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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Contents

• 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

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In 1950, only 7 cities from Asia...
World 30 Largest Metropolitan Areas (2003)

By 2003, 16 cities from Asia..

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Out of 52, 27 cities from Asia

Legend
- 5 mil
- 10 mil

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

<table>
<thead>
<tr>
<th>City</th>
<th>Years</th>
<th>Area Km²</th>
<th>First Subway</th>
</tr>
</thead>
<tbody>
<tr>
<td>London (1800-1901)</td>
<td>101</td>
<td>1580</td>
<td>1863</td>
</tr>
<tr>
<td>New York (1860-1920)</td>
<td>60</td>
<td>835</td>
<td>1904</td>
</tr>
<tr>
<td>Tokyo 23-ku (1895-1932)</td>
<td>37</td>
<td>621</td>
<td>1927</td>
</tr>
<tr>
<td>Bangkok (1945-80)</td>
<td>35</td>
<td>1577</td>
<td>2004</td>
</tr>
<tr>
<td>M. Manila (1945-75)</td>
<td>30</td>
<td>637</td>
<td>-</td>
</tr>
<tr>
<td>Jakarta (1945-75)</td>
<td>30</td>
<td>661</td>
<td>-</td>
</tr>
<tr>
<td>Seoul (1942-70)</td>
<td>28</td>
<td>606</td>
<td>1974</td>
</tr>
</tbody>
</table>

Data source: Compilation from multiple sources

* City proper (not extended metropolitan area)

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

Source: UN (2005)

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Urban density in Selected Metropolitan Areas 1995

- New York
- Los Angeles
- Paris
- London
- Tokyo
- Beijing
- Bangkok
- Jakarta
- Manila
- Taipei
- Seoul

Source: UITP (2001)

Urban density: Only urbanized area is considered

Higher urban density in Asian megacities

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Rapid increase of income and car ownership in Asian megacities
Not only ownership, but car usage rates are also higher…
Inadequate road in mega-cities of Asian developing countries

Road space ratio in selected cities

- New York
- London
- Paris
- Tokyo 23ku
- Seoul
- Bangkok
- Shanghai

Data source: MLIT, Vasconcello (2001)
Traffic Congestion

Average speed of road traffic 1995

<table>
<thead>
<tr>
<th>City</th>
<th>Average Speed (Km/hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangkok</td>
<td>15</td>
</tr>
<tr>
<td>Manila</td>
<td>16</td>
</tr>
<tr>
<td>Jakarta</td>
<td>17</td>
</tr>
<tr>
<td>Shanghai</td>
<td>21</td>
</tr>
<tr>
<td>Mumbai</td>
<td>24</td>
</tr>
<tr>
<td>Tokyo</td>
<td>30</td>
</tr>
<tr>
<td>London</td>
<td>35</td>
</tr>
<tr>
<td>Paris</td>
<td>40</td>
</tr>
<tr>
<td>New York</td>
<td>42</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>45</td>
</tr>
</tbody>
</table>

Data source: UITP (2001)

Severe Road traffic congestion in Asian megacities

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Traffic accident and Pollution

Traffic accident rate (1996)

- Jakarta
- Mumbai
- Shanghai
- Kuala Lumpur
- Bangkok
- Manila
- Singapore
- Tokyo
- Los Angeles

Death/bil. Veh-km

SPM Concentration (1998)

- N. Delhi
- Beijing
- Mumbay
- Shanghai
- Bangkok
- M. Manila

Data source: WHO AIMS

Recommended limit: 90 g/m³
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 levels 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

Current situation, problems, responses

• International experiences
• Asian cities’ characteristics
• Need of new perspective

Output 1: Vision-Guiding principles

Explore long-term strategic options for Asian cities

Output 2: Strategic Options

Specific issues and implementation measures

Output 3: Implementation measures

Conceptual framework (dynamic)

Case studies

Tokyo
Seoul
Hongkong
Taipei
Bangkok
M.Manila
Beijing
Jakarta
Hochimin - city

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

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

Accessibility: *Potential for interactions*

ECMT (2002)

Accessibility (High):
- Polycentric city structure
- Rail dominated transport

Accessibility (Low):
- Road-oriented city structure
- Car dominated transport

Mobility (Low):
- Low density sprawl
- Inadequate infrastructure

Mobility (High):
- High-density city structure
- Inadequate infrastructure

Developing Asian cities

Tokyo

US Cities

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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

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Operation Revenue of Public Transport
(% of operating cost)

Data source: UITP (2001)

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

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Comparative Examples from selected cities

*Seoul and Bangkok*

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

**Seoul city**
- Area: 606 sq km
- Population: 10.3 million

**Seoul Metropolitan Area**
- Area: 11,748 sq km
- Population: 21.4 million

### Seoul Metropolitan Area (% Share in Korea total)

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>11.8 %</td>
</tr>
<tr>
<td>Population</td>
<td>45.6 %</td>
</tr>
<tr>
<td>GRP</td>
<td>46.4 %</td>
</tr>
<tr>
<td>Business</td>
<td>43.7 %</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>48.8 %</td>
</tr>
<tr>
<td>Universities</td>
<td>42.3 %</td>
</tr>
</tbody>
</table>

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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

- 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

Seoul Metropolitan Area: New Towns

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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
Expansion of Road Network in Seoul City

Priority to road building: 1960s through 1980s

Source: Seoul Metropolitan Government

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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

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

Rate of motorization is even faster than the rate of road expansion…

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Increasing trend of parking: demand driven road transport strategy?

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Average road traffic speed in Seoul 1984-1998

Data source: Seoul Statistical yearbook

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

Inadequate suburban rail network

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Bus and Subway fare is well harmonized…
## Comparing Tokyo MA and Seoul MA (urban rail)

<table>
<thead>
<tr>
<th></th>
<th>Seoul MA</th>
<th>Tokyo MA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (sq km)</td>
<td>11,753</td>
<td>13,494</td>
</tr>
<tr>
<td>Population (million)</td>
<td>21.4</td>
<td>33.5</td>
</tr>
<tr>
<td>Subway (km)</td>
<td>287</td>
<td>333</td>
</tr>
<tr>
<td>Suburban rail (km)</td>
<td>200</td>
<td>1973</td>
</tr>
<tr>
<td>Daily ridership (mil)</td>
<td>6.5</td>
<td>13.2</td>
</tr>
<tr>
<td>Operating subsides</td>
<td>~25 %</td>
<td>Profit</td>
</tr>
<tr>
<td>Subway fare</td>
<td>100 yen</td>
<td>190 Yen</td>
</tr>
<tr>
<td></td>
<td>(12 km)</td>
<td>(10 km)</td>
</tr>
</tbody>
</table>

**Seoul**

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

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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

<table>
<thead>
<tr>
<th>Mode</th>
<th>Year 2000</th>
<th>2006 (target)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td>26.0%</td>
<td>33.4%</td>
</tr>
<tr>
<td>Subway</td>
<td>34.6%</td>
<td>36.6%</td>
</tr>
<tr>
<td>Car</td>
<td>26.9%</td>
<td>18.7%</td>
</tr>
<tr>
<td>Others</td>
<td>12.5%</td>
<td>11.3%</td>
</tr>
</tbody>
</table>

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

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Seoul Bus Reform: 8 Programs (from 2004)

4. Bus Management system

5. Smart card system

- Makes integrated fare collection possible

State-of-the-Art IT application
6. Exclusive Median Bus Lane

7. Quality buses & shelters

8. New urban governance
Impact of Bus Reform: Preliminary results

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

<table>
<thead>
<tr>
<th></th>
<th>Dobong-Mia Street</th>
<th>Soosek-Sungsan Street</th>
<th>Dobong-Mia Street</th>
<th>Soosek-Sungsan Street</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before reform</td>
<td>Bus Speed</td>
<td>Car Speed</td>
<td>Bus Speed</td>
<td>Car Speed</td>
</tr>
<tr>
<td>After reform</td>
<td>20</td>
<td>15</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>(no bus lane)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(bus lane)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data source: Seoul Metropolitan Government (2005)

Significant improvement in traffic speed

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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
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**

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## Bangkok

### 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

### Bangkok Metro. Region (% Share in Thai total)

<table>
<thead>
<tr>
<th></th>
<th>Area</th>
<th>Population</th>
<th>GRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangkok MA</td>
<td>1.1%</td>
<td>15.6%</td>
<td>48.2%</td>
</tr>
</tbody>
</table>

(C) Dr. Surya Raj ACHARYA, Institute for Transport Policy Studies, 2006
Urban Expansion of Bangkok

- Mono-centric urban form
- Expansion of built-up area along arterial roads
- Weak land-use planning and control
Population densities in Bangkok MR (BMR)

High density in inner city areas

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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

Average car speed in central city area

Km/hr

1989 8
1998 10
2003 15

Speed Data Source: Hanaoka (2005)

<table>
<thead>
<tr>
<th>Exprs. ways</th>
<th>Open. Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>I stage</td>
<td>1981-87</td>
</tr>
<tr>
<td>II stage</td>
<td>1993-00</td>
</tr>
<tr>
<td>III stage</td>
<td>Planned/Unde r const</td>
</tr>
<tr>
<td>IV stage</td>
<td>1996-00</td>
</tr>
<tr>
<td>Other</td>
<td>1994-00</td>
</tr>
</tbody>
</table>
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**

- Operation Revenue: 560 million Bhat
- Operation Expenses: 867 million Bhat
- Operation Loss: 307 million Bhat

Data Source: BMTA (2005)

1 Bhat = 3 Yen

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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

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Public Transport fare level and modal split

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

1 Bhat = 3 Yen

<table>
<thead>
<tr>
<th>Fare Level (Thai Bhat)</th>
<th>Modal Split in Bangkok MR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary bus: 4-8</td>
<td>100%</td>
</tr>
<tr>
<td>AC Bus: 10-18</td>
<td>90%</td>
</tr>
<tr>
<td>Sky train: 10-40</td>
<td>80%</td>
</tr>
<tr>
<td>Subway: 14-36</td>
<td>70%</td>
</tr>
<tr>
<td>Subway: 14-36</td>
<td>60%</td>
</tr>
<tr>
<td>Subway: 14-36</td>
<td>50%</td>
</tr>
<tr>
<td>Subway: 14-36</td>
<td>40%</td>
</tr>
<tr>
<td>Subway: 14-36</td>
<td>30%</td>
</tr>
<tr>
<td>Subway: 14-36</td>
<td>20%</td>
</tr>
<tr>
<td>Subway: 14-36</td>
<td>10%</td>
</tr>
<tr>
<td>Subway: 14-36</td>
<td>0%</td>
</tr>
</tbody>
</table>

1 Bhat = 3 Yen

(C) Dr. Surya Raj ACHARYA, Institute for Transport Policy Studies, 2006
Bangkok Urban Rail Development Plan

Total route of 291 km by 2009.

Ambitious Plan!

Source: OPT (2004)

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Bangkok: Summary and Issues

1. Suburbanization

- Weak land use control
- Arterial and narrow streets only

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

<table>
<thead>
<tr>
<th>Urban form and Land Use</th>
<th>Seoul MA</th>
<th>Bangkok MR</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Strong Land-use control • High density, mono-centric</td>
<td></td>
<td>• Weak land use • Ribbon-type expansion</td>
</tr>
<tr>
<td>Urban density Avg Commuting distance Cross commuting</td>
<td>230 pers/ha 12.9 km 14.8 %</td>
<td>62 persons/ha 20 km (106 min) 47.2 %</td>
</tr>
<tr>
<td>Urban roads/motorization</td>
<td>• Toll-free Expressways • Good stock of roads? • Control on car use</td>
<td>• Expressways with toll • Secondary roads missing • No control on car use</td>
</tr>
</tbody>
</table>
**Comparative analysis: differences**

<table>
<thead>
<tr>
<th>Public Transport (PT) and urban railways</th>
<th><strong>Seoul MA</strong></th>
<th><strong>Bangkok MR</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- PT mode share high</td>
<td>- PT share much lower</td>
<td></td>
</tr>
<tr>
<td>- Balanced and integrated Bus/MRT fares</td>
<td>- Bus fare subsidized, but MRT not subsidized</td>
<td></td>
</tr>
<tr>
<td>- Challenge: maintain public transport mode share</td>
<td>- Challenge: modal shift from private to public mode</td>
<td></td>
</tr>
<tr>
<td>- Response: Bus reform</td>
<td>- MRT investment</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th><strong>Seoul MA</strong></th>
<th><strong>Bangkok MR</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Subway/MRT</td>
<td>287 km</td>
<td>43.5 km</td>
</tr>
<tr>
<td>Suburban rail</td>
<td>200 km</td>
<td>-</td>
</tr>
<tr>
<td>Public mode share</td>
<td>61.2 %</td>
<td>29 %</td>
</tr>
<tr>
<td>Bus fare</td>
<td>100 yen</td>
<td>35-60 yen</td>
</tr>
<tr>
<td>MRT Fare</td>
<td>100 yen</td>
<td>40-120 yen</td>
</tr>
</tbody>
</table>

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

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Policy Implications for Asian Megacities

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

<table>
<thead>
<tr>
<th>Factors</th>
<th>Lower income stage</th>
<th>Higher income stage</th>
<th>Policy implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>○</td>
<td>○</td>
<td>Basic infrastructure needed</td>
</tr>
<tr>
<td>Cost (affordability)</td>
<td>○</td>
<td>○</td>
<td>Subsidy more effective in low income stage</td>
</tr>
<tr>
<td>Quality of service</td>
<td></td>
<td></td>
<td>As the income rises, service quality is important</td>
</tr>
<tr>
<td>• Accessibility</td>
<td>○</td>
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<td>• Comfort</td>
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</table>

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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）