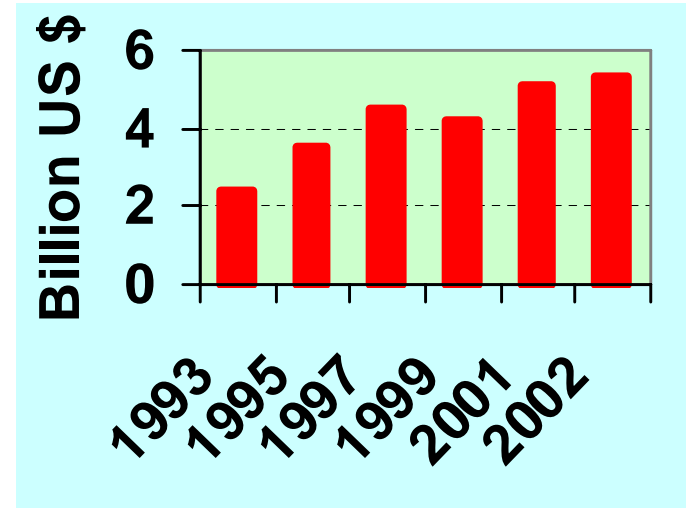
Increasing trend of parking: demand driven road transport strategy?

Average road traffic speed in Seoul 1984-1998



Data source: Seoul Statistical yearbook

Annual congestion cost

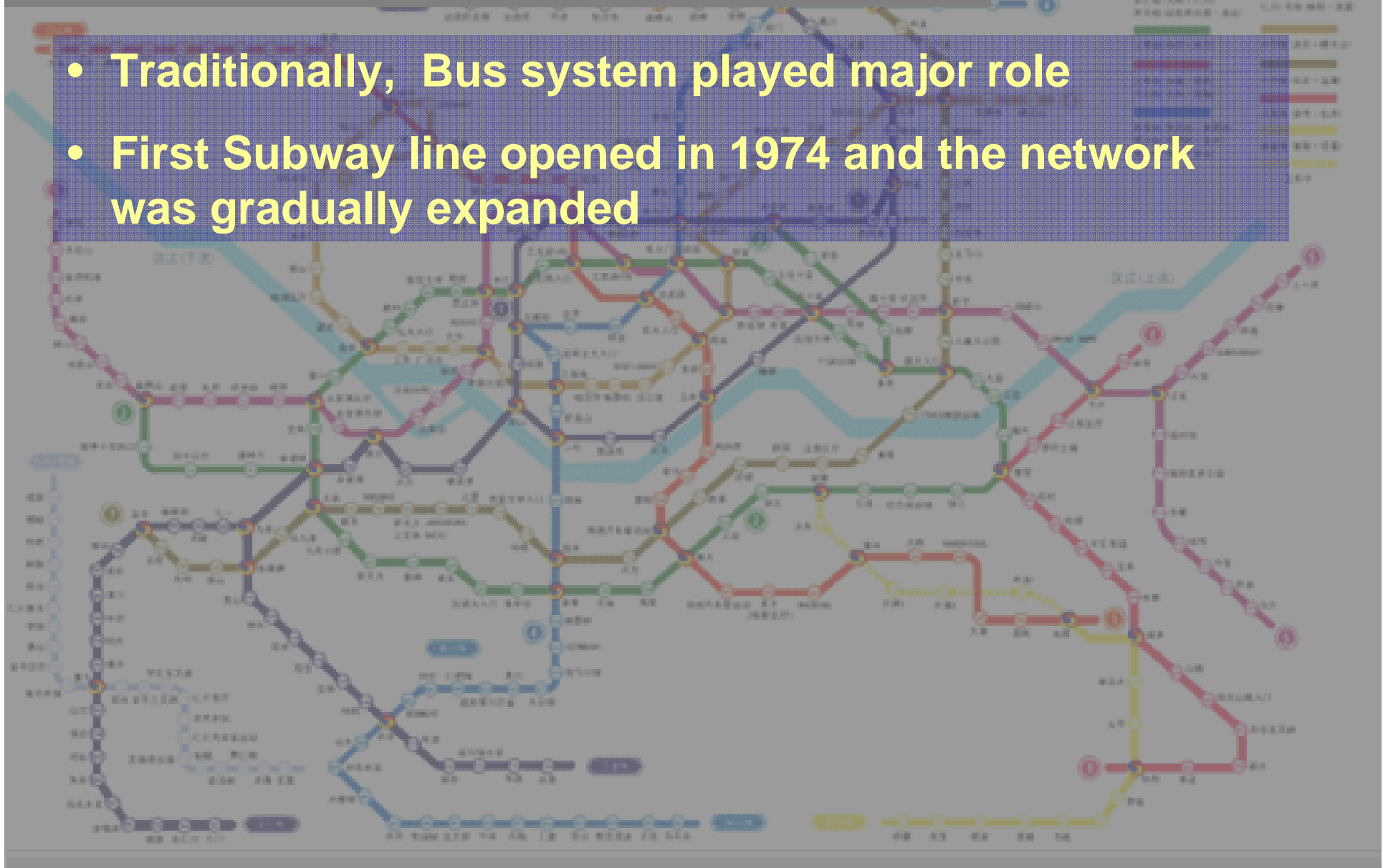


➡ **Increasing trend of road traffic congestion and heavy economic cost !**

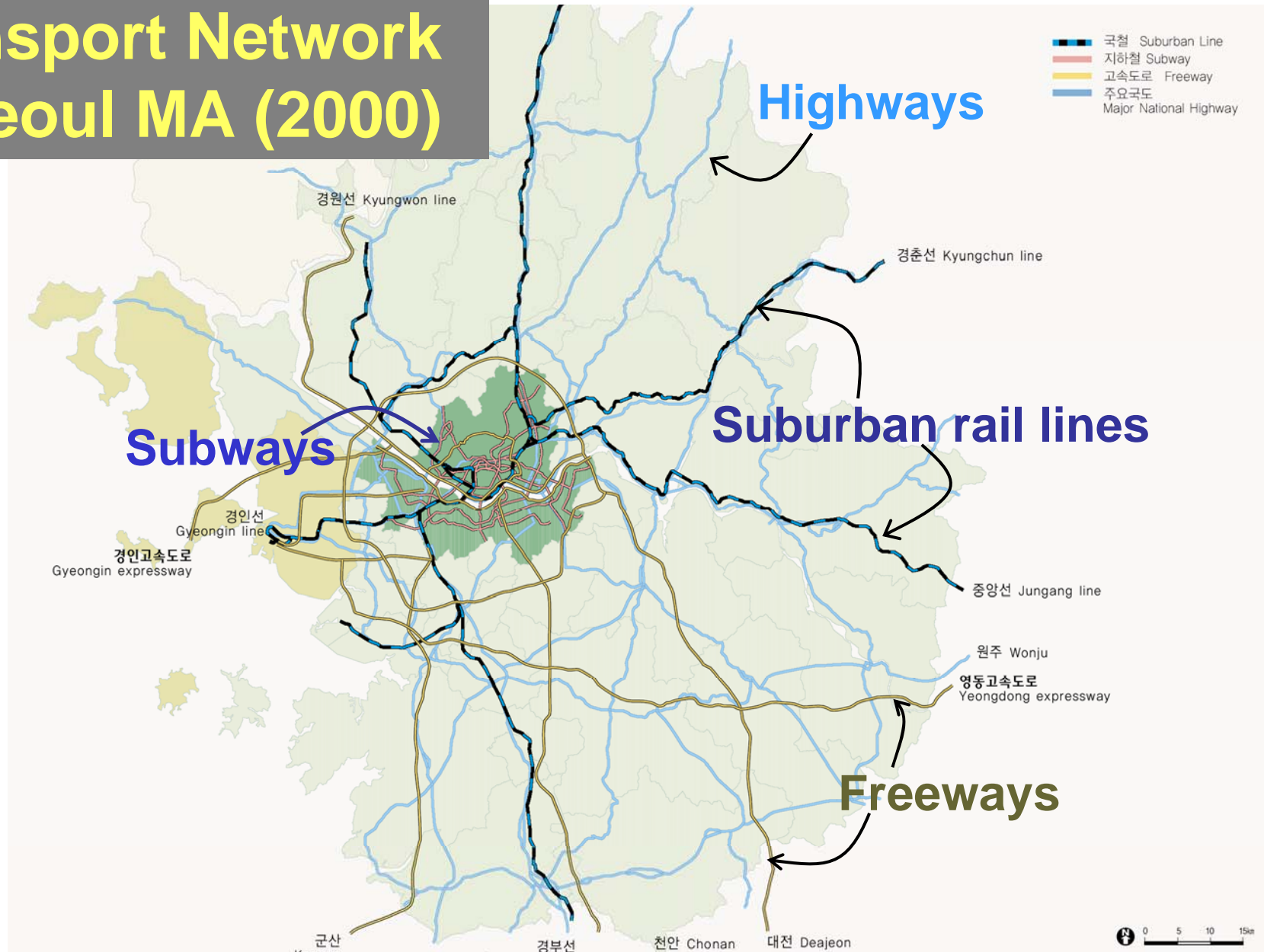
Public Transport and Urban railways

Seoul Public Transport System

- Traditionally, Bus system played major role
- First Subway line opened in 1974 and the network was gradually expanded

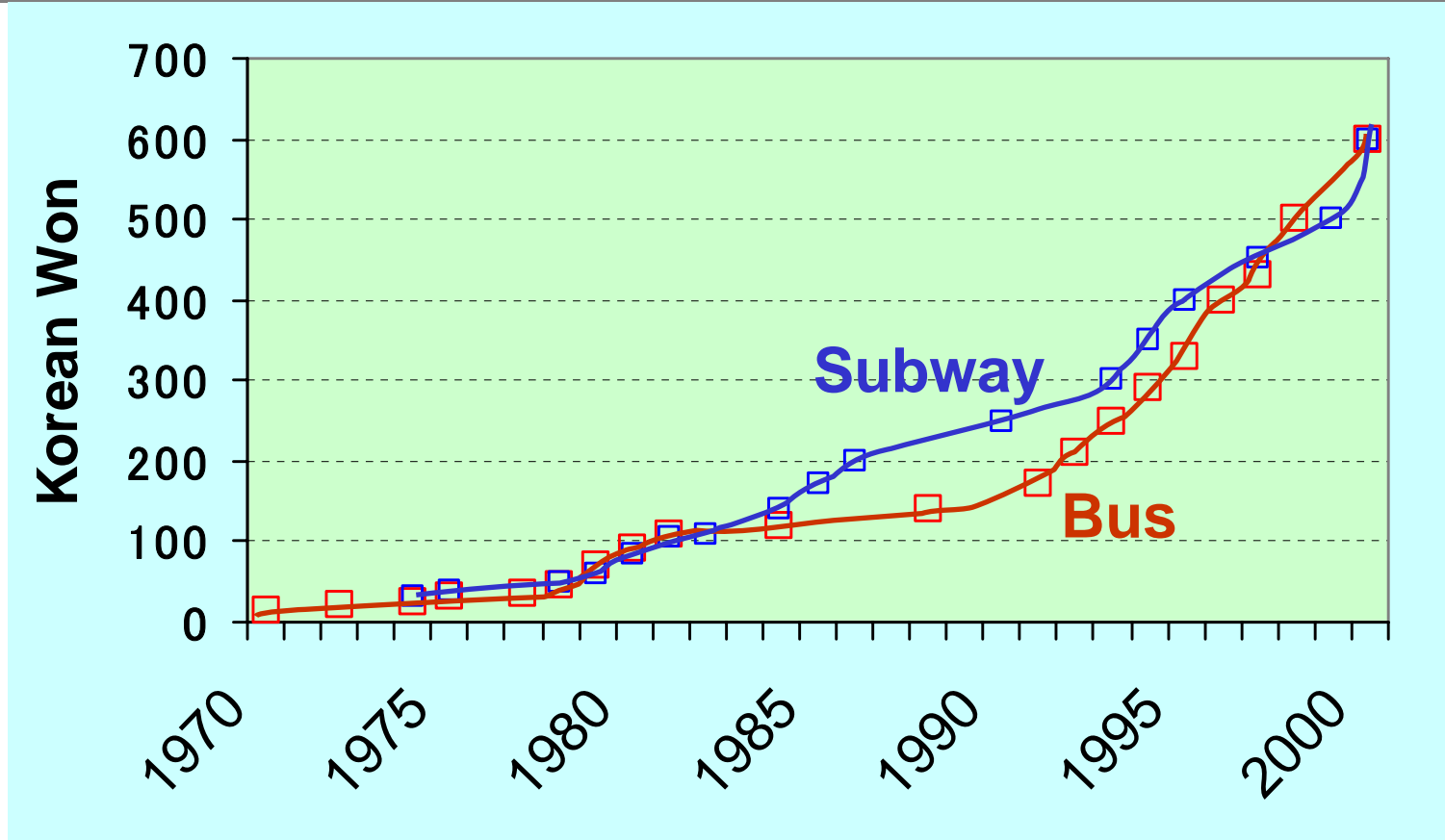


Transport Network in Seoul MA (2000)



👉 **Inadequate suburban rail network**

Trend of Bus and Subway Fare in Seoul



👉 **Bus and Subway fare is well harmonized...**

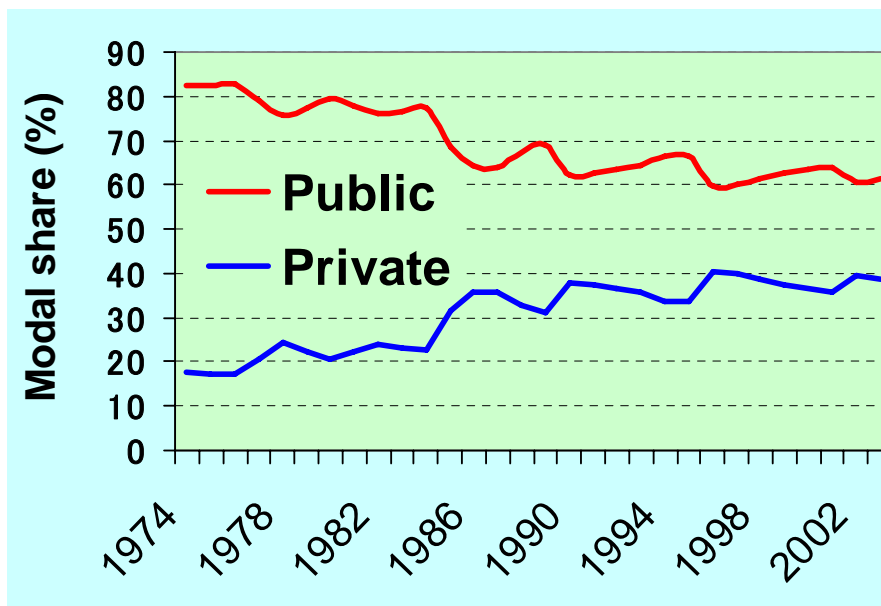
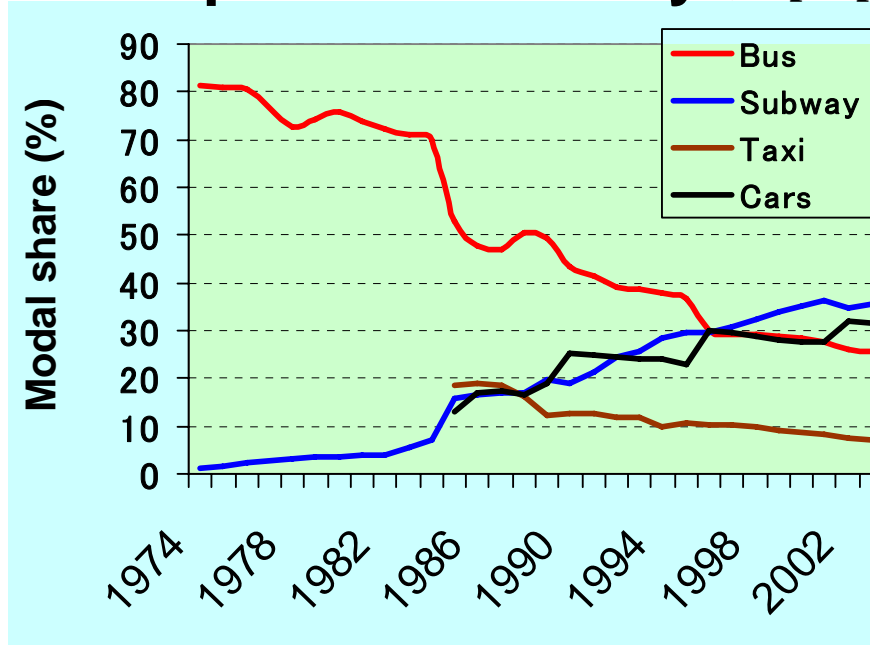
Comparing Tokyo MA and Seoul MA (urban rail)

	Seoul MA	Tokyo MA
Area (sq km)	11,753	13,494
Population (million)	21.4	33.5
Subway (km)	287	333
Suburban rail (km)	200	1973
Daily ridership (mil)	6.5	13.2
Operating subsidies	~25 %	Profit
Subway fare	100 yen (12 km)	190 Yen (10 km)

Seoul

- Smaller suburban rail network
- Need of operational subsidies: due to low fare level

Modal split in Seoul City (all purpose)



- Increasing trend of modal share of private mode
- Rapid decline of Bus share

Response?

- ➡ **Modal shift from private mode to public mode is the main element of current urban transport policies....**

Objective: Achieve modal shift		
	<u>Year 2000</u>	<u>2006 (target)</u>
Bus	26.0%	33.4%
Subway	34.6%	36.6%
Car	26.9%	18.7 %
Others	12.5 %	11.3 %

Diagram illustrating the modal shift objective. A large arrow points from the 2000 data to the 2006 target data. A bracket on the left side of the 2000 data indicates a total of 60.6% for Bus and Subway. A bracket on the right side of the 2006 target data indicates a total of 70% for Bus and Subway.

- **Reform for high-quality bus service**
- **Restrain ownership and use of car**

Seoul Bus Reform: 8 Programs (from 2004)

1. Bus Route System

Trunk, Feeder, Circular, Express



2. Bus Fare System

- Flat fare for non-transfer ride
- Distance-based fare for transfer-ride (include subway)

3. Bus Business Structure

- Bus ownership privates
- Operation control: public
- Revenue basis: bus-km

Seoul Bus Reform: 8 Programs (from 2004)

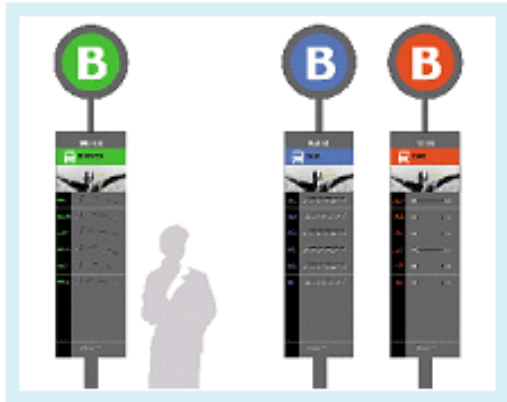
4. Bus Management system

State-of-the-Art IT application

5. Smart card system

- Makes integrated fare collection possible

6. Exclusive Median Bus Lane



7. Quality buses & shelters

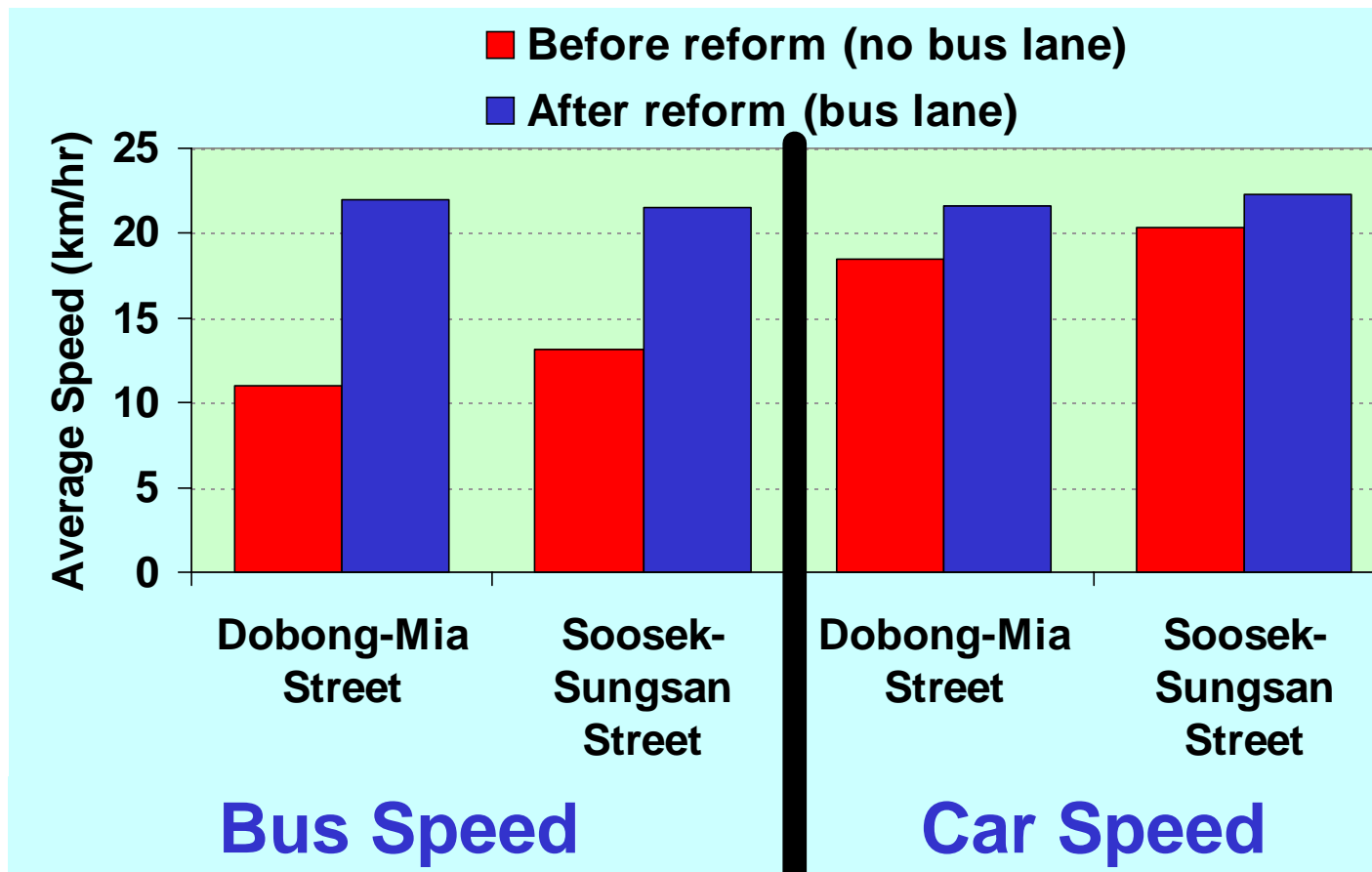
Low floor buses

8. New urban governance

Participation by
stakeholders

Impact of Bus Reform: Preliminary results

Average Bus and Car Speed (before and After Bus reform)



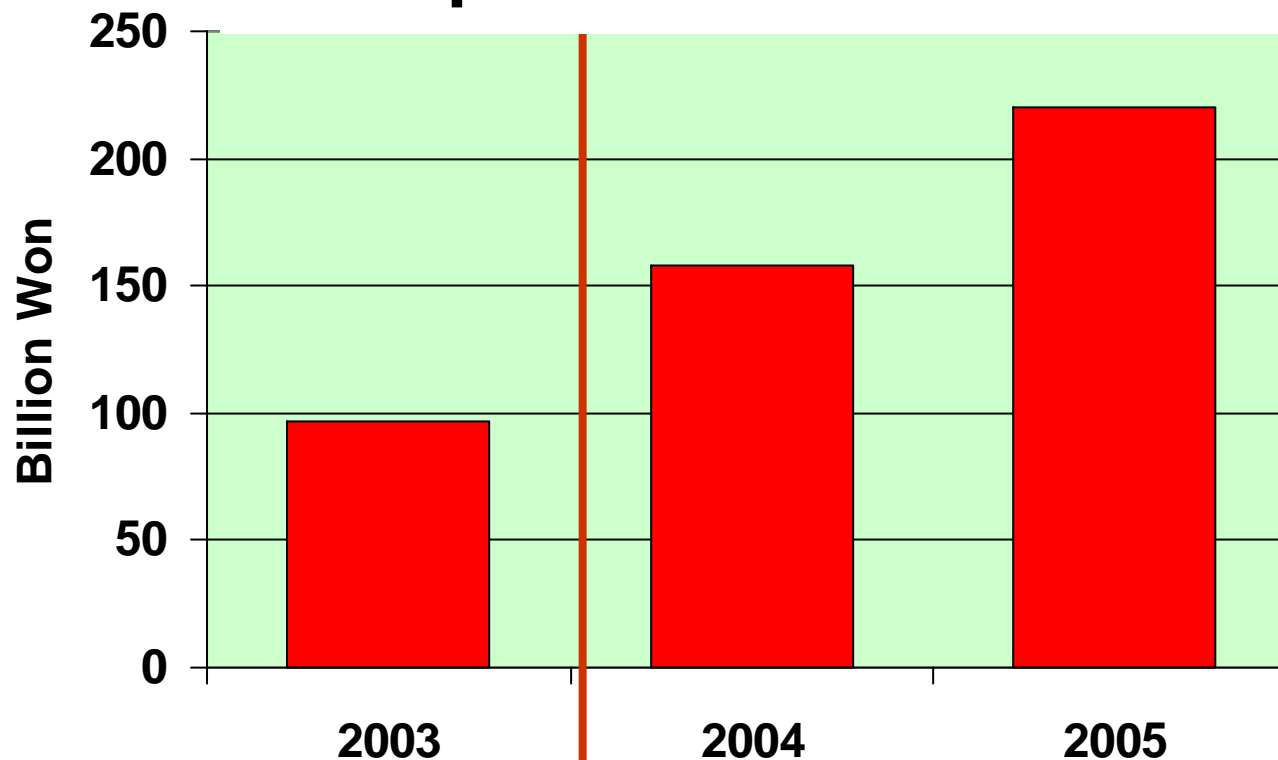
Data source: Seoul Metropolitan Government (2005)

👉 **Significant improvement in traffic speed**

(C) Dr. Surya Raj ACHARYA, Institute for Transport Policy Studies, 2006

The improvement came with a significant cost !

Bus operation **deficit** in Seoul



Data source: Hwang (2005)

Implementation
of Bus Reform

1 Yen = 8.5 Won

Seoul: Summary and Issues

1. Suburbanization

- Population decentralization
- **Rapid motorization**
- **Inadequate suburban rails network**



Risk of suburban sprawling

2. Heavy investment in urban rail did not stop increasing use of private car

3. Alternatives?

- **High-quality bus service**
 - Needs less investment
 - Bus lane: less road space for car
- **Restrain on car use**

Bangkok

Bangkok Metro. Region (% Share in Thai total)

Area	1.1 %
Population	15.6 %
GRP	48.2%

Bangkok Metropolitan Area (BMA)

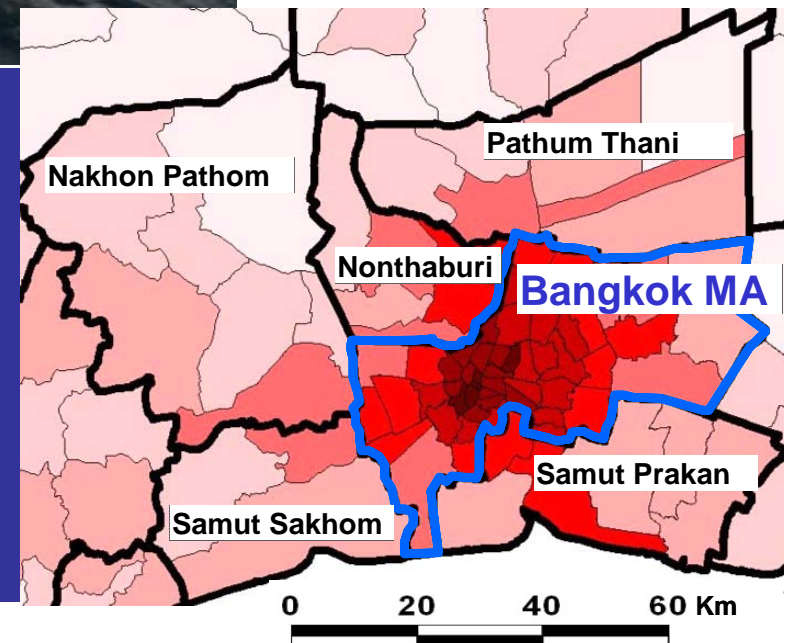
Area: 1,577 sq km

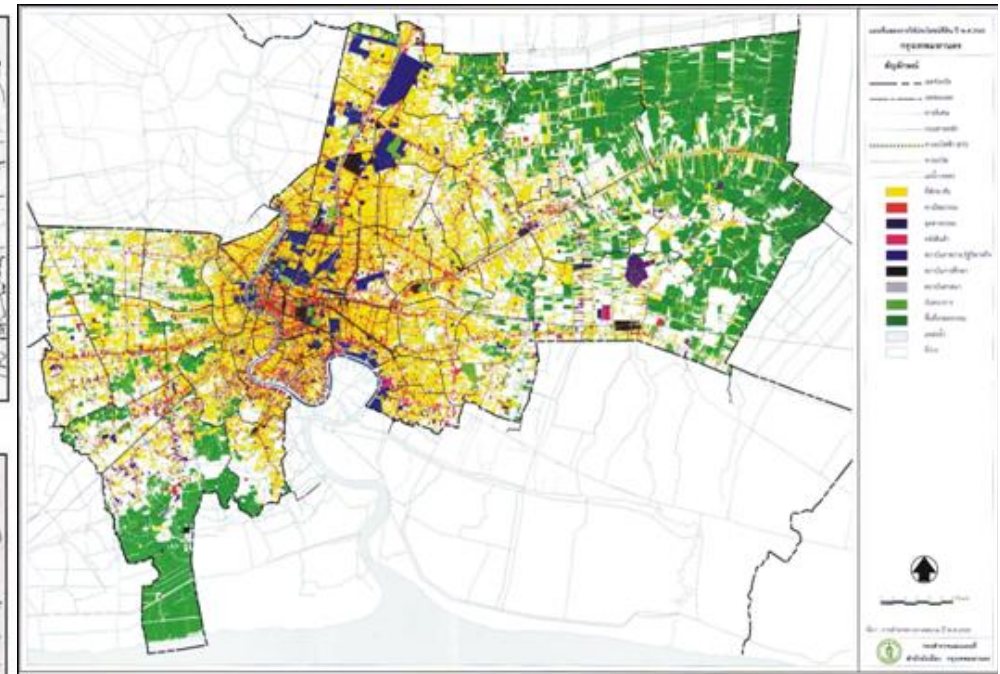
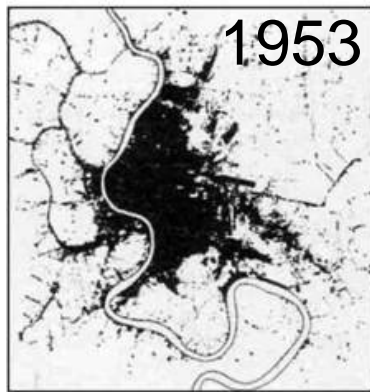
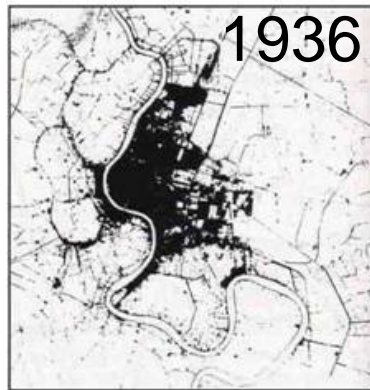
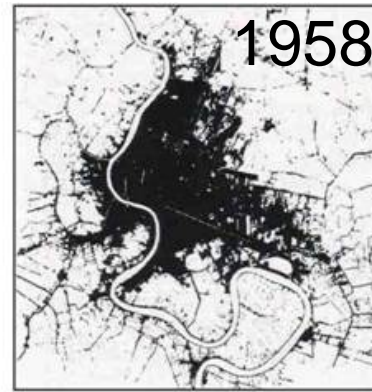
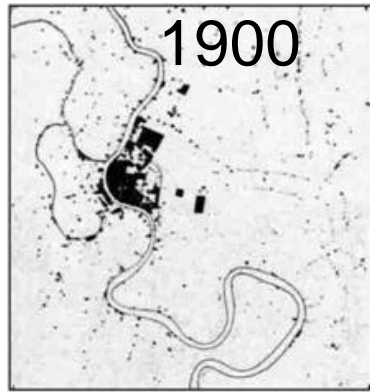
Population: 6.7 million

Bangkok Metropolitan Region (BMR)

Area: 7,761 sq km

Population: 10.7 million



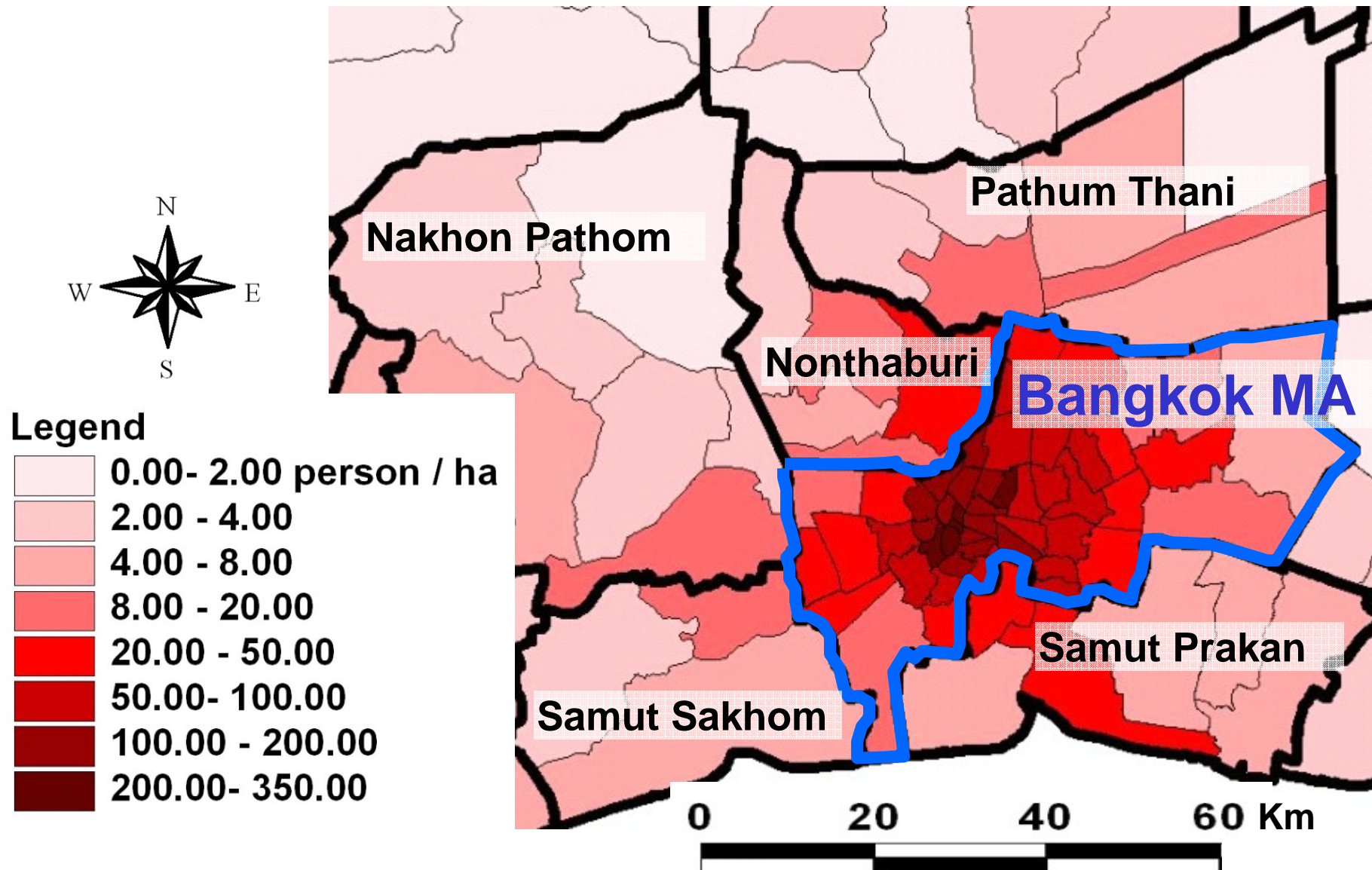


BMA Builtup Area 2004

- **Mono-centric urban form**
- **Expansion of built-up area along arterial roads**
- **Weak land-use planning and control**

Urban Expansion of Bangkok

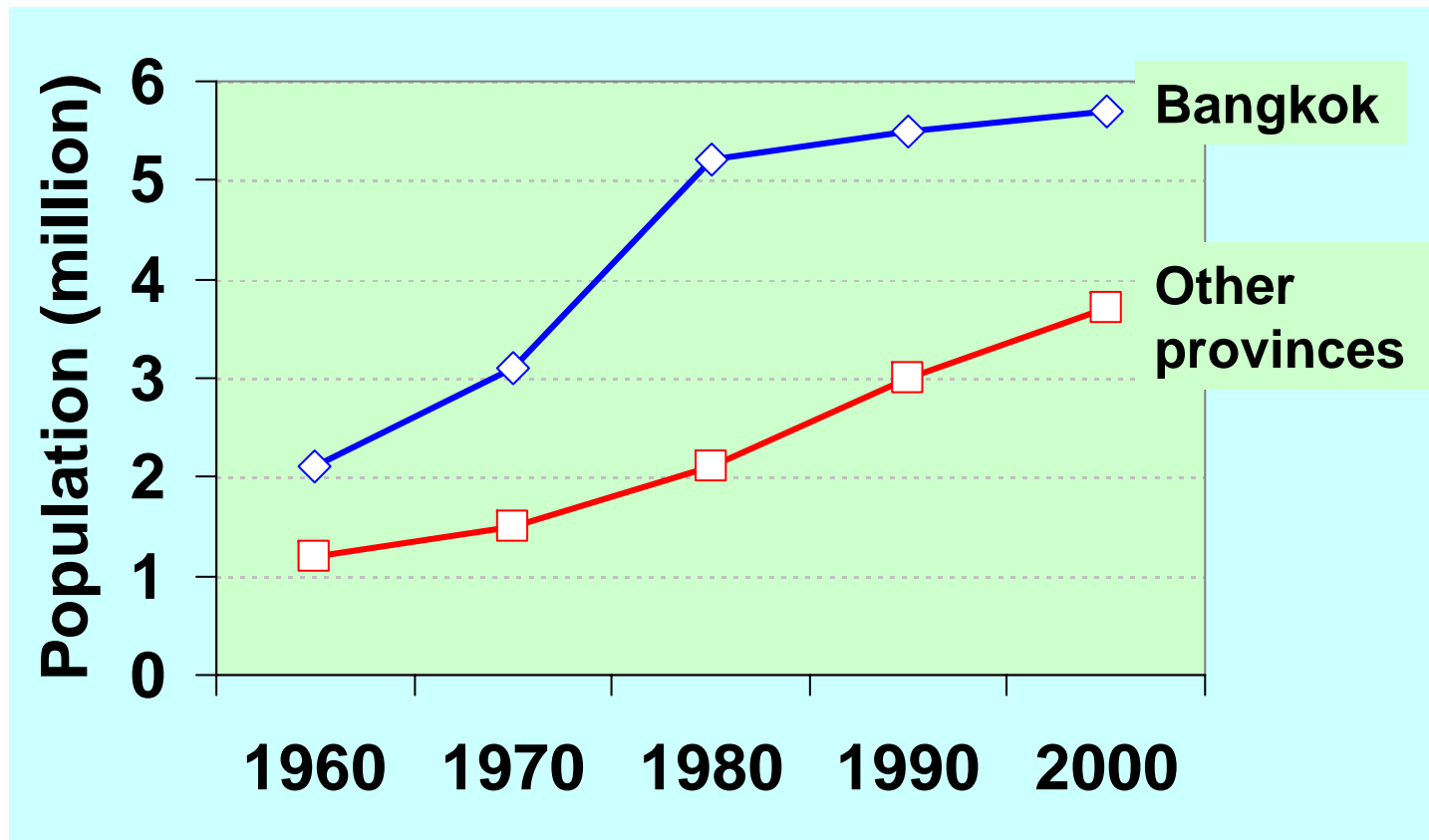
Population densities in Bangkok MR (BMR)



👉 **High density in inner city areas**

(C) Dr. Surya Raj ACHARYA, Institute for Transport Policy Studies, 2006

Population Trend in Bangkok MR (BMR)

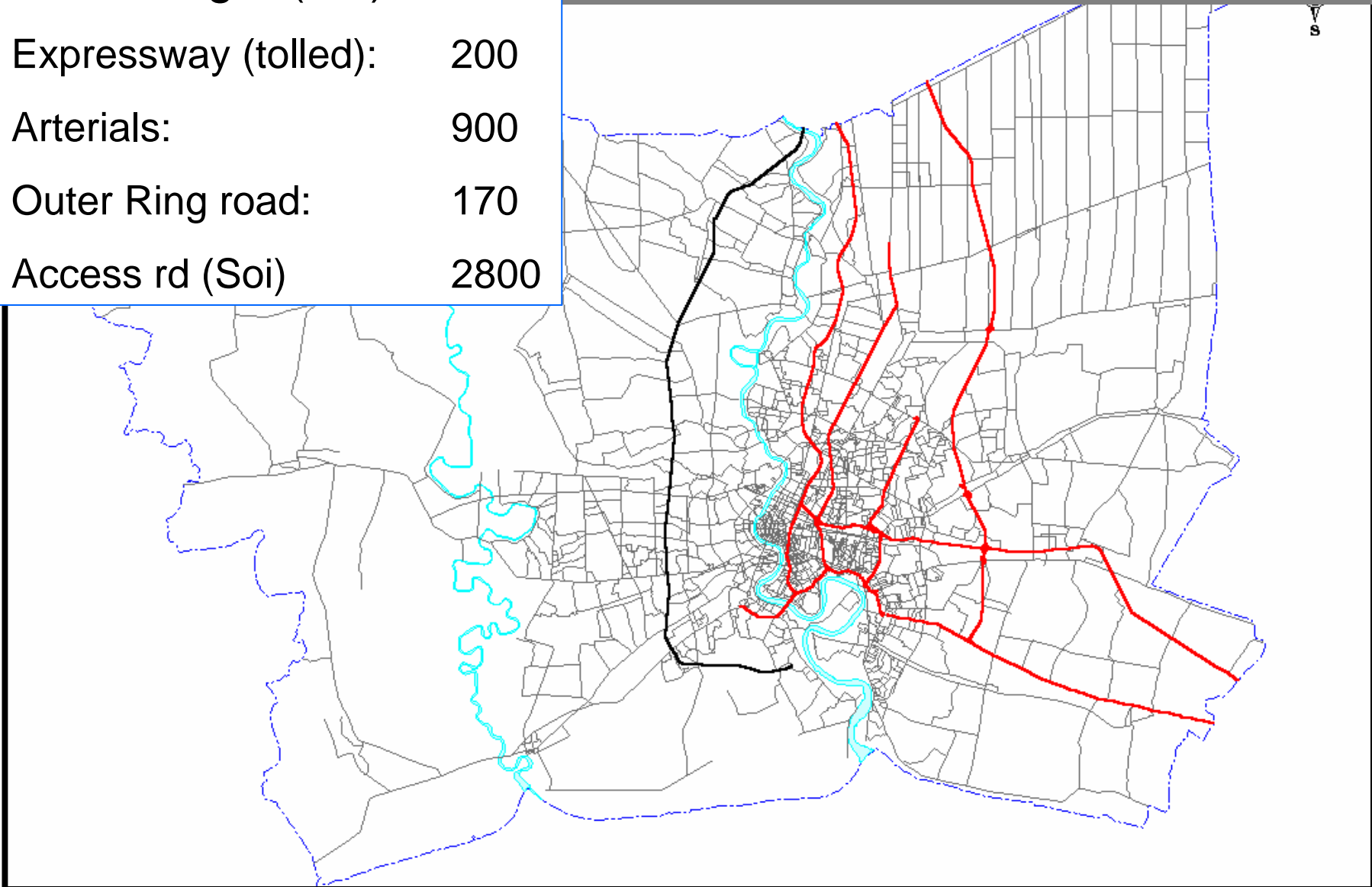


➡ **Trend of rapid suburbanization**

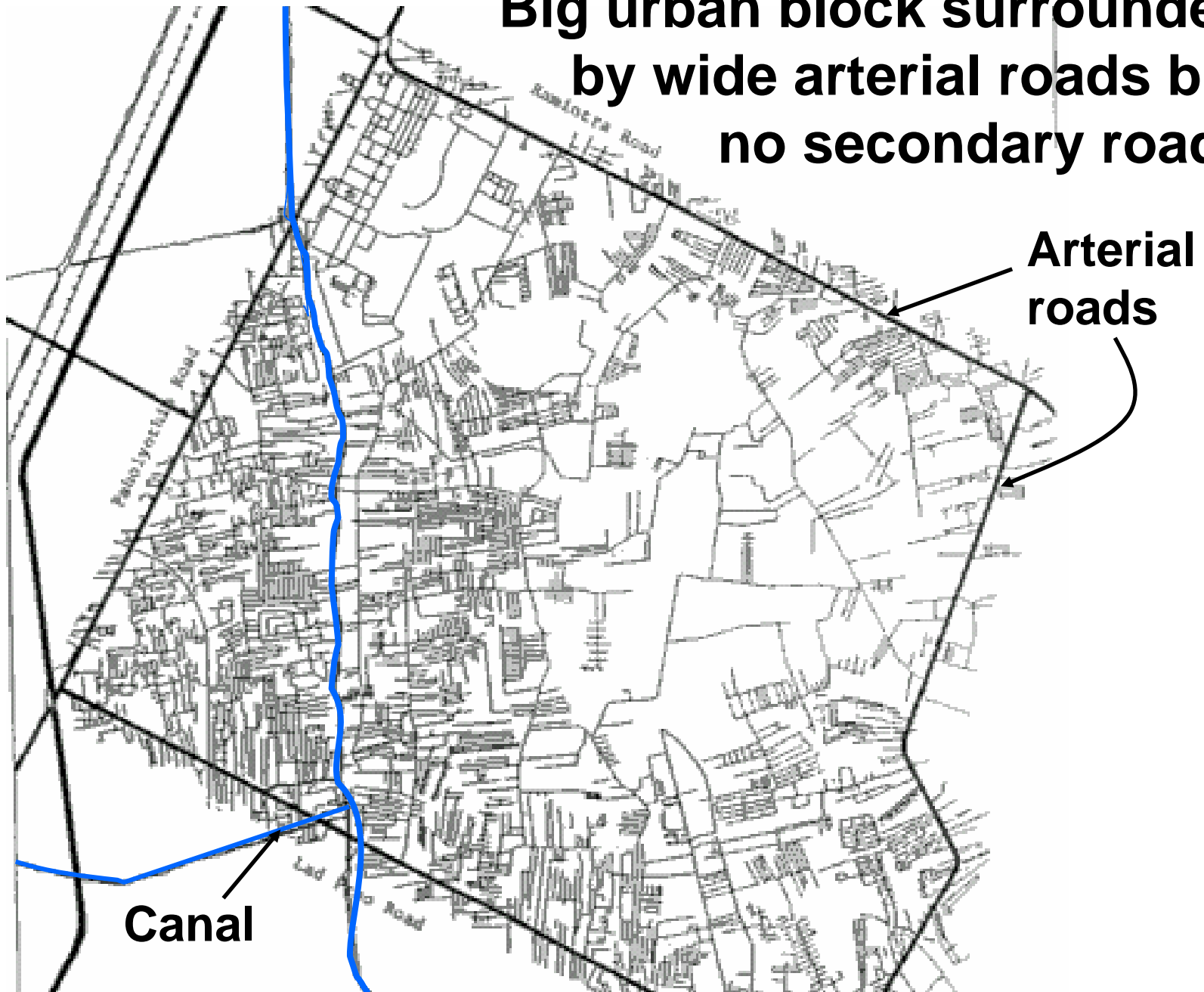
Road Network in Bangkok Metropolitan

Road length (km)

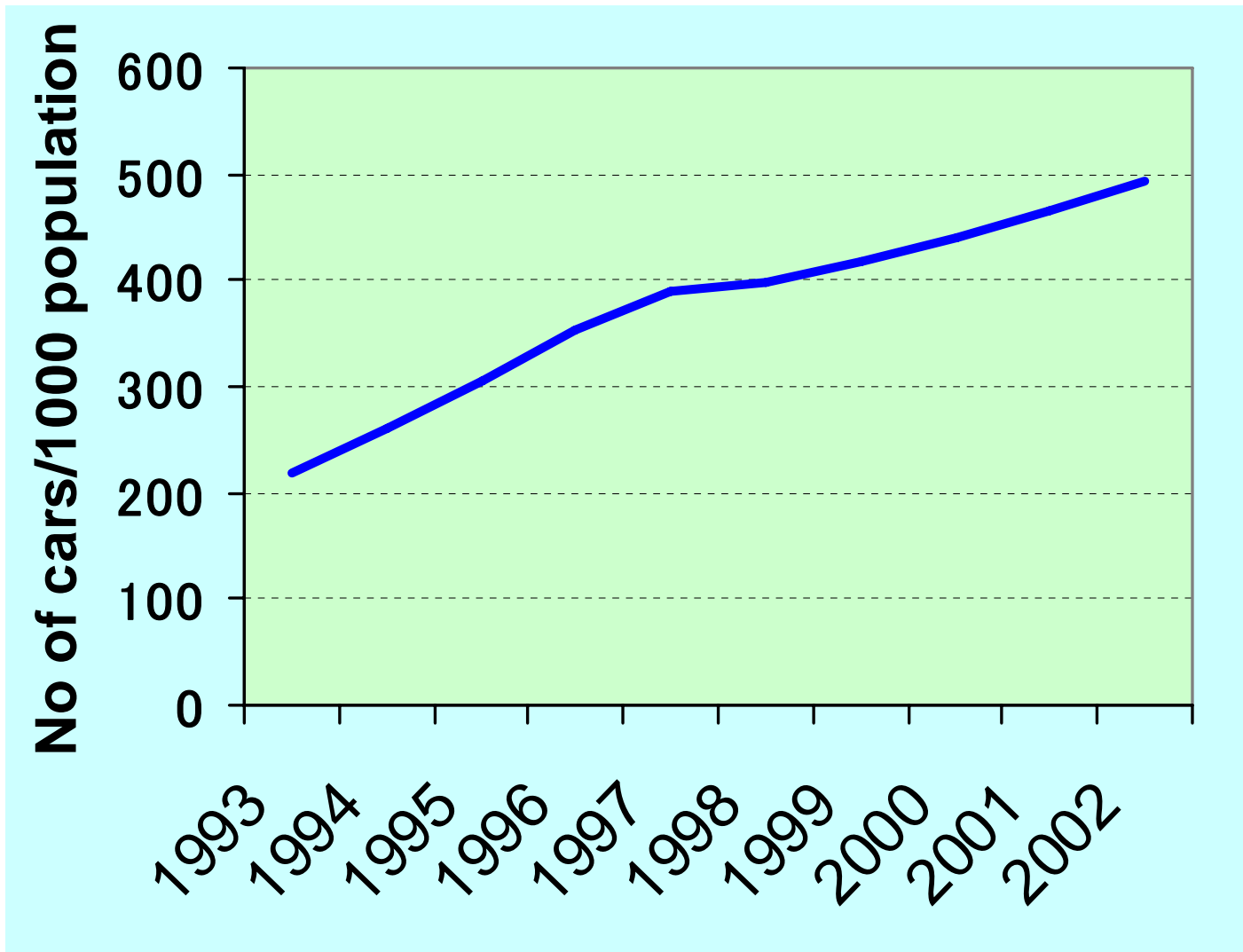
Expressway (tolled):	200
Arterials:	900
Outer Ring road:	170
Access rd (Soi)	2800



**Big urban block surrounded
by wide arterial roads but
no secondary roads**



Car ownership rate in Bangkok

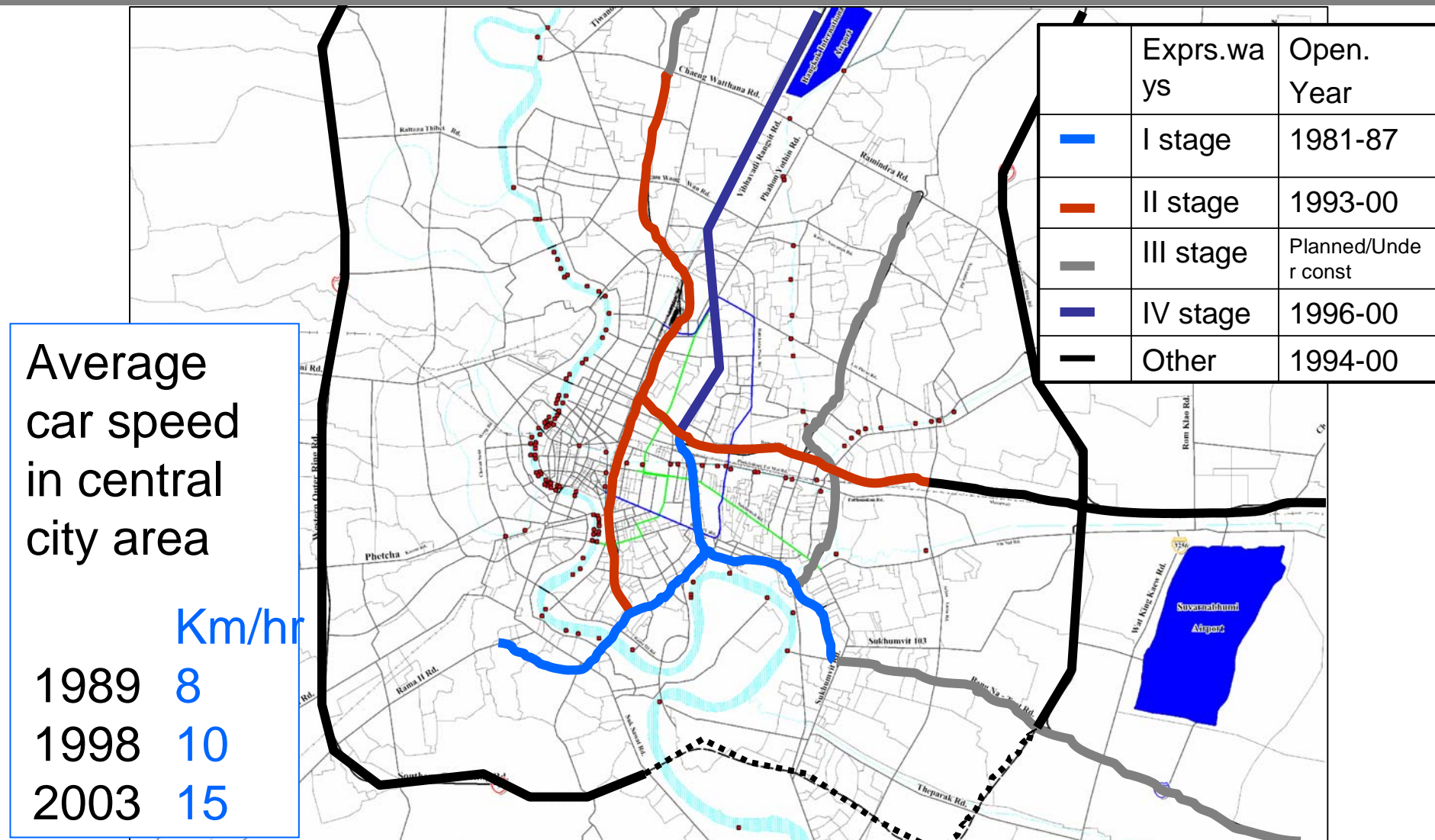


 **Rapid motorization → road congestion**

Rapid expansion of Expressway network as a response to congestion



Rapid expansion of expressway network



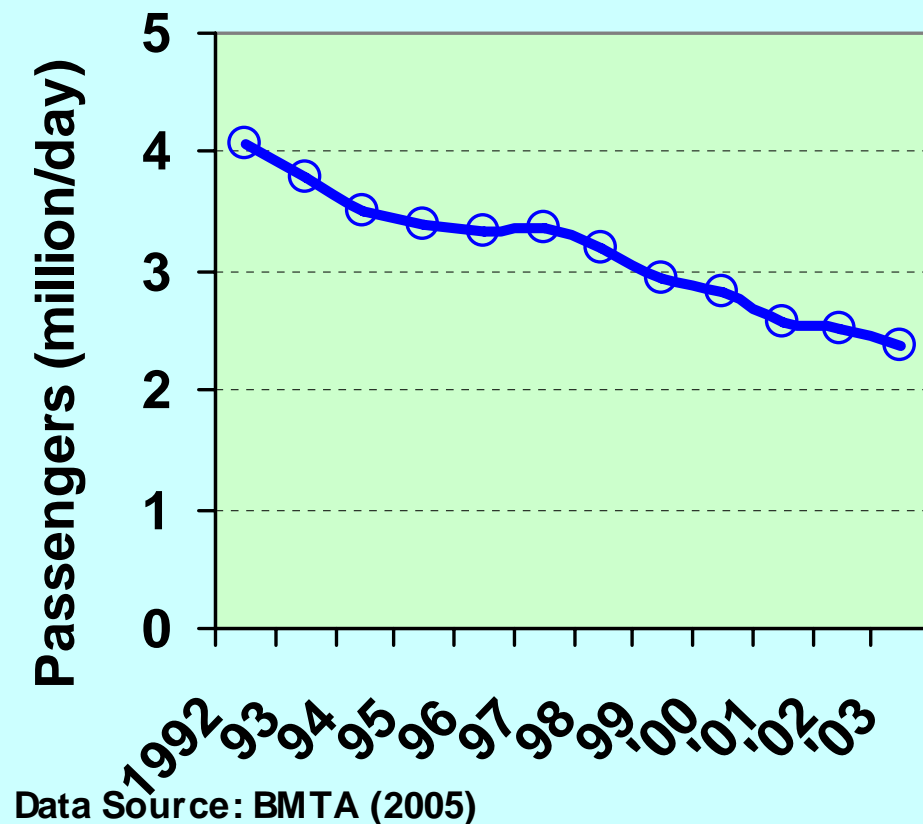
Speed Data Source: Hanaoka (2005)

Public Transport and urban rails

Public Transport in Bangkok: Bus

☞ Major mode Bus: Operated by public corporation (BMTA)

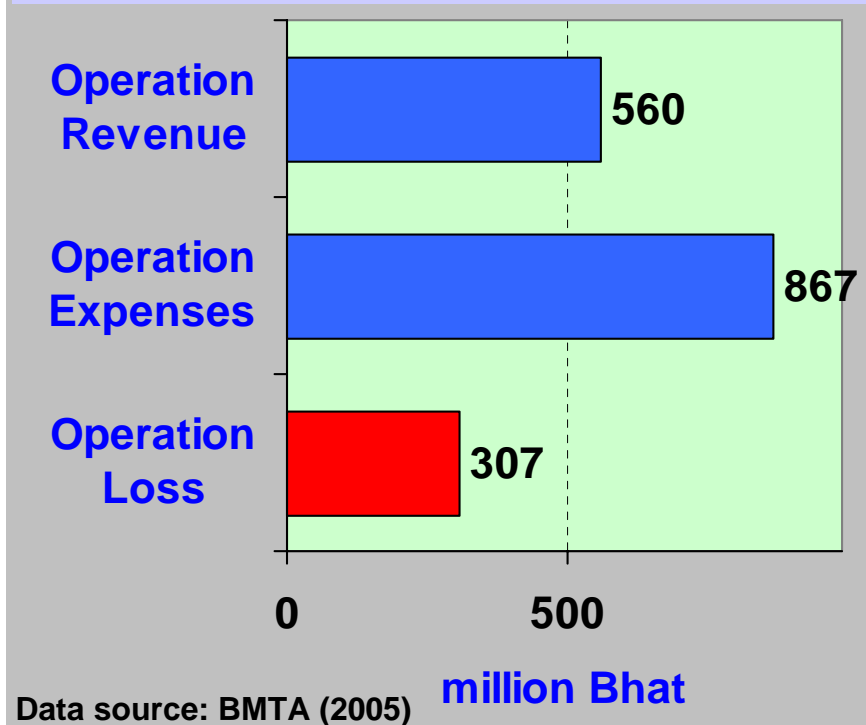
Bus passenger trend, Bangkok



☞ Declining Ridership

☞ Operational deficit

Revenue and Cost for Bus operation in Bangkok 2004



million Bhat

1 Bhat = 3 Yen

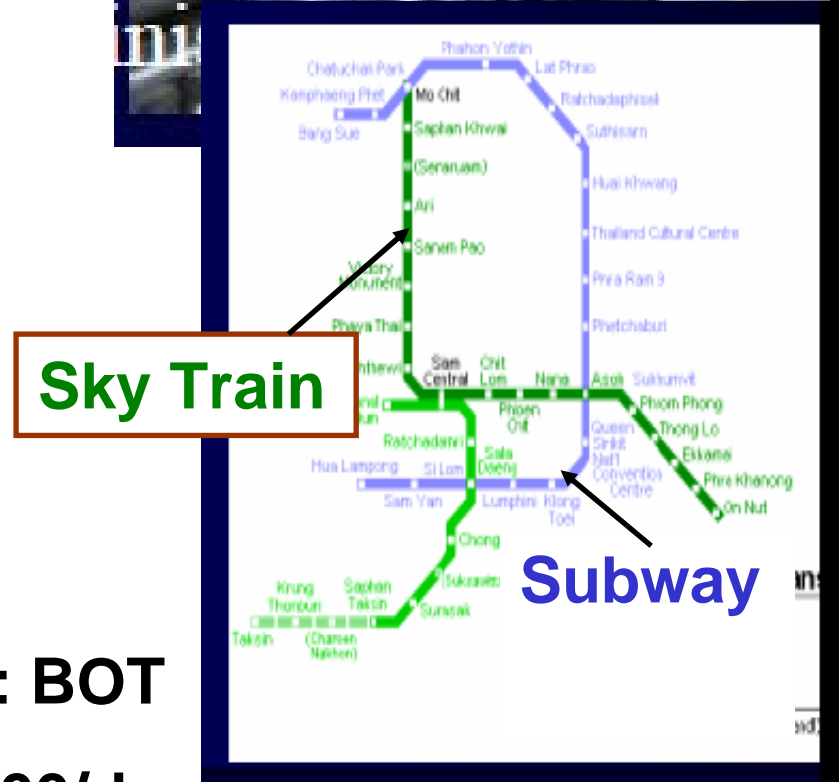
Public Transport in Bangkok: Urban Rail

Sky Train-BTS: 23.5 km

- Opened: 1999
- Full BOT Scheme
- Daily Ridership (2004): 325,000 /day

Subway: 20 km

- Opened: 2004
- Civil works (tunnel): Public
- Track, signals, rolling stocks: BOT
- Daily Ridership (2004) : 180,000/day



Public Transport fare level and modal split

Fare Level (Thai Bhat)

Ordinary bus: 4-8

AC Bus: 10-18

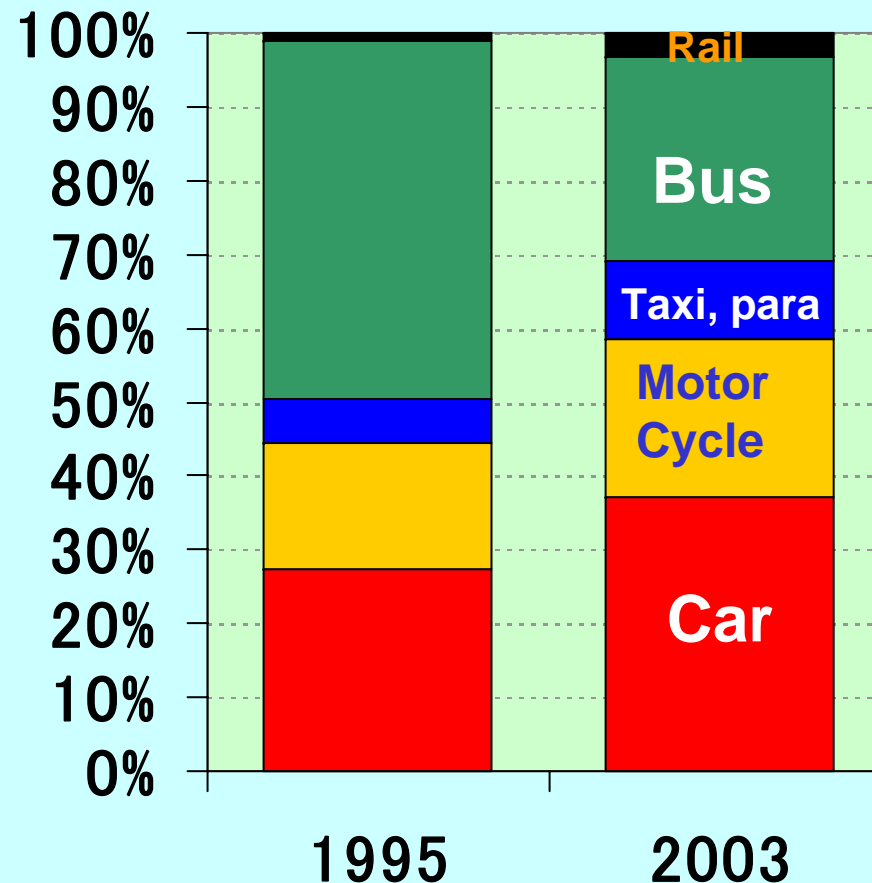
Sky train: 10-40

Subway: 14-36

- Train fare is much higher than AC Bus
- Unfair modal competition !

1 Bhat = 3 Yen

Modal Split in Bangkok MR



Bangkok Urban Rail Development Plan

Total route of 291 km by 2009.

Ambitious Plan!



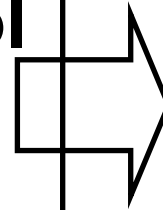
Source: OPT (2004)

(C) Dr. Surya Raj ACHARYA, Institute for Transport Policy Studies, 2006

Bangkok: Summary and Issues

1. Suburbanization

- Weak land use control
- Arterial and narrow streets only



- Road side haphazard development
- Problem of road network hierarchy

2. Rapid expansion of Expressway → improved road speed: may be only short-term relief?

3. Current plans for long-term solution

- 291 Km MRT network by 2009
- Poly-centric urban form

4. No concrete plan or measures to control motorization ! Implication for MRT system?

Comparative analysis: differences

		Seoul MA	Bangkok MR
Urban form and Land Use		<ul style="list-style-type: none"> • Strong Land-use control • High density, mono-centric 	<ul style="list-style-type: none"> • Weak land use • Ribbon-type expansion
	Urban density Avg	230 pers/ha	62 persons/ha
	Commuting distance	12.9 km	20 km (106 min)
	Cross commuting	14.8 %	47.2 %
Urban roads/motorization		<ul style="list-style-type: none"> • Toll-free Expressways • Good stock of roads? • Control on car use 	<ul style="list-style-type: none"> • Expressways with toll • Secondary roads missing • No control on car use
	Road area (%)	20.4	11.0
	Car (no/1000 people)	173 (2000)	493 (2002)
	Average road speed	20 km/hr (1999)	15 km/hr (2003)

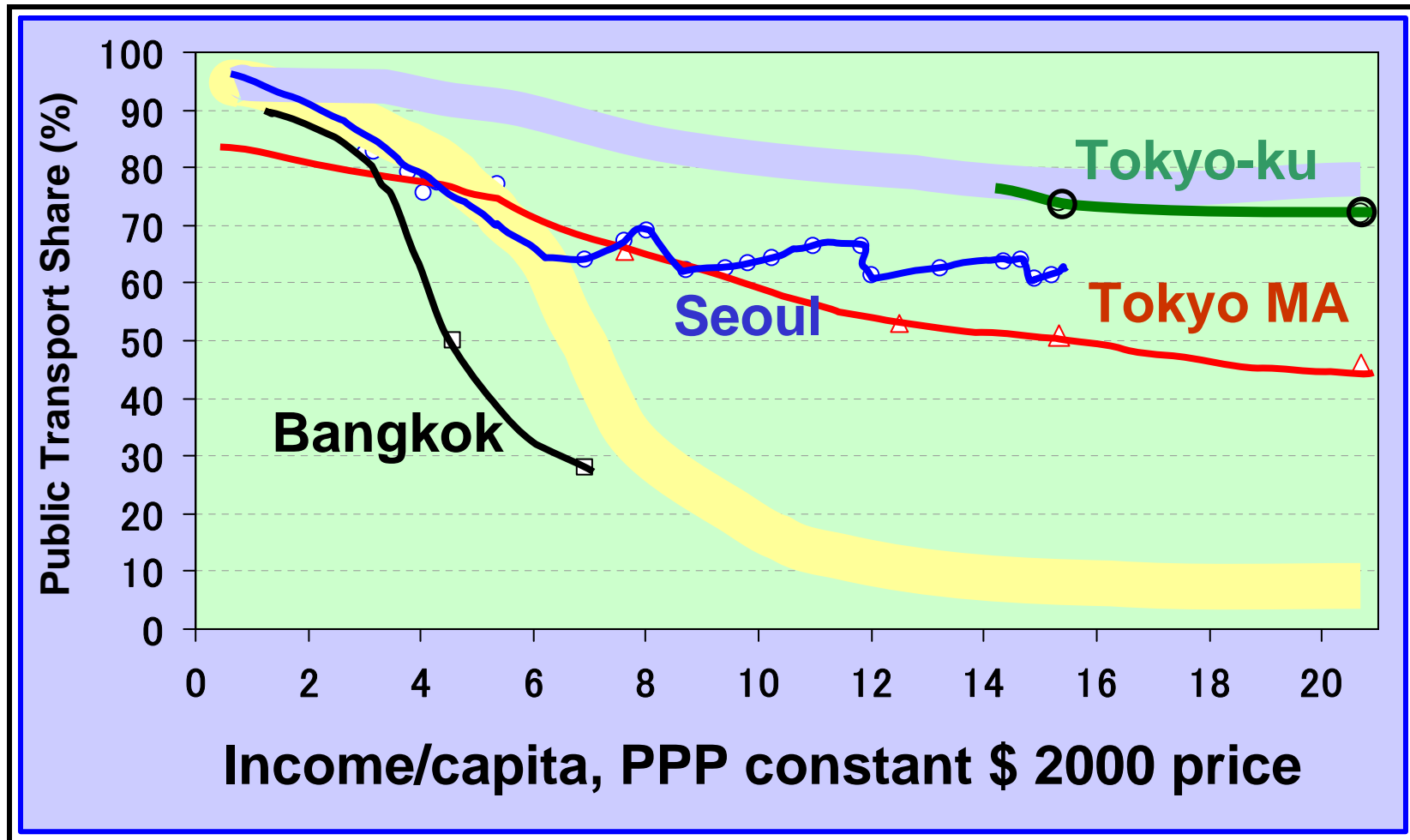
Comparative analysis: differences

		Seoul MA	Bangkok MR
Public Transport (PT) and urban railways		<ul style="list-style-type: none"> • PT mode share high • Early opening of MRT (1974) • Balanced and integrated Bus/MRT fares • Challenge: maintain public transport mode share • Response: Bus reform 	<ul style="list-style-type: none"> • PT share much lower • Late opening of MRT (1999) • Bus fare subsidized , but MRT not subsidized • Challenge: modal shift from private to public mode • MRT investment
	Subway/MRT	287 km	43.5 km
	Suburban rail	200 km	-
	Public mode share	61.2 %	29 %
	Bus fare	100 yen	35-60 yen
	MRT Fare	100 yen	40-120 yen

Comparative analysis: Commonalities

- **High density city center**
- **Increasing trend of suburbanization**
- **High Motorization and congestion**
- **Radial-ring arterial road network structure**
- **Higher demand density for MRT in inner city corridor**
- **Challenge of developing suburban rails**

What path Seoul and Bangkok are following ?



Challenge:

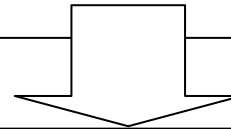
Seoul: How to maintain Public Transport share?

Bangkok: How to achieve modal shift from private to Public?

Policy Implications for Asian Megacities

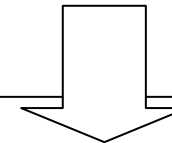
1. Vision: *What are the desirable scenarios?*

- Higher mobility and higher accessibility
- Concentrated decentralization (polycentric urban form)
- Modal balance (private vs public mode)



2. Strategies: *What are the options for desirable scenarios?*

- Building Infrastructures (Roads and MRT facilities)
- Managing motorization
- Promoting Public Transport oriented land use
- Improving service quality and competitiveness of public transport



Implementation measures.....

Policy Implications for Asian Megacities

3. Implementation measures, priority and sequence

- Investment for new infrastructure
 - What mode? What type? When to invest?
 - How to invest? Public or Private?
- Development of high-density MRT corridor
 - Land-use regulation (control oriented)
 - MRT investment (market oriented)
- Transport Demand Management (TDM) measures
- Hierarchical network of urban railways
- Inter-modal coordination and competition
 - Transfer facilities (station plaza)
 - Coordinated service routes
 - Harmonized fares for inter-modal competition

Constraints:

- Institutional
 - Organizational
 - Capacity building
 - Regulatory
- Financial

Policy Implications for Asian Megacities

Factors for modal competition have different degree of influence at different stage of income

Factors	Lower income stage	Higher income stage	Policy implications
Availability	◎	◎	Basic infrastructure needed
Cost (affordability)	◎	○	Subsidy more effective in low income stage
Quality of service <ul style="list-style-type: none"> • Accessibility • Frequency • Speed • Transferability • Comfort 	○	◎	As the income rises, service quality is important
			High ◎ Low ○

Further Works

- **Conduct full-fledge case studies on the candidate cities, in collaboration with partner institutions:**
 - **East Asian Society for Transportation Studies (EASTS)**
 - **Korea Transport Institute (KOTI)**
 - **National Center for Transport Studies (NCTS), Manila**
 - **Asian Institute of Technology (AIT), Bangkok**
 - **Institute of Traffic and Transportation, National Chiao Tung Univ., Taiwan**
 - **Indonesia Transport Society**
 - **Hong Kong Polytechnic University**
 - **Experts from Beijing, Hochimin city (requested)**
- **Book publication from the research outputs**

Thank you for your kind attention !

今後の課題 Task Ahead

- 国際共同研究プロジェクト「アジアの都市における持続可能なモビリティのための公共交通—国際比較研究」として継続の予定
To be continued as an International Collaborative Research Study titled “Public Transport for Sustainable Mobility in Asian Cities” covering about a dozen of Asian mega-cities
- Collaboration with,
 - 東アジア交通学会 (EASTS)
 - 韓国交通研究院 (KOTI)
 - 交通研究センター (NCTS) マニラ
 - アジア工科大学, バンコク
 - Indonesia Transport Society
 - Hong Kong Polytechnic University
 - Institute of Traffic and Transportation, National Chiao Tung Univ., Taiwan
 - アジア諸国の専門家
 - アジアの他の研究機関 (予定)