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Urban Transportation Planning and TOD Research in Japan

Fumihiko Nakamura
Yokohama National University

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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
• E-mail: nakamura-fumihiko-xb@ynu.ac.jp
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.
Contents of the Lecture

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6. Learning from Latin American Cases
7. Discussion on Perspectives
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
Contents of the Lecture

1. Trend of Urban Transportation
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7. Discussion on Perspectives
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
Contents of the Lecture

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7. Discussion on Perspectives
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

- Smart
  - Environmentally Friendly
    - Economic Efficiency
    - Social Inclusion
  - Sustainability
    - Creativity
- ICT-aided
- Less Car Dependence
  - Less Car Usage (wise use of car)
  - CHANGE of TRAVEL BEHAVIOR (TDM) + ???
  - QUALITY OF CITY LIFE
    - Multi-modal + Inter-modal

In the diagram, the keywords are interconnected to represent their relationships and implications in a sustainable urban environment.
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)

BEFORE
Modal shift

HOME ➔ commuting ➔ OFFICE

AFTER

PARKING @ STATION ➔ PUBLIC TRANSIT

recommended

CAR ➔Modal shift ➔ CAR
Park & Ride (modal shift case 2)

Before

Modal shift

Public Transit (Bus)

After

Car @ Station

Public Transit

Not recommended
Park & Ride (modal shift case 3)

Before:
- HOME ➔ BUS ➔ STATION ➔ PUBLIC TRANSIT

After:
- HOME ➔ CAR ➔ PARKING @ STATION ➔ PUBLIC TRANSIT

Not recommended
Behavioral Change should be observed for evaluation not by the patronage
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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4. Strategy Framework

5. Learning from Asian Cases

6. Learning from Latin American Cases
7. Discussion on Perspectives
5.1 Tokyo
High Share of Rail for commuting

[Tokyo]

<table>
<thead>
<tr>
<th></th>
<th>RAIL</th>
<th>BUS</th>
<th>CAR</th>
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<tr>
<td>Tokyo</td>
<td>74%</td>
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<tr>
<td>N.Y.</td>
<td>43%</td>
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<tr>
<td>London</td>
<td>52%</td>
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</tbody>
</table>
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
DID and Commuter Rails in Tokyo
Tama-Den-En-Toshi
Unique Example of TOD

Private Railway Company initiated Development as well as rail construction
<Tokyo>
Tama-Den-En-En-Toshi
Unique Example of TOD

DEVELOPING GOOD ENVIRONMENT
MORE PASSENGERS
LAND PRICE RISE
RE INVESTMENT
Tokyo
Tama-Den-En-En-Toshi
Unique Example of TOD
1990’s
<Tokyo>
Tama-Den-En-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
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?

NEW RAIL SERVICE (ARL) HAS COME
<Bangkok>
Gated Community shift to TOD?

NEW RAIL SERVICE (ARL) HAS COME

New Small Gate Open Just for Pedestrian
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URBAN DESIGN & PLANNING

MODERN CITY
BRASÍLIA
Density: 441.74 Hab/Km²

cidade dispersa

COMPACT CITY
CURITIBA
Density: 4056.72 hab/Km²

cidade compacta
residences

offices

stores

public transport

ALL IN ONE
PLACE CONCEPT
In the 1970s, Curitiba implemented the first exclusive lane to public transport. The beginning of the implementation of structural axes.
Curitiba adopted a very simple way to define its growth structure, combining three main concepts adopted in five main structural axes.
<Curitiba>
Well-Known Successful case of BRT based TOD
Serious Traffic Jam in Curitiba

WHY?
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 outside

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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TARGET FOR CONTROL

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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)

**INTRODUCTION OF SUPPORTIVE DEVELOPMENT**

LESS DEPENDENCE ON CAR USE

CONTROL BY ENFORCEMENT, PRICING

**PROVISON OF ALTERNATIVE MODES (PUBLIC TRANSIT)**

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.
Needs, Potential and Limitation of BRT

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

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

<table>
<thead>
<tr>
<th>Region</th>
<th>1970s</th>
<th>1980s</th>
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<th>2010s</th>
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<td>Kunming</td>
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<td>Paris</td>
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<td>Adelaide</td>
<td></td>
</tr>
</tbody>
</table>

**Organized by presenters**

- Lagos
- Dal es salaam

**Formal Term BRT started In 1996**

- Metz
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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   2. Potential of BRT
   3. Limitation of BRT
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
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!
METTIS (in Metz city in France)

Planned and Designed by urbanists

Le DESIGN
Urbanist proposed the design of the vehicle, which was realized.
Jakarta
Learned from Bogota, opened in 2004
<table>
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<tr>
<th>BRT elements</th>
<th>Fast</th>
<th>Safe</th>
<th>capacity</th>
<th>efficient</th>
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<tr>
<td>Bus station</td>
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<td>ICT</td>
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<td>Land use</td>
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</table>
Planning, Managing and Operating of Buses

Urban Planning and Urban Design

Urban Bus

Road Traffic Management and Operation

Planning of Bus service

Management of Bus Service, Finance

Operation of Bus Service, Bus Vehicles, Bus Drivers

Local Government

(Public) Management organization

Private Company
# Urban Bus (all buses) in Curitiba

<table>
<thead>
<tr>
<th></th>
<th>Local government with IPPUC</th>
<th>Public Authority (URBS)</th>
<th>Operator</th>
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<td>planning</td>
<td>Decide concept</td>
<td>Decide everything</td>
<td></td>
</tr>
<tr>
<td>management</td>
<td></td>
<td>Contract with operators.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Fare revenue collection and distribution</td>
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<tr>
<td>operation</td>
<td></td>
<td>Monitor by CS</td>
<td>do</td>
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## BRT and Feeders in Bogota

<table>
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<th>Public Company (Transmilenio)</th>
<th>Operator</th>
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<td>Decide concept</td>
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<td>management</td>
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<td>Contract with operators.</td>
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<tr>
<td>operation</td>
<td></td>
<td>Monitor by full set of ICT</td>
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</table>

Transmilenio for Planning, Management and CONTROL
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2. Advanced BRT cases
   1. Curitiba
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   3. Metz
   4. Jakarta
   5. Discussion

3. Future BRT
   1. Needs of BRT
   2. Potential of BRT
   3. Limitation of BRT
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!!