Public Transport Reform of Seoul

Sangjune PARK

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I. Introduction
Facts about Seoul

* Including Seoul, Gyeonggi, Incheon
Facts about Seoul

General Figures (2009)

- Population: 10.46 million (23.5%)
- Area: 605.25km² (0.6%)
- No. of Gu: 25
- No. of Households: 4,116,660
- No. of Foreign Residents: 255,207 ('08)
- No. of vehicles: 2,999,731 ('11.4)
- GRDP: 1,887 trillions $ (23%) ('08)
## Seoul & SMA

### SMA: Seoul, Incheon and Gyeonggi

<table>
<thead>
<tr>
<th></th>
<th>Seoul</th>
<th>SMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>605.2 km² (0.6%)</td>
<td>11,818 km² (11.8%)</td>
</tr>
<tr>
<td>Population</td>
<td>10.0 million (20.1%)</td>
<td>26.6 million (49.3%)</td>
</tr>
<tr>
<td>GRDP</td>
<td>283,651 billion won (22.8%)</td>
<td>585,978 billion won (47.1%)</td>
</tr>
</tbody>
</table>

* Source: e-National Indicators (2011)
## Transportation infrastructure

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total length of the road</td>
<td>8,093km</td>
</tr>
<tr>
<td>Road ratio</td>
<td>21.89%</td>
</tr>
<tr>
<td>Total length of the subway</td>
<td>362.0km</td>
</tr>
<tr>
<td>Total length of the median bus lanes</td>
<td>90.3km</td>
</tr>
</tbody>
</table>
Overview of Seoul Transport

Population and Vehicles

- Population: doubled
  - 1970: 5.4 million
  - 1990: 10.9 million
  - 2007: 10.4 million

- Registered Vehicles: 46 times
  - 1970: 60,000
  - 1990: 1.2 million
  - 2007: 2.9 million

Population density: 17,000 persons/km² ⇔ 485.9 person/km²
### Mode share

<table>
<thead>
<tr>
<th></th>
<th>Seoul</th>
<th>Incheon</th>
<th>Gyeonggi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxi, 6.0%</td>
<td></td>
<td>Taxi, 6.5%</td>
<td>Taxi, 5.3%</td>
</tr>
<tr>
<td>etc., 4.8%</td>
<td></td>
<td>etc., 9.5%</td>
<td>etc., 9.0%</td>
</tr>
<tr>
<td>Rail, 35.5%</td>
<td>Auto, 26.1%</td>
<td>Rail, 15.7%</td>
<td>Rail, 8.4%</td>
</tr>
<tr>
<td>Bus, 27.6%</td>
<td></td>
<td>Bus, 25.7%</td>
<td>Bus, 27.4%</td>
</tr>
</tbody>
</table>

- Seoul intra-city trips: 20,011 thousand trips per day
- SMA intra-city trips: 49,660 thousand trips per day

*Source: Metropolitan Transportation Authority*
Ⅱ. Reform of Seoul's Public Transport System
Vicious circle of bus

Increasing vehicles

- Lack of bus priority policies (bus lane & subsidies)
- Poor punctuality
- Poor reliability
- Slow speed

Inefficient bus management system

- Worsen bus operating conditions
- Stress on driver from traffic congestion
- Unfriendly to passenger, and causing accident

Limited road capacity → Congestion

- Abolition of route → Reduced operation
- Periodic increase of fare
- Labor dispute → Inconvenience for citizen
- No other options except periodic fare raising

- Decrease of bus users
- Abolition of bus service
- Bankrupt of bus company
## Background of the Reform

### External Factors

- **Socio-Economic Situation**
  - Significant drop in bus users due to high car ownership

- **Transport Policy**
  - Changing transport paradigm

- **Environmental Issues**
  - Concerning air pollution

- **Bus Industry**
  - Decreasing bus users due to a vicious cycle

### Internal Factors

- **Bus Passengers**
  - Demanding better quality of public services

- **Bus Service Quality**
  - Long waiting/arrival times, antiquated buses, poor punctuality

- **Bus Routes**
  - Circuitous/long bus routes passing through congested areas

- **Bus Companies**
  - Entering bankruptcy/merging of some bus companies
### Background

**Mode Share**

<table>
<thead>
<tr>
<th></th>
<th>1996</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td>30.1%</td>
<td>26.0%</td>
</tr>
<tr>
<td>Underground</td>
<td>29.4%</td>
<td>34.6%</td>
</tr>
<tr>
<td>Auto</td>
<td>24.6%</td>
<td>26.9%</td>
</tr>
</tbody>
</table>

- Drive-alone: 79%
- Underground construction:
  - normally takes 10 years
  - 350 M USD
## Background

### Construction costs

<table>
<thead>
<tr>
<th></th>
<th>HRT</th>
<th>LRT</th>
<th>BRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction costs per km (M USD)</td>
<td>35~176</td>
<td>8.7 ~ 87</td>
<td>0.18 ~ 2.1</td>
</tr>
<tr>
<td>Capacity (thousand persons/hour)</td>
<td>40 ~ 80</td>
<td>5 ~ 66</td>
<td>15 ~ 35</td>
</tr>
</tbody>
</table>
**BRT (Bus Rapid Transit)**

**Definition**

- Bus Rapid Transit: Express Trunk Bus System
- A good example of **Bus Priority System**
- Less financial investment, Effective bus system based on high-tech
BRT

Characteristics

- Exclusive bus lane => fast get on & off
- Pre/after-paid fare collection system
- Provide safe bus stops and terminal facilities => pleasant and comfortable service
- Integration of transport modes at the bus stop and terminals
- High quality bus service => luxury image of public transport
- Improvement of service quality
- Real time information and effective signals
- Exclusive bus priority at the intersection
Reform of the bus system

Changes of the system

- Separate revenue management by individual companies
- Route-based profit structure (depending on the number of passengers)

Joint management of revenue pool

- Joint management of revenue pool
  - Profit structure based on operational performance (depending on the total distance (km) of operation per bus)
- Public management of bus routes
- Introduction of bus route bidding system
- Evaluation of bus operation and service

Joint management of revenue pool

- Seoul Metropolitan Government (Bus route & operation planning, service evaluation)
  - Service evaluation, tenders
  - Operation monitoring
- Bus Companies A, B, C...
  - Bus operation consulting body (Bus Association)
  - Operation information
  - Financial support for route planning
  - Request for financial support
  - Participation
  - Distribution of operation profits
- Transportation card settlement company
  - Settlement of operational profit
  - Operation information
  - Operation monitoring
 Median Bus Lane

Scheme and Implementation

- Open Chonhodaero line (4.5km) in 1996
- Expansion to the trunk roads in 2004
- 12 lines in operation: total 100.4km
- Total length: 128.9km by 2012 (expansion with 7 lines, 28.5km)

Fig. 4)Median Bus Lane Scheme
## Function of Bus Type

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trunk (Main) Line</strong></td>
<td>- Connection between Suburban • CBD • Sub-centers</td>
</tr>
<tr>
<td></td>
<td>- Key factors: punctuality &amp; speed</td>
</tr>
<tr>
<td><strong>Feeder (Branch) Line</strong></td>
<td>- Transfer to Underground lines</td>
</tr>
<tr>
<td></td>
<td>- Key factors: securing accessibility, dealing with intra-trip demand</td>
</tr>
<tr>
<td><strong>Circular Line</strong></td>
<td>- Feeder line within CBD or sub-center</td>
</tr>
<tr>
<td></td>
<td>- Dealing with work or shopping trip of CBD or sub-center</td>
</tr>
<tr>
<td><strong>Wide Area Line</strong></td>
<td>- Connection between CBD and outside of Seoul</td>
</tr>
<tr>
<td></td>
<td>- Dealing with inbound/outbound trip (auto)</td>
</tr>
</tbody>
</table>
Bus Route System

Blue bus (Trunk line) connects suburban areas, city center and sub-centers.

Red bus (Wide area line) links the metropolitan area, city center and sub-centers.

Yellow bus (Circula line shuttle) serves as a branch line transport in sub-center and city center.

Green bus (Feeder line) supports connecting between bus and subway within the area.
Bus Route System

New Bus Numbering System (8 zones) and Colors

- **Zone 0**: Jongno-gu, Jung-gu, Yongsan-gu
- **Zone 1**: Dobong-gu, Gangbuk-gu, Seongbuk-gu, Nowon-gu
- **Zone 2**: Dongdaemun-gu, Jungnang-gu, Seongdong-gu, Gwangjin-gu
- **Zone 3**: Gangdong-gu, Songpa-gu
- **Zone 4**: Seocho-gu, Gangnam-gu
- **Zone 5**: Dongjak-gu, Gwanak-gu, Seocho-gu
- **Zone 6**: Gangseo-gu, Yangcheon-gu, Guro-gu, Yeongdeungpo-gu
- **Zone 7**: Eunpyeong-gu, Mapo-gu, Seodaemun-gu

*Gyeonggi Province is also divided into 8 zones, like Seoul.

**Trunk line (Blue bus)**
- Number: 101
- Starting from North-East area, arriving at Downtown
- Trunk line number 1

**Feeder line (Green bus)**
- Number: 1012
- Starting from North-East area, arriving at Downtown
- Feeder line number 12

**Wide area line (Red bus)**
- Number: 9112
- Starting from Ujongbu, arriving at Downtown
- Wide area line number 1

**Circular line (Yellow bus)**
- Number: 41
- Circular line number 1 in Gangnam

Easier to identify the origin and destination for bus users
Seoul's BRT Components

1. Busway

- Exclusive bus lanes on the middle of the road
- Installation on the trunk roads which have more than 3 lanes

Table 4) Characteristics of Busway

<table>
<thead>
<tr>
<th>Axes</th>
<th>Distance (km)</th>
<th>No. of Intersec</th>
<th>No. of bus stops</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chonho-Hajungro</td>
<td>7.6</td>
<td>12</td>
<td>11</td>
<td>Not in operation 8.3km</td>
</tr>
<tr>
<td></td>
<td>4.5</td>
<td>9</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Gangnamdaero</td>
<td>5.9</td>
<td>13</td>
<td>10</td>
<td>6.9</td>
</tr>
<tr>
<td></td>
<td>5.9</td>
<td>13</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Susak-Seongsanro</td>
<td>6.8</td>
<td>16</td>
<td>13</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>6.8</td>
<td>16</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Dobong-Miao</td>
<td>15.8</td>
<td>21</td>
<td>22</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>14.0</td>
<td>18</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Gyungin-Maporo</td>
<td>12.1</td>
<td>10</td>
<td>14</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>12.1</td>
<td>10</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Mangwooro</td>
<td>4.8</td>
<td>11</td>
<td>8</td>
<td>9.5</td>
</tr>
<tr>
<td></td>
<td>3.3</td>
<td>8</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Siheoung-Hangangro</td>
<td>14.9</td>
<td>19</td>
<td>20</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>14.9</td>
<td>19</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>
2. Shelters

- Unify with an open-shelter type
- Hub of public transport system with transit center

Table 5) Seoul's Bus stops

<table>
<thead>
<tr>
<th></th>
<th>No. of bus stops</th>
<th>No. of Routes</th>
<th>No. of stop space</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>downtown</td>
<td>Seoul</td>
<td>Gyunggi</td>
</tr>
<tr>
<td>Chonho-Hajungro</td>
<td>12</td>
<td>8~12</td>
<td>0~2</td>
</tr>
<tr>
<td></td>
<td>Sururban</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gangnamdaeoro</td>
<td>10</td>
<td>4~20</td>
<td>6~22</td>
</tr>
<tr>
<td></td>
<td>Sururban</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Susak-Seongsanro</td>
<td>13</td>
<td>15~20</td>
<td>6~11</td>
</tr>
<tr>
<td></td>
<td>Sururban</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dobong-Miaro</td>
<td>22</td>
<td>11~20</td>
<td>8~12</td>
</tr>
<tr>
<td></td>
<td>Sururban</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyungin-Maporo</td>
<td>14</td>
<td>7~17</td>
<td>4~11</td>
</tr>
<tr>
<td></td>
<td>Sururban</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mangwooro</td>
<td>8</td>
<td>7~18</td>
<td>4~25</td>
</tr>
<tr>
<td></td>
<td>Sururban</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Siheoungh-Hangangro</td>
<td>20</td>
<td>5~18</td>
<td>1~9</td>
</tr>
</tbody>
</table>

Fig. 6) Bus stops and transit center
Seoul's BRT Components

3. Vehicles

- Semi-Public operation (private ownership-vehicles, properties, revenue sharing system)
- 4 Types: Trunk(Blue)/Feeder(Green)/Wide area(Red)/Circular(Yellow)

Vehicle's Colors

- Trunk bus
- Feeder bus
- Wide Area bus
- Circular bus
Seoul's BRT Components

4. Fare Collection system

- Smartcard system
  - 95.1% of passengers pays by cards and the remain pays by cash ('11.4)
- Fare differentiation according to distance and transfer

Smartcard reader

Cash collector
5. Bus Card Information

- Every bus has an on-board equipment (terminal) after the Bus reform in 2004.
- Data (gathering and managing at the BMS center)
  - passengers taking on & off
  - historic data (take on & off)
  - operation data of bus and Metro
- Data for distance based fare system
  - time of taking on & off, locations
  - mode and vehicle information
Seoul's BRT Components

6. ITS (Intelligent Transport System)

- BMS (Bus Management System)
  - BIS: real-time vehicle tracking with the on-board GPS receiver
  - Bus operating information: provide information in real-time through the internet, mobile wireless internet, and ARS

- TOPIS (Transport Operation and Information Service)
  - Integration and management of BMS data, Smartcard data, other ITS data
  - Effective bus operation management
Seoul's BRT Components

6. ITS: Bus Management System

- BMS: Key role for efficient management of bus services

For Passenger
- BIT
  - ARS
  - Mobile
  - Internet
  - Route and operation Info.
  - Bus Arrival Time

On-board device installed on every bus

Bus Company
- Bus Location
- Allocating Buses
- Notice
- Bus Interval Info.
- Bus Operation Info.

Seoul BMS
- Real-time Bus Operation Information
- Route and Transfer Information
- Real-time Bus Operation Info.
- Bus Operation DB
- Bus real-time location Info.
- Interval and operation Info.
Seoul's BRT Components

6. ITS : Bus Information System

- Information Display at Bus Stop
- Smart Phone Application

1. Check a QR code at bus stop
2. Run a QR code reader
3. Get information
Ⅲ. Outcomes
### Effects (early stage)

<table>
<thead>
<tr>
<th>Goals</th>
<th>Achievement indicators</th>
<th>Goal achievement rates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Speed</strong></td>
<td>Travel speed (km/h)</td>
<td>16.7 (2003. 12) → 22.0 (2004. 12)</td>
</tr>
<tr>
<td><strong>Punctuality</strong></td>
<td>Distribution of operation intervals</td>
<td>0.69 (2004. 7 curbside) → 0.56 (2004. 7 median) → 0.50 (2006. 2 median)</td>
</tr>
<tr>
<td><strong>Transport efficiency</strong></td>
<td>Number of passengers</td>
<td>Up 26.8% (2004. 12 → 2005. 12)</td>
</tr>
<tr>
<td><strong>Cost reduction</strong></td>
<td>Travel cost reduction benefits</td>
<td>Saving of about 195.7 M USD</td>
</tr>
</tbody>
</table>
## Effect of fare reform

- Change in per-trip fare before-and-after fare reform

<table>
<thead>
<tr>
<th>Goals</th>
<th>Achievement indicators</th>
<th>Goal achievement rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inexpensive fare</td>
<td>Fare per trip (won)</td>
<td>620 (2003, second half) → 592 (2004, second half)</td>
</tr>
<tr>
<td>Revenue transparency</td>
<td>Card usage rate (%)</td>
<td>77.4% (2003. 1) → 88.9% (2004. 12)</td>
</tr>
</tbody>
</table>
Effects (early stage)

Reduction of Congestion

- Decrease of private car use
  - contribution to the punctuality and reliability of bus services
  - Increase of no. of bus passengers
    After the reform => increase of bus users on 15 ~ 37 %

<table>
<thead>
<tr>
<th>Route</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gangnamdaero</td>
<td>15.3%</td>
</tr>
<tr>
<td>Soosak-Seongsanro</td>
<td>19.1%</td>
</tr>
<tr>
<td>Dobong-Miaro</td>
<td>37.6%</td>
</tr>
</tbody>
</table>

- Reduction of accident risk
  - low conflicts with the ordinary roadways
  - reduction of accidents due to the low conflicts
Effects (from SMG)

Increase in bus passengers
(thousand/day)

<table>
<thead>
<tr>
<th>Year</th>
<th>Before reform</th>
<th>After reform</th>
</tr>
</thead>
<tbody>
<tr>
<td>'04.1~6</td>
<td>3,827</td>
<td>4,455</td>
</tr>
<tr>
<td>'06.1~6</td>
<td>4,531</td>
<td>5,000</td>
</tr>
<tr>
<td>'08.1~6</td>
<td>5,173</td>
<td>5,576</td>
</tr>
</tbody>
</table>

Increase in fare revenues
(million won)

<table>
<thead>
<tr>
<th>Year</th>
<th>Before reform</th>
<th>After reform</th>
</tr>
</thead>
<tbody>
<tr>
<td>'04.1~6</td>
<td>2,577</td>
<td>2,760</td>
</tr>
<tr>
<td>'06.1~6</td>
<td>2,760</td>
<td>3,013</td>
</tr>
<tr>
<td>'08.1~6</td>
<td>3,013</td>
<td>3,200</td>
</tr>
</tbody>
</table>
Effects (from SMG)

Decline in bus accidents

Citizens' satisfaction

(%)
Effects (from SMG)

Bus speed

(km/h)

- Dobong-Ma-ro: 81.8%
- Susaek-Seongsan-ro: 51.9%
- Gangnam-dae-ro: 33.1%
- Mangu-ro: 18.8%
- Gyoongin-ro: 35.0%
- Sihuong-Hangang-ro: 22.8%
- Mapo-ro: 37.1%
- Songpa-dae-ro: 21.6%

※ Source: Bus management system
※ Morning peak-hours (07:00-09:00), in the direction of CBD
Bus passengers (thousand)
Problems

- Frequent change of routes
- Slow increases on public transport passengers
- No incentives for effective bus management
- Increase of operation subsidies

Table: SMG Subsidies for bus

<table>
<thead>
<tr>
<th>Year</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount</td>
<td>81.6</td>
<td>222</td>
<td>195</td>
<td>164</td>
<td>189</td>
<td>190</td>
</tr>
</tbody>
</table>

Unit: Billion won
IV. Discussions
A success story on emphasizing the urban transport problems
- role of public transport system and attitude about public transport

The reform of Seoul's PT => a role model of other cities in Korea
(Busan, Gwangju, Daejeon, etc)

Huge increase of public transport subsidies
- funding source of the local governments

Connection to other BRT system ex) Kyunggi Province's BRT

So far, BRT is regarded as a practical answer to sort out the urban transport congestion under the budget restrictions
Thank you very much!

spark@koti.re.kr