2-9-2018

Urban Transportation Planning and TOD Research in Japan

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Yokohama National University

YNU

TREC Special Lecture on Feb. 9, 2018

Urban Planning and Urban Public Transportation

-Learning from Asian and Latin American cases-

By

Fumihiko Nakamura

Executive Director, Vice President

Professor

Yokohama National University (YNU)

About Fumihiko Nakamura

- 1962 Born in Niigata, Japan
- 1985 Graduate from University of Tokyo
- 1991 Doctor of Engineering,
  University of Tokyo,
  (Urban Engineering)

- 1989-1992: Research Associate
  - University of Tokyo
- 1992-1994: Assistant Professor
  - Asian Institute of Technology (Bangkok)
- 1995-2004 : Associate Professor
  - Yokohama National University (YNU)
- 2004- : Professor

About Fumihiko Nakamura (Cont.)

- 2011- : Visiting Professor
  - Parana Catholic University (PUC) at Curitiba, Brazil.
- 2013-2015: Dean,
  - Graduate School of Urban Innovation ,YNU
- 2015- : Executive Director, Vice President,
  - YNU

- Majoring in
  - Urban Transportation Planning and policies,
  - Urban planning,
  - Public transportation planning

- http://www.cvg.ynu.ac.jp/G4/index_e.htm
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Contents of the Lecture

1. **Trend of Urban Transportation**

2. **Trend of Research**
3. **Trend of Technical Keywords**
4. **Strategy Framework**
5. **Learning from Asian Cases**
6. **Learning from Latin American Cases**
7. **Discussion on Perspectives**

Negative Impact of Traffic

Damage on Environment

Traffic Accident

Social Exclusion

Negative Impact of Traffic

- Damage of Environment
- Traffic Accidents
- Social Exclusion

Negative Impact of Traffic

- Damage of Environment
- Traffic Accidents
- Social Exclusion
- We should solve them somehow.

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Trend of Research

- Focusing points
  - Traveling Vehicles
  - Traveling Human
  - Quality of (Human) Life

Trend of Research

- Understanding of Motorization
  - Increase of Vehicles
  - Stable situation (Peak-Car)
  - From Ownership to Sharing

Trend of Research

- Methodology for Policy Application
  - Predict and Provide
  - Predict and Protect
  - Decide Vision and Act Together

Trend of Research

- Expansion of the perspectives.
  - Efficiency and Reliability
  - Safety
  - Environment
  - Social Welfare
  - Landscape
  - Town center revitalization

- Wider range of target modes

  ++ Walking, Bicycle, Paratransit, Bus

Trend of Research

- Summary

  - More on Human Based
  - More interdisciplinary
  - Decision making supportive

  - Sustainability - Oriented
  - Multi- and Inter- Modal Oriented
  - Implication with other areas such as Urban Planning

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Keywords for Next Generation

- Streets for Place-making
- Autonomous Vehicle

Keywords for Revolution of Urban Transportation

- Smart Mobility
- Connected and Shared Mobility
- Green Modes First
- Walkable City Center and Streets
- Safe and Secured Bicycles
- Reliable Public Transportation
- Enjoyable Transportation Nodes

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SUSTAINABLE URBAN MOBILITY STRATEGY FRAMEWORK

GOAL FOR SUSTAINABLE MOBILITY

LESS DEPENDENCE ON CAR TRAFFIC

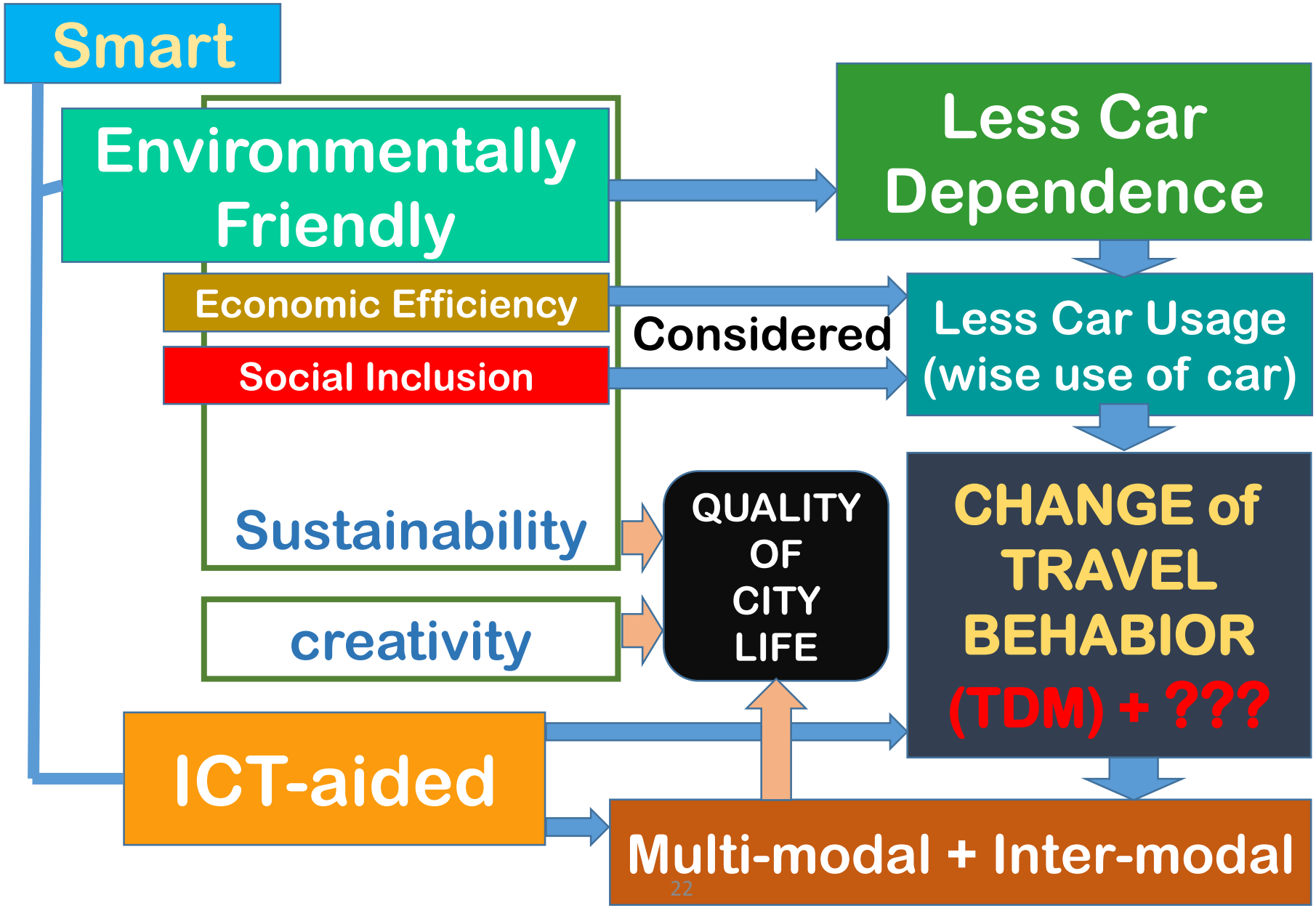
TARGET FOR CONTROL

CAR OWNERSHIP
CAR USAGE
CAR PARKING

STRATEGY FRAMEWORK

SUPPLY SIDE & DEMAND SIDE
LONG TERM & SHORT TERM

Several Conceptual Keywords

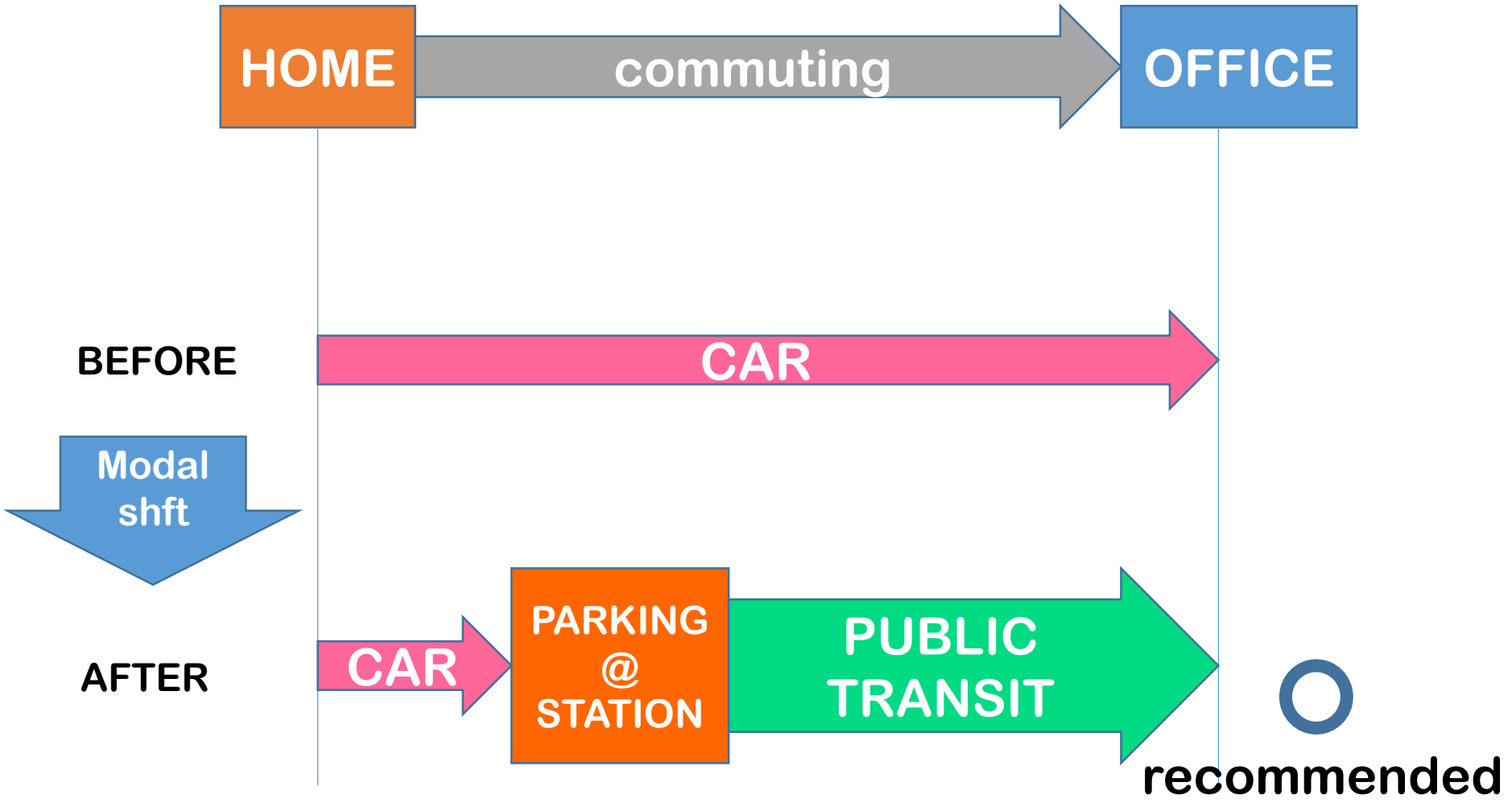


Travel Demand Management (TDM)

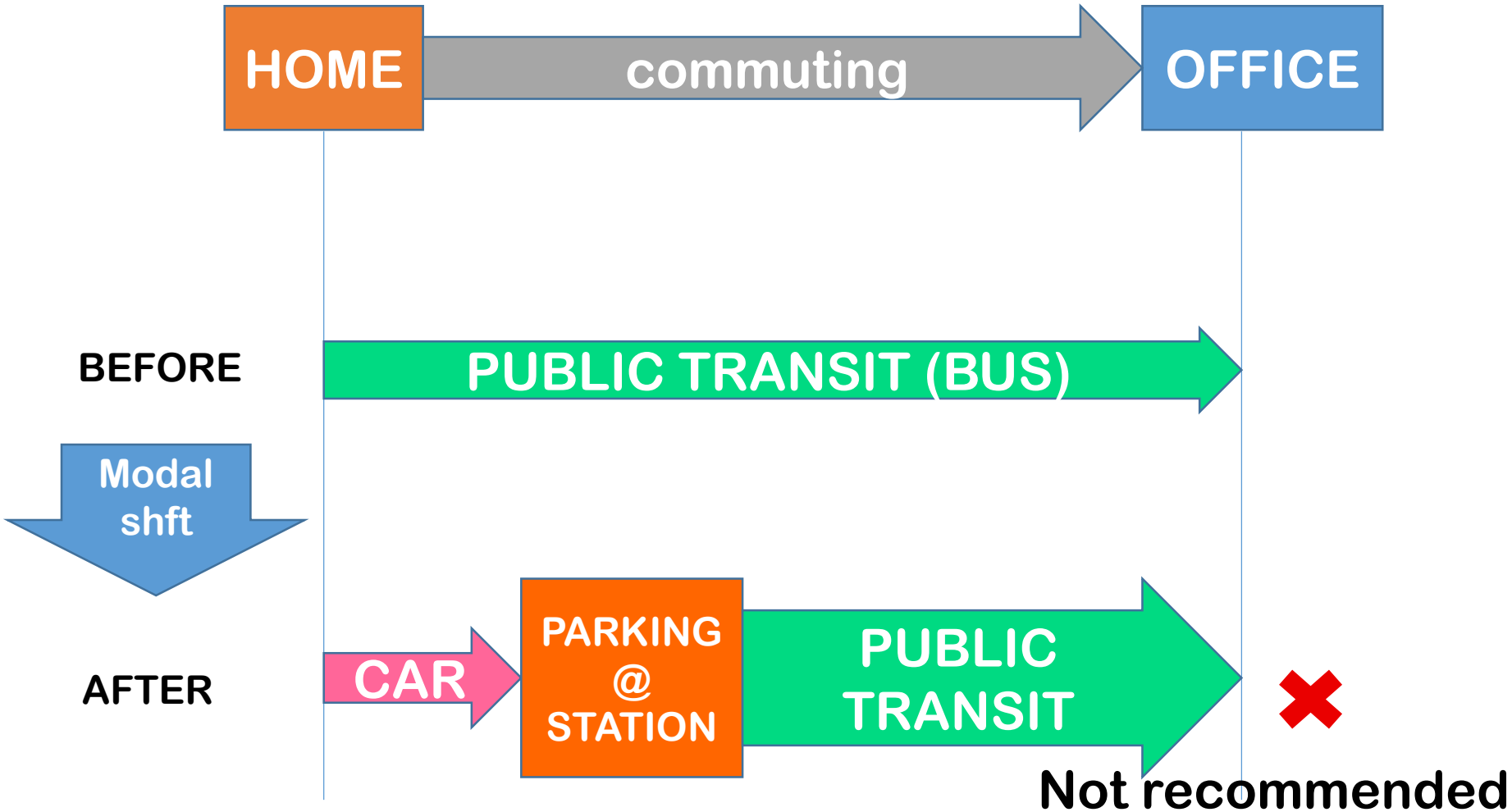
To Ask Travelers (Drivers) to change behavior (in order to reduce congestion)

Route change	Ex. Navigation system
Mode change	Ex. Park and Ride
Destination change	Ex. Satellite office
Frequency change	Ex. 3 days week work
Time change	Ex. Triggered commuting

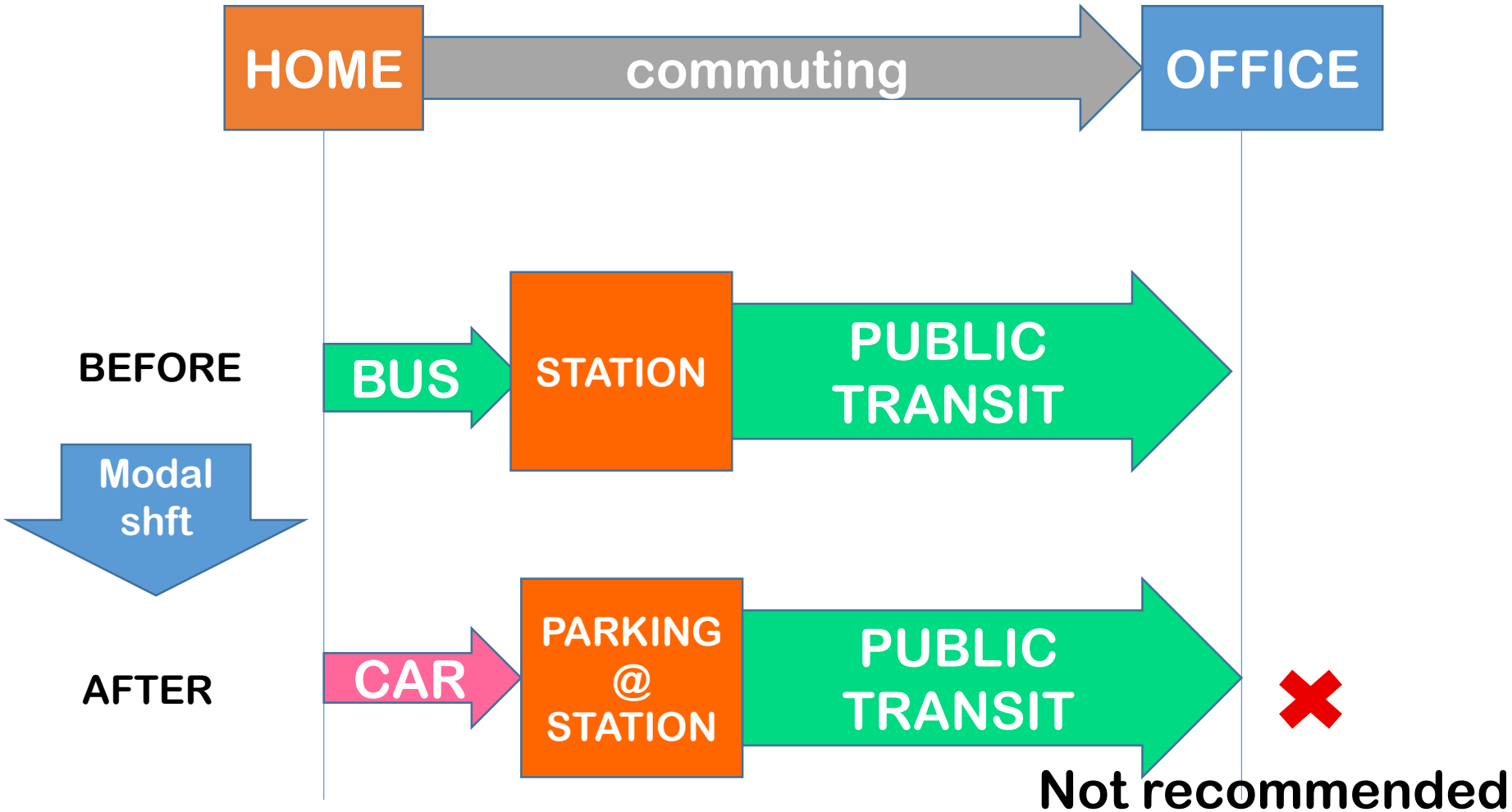
Park & Ride (modal shift case 1)



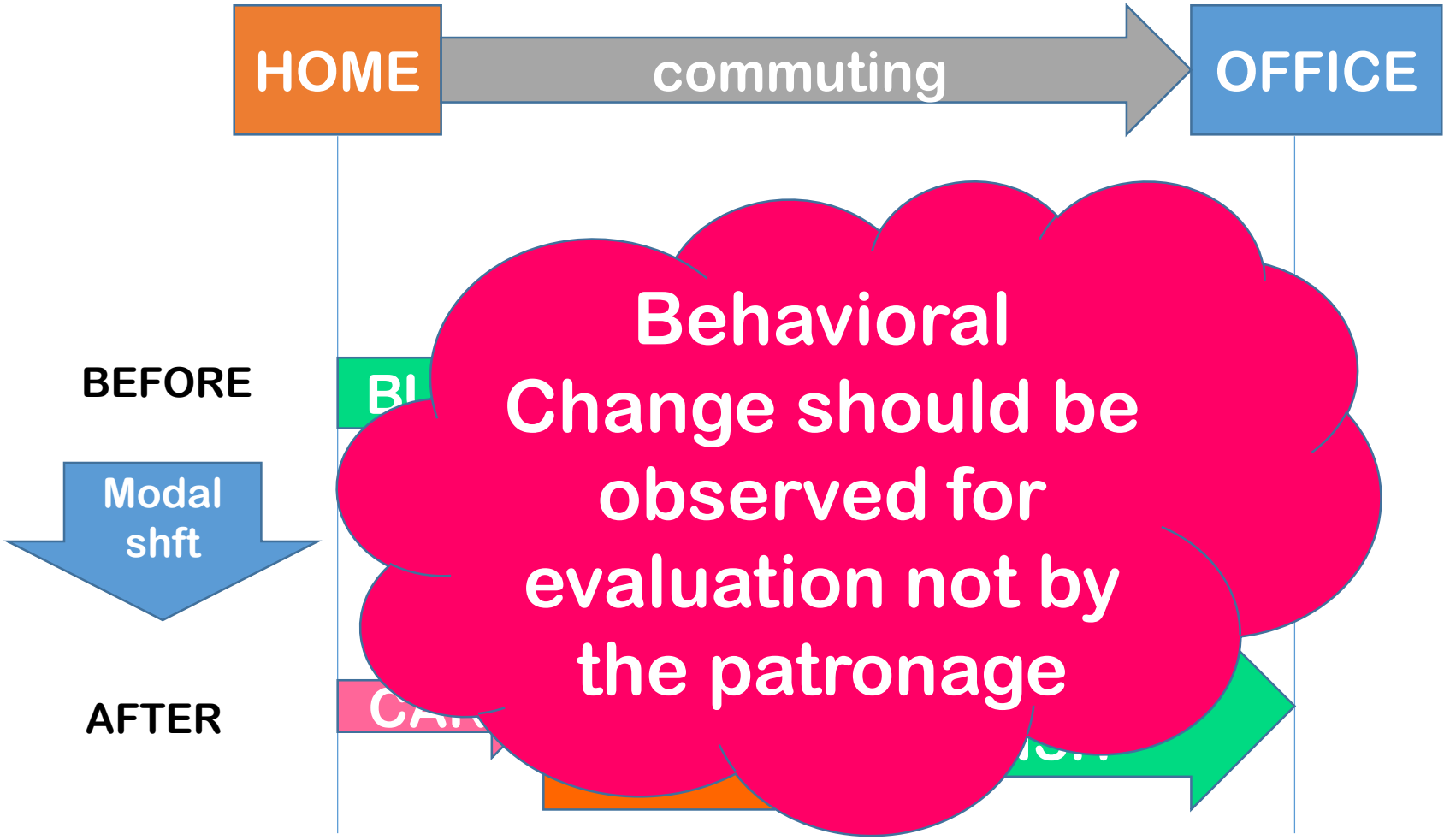
Park & Ride (modal shift case 2)



Park & Ride (modal shift case 3)



Park & Ride (discussion)



Another Strategy for modal shift

Transit Oriented Development

LESS DEPENDENCE ON CAR USE

CONTROL BY ENFORCEMENT, PRICING

+

PROVISON OF ALTERNATIVE MODES (PUBLIC TRANSIT)

INTRODUCTION OF SUPPORTIVE DEVELOPMENT

TOD : TRANSIT ORIENTED DEVELOPMENT

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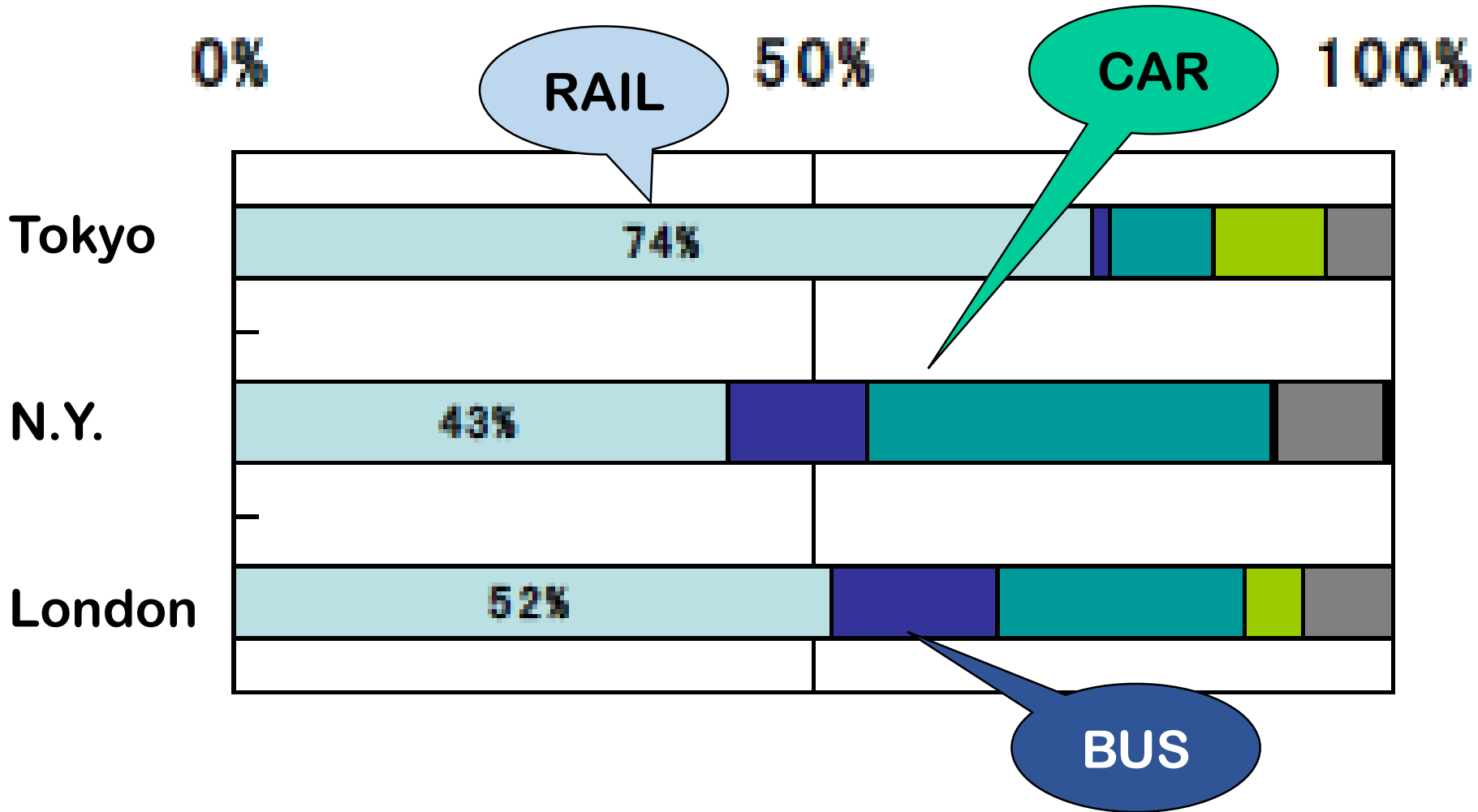
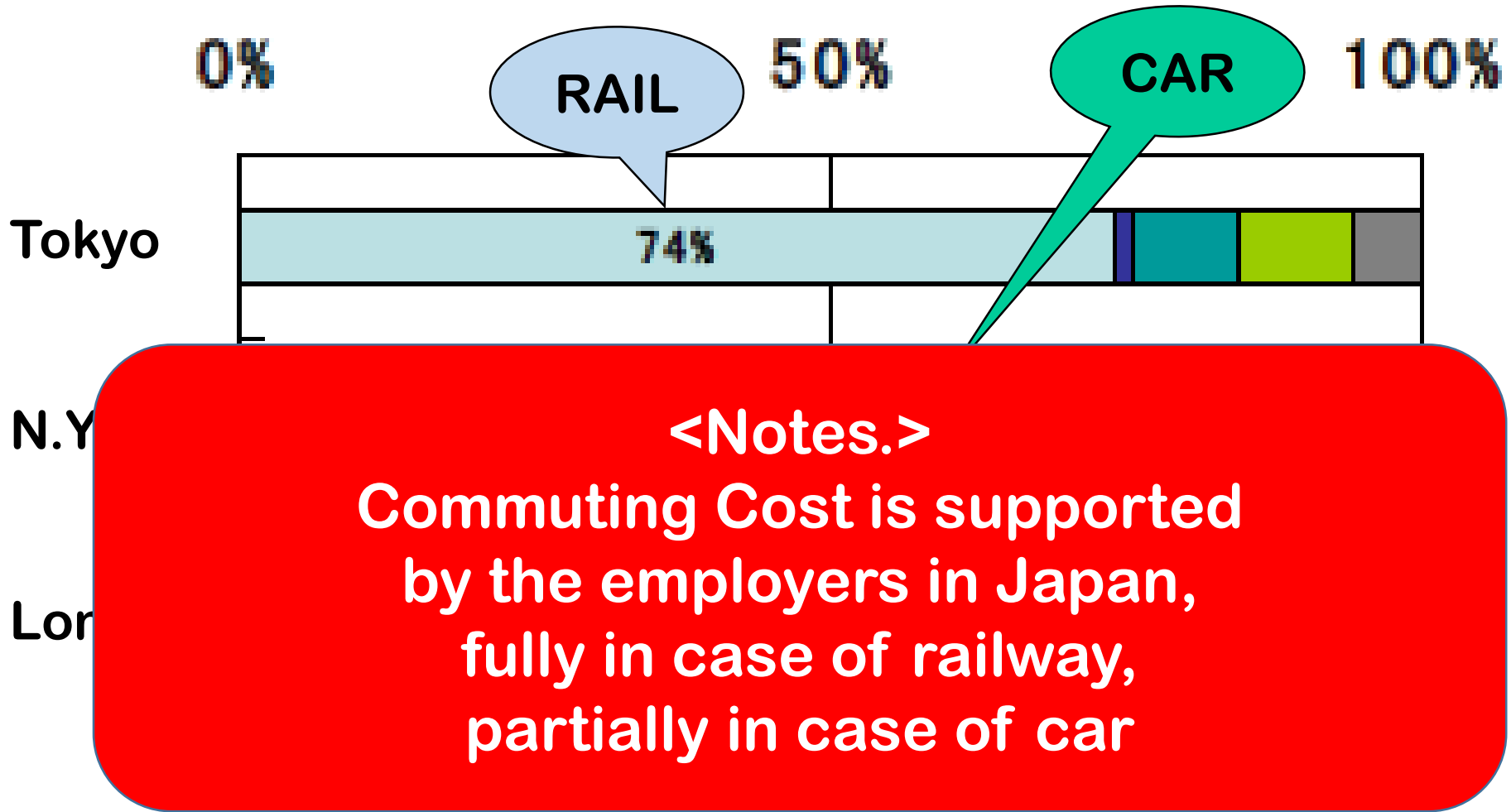
5.1 Tokyo

<Tokyo>
High Share of Rail for commuting

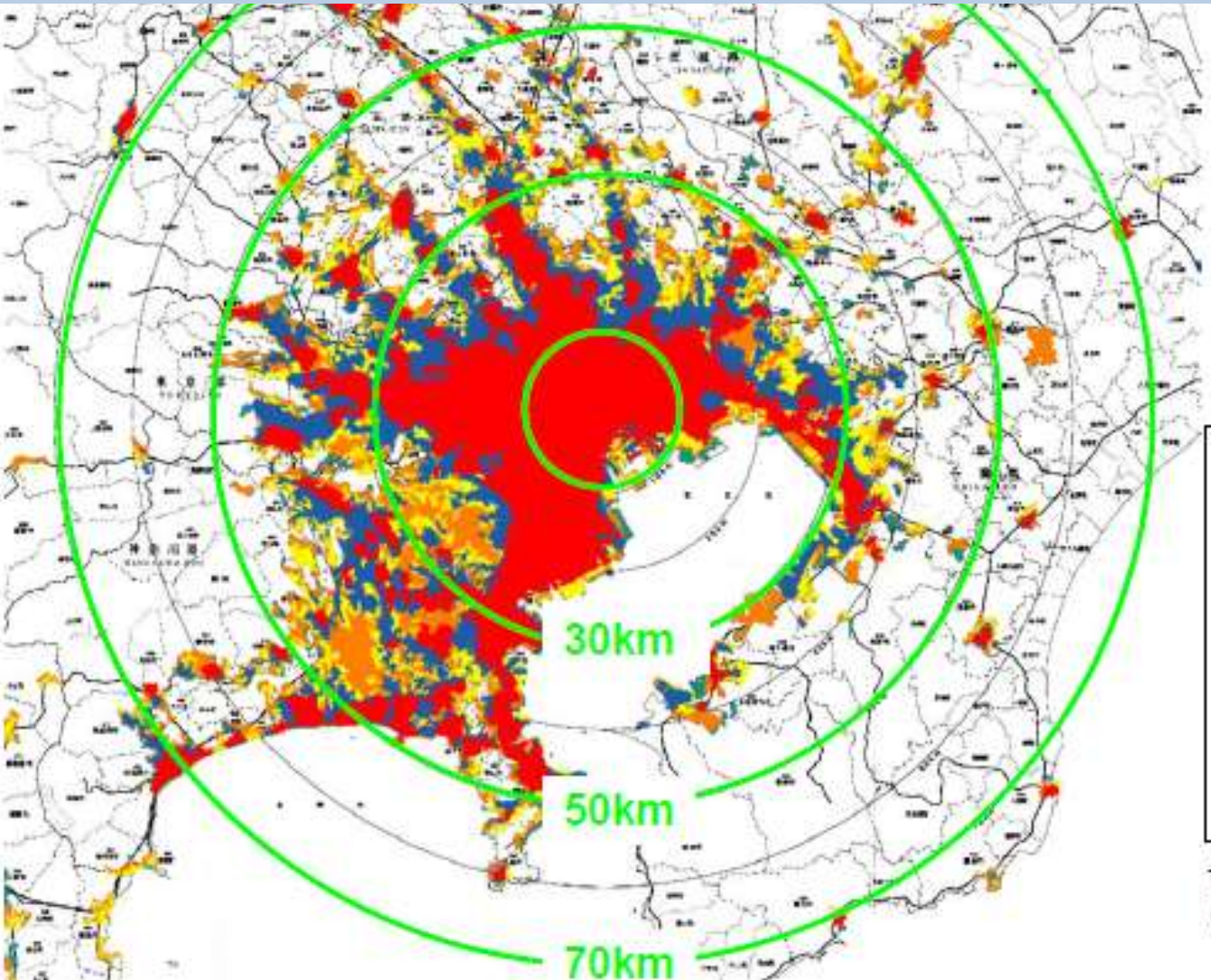


<Tokyo>
High Share of Rail for commuting



<Notes.>
Commuting Cost is supported by the employers in Japan, fully in case of railway, partially in case of car

<Tokyo>
Rail 1st, Development 2nd, Motorization 3rd



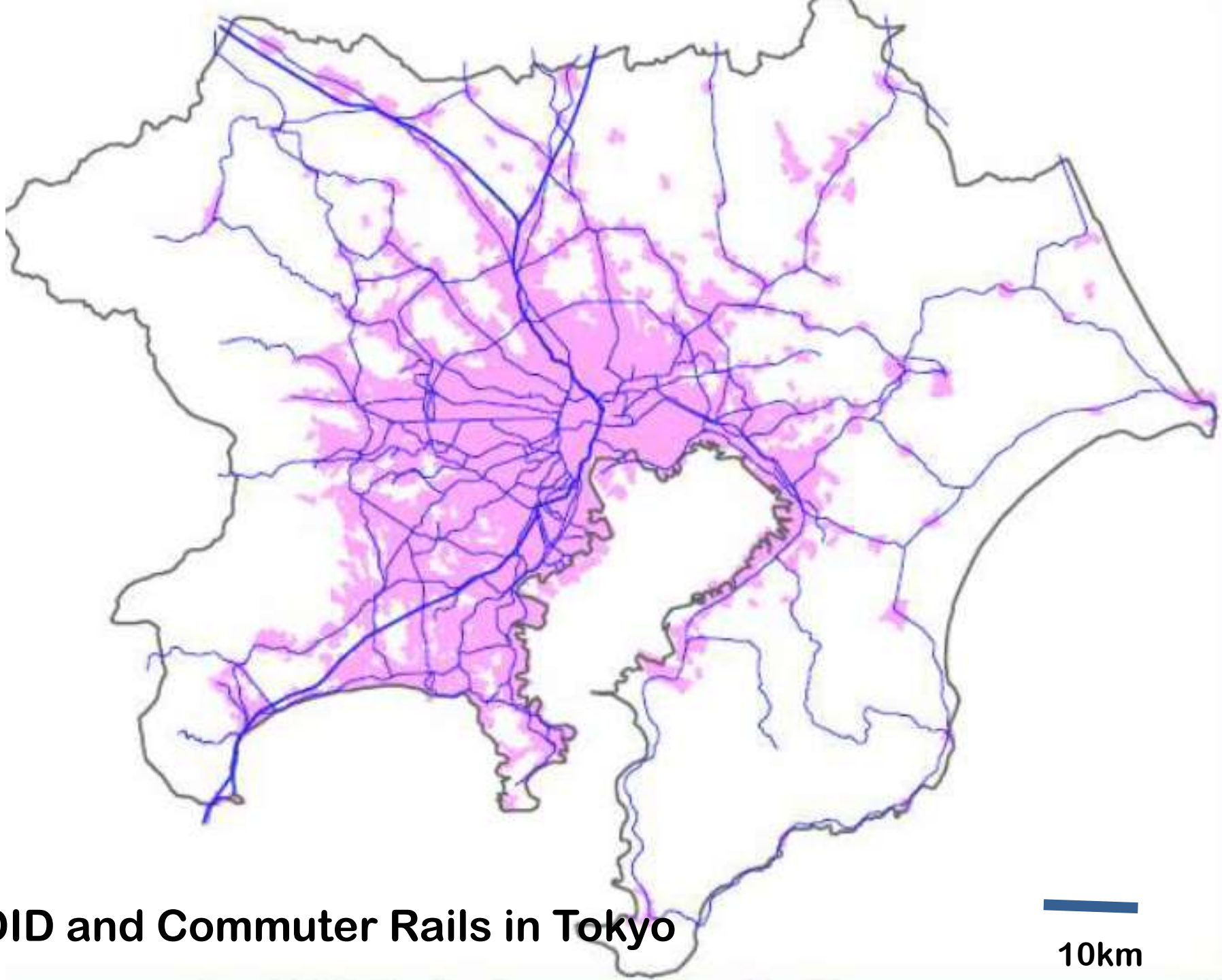
Population of 70km-radius: 34million

Expansion of urban area *

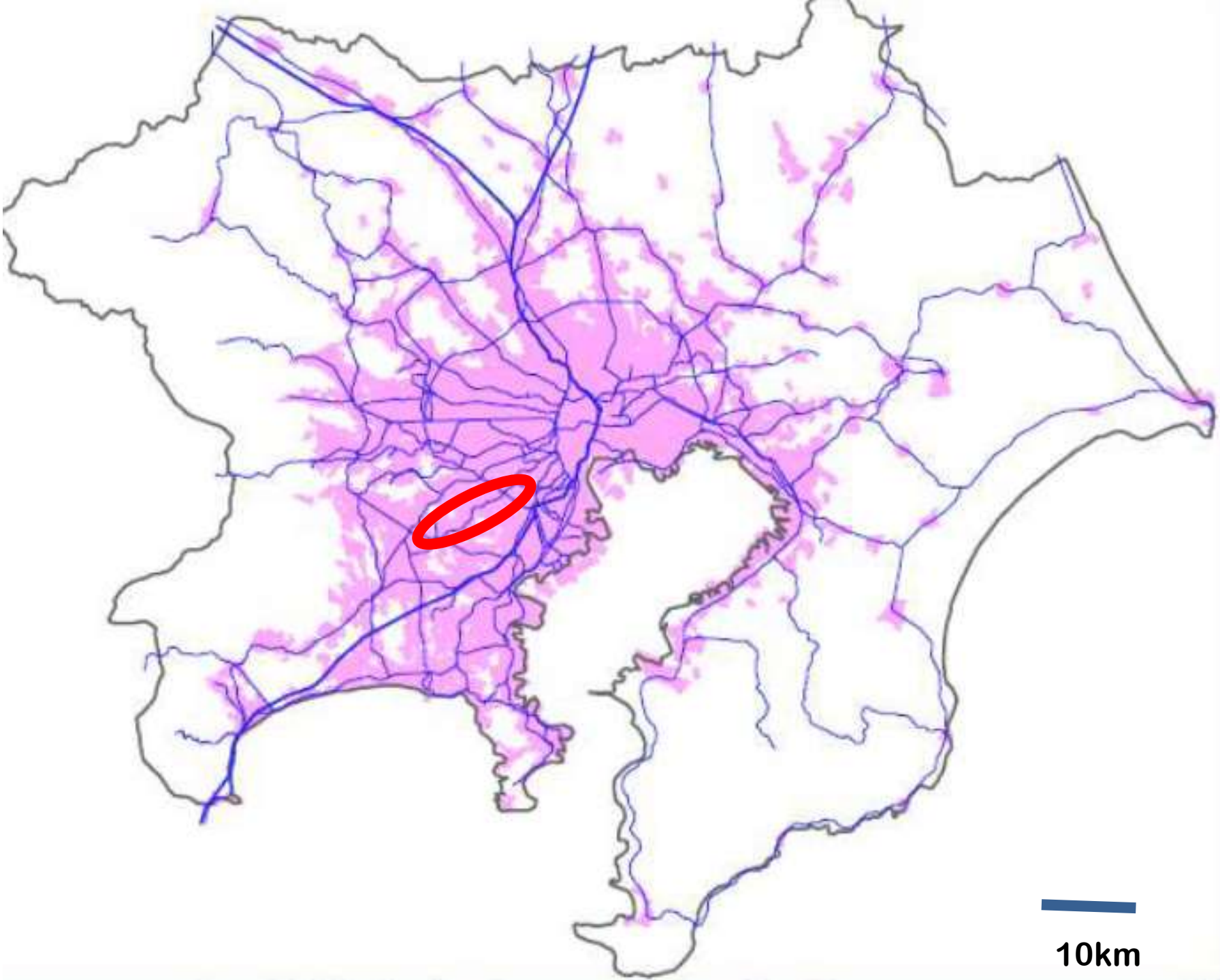
- 1965
- 1975
- 1985
- 1990
- 2000

The urban area refers to DIDs (densely inhabited districts).

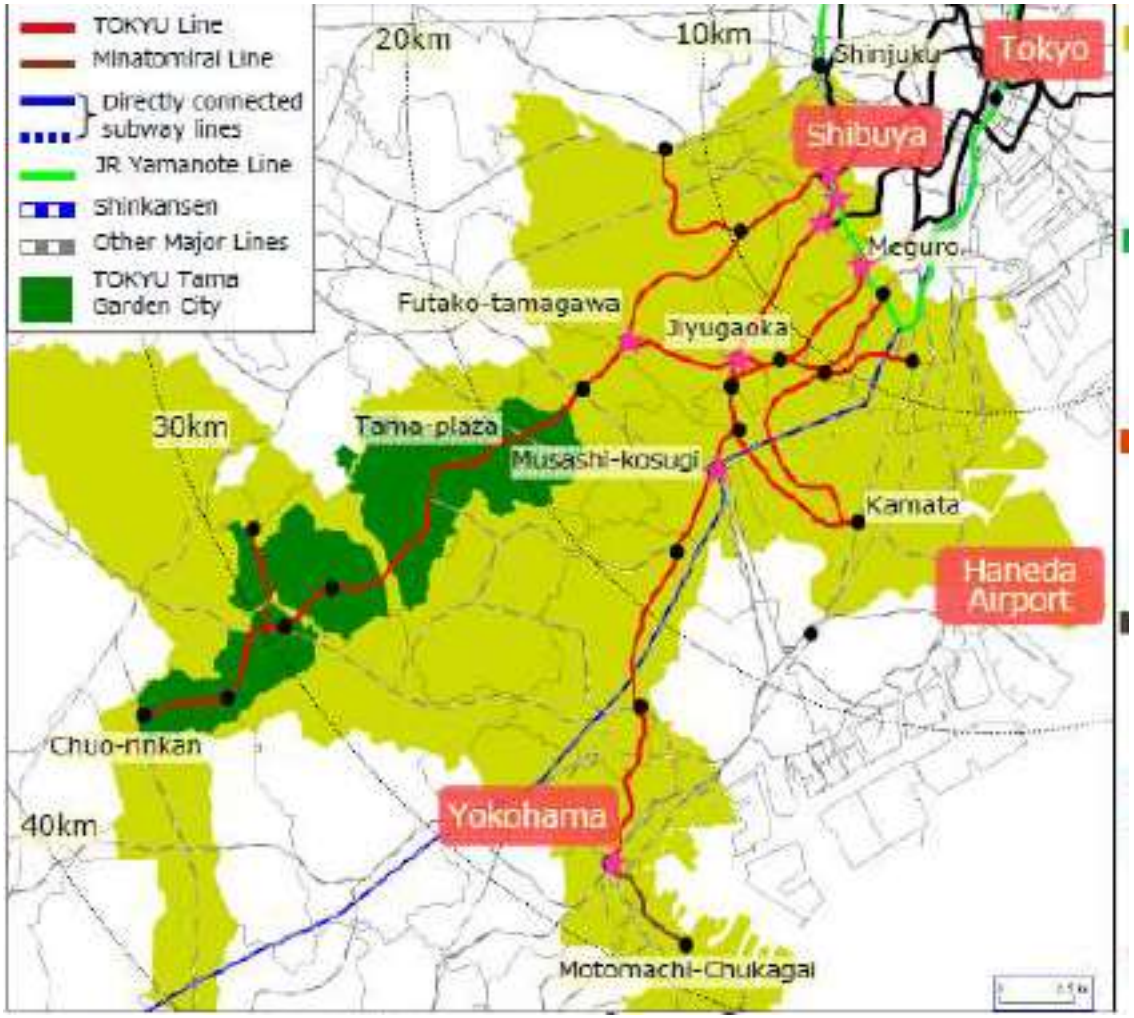
Source: national census



DID and Commuter Rails in Tokyo

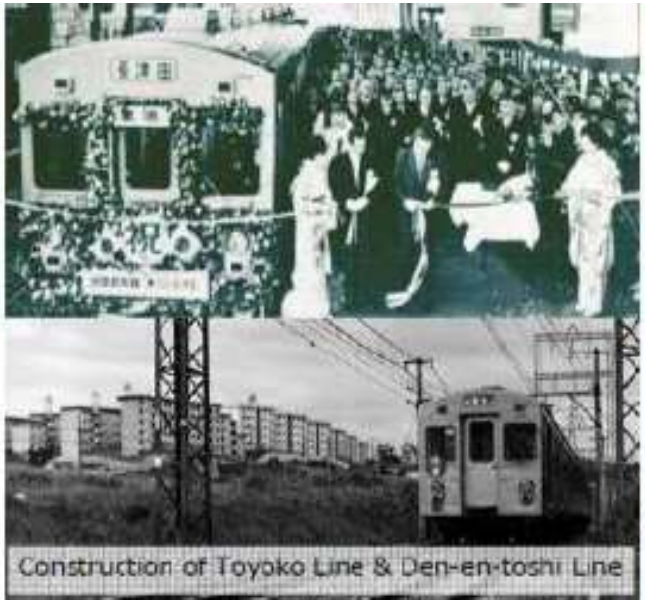

10km

<Tokyo>
Tama-Den-En-Toshi
Unique Example of TOD



Private Railway Company initiated Development as well as rail construction

<Tokyo>
Tama-Den-En-Toshi
Unique Example of TOD



DEVELOPING GOOD ENVIRONMENT

MORE PASSENGERS

LAND PRICE RISE

RE INVESTMENT

Tama Plaza in 1970's

<Tokyo>
Tama-Den-En-Toshi
Unique Example of TOD

1970’s

1970’s

1970’s

1970’s

1990’s


2010's
NEW STATION

<Tokyo>
Tama-Den-En-Toshi
Unique Example of TOD

- Located west of Tokyo by 20-30 km
- 600,000 Residents living in about 50 km sq.
- Private Operator (Tokyu) developed the area and runs the commuter railway.

- Results

- High share of Commuting Rail
- Less number of Commuters to Tokyo by car.

<Tokyo>
Tama-Den-En-Toshi
Unique Example of TOD

Q : Perfectly Successful?

<Tokyo>
Tama-Den-En-Toshi
Unique Example of TOD

Q : Perfectly Successful?

- Residents with Higher Density
- Shopping Function at rail stations

<Tokyo>
Tama-Den-En-Toshi
Unique Example of TOD

Q : Perfectly Successful?

- Residents with Higher Density
- Shopping Function at rail stations

- Higher level of Car ownership after motorization
- Access to stations by cars is cheaper.

<Tokyo>
Tama-Den-En-Toshi
Unique Example of TOD

Q : Perfectly Successful?

- Residents with Higher Density
- Shopping Function at rail stations

- Higher level of Car ownership after motorization
- Access to stations by cars is cheaper.

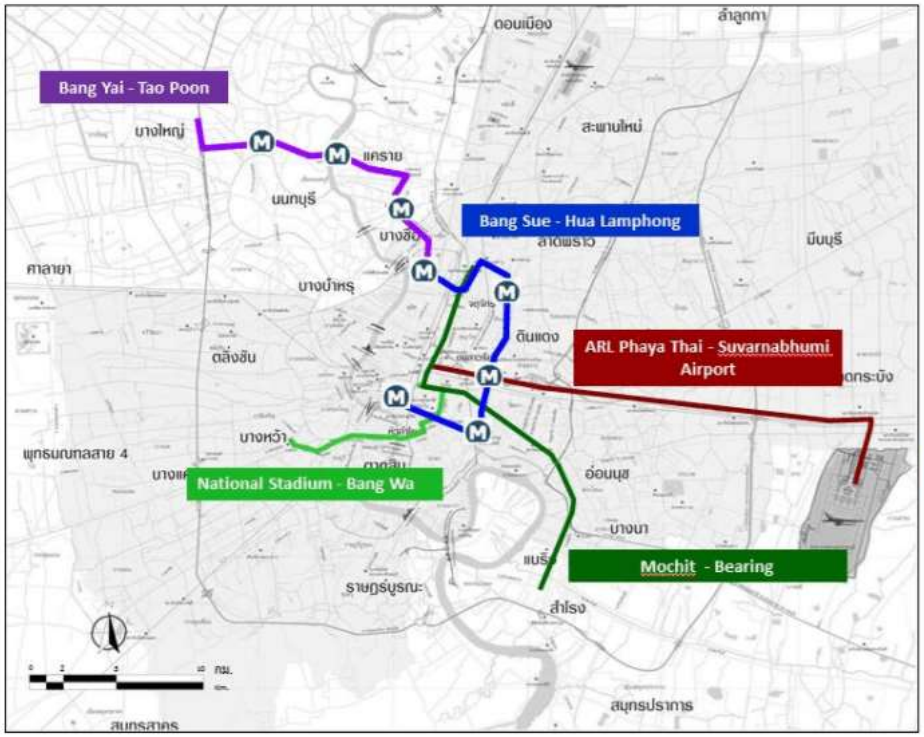
- A lot of cars to rail station, causing congestion
  - In Weekdays as feeder mode to railway commuting
  - In Weekends as shoppers to Shopping

5.2 Bangkok

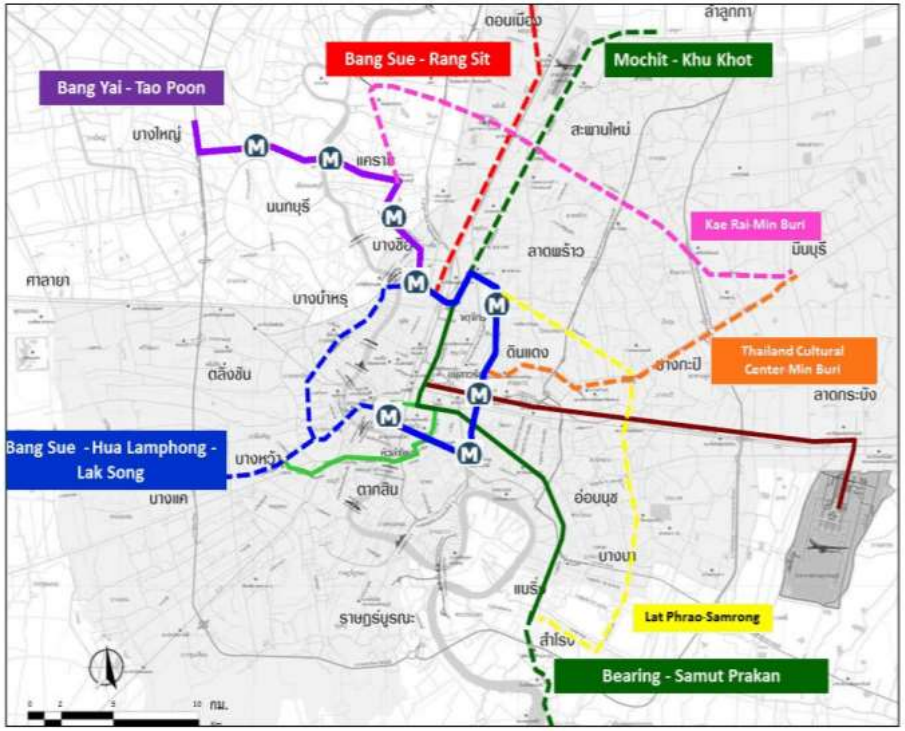
<Bangkok>

Boom of Urban Rails followed by TOD

Existing Metro Lines

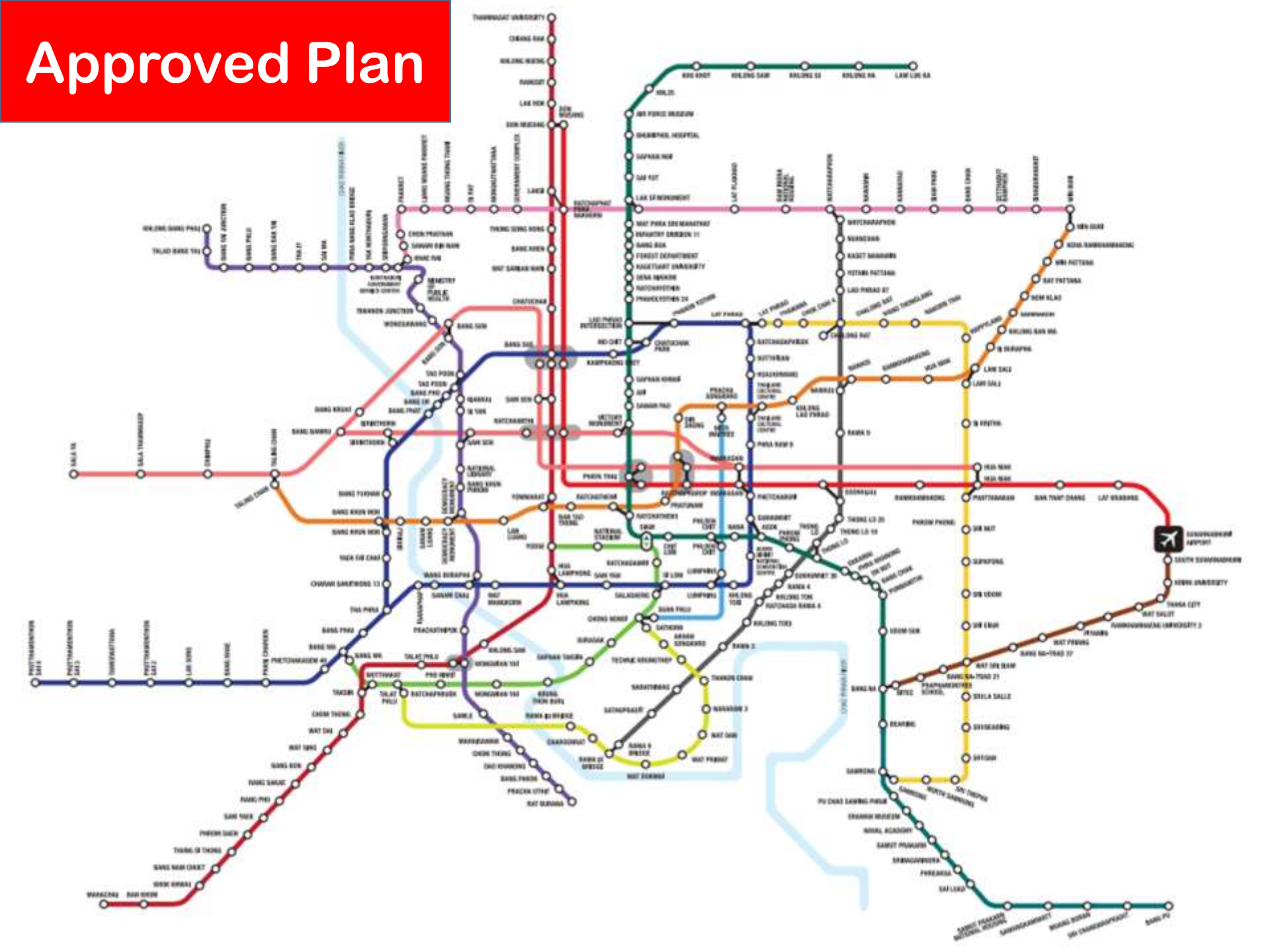


6 more Lines under construction



At Present → **Under Construction**

Approved Plan



Rails in BANGKOK carry a lot of passengers


Condominiums are
Constructed near
Rail stations


Condominiums are
Constructed near
Rail stations

BUT

Still severe traffic congestion remains.

WHY ?
HOW TO JUDGE?

<Bangkok>
Boom of Urban Rails followed by TOD

- Modal shift
  - Partially occurs as Rails are punctual and safe.
  - Mainly from former users of Air-Conditioned bus and taxi
  - Some from “choice” car users
  - Majority still prefer door-to-door movement
  - Mainly due to poor walking environment.

- Multi-modal Aspect
  - Many people have a choice of punctual mobility

<Bangkok>
Boom of Urban Rails followed by TOD

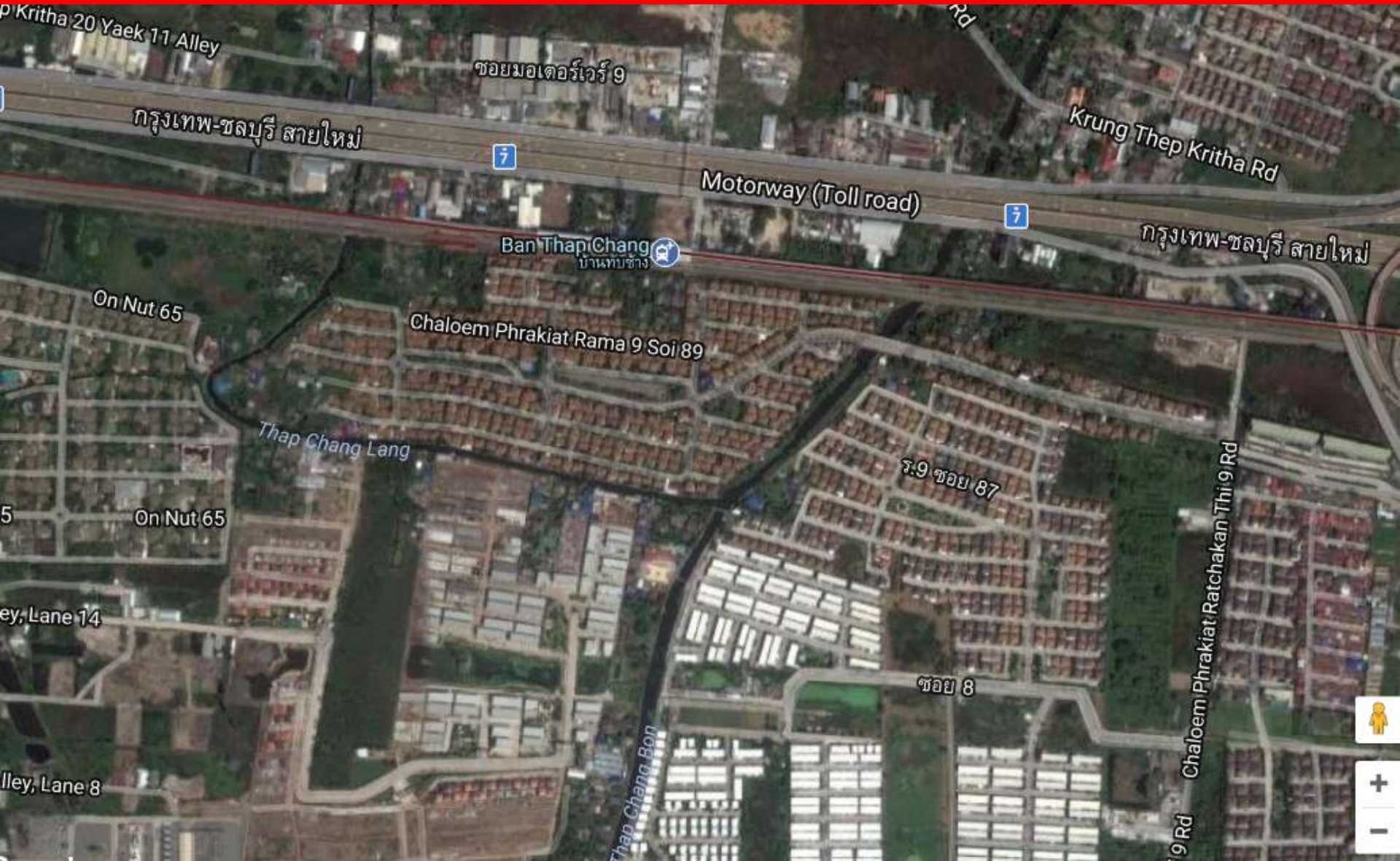
- Condominiums
  - Less consideration for walkability and its circulation
  - More consideration for garages and its circulation
  - Mainly Investment for richer people

<Bangkok>
Boom of Urban Rails followed by TOD

- Condominiums
  - Less consideration for walkability and its circulation
  - More consideration for garages and its circulation
  - Mainly Investment for richer people

Codominiums near stations look like TOD
But
Less contribution
to car reduction and better environment

<Bangkok>
Gated Community shift to TOD?



<Bangkok>
Gated Community shift to TOD?

<Bangkok>
Gated Community shift to TOD?

<Bangkok>
Gated Community shift to TOD?


CITY LINE


บ้านทับช้าง
BAN THAP CHANG


โปรดระมัดระวังอันตรายรถไฟ

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CITY CAR
Brasília


PEOPLE CITY
Curitiba

URBAN DESIGN & PLANNING

MODERN CITY

BRASÍLIA

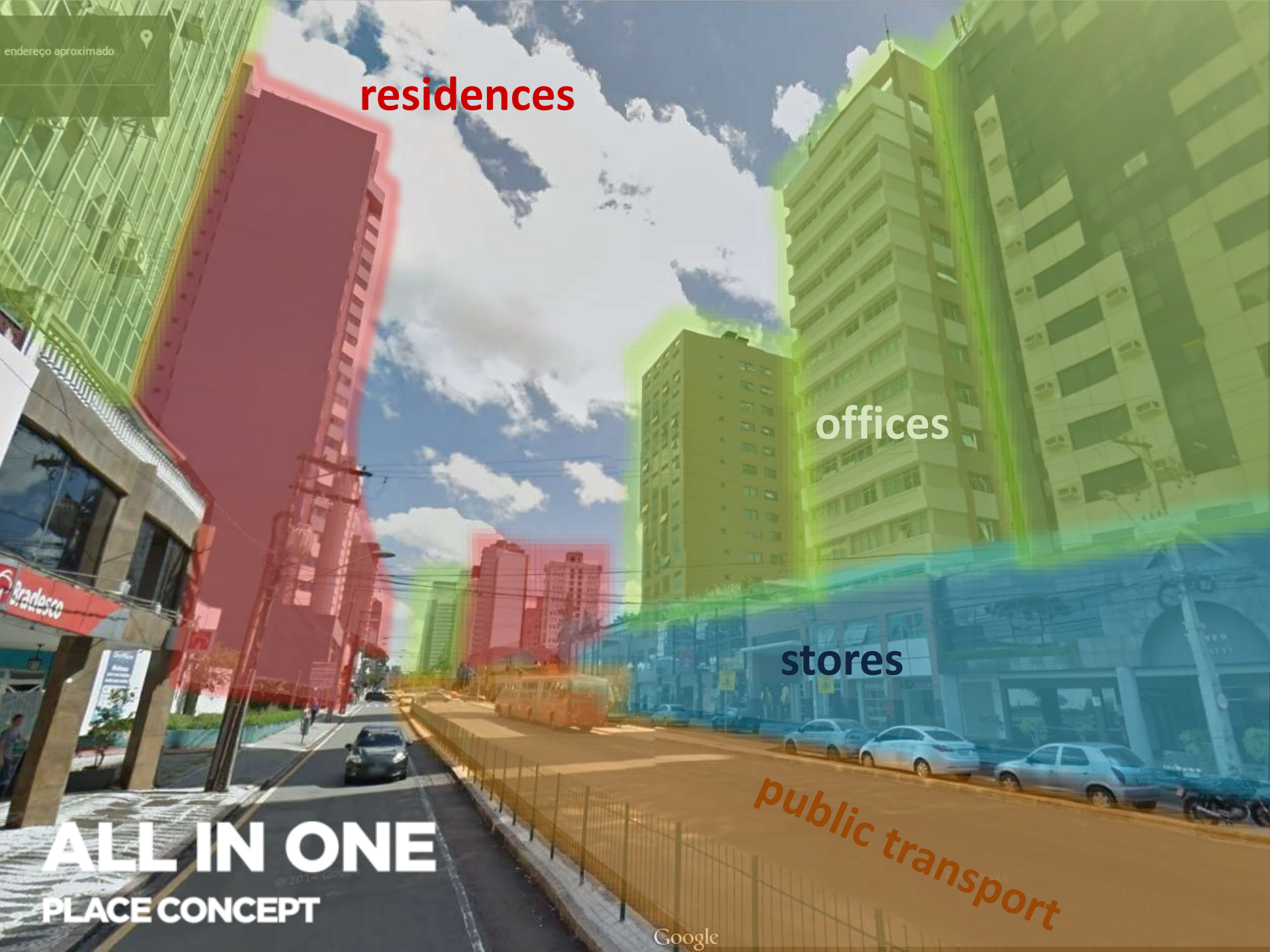
Density: 441.74 Hab/Km2

X

COMPACT CITY

CURITIBA

Density: 4056.72 hab/Km2


endereço aproximado
residences
offices
stores
public transport
ALL IN ONE
PLACE CONCEPT
Google

CURITIBA
1970

Divulgação

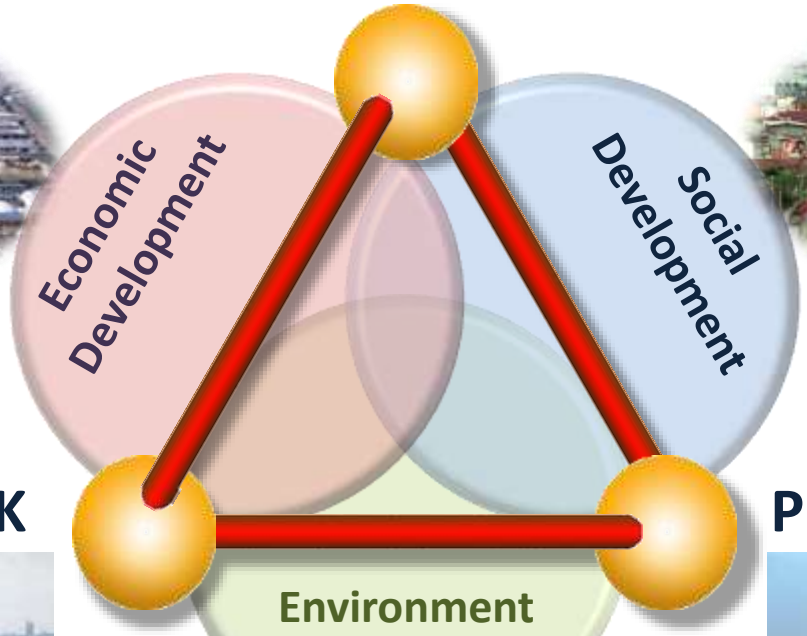
In the 1970s, Curitiba implemented the first exclusive lane to public transport.

The beginning of the implementation of structural axes

BASIS OF THE URBAN PLANNING

LAND USE

CIC



Job Line

STREET NETWORK

PUBLIC TRANSPORT

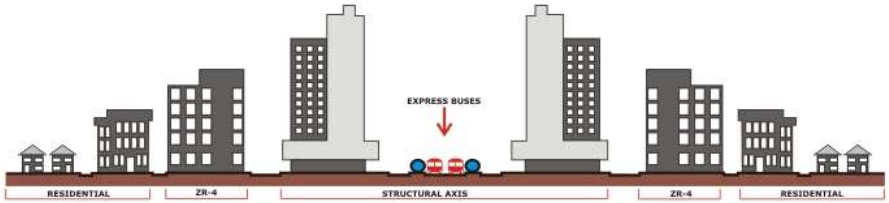
Barigui Park

STRUCTURAL AXIS

Curitiba adopted a very simple way to define its growth structure, combining three main concepts adopted in five main structural axes.

STRUCTURAL AXIS

LAND USE



STRUCTURAL AXIS

STREET NETWORK

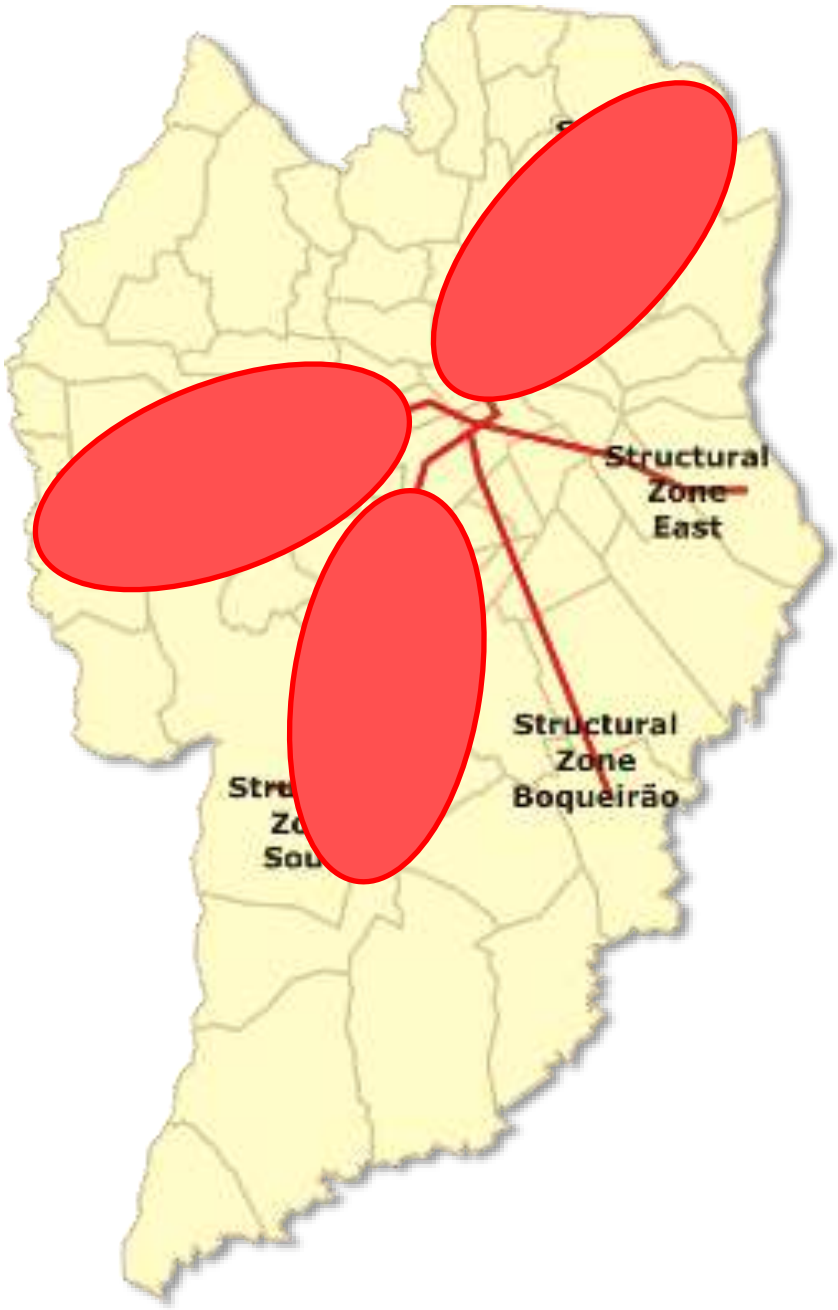
<Curitiba>
Well-Known Successful case of BRT based TOD

Pedestrian Street

BUS TERMINAL in DOWNTOWN PARK

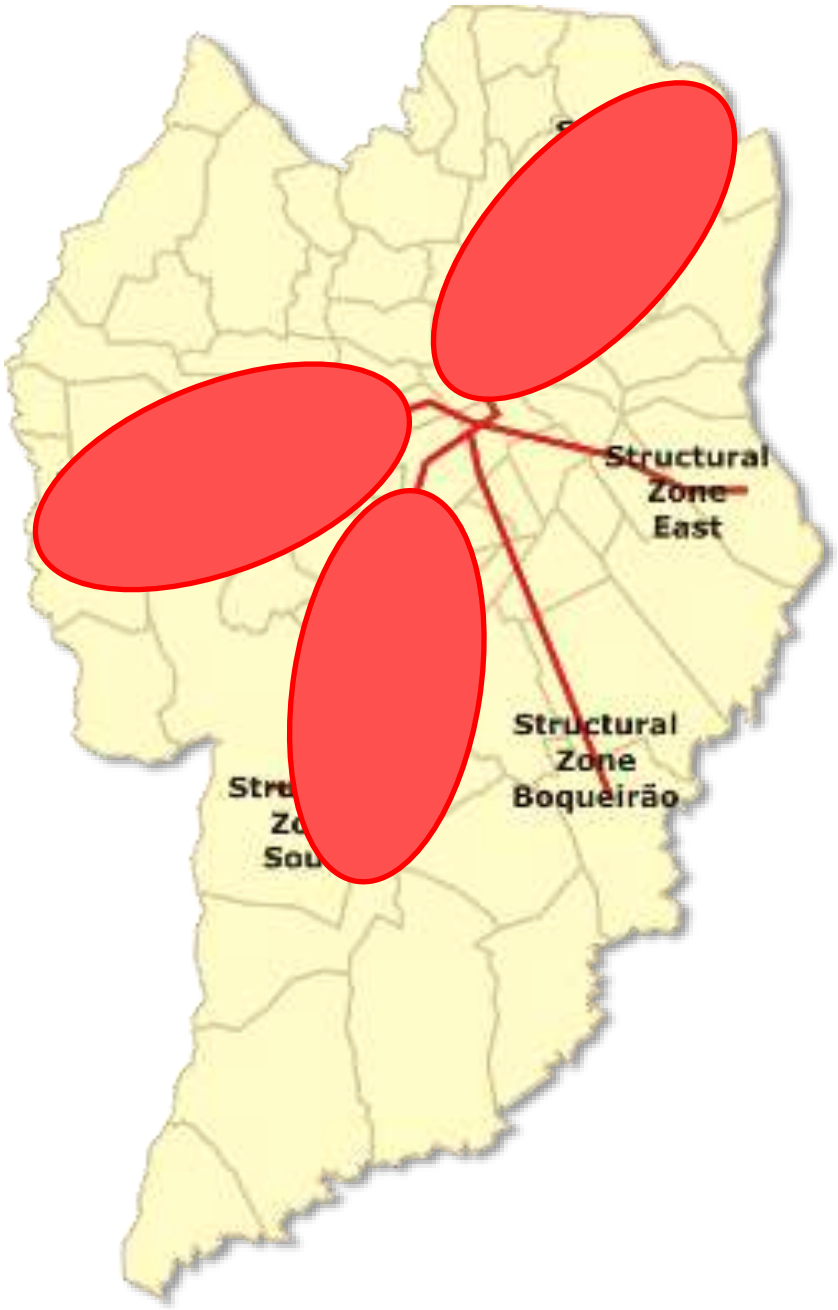
Serious Traffic Jam in Curitiba
WHY?

Development Axis Started to grow up



Development Axis Started to grow up

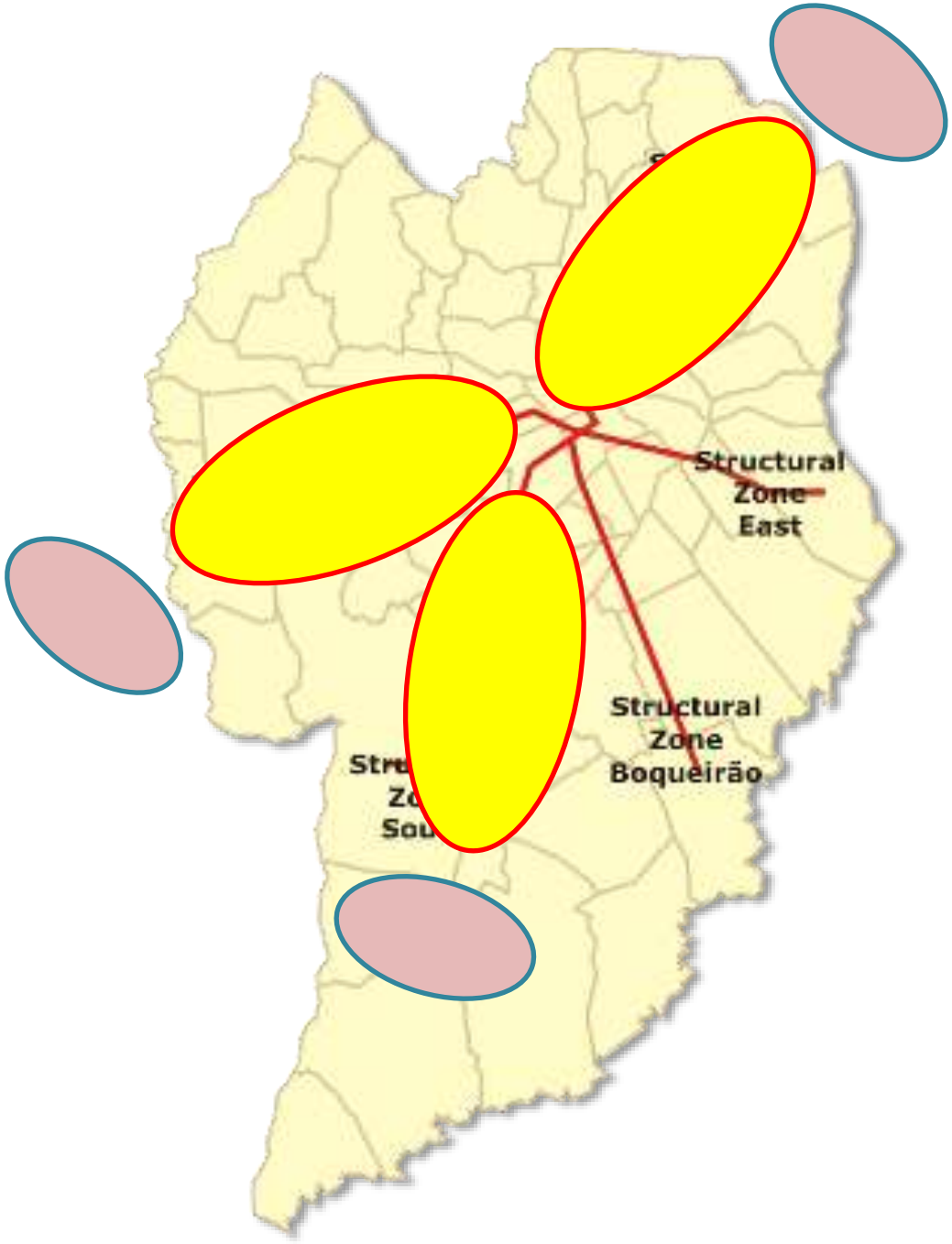
Attractive Condominiums



Development Axis Started to grow up

Attractive Condominiums

Rent Price UP



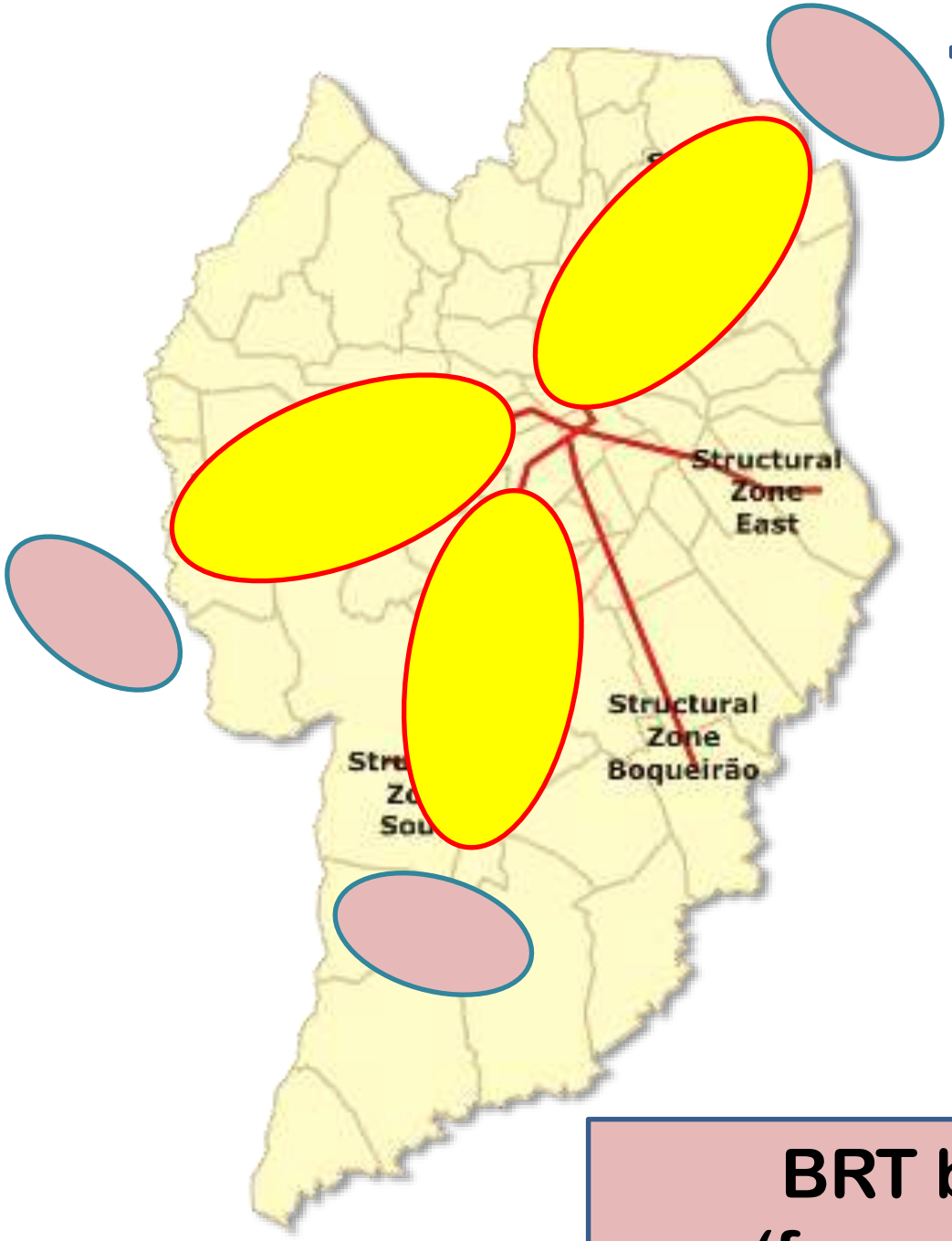
Development Axis
Started to grow up

Attractive
Condominiums

Rent Price UP

Rich People Lives

Low Income
outsided



Development Axis
Started to grow up

Attractive
Condominiums

Rent Price UP

Rich People Lives

Low Income
outsided

BRT bus are congested
(few use BRT on the axis)

BRT bus are congested
(few use BRT on the axis)

<Curitiba>
Well-Known Successful case of BRT based TOD

- No action to discourage car usage
- No need, no attractiveness to use buses
- Image of poor security is also affecting
- Two streams of Politics are also.
  - Subway should be the symbol of mega-city
  - Cars are symbol of industrial rich nation

- Even though, the city is struggling to revive.

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CAR USAGE
CAR PARKING

STRATEGY FRAMEWORK

SUPPLY SIDE & DEMAND SIDE
LONG TERM & SHORT TERM

for modal shift
Public Transit and Urban Planning should be Combined
(Transit Oriented Development)

LESS DEPENDENCE ON CAR USE

CONTROL BY ENFORCEMENT, PRICING

+

PROVISON OF ALTERNATIVE MODES (PUBLIC TRANSIT)

INTRODUCTION OF SUPPORTIVE DEVELOPMENT

TOD : TRANSIT ORIENTED DEVELOPMENT

Several Points should be noted learning from cases

- Urban Planning and Urban Public Transportation could work together.

- TOD is needed for Sustainable future
  - Control of Cars is needed
    - Especially inside the areas
    - Priority should be given to Pedestrian
  - Walkability of Areas should be designed
  - Variety of housing is needed
  - Quality, Safe and Reliable MRT or BRT is needed
  - Role of Private Sector would be appreciated.

Thank you for your kind attention.

YNU

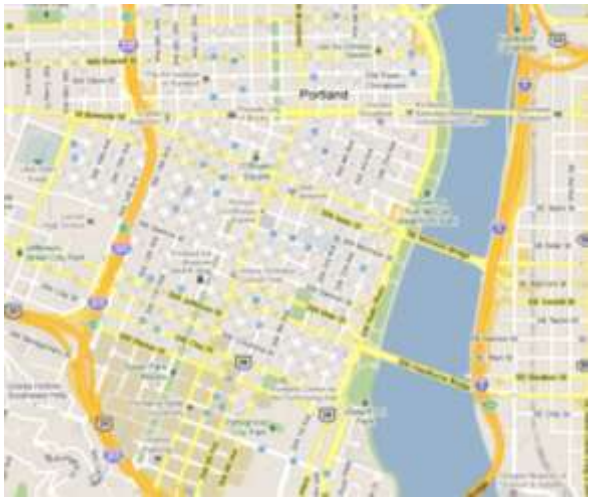
Needs, Potential and Limitation of BRT

By
Fumihiko Nakamura
Executive Director, Vice President
Professor
Yokohama National University

Comparison of Blocks

200m

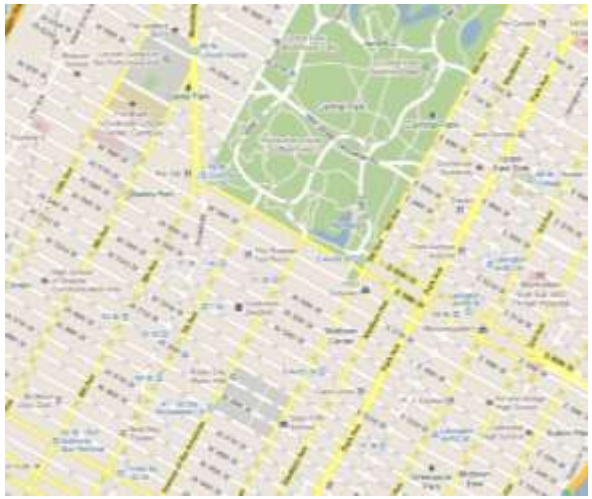
Portland



Vancouver

Chicago

Manhattan



Yokohama (Old Downtown)

Yokohama (New Area)

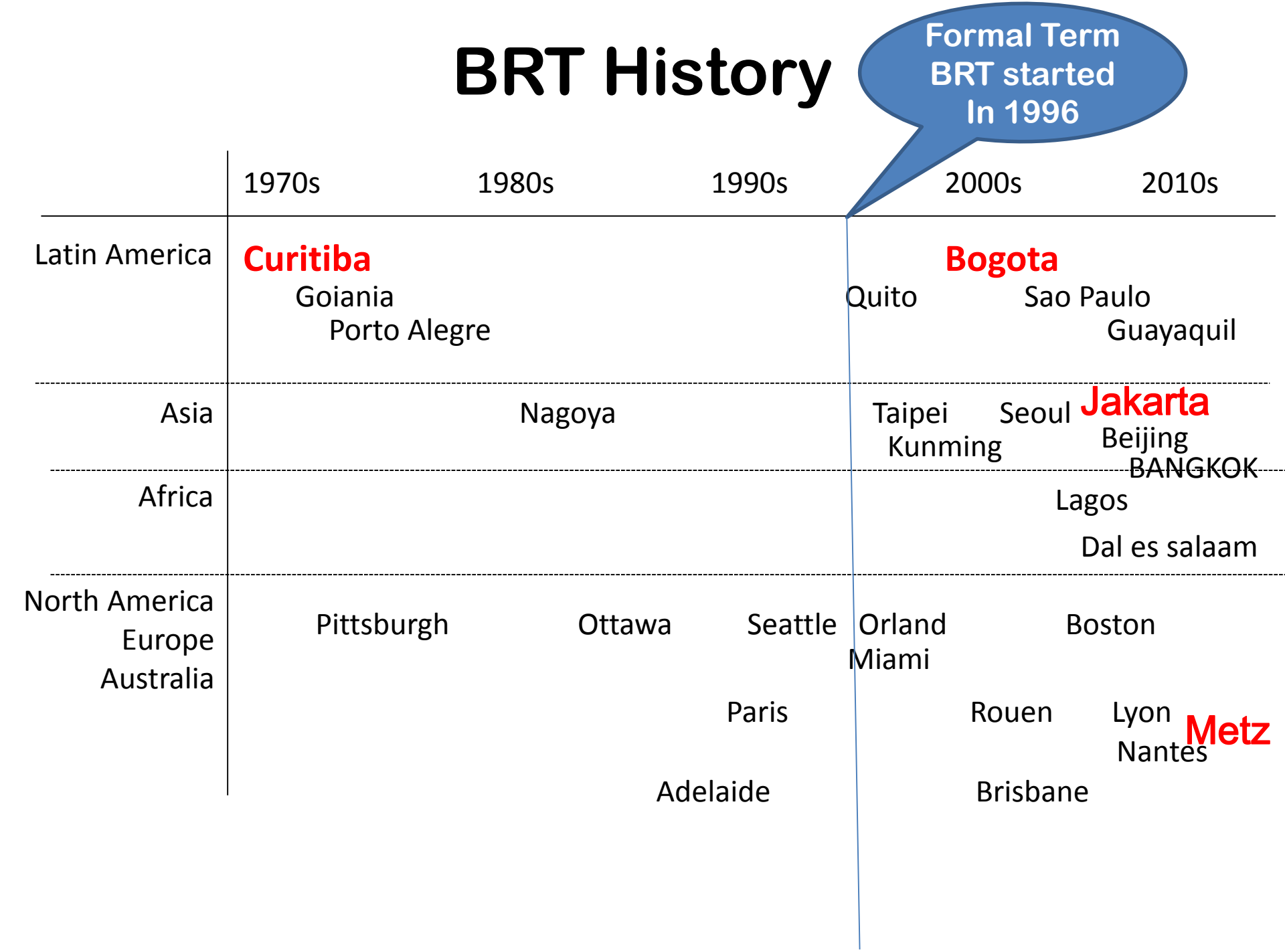
Contents of the Presentation

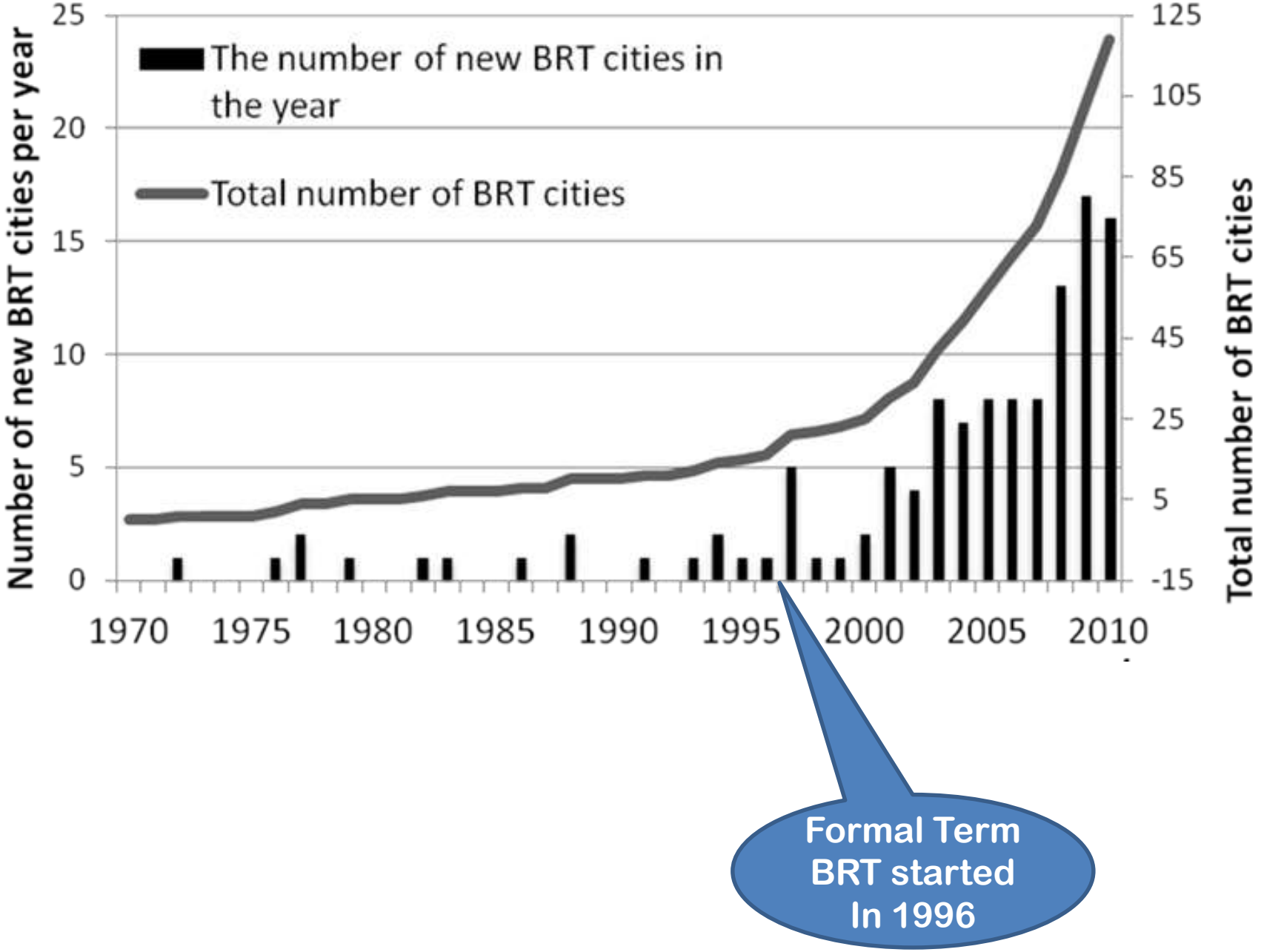
1. **What is BRT?**
2. Advanced BRT cases
    1. Curitiba
    2. Bogota
    3. Metz
    4. Jakarta
    5. Discussion
3. Future BRT
    1. Needs of BRT
    2. Potential of BRT
    3. Limitation of BRT

BRT Definitions

- **Bus Rapid Transit (BRT)**
  - Advanced bus system with high level of capacity, punctuality, operating speed, reliability and excellent and distinguished image to citizen.
  - a sustainable solution for urban transportation problems especially in developing cities.
- **BRT Cases in South-East Asian region**
  - several cities have already started BRT systems
  - many of them are facing with some serious criticism.
- **BRT Cases in Latin American region**
  - many keys to consider the possibilities.
- **BHLS (Bus with High Level of Service) (BHNS in French)**
  - Advanced bus system cases in Europe are called BHLS by UITP (International Union of Public Transport)

BRT History


Formal Term
BRT started
In 1996
1970s
1980s
1990s
2000s
2010s
Latin America
Curitiba
Goiania
Porto Alegre
Bogota
Quito
Sao Paulo
Guayaquil
Asia
Nagoya
Taipei
Seoul
Jakarta
Kunming
Beijing
BANGKOK
Africa
Lagos
Dal es salaam
North America
Europe
Australia
Pittsburgh
Ottawa
Seattle
Orland
Miami
Boston
Paris
Rouen
Lyon
Metz
Nantes
Adelaide
Brisbane


Number of new BRT cities per year
Total number of BRT cities
The number of new BRT cities in the year
Total number of BRT cities
25
20
15
10
5
0
125
105
85
65
45
25
5
-15
1970
1975
1980
1985
1990
1995
2000
2005
2010
Formal Term BRT started In 1996

BRT History 1974 to 2003

- **Curitiba, Brazil**
  - the **earliest** installation of BRT
  - Operation started in 1974.
- **Several Brazilian cities**
  - Started to introduce BRT (just with busways in many cases)
- **Some cities in Mexico, Peru and Ecuador**
- **Bogota, Colombia "Transmilenio"**
  - based on Curitiba's BRT with some of their own ideas
  - Operation started in 1999.
- **Other cases in 1999-2003**
  - After Bogota.
  - All cases do not look so impressive as that in Bogota

BRT History 2004 to now

- **Jakarta, Indonesia, "Transjakarta"**
  - started in 2004, created 170 km busways in 2010
- **Buses in United States and Canada, Australia and European countries (ex. Metz (France) in 2015)**
- **Indian and Chinese cities** (4 and 13 each)
- **African and Middle Eastern cities**
  - Dar es Salaam, Amman, Johannesburg)
- **Nagoya in Japan**
  - Center-located exclusive bus lanes operation started in 1982
- **Seoul**
  - Full re-organization of urban bus system with center-located exclusive bus lanes and ICT aided management and control (learning mainly from Curitiba)
- **Bangkok**

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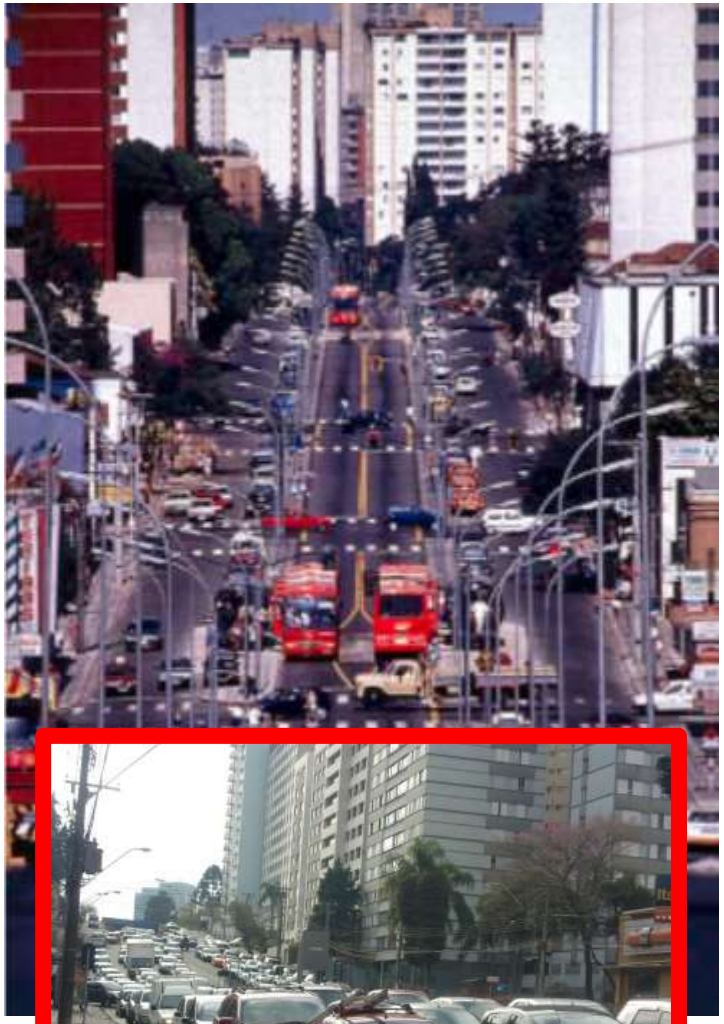
Bus system in Curitiba since 1974

High Density along the bus exclusive ways

Hierarchical bus network with different colored bus, and free-interchange, sometimes with public facilities near-by

Planned and managed by public & operated by private. Fare revenue is gathered to the city

PDCA-style revolution esp. from 1974 to 2000.Bus stop with raised platform and pre-payment gate with bi-articulate bus and so on.



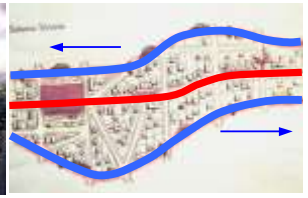
Car possessing and using are strongly promoted by federal government.
City center parking control was expired in 2004.

Less comfort due to less disciplined drivers

Low-income people cannot live along busways due to high land price. Residents along busways do not use buses but cars

Poor management and operation due to lack of ICT-aided systems

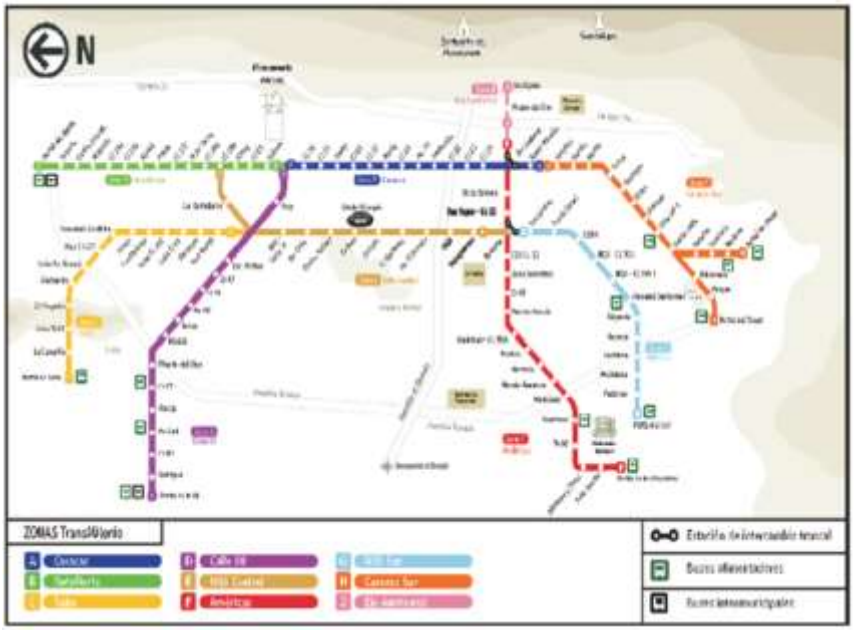
Poor PDCA (2000 -)



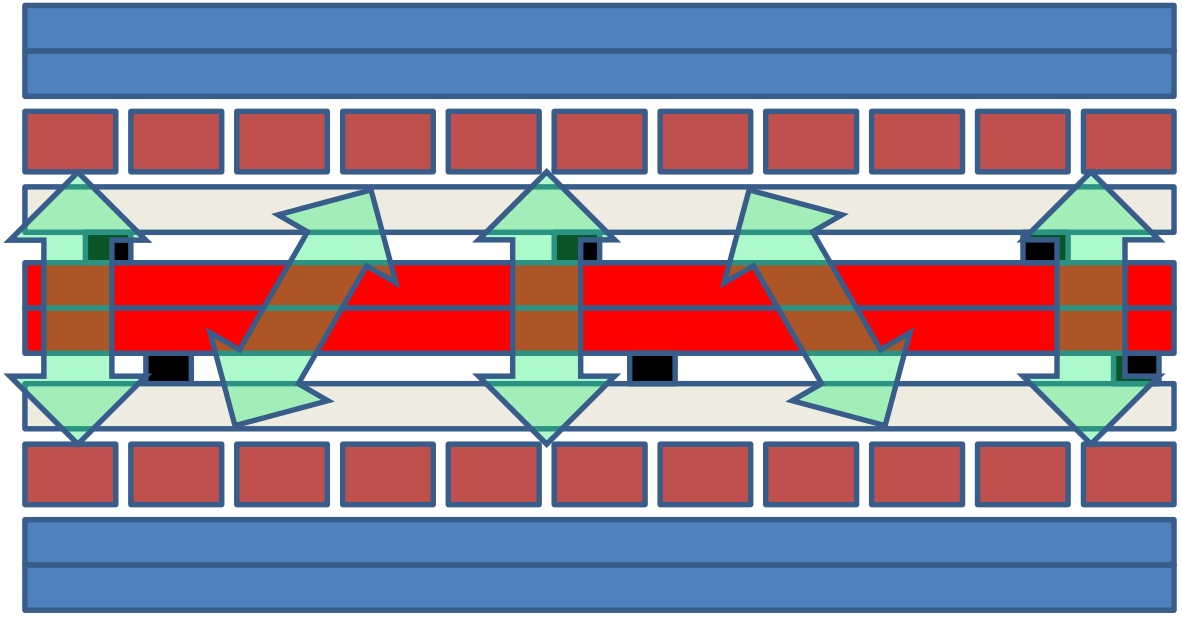
BRT in Bogota since 1999

- Gasoline Tax Increase For BRT funding
- License Plate Control For traffic reduction
- Highest Capacity (45,000 passenger/dir/h)
- High speed service by limited stop operation
- Gate control BRT and Free-ride feeder for No fare leakage
- Modal shift achieved by fast & secured service
- ICT oriented efficient management
- Human resource development for Quality staff

- No signal preemption sometimes cause delay
- No land use control along the corridors makes some troubles
- Poor management of pavement construction often causes serious delay



CURITIBA
N-S & E-W
axes



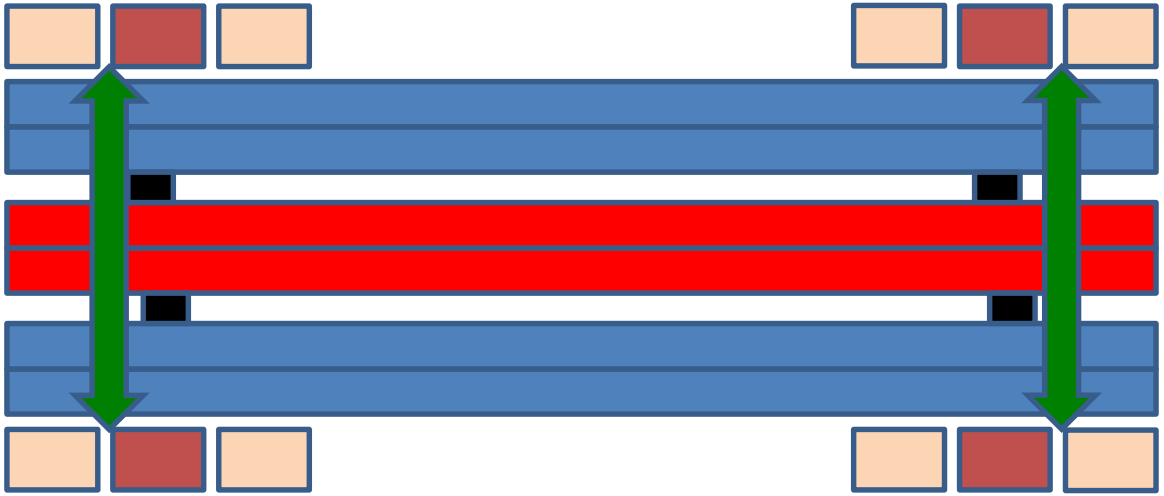
SLOW & LIGHT
Traffic

EASY ACCESS

SLOW & LIGHT
Traffic

Structural Axis in Curitiba is very unique in terms of continuity of space. random surface crossing and access to stops. These concepts should be preserved !

Typical BRT
with TOD



FAST & HEAVY
Traffic

LIMITED ACCESS

FAST & HEAVY
Traffic

METTIS (in Metz city in France)

Planned and Designed by urbanists

Urbanist proposed the design of the vehicle, which was realized.

Jakarta
Learned from Bogota, opened in 2004

- ∧∩T∩ -


DAMRI
5098
Call Center :
(021)80879449

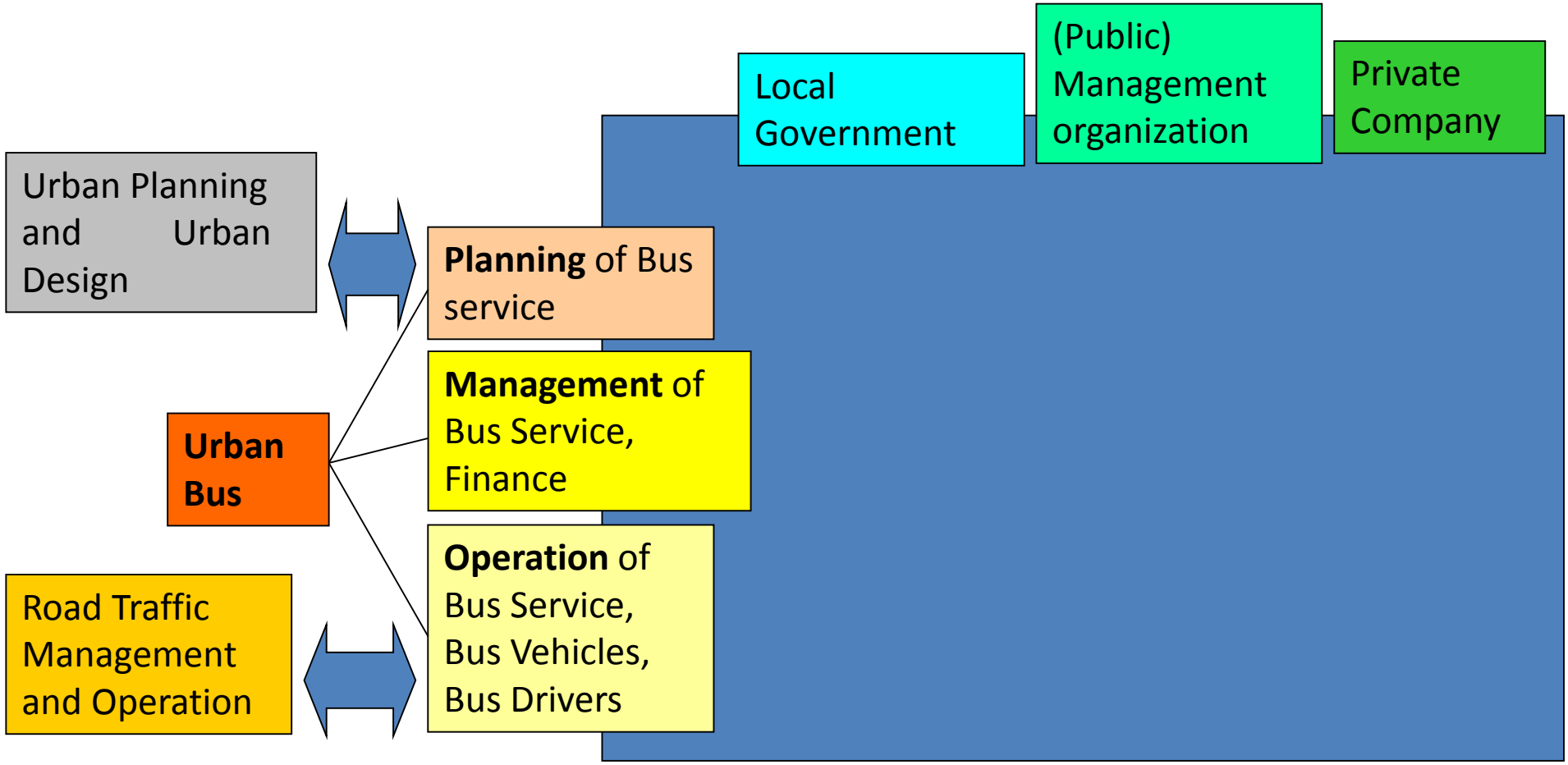

transjakarta


GADAI


The Jakarta Post
Isuzu

BRT elements		Fast	Safe	capacity	efficient
infrastructure	busway				
	Bus station				
	vehicle				
	ICT				
Planning Operation	scheduling				
	Station operation				
	Feeder connect				
Management	separation				
	Salaries				
	Fleet				
	staff				
Exogenous factors	Traffic				
	Car restriction				
	Land use				

Planning, Managing and Operating of Buses



Urban Bus (all buses) in Curitiba

	Local government with IPPUC	Public Authority (URBS)	Operator
planning	Decide concept	Decide everything	
management		Contract with operators. Fare revenue collection and distribution	
operation		Monitor by CS	do

BRT and Feeders in Bogota

	Local government	Public Company (Transmilenio)	Operator
planning	Decide concept	Decide everything	
management		Contract with operators. Fare revenue collection and distribution	
operation		**Monitor by full set of ICT**	do

Transmilenio for Planning, Management and CONTROL

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Needs of BRT (Developed cities)

- Clear Priority
  - Main modes : Rails and Metro
  - Sub-main modes : LRT or BRT
  - Feeder modes : BRT or buses

  - Higher capacity is not expected as it become costly.
  - Rather, punctuality is well expected.

Needs of BRT (Developing cities)

- BRT could be an alternative for main mode.
  - Clear Criteria
    - Capacity and Cost is deeply related
    - Personnel cost and Technical Transfer cost is serious
    - Short-term construction period and general flexibility should be attractive.
  - Important factors
    - Capacity, Cost, Image, Construction Period

Potential of BRT

- Cheaper Option
  - Utilization of Bus Technology
  - Utilization of Bus Management
- Quick Option
  - Utilization of Bus Infrastructure
- Trigger to restructure the whole bus system

- **High Performance for Arterial Buses**
  - **Higher Speed**
  - **Higher Punctuality**
  - **Higher Capacity**
    - **Higher capacity but Costly**
  - **Better Image**

- **Alternative to Rails**
  - **Lower Cost**
  - **Shorter Period for construction**

Limitation of BRT

- Ridiculous Argument on LRT vs. BRT

- LRT is better in terms of
  - image to citizen
  - better performance on Capacity /Cost

- Railway-like Bus vs. Flexibility of Bus

Future of BRT

- Importance of Planning, Management, Operation.
- **Taylor-made style approach**
  - how to manage the operators
  - how to design the roles of public sectors and private sectors,
  - how to coordinate the system with traffic management, land development, public facilities setting and other public transport modes,
  - how to control the whole system aided by information and communication technology.
- Sustainability
  - To attract car users
  - To be friendly to everyone
  - To be economically efficient

Furthermore for BRT

- **Strong arrangement and coordination** with
  - Existing bus operators
  - Feeder systems (bus and/or paratransit)
  - Car restriction policies
  - Traffic control system (traffic police)
  - Land use and Social welfare policies
- **Clear and powerful system** on
  - Human resource development and training
  - Money flow (fare, salary, etc.) management
  - Vehicle and infrastructure maintenance
  - ICT-aided secured and rapid service monitoring
- **Management renovation**
  - in advance for infrastructure planning implementation.

Thank you for your kind attention !!