Key Issues for Mass Rapid Transit in Bangkok

~ from Japanese and Asian experiences ~

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I. Introduction

Rapid Increase of Population from 1 to 5 millions

- Jakarta: 1800 - 2000, 25 years
- Manila: 1800 - 2000, 25 years
- Bangkok: 1800 - 2000, 35 years
- Seoul: 1800 - 2000, 28 years
- Bogota: 1800 - 2000, 34 years
- Lima: 1800 - 2000, 37 years
- Sao Paulo: 1800 - 2000, 34 years
- Mexico City: 1800 - 2000, 34 Years
- Rio de Janeiro: 1800 - 2000, 68 years
- Tokyo 23 Wards: 1800 - 2000, 37 years
- New York: 1800 - 2000, 60 years
- London: 1800 - 2000, 101 years

S.MORICHI
Highest Population Density in Asian Megacities

Seoul
Taipei
Manila
Jakarta
Bangkok
Beijing
Bogota
Mexico
Santiago
Tokyo
Buenos Aires
Sao Paulo
London
Rio de Janeiro
Paris
Curitiba
Los Angeles
New York

(S.MORICHI)
Rapid growth of mega-cities and motorization in Asia

- Many mega-cities are in Asia
- High density and Rapid growth of population
- Serious traffic congestion becomes bottle neck of the economy
- Required modal shift from automobile to railway

Mono-centric Urban Structure and Over-concentration in capital city
Population Decentralization: possible spatial patterns

- **Mono-centric**
  - Low density dispersion
  - Undesirable!

- **Poly-centric decentralization**
  - Car-oriented sprawl
    - Undesirable!
  - Public-transport oriented poly-centric form
    - Desirable!
  - Or Transit corridor with weak centers
GDP per capita and city-level car ownership rate

Higher car ownership rate in developing megacities for given GDP per capita level
## Road Space in Selected Cities 2004

<table>
<thead>
<tr>
<th>City</th>
<th>Area (Km²)</th>
<th>Pop. Density Per/ha</th>
<th>Road Area (Km²)</th>
<th>% (city area)</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Paris</td>
<td>105</td>
<td>202</td>
<td>27</td>
<td>25.8</td>
</tr>
<tr>
<td>New York City</td>
<td>678</td>
<td>112</td>
<td>210</td>
<td>25.2</td>
</tr>
<tr>
<td>Inner London (12 boroughs)</td>
<td>589</td>
<td>72</td>
<td>96</td>
<td>16.4</td>
</tr>
<tr>
<td>Inner Tokyo (8 wards)</td>
<td>110</td>
<td>121</td>
<td>24</td>
<td>21.7</td>
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<tr>
<td>Tokyo 23-wards</td>
<td>621</td>
<td>131</td>
<td>114</td>
<td>18.1</td>
</tr>
<tr>
<td>Seoul City</td>
<td>605</td>
<td>168</td>
<td>80</td>
<td>13.3</td>
</tr>
<tr>
<td>Taipei City Inner Core</td>
<td>134</td>
<td>197</td>
<td>20</td>
<td>14.9</td>
</tr>
<tr>
<td>Shanghai City Inner Core</td>
<td>108</td>
<td>378</td>
<td>13</td>
<td>12.0</td>
</tr>
<tr>
<td>Bangkok City Core</td>
<td>225</td>
<td>96</td>
<td>16</td>
<td>7.2</td>
</tr>
<tr>
<td>Jakarta City</td>
<td>656</td>
<td>133</td>
<td>48</td>
<td>7.3</td>
</tr>
</tbody>
</table>

Data source: STREAM Study compilation

**Asian Megacities:**

- In adequate road
- Inefficient road hierarchy
Rapid growth in motorcycle ownership
Impact on safety and environment
Urban sprawl and low density land-use in suburban area
Environment for Pedestrian

Lack of Car Parking Space and regulation
II. History of Urban Railway Master Plan in Tokyo Metropolitan Area

• The plan is a proposal report by the Council for Transport Policy
• The role as master plan
  * The Ministry of Transport has never approved the permission for the construction of railway line which was not include in the proposal plan.
  * Local governments and railway companies have to wait 15 years for next chance of the council.
• The financial scheme and institutions have been proposed by the Council for the implementation of the plan.
• The outline of the network had been decided in 1960s.
  * Coordination between urban development and railway
  * Information for private sector for their investment
1\textsuperscript{st} Master plan of Urban railway in Tokyo

- Proposal by Railway Association and Japan Society of Civil Engineer 1919: 5 Lines
- Ministry of Interior approved Plan of 7 lines
  (2 Lines had been eliminated 2 years later).

![Map of the 1\textsuperscript{st} Master plan of Urban railway in Tokyo](image-url)

- Urban Railway plan, 1920
- Tram
- Private Railway
- JNR
Plan in 1925 after the Earthquake in 1923 : 5 Lines

1st line between Asakusa and Shinbashi was started the construction in 1925, and the operation in 1927.
Plan in 1946 after the World War : 5 Lines

- Lines were expanded outside of Yamanote Line
- Early construction of Line 4 (Marunouchi Line)
- The financial resource was GARIOA (Government Appropriation for Relief in Occupied Area)
Report # 1 of the Council for Urban railway (1956)

- 7 Lines
- Direct operation between subway line and two private railway lines
- Additional subway organization
Transfer of tram lines to subway and subsidy scheme (Report # 4)
10 Lines
- Upgrade of subsidy ratio, and new subsidy scheme for Newtown railway
- 13 Lines (existing lines in 2017)
Revise the plan Including the Plan of JR, Tsukuba Express
The Special Account by increasing fare
The low for Tsukuba Express and for value capture.

- Revise the plan
- Priority for the lines
- Vertical division for railway
- New subway subsidy scheme
- Gas tax as financial resource for urban railway

<table>
<thead>
<tr>
<th>Category</th>
<th>A1</th>
<th>A2</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start the operation until 2015</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Start the construction until 2015</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Additional study</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(注) 1. 本図は、線路の状況について、概ねのルートによりネットワークの概要を示したものである。
2. 「路線の新設」には貨物線の線路線化、「複線線」等には改良を含む。
Distance of Urban Railway Lines

Km

- Double
- Double Truck
- Subway
- Private Railway
- JR
Demand for each direction
Main Issues in the plan 2000
(1) Congestion
(2) Travel Speed
(3) Urban Renewal
(4) Access to Airports and HSR Stations
(5) Seamless Service
(6) Barrier-free

Additional issues in 2015
① Quality of Station Space
② Delay of operation
③ Disaster
Purposes of the Master plan 2015

(1) Urban Railway for higher international competitiveness

(2) Urban railway for higher quality of life

(3) Sustainable Urban Railway coordinated with Urban Development

(4) Innovation of Station Space

(5) Reliability

(6) Disaster-proof
Master Plan for 2030
(Proposed in 2016)
Ⅲ. Key Issues for Urban Railway in Asian Megacities

Public transport share is going down under the growing economy and motorization. What are key issues for this problem?

1. The urban railway system have to meet the future demand and land-use in mega-city.
   Master plan and its implementation are essential.
2. The timing of investment for urban railway is considered.
3. Hierarchy railway network is required for mega-cities as same as road network.
4. Road policies related to urban railway such as Station plaza, car parking regulation, and cost for car usage are important.
5. Profitability of railway operators is necessary for the innovation of service and operation.

Financial schemes is discussed in next chapter Ⅳ.
1. The urban railway system for future demand

• Without Railway, with BRT and with LRT, it is impossible to manage the huge transport demand in Asian Megacities.
  ex. Failure in Manila: two hours waiting time at peak hour for LRT 3
  The master plan of urban railway network in Tokyo in early 1960’s.

• Car oriented system: Low density land-use and sprawl in suburban area: Difficulty of railway development forever

• Master-plan of urban railway network for long term.
  Coordination between “transport and land-use”,
  and “railway and road”
2. The timing of investment for urban railway

- Delay of Urban railway operation means urban sprawl because of usage of cars and motorcycles.
- Railway demand share will be low under such low density land-use, if urban railway will be introduced in future. • • • ex. Los Angels
- To early introduction of urban railway cause financial problems, because the cost is too high for economy level and fare level is too low.

- Timing is difficult in Asia because of huge population and increasing speed
  - Low fare of bus, many bikes
  - Opposition to higher fare of public transport
Timing of MRT development: to maintain the high share of public transport mode

Timing should be decided considering the state of all indicators!
Timing of transit investment and ridership trend

Taipei: Investment not too late
→ Ridership regained

US: Late investment
→ only marginal gain in ridership
3. Hierarchy railway network

- The necessity of hierarchy road network is well known. (Urban expressway, Arterial road, Collector & Distributor and Local road)

- Function of higher level road is mainly for car traffic, and it for lower level road is mainly as the space for activities in the community.

- The hierarchy railway network is necessary in mega-city

- Wider distances between stations and High speed railway lines for long trips from suburban area to down town, Railway lines with short distances between stations for short trips and feeder trips.
<table>
<thead>
<tr>
<th>Railway Type</th>
<th>St. Spacing</th>
<th>Operating Speed *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shinkansen Railway (Bullet Train)</td>
<td>30 – 50 km</td>
<td>120 -130 km / hr</td>
</tr>
<tr>
<td>Inter-city Train (Japan Railways)</td>
<td>5 – 6 km</td>
<td>50 - 60 km / hr</td>
</tr>
<tr>
<td>Express Train (Private Railways)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ordinary Train (Private Railways)</td>
<td>1 – 2 km</td>
<td>40 - 45 km / hr</td>
</tr>
<tr>
<td>Subway</td>
<td>0.5 – 1 km</td>
<td>30 - 35 km / hr</td>
</tr>
<tr>
<td>Monorail / AGT</td>
<td>0.5 – 1 km</td>
<td>20 - 30 km / hr</td>
</tr>
</tbody>
</table>
4. Road policies related to urban railway

Station Plaza

- Station Plaza is necessary for feeder service and urban development.

The case of LRT1 in Manila

The plan of surface LRT was changed to elevated line to keep road space, however the road congestion became more serious because of many waiting Jeepnies and tricycles for feeder service at stations.

- The cost was shared by road budget of local government and railway company by the fixed rule and central government gives subsidy.

Car Parking and Bicycle Parking Space

- Regulation for parking Space
- Regulation for Garage
- Parking at Railway Station (Feeder Transport)

Cost of automobiles

Automobile Tax, Fuel Tax, Tool Rate, Parking Fee
## 5. Profitability of railway operators

Subways in Tokyo and Taipei are profitable (2005), while in other cities not profitable in spite of huge subsidy.

<table>
<thead>
<tr>
<th></th>
<th>Tokyo</th>
<th>Seoul¹</th>
<th>Taipei</th>
<th>London</th>
<th>New York</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tokyo Metro</td>
<td>Toei Metro</td>
<td>Seoul Metro</td>
<td>SMRT</td>
<td></td>
</tr>
<tr>
<td>Route (km)</td>
<td>183</td>
<td>109</td>
<td>135</td>
<td>152</td>
<td>67</td>
</tr>
<tr>
<td>Passengers (mil/year)</td>
<td>2,110</td>
<td>761</td>
<td>1,440</td>
<td>819</td>
<td>361</td>
</tr>
<tr>
<td>Pass/km/day (1000 persons)</td>
<td>32</td>
<td>19</td>
<td>29</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Revenue/cost</td>
<td>1.29</td>
<td>1.07</td>
<td>0.74</td>
<td>0.55</td>
<td>1.07</td>
</tr>
<tr>
<td>Fare (US$)</td>
<td>1.3 ~ 2.5</td>
<td>1.4 ~ 3.5</td>
<td>0.8 ~ 1.1</td>
<td>0.6 ~ 1.9</td>
<td>3.0 ~ 8.0</td>
</tr>
</tbody>
</table>

1. Data year 2003. 2. Revenue/cost includes also of bus.

Data source: Seoul (Sung 2007), rest from homepage of respective agencies.
Profitability of Urban Railway

- Profitability is key issue for successful railway projects.
- Only profitable operators can innovate the railway system R&D, Expansion of network, Improvement of System, etc.

Japan: 50% of Construction Cost, No subsidy for operation cost
   (25% Government, 25% Local Government)
US & EU: 100% of Construction Cost, 20-80% of Operation Cost

Railway policy in US and EU: major decision maker is the government

- Benchmark regulation to improve the efficiency of railway operators
- Expansion of network through 100% public decision and investment
- Better service and fare through government efforts

Railway policy in Japan: major decision makers are railway operators

- Incentives for railway operators
- Private railway operators and operators by Local government make efforts for better service under the competition
IV. Financial Scheme for Urban Railway

Misunderstanding for railway from Japanese experiences

“Private railway companies in Tokyo are profitable, therefore PFI scheme might be feasible for urban railway”

- Dose the high efficiency of Japanese railway means the possibility of PFI project for railway?
  - Subsidy and cross subsidy support the profitability of new line.
  - High demand and high fare are requested for the profitability.
- Is low level of fare necessary to keep demand for profitability?
  - Mistake of MRT 3 in Manila vs Successful case in Bangkok.
  - Only profitable railway operators can innovate the service.

Limited Successful PFI Project for Urban Railway in Asia

- Failure of public and private sectors
- Limited Investors
  - Weakness of competitiveness of project in the world-wide market
- Lack of cross subsidy
Key issues for each financial resources are explained in following pages!
Fare for Profitability

Key Issue: Fare for Profitability beyond the Populism

- Fare Regulation and Political Decision
- Balance between Bus and Railway Competition under the Different Costs
- Regional Disparity between Prior and Inferior Regions
- Fare related to inflation and increased income level
- Modal Choice by Income Segmentations and the Time Series Change

- Philippines’ Example:
  LRT3 Fare and Deregulation for Air-conditioning Bus

- Thailand’s Example:
  High Fare for New Urban Railway: High Income Passengers
② Subsidy

* Without subsidy, Railway is not feasible at first stage
* Independent account from the National Railway
* Vertical division or direct subsidy to railway company

however

* Too much subsidy caused less efficiency
* Too low subsidy (lack of profitability) caused less efforts

Financial Resources of Subsidy for Railway

- General tax
- Automobile Fuel Tax (US and many EU countries, Currently Tokyo)
- Property Tax (Many countries)
- Sales Tax (Urban Transport in US)
- Corporate Inhabitant Tax (Urban railway in Japan)
- Special Account of Budget (for each mode in Japan)
Cross Subsidy between Routes

- Profitability of Urban Railway Operator  Ex. Tokyo Metro
- Problem of Independent PFI Projects

Rationale for Cross-subsidy
- Financial support at the first stage
- Risk taking for innovation / technology, service, etc.
- Regional disparity between Prior and Inferior Regions because of different service and fare
- Inefficient investment and operation

Cross Subsidy Scheme
- public organization ↔ Political pressure
- In same organization or between different organizations
- Direct cross subsidy or through government
- Independent PFI Projects : lack of cross subsidy
- Constraint scheme for cross subsidy (Highway in Japan)
④ Value Capture

- Transit Oriented Development
- Combination Railway project and land readjustment project or urban renewal
How can such projects become possible?

• Profitability of Railway Company
• Agreement by land owners and citizens
  Improvement of environment
  Increase of property value (higher land price of smaller space)
• Difference of land prices before and after the project
  (Land use regulation, reasonable reduction of space)
• Speedy Implementation of the projects (Role of government)
• Support of Central and Local Governments
  Coordination
  Subsidy for the project
  Change the zoning of land-use
  Deregulation for urban development and building
  Investment for infrastructure
Scheme of Value Capture

- Development business by Railway operator
  (JR, Taiwan HSR, etc.)
- Land readjustment business by railway operator
  (Private railway in Japan, Tokyu, etc.)
- Tsukuba express railway
  : Land readjustment by public sector
  (Land Readjustment law for Railway)
- Subsidy by increment property tax and other tax revenue

- IF : Impact fee
- TIF : Tax Increment Financing
  (Special Assessment District)
⑤ PPP Scheme

Limited successful projects for railway
  • Failure of public and private sectors
  • Competitiveness of project in the world-wide market

Change of PFI scheme: PF2 from PFI in UK

Reasons:
  • too much profit of private sector
  • too much cost after the withdraw of the private sector
  • time consuming process of PFI

<table>
<thead>
<tr>
<th></th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Case 4</th>
<th>Case 5</th>
<th>Case 6</th>
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</thead>
<tbody>
<tr>
<td>Land Acquisition</td>
<td>Public</td>
<td>Public</td>
<td>Public</td>
<td>Public</td>
<td>Public</td>
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<tr>
<td>Civil Work</td>
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<td>Private</td>
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<td>Public</td>
<td>Public</td>
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</tr>
<tr>
<td>E &amp; M</td>
<td>Public</td>
<td>Private</td>
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<td>Private</td>
<td>Private</td>
<td>Private</td>
<td>Private</td>
<td>Public</td>
</tr>
</tbody>
</table>

Case1: JNR Shinkansen  Case2: Taiwan Shinkansen  Case4: Present HSR in Japan
Examples of PPP urban railway projects in Asia

**Seoul Metro Line 9**: example of country risk
- Change of MRG (Minimum revenue guarantee)
- Government rejected the SPC report for increase of fare
- Lawsuit against government
- Withdraw of MKIF (Macquarie Korea Infrastructure Fund) and Hyundai Rotem

**Delhi Airport Express Line**: private to public after the bankrupt
- Delay of construction and broken parts
- Lack of demand and revenue
- Lack of revenue from rental business
- Transfer the project to the Delhi Metro (public sector)
Bangkok Metro: private to public after the bankrupt

- Lack of demand and revenue
- Excess of assets
- Debt rescheduling, Loan condition changing
- Financing by public corporations
- Revision of fares

Kuala Lumpur Kelana Jaya Line (Putra LRT)

- BOT, Concession period: 60 years
- Delay of the construction:
  - Start of operation after Commonwealth Games (1998)
- Shortage of the demand → huge deficit
- Significant deterioration of business conditions of the Holding company (Renong) through the Asian Financial Crisis (1997).
  (Takeover by other company)
- Special purpose company SPNB (owned by Government) purchased Putra LRT to keep the service in 2002.
- Purchase price was 1.6 billion US $ and loan (1.5 billion US $) was transfer to the government bond.
Taipei MRT Xinyi Line: limited role of private sector

- DORTS (Dept. of Rapid Transit System, Taipei City)
  Construction, Vehicles, Control and signal system
  Subsidy of Central Gov. : 32%
- TRTC (Taipei Rapid Transit Company): Operation
  Taipei City(74%), Central Go.(17%), New Taipei City(9%)
  Private Co. (0.3%)

Asian countries are introducing PFI scheme for urban railway. Almost PFI projects for urban railway end in failure. Successful project in Taiwan was almost public project.

What kinds of risks?
Limited demand, High construction cost, delay of construction, Inefficient operation

The detailed information will be explained later presentations
V. Conclusion

Urban Railway in Asian Mega-cities

- Lessons from the failure urban railway projects in Asia.
- Effective master plan for urban railway.
- Subsidy for construction, effective operation and fare level.
- Coordination of urban railway lines by different donors.

Japanese Contributions

Role of JICA:

- Planning and construction stage and operation and maintenance

Examples of Japanese operators

- JR East : Bangkok, London
- Tokyo METRO : Hanoi, Ho-Chi-Min, Manila
- Tokyu Railway Co. : Binh Duong Garden City (Ho-Chi-Min MA)
- JR West : Brazil (San Paulo, Rio de Janeiro, Goiânia)
Thank you for your attention!