Public Transport Reform in Seoul

ChoongYeol Peter YE
Vice President
The Korea Transport Institute
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KOTI
Leading the Transport People Want
01 General Introduction

1. Area, Population and GRDP

- **Seoul:** Capital city with 600 years of history
- **Concentration on Metropolitan area**
  - Seoul: 0.6% of Korean territory, 20% of population
  - SMA: 12% of territory, half of population/GRDP

(SMA: Seoul, Incheon, and Gyeonggi)

<table>
<thead>
<tr>
<th></th>
<th>Seoul</th>
<th>SMA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Area</strong></td>
<td>605.2 km² (0.6%)</td>
<td>11,818 km² (11.8%)</td>
</tr>
<tr>
<td><strong>Population (2014)</strong></td>
<td>9.89 million (19.6%)</td>
<td>26.6 million (49.6%)</td>
</tr>
<tr>
<td><strong>GRDP (2013)</strong></td>
<td>318,607 billion won (22.3%)</td>
<td>696,932 billion won (48.7%)</td>
</tr>
</tbody>
</table>

* Source: e-National Indicators (2014)

- **Suburbanization and Urban Sprawl (Seoul->SMA)**
  - Urban sprawl causes longer Supply Chain & Traffic Issues
2. Motorization

- **Registered vehicles Increase: 50 times**
  → 1970: 60 thousands, 2040: 3.01 millions

- **Slow increase in Seoul, rapid increase in SMA**

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<tbody>
<tr>
<td><strong>Seoul</strong></td>
<td>206,718</td>
<td>1,193,633</td>
<td>2,440,992</td>
<td>2,981,400</td>
<td>3,013,541</td>
</tr>
<tr>
<td><strong>Population</strong></td>
<td>8,364,379</td>
<td>10,612,577</td>
<td>10,373,234</td>
<td>10,575,447</td>
<td>10,369,593</td>
</tr>
<tr>
<td><strong>Vehicle per Person</strong></td>
<td>0.025</td>
<td>0.112</td>
<td>0.235</td>
<td>0.282</td>
<td>0.291</td>
</tr>
</tbody>
</table>

*Source: e-National Indicators (2011)*
01 General Introduction

3. Traffic of Seoul

- **City Bus**: 390 routes / 7,855 buses / 6,064 bus stops
  Enter 5,000 buses into Seoul everyday, 4.6 million passengers a day

- **Subway**: 9 lines (332km) / 311 station
  Capital Region: 19 lines(1,043km) / 567 stations, 6.8 million passengers a day

- **Taxi**: 72,000 (company: 22,000 / individual: 50,000)

- **Volume of trips**: 36,650 thousand(inflow: 24%)

- **Mass Transit oriented** system: 65% of modal share
  bike and walk is becoming important but stay in low level in modal share

4. Mass Transit

- **From tram to bus**: 18 routes of trams → closed service in 1968
  allow unlimited private bus operation: 67% of modal share(1978)
  (600 buses in 1950) → 7,138 in 1979

- **First subway (line 1)**
  planned in 1965 / construction: 1971 – 1974(9.8km)
02 Challenges and Public Transport Reform

1. Challenge: urban sprawl and sustainability

- Satellite cities: increasing commuting distance (10km → 30km) / inflow of 2 million vehicles everyday
- Air pollution (2002): $PM_{10} (76 \mu g/m^3) / PM_{2.5} (40 \mu g/m^3)$
- Population: decline / aged society (rate of people 65 and more: 11.4%)
- Urgent Task: how to achieve sustainability (new paradigm: sophisticated and smart solution)
2. Bus Reform in Seoul

A. Background

Major mass transit: bus → subway
- No. of company: 103 (1990’s) → 58 (2002)
- No. of passengers/day: 9.5 million (1995) → 7.2 million (2002)

Necessity for reform: balanced and integrated transit
- corruption from seeking profitable routes
- impossible to cover traffic demand with subway only

B. Direction for Bus Reform

- Operation Scheme: New revenue system
- Network: Trunk & Feeder
- Fare: Distance-based free transfer fare with smart card
- Information: Bus Management/Information System
- Infrastructure: Exclusive bus lane, Station improvement
- Fleet: CNG bus, Low-floor bus
C. Operation: private ⇒ partnership

- **Service contract**: gov’t and bus association
  - gov’t: authority in service level and evaluation obligation to supply infrastructure / subsidy
  - bus company: right to demand subsidy / duty to maintain service quality
  - citizens’ committee: reconciles conflict of interest
  - Korea Smart Card Company: distribute the fare revenue

- **Revenue and subsidy**
  - managed by bus association (supervised by gov’t) / performance based subsidy

Efficiency of private sector + public interest: based on mutual trust of government and companies

Regulator (SMG)
(Planning, Evaluation, Audit, Bid-out)

KSCC (AFC-Data Service) Fare-Integration

Transfer Generated Revenue

User: Smart card

Regular opening

Report

Citizen’s Committee
(Hearing, Regulation, Review)

Audit, Monitoring and subsidy

Operator

Participation

Revenue distribution

Bus Association (Revenue Sharing Committee)

Bus companies
02 Challenges and Public Transport Reform

- Semi-public bus operating system

**Revenue allocation between transport company**
- Equal allocation between profitable/non-profitable route.
- Revenue allocation based on a basic and distance scale rate.

**Deficit covering from government**
- Subsidy → bus association → bus company.
- Compensation of fixed and operation cost.

<table>
<thead>
<tr>
<th>1.5 Billion dollar</th>
<th>5.5 Billion dollar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsidy (government)</td>
<td>Fare revenue (passenger)</td>
</tr>
<tr>
<td>20%</td>
<td>80%</td>
</tr>
</tbody>
</table>
D. Integrated Fare System

**Free transfer**: within 30 minutes (maximum 5 times)

Separate card collection system (1995) ⇒ Integrated card system (**T-Money Card**)

- Established KSCC: issue card / revenue distribution

**Export of system**
- 2008: Wellington and Auckland
- 2011: Kuala Lumpur
- 2015: Mongolia
E. BRT (Bus Rapid Transit) : Overview


**Seoul BRT**: low or middle level

<table>
<thead>
<tr>
<th>Type</th>
<th>Requirement</th>
<th>Capacity (person/hour)</th>
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<tbody>
<tr>
<td>High level</td>
<td>Exclusive road</td>
<td>30,000 and more</td>
</tr>
<tr>
<td>Middle level</td>
<td>Exclusive lane (road)</td>
<td>20,000</td>
</tr>
<tr>
<td>Low level</td>
<td>Priority (lane)</td>
<td>10,000</td>
</tr>
</tbody>
</table>

**Operation**: 12 corridors (120km)
F. BRT (Bus Rapid Transit) : Operation

Direct service → Main-feeder system

Bus line hierarchy : 4 colors

Bus Management System (BMS): Real time monitoring bus operations
02 Challenges and Public Transport Reform

G. BRT (Bus Rapid Transit) : Facilities and Infrastructure

**Design**

- Bus Stop: set up with PPP
- Bus Arrival Information

**Operation control**: BMS by TOPIS

**Public Bus Garage**

- 1994 – 2012
- 11 facilities (4,000 buses)

**Transfer Centers**

- Seoul Station
- Cheongnyangni Station
- Yeouido
- Guro-digital station
H. CNG Bus and Service Improvement

**Bus with CNG engine (2002 – 2014)**: 7,500 city buses
- Expenditure: 350 million dollar (subsidy: 18.5 thousand USD)
- Effect: $PM_{10}$: 76 $\mu g/ m^3$ (2002) → 45 $\mu g/ m^3$ (2013)
  - Energy saving: 240 million dollar (10 years)

**Low-deck bus**
- Vision: replace 50% of buses (2007 city ordinance)
- Subsidy: 50% of purchasing price (**35% of buses were converted**)

**Night time bus service (Owl bus)**
- Increasing night time activities (introduced: September 2013)
- Operation: 8 routes (from 00:00 – 05:00)
Benefit

- Citizens QOL with easy access to public transportation
- Cheap Public transport (average 1 USD per trip, maximum 2 USD)
- Trade-off with investment on roads
- Contribute in improving air pollution

Cost

- Deficit by public transport is about 730 million USD (in 2013)
- After bus system reform, increasing public subsidy by PPP scheme

Public Subsidy (million USD)

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<tr>
<td></td>
<td>160</td>
<td>222</td>
<td>164</td>
<td>265</td>
<td>209</td>
</tr>
</tbody>
</table>

Effort for economic performance of bus system

- Assessment of operators performance: performance based support
- Critical review of operation cost
- Reduction of excessive number of bus
03 Economic Efficiency of Public Transport

Transport Infrastructure Special Account (1994)

- Securing stable financial resources
- Based on the revenue from ear-marked fuel tax (Mileage based)
  - 18.9 trillion KRW / year
- Funding for transport infra. (highway, rail, airport and seaport)
- Major resources for transport infra. special account

- Allocation of Transport Special Account by Mode

<table>
<thead>
<tr>
<th>Year</th>
<th>Road (%)</th>
<th>Rail (%)</th>
<th>Airport (%)</th>
<th>Port (%)</th>
<th>Others (%)</th>
<th>Total Budget (Trillion KRW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>62.6</td>
<td>21.5</td>
<td>7.1</td>
<td>8.8</td>
<td>0</td>
<td>4.53</td>
</tr>
<tr>
<td>2000</td>
<td>61.1</td>
<td>23.2</td>
<td>6</td>
<td>7.9</td>
<td>1.8</td>
<td>12.33</td>
</tr>
<tr>
<td>2005</td>
<td>53</td>
<td>26.7</td>
<td>3.1</td>
<td>13.5</td>
<td>3.8</td>
<td>13.06</td>
</tr>
<tr>
<td>2008</td>
<td>52.8</td>
<td>27.4</td>
<td>1.7</td>
<td>13.1</td>
<td>5.1</td>
<td>13.22</td>
</tr>
<tr>
<td>2012</td>
<td>52.7</td>
<td>37.6</td>
<td>0.8</td>
<td>8.9</td>
<td>-</td>
<td>15.01</td>
</tr>
<tr>
<td>2014</td>
<td>44.8</td>
<td>36</td>
<td>0.5</td>
<td>8</td>
<td>10.7</td>
<td>18.89</td>
</tr>
</tbody>
</table>
Integration with walking and cycling
In 2004, Public Transport Reform in Seoul Metropolitan Area.

In 2018, new Integration with Public Transport and Walking & Biking
Introduction of Metro Transportation Saving Card

- Saving Transport Expenditure
- Using Metro Saving Pass: 30% Benefit
- Promoting Walking and Biking

10% Discount fare

As your transportation pass!!

20% Save fare

As much as walking, biking distance!!
Air Pollutants from the road in Korea

- Decreasing air pollutants (Nox] emission form the road
- PM10 from the road accounts for 10%, with decreasing trend

<table>
<thead>
<tr>
<th>Year</th>
<th>NOx Amount(ton)</th>
<th>NOx Road Pollutant (ton)</th>
<th>NOx %</th>
<th>PM10 Amount(ton)</th>
<th>PM10 Road Pollutant (ton)</th>
<th>PM10 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1,061,210</td>
<td>382,226</td>
<td>36.0</td>
<td>116,808</td>
<td>15,255</td>
<td>13.1</td>
</tr>
<tr>
<td>2011</td>
<td>1,040,214</td>
<td>322,307</td>
<td>31.0</td>
<td>131,176</td>
<td>13,030</td>
<td>9.9</td>
</tr>
<tr>
<td>2012</td>
<td>1,075,207</td>
<td>345,666</td>
<td>32.1</td>
<td>119,980</td>
<td>12,969</td>
<td>10.8</td>
</tr>
<tr>
<td>2013</td>
<td>1,090,614</td>
<td>335,721</td>
<td>30.8</td>
<td>121,563</td>
<td>12,103</td>
<td>10.0</td>
</tr>
<tr>
<td>2014</td>
<td>1,135,743</td>
<td>361,230</td>
<td>31.8</td>
<td>97,918</td>
<td>10,019</td>
<td>10.2</td>
</tr>
</tbody>
</table>

(Source: National Institute of Environmental Research (2014))
- CNG Bus Ratio in Seoul: 0.6% (51 buses) in 2000 → 100.0% (7,482)
  - air pollutants and fine dust decreased with provision of CNG buses
### Air Pollutants from the road in Seoul Metropolitan Area (SMA)

- 32% of air pollutants are concentrated in SMA
- In SMA, 91% of air pollutants are produced by truck and Recreational Vehicle
- SMA has more than 40% Pollutants from passenger car and RV

<table>
<thead>
<tr>
<th>구분</th>
<th>Air Pollutants(ton)</th>
<th>Percentage to National Total(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PM10</td>
<td>PM2.5</td>
</tr>
<tr>
<td>SMA Total</td>
<td>3,251</td>
<td>2,991</td>
</tr>
<tr>
<td>Pax car</td>
<td>38</td>
<td>35</td>
</tr>
<tr>
<td>Minivan</td>
<td>156</td>
<td>143</td>
</tr>
<tr>
<td>Bus</td>
<td>58</td>
<td>54</td>
</tr>
<tr>
<td>Truck</td>
<td>1,952</td>
<td>1,795</td>
</tr>
<tr>
<td>Special vehicle</td>
<td>22</td>
<td>21</td>
</tr>
<tr>
<td>RV</td>
<td>1,025</td>
<td>943</td>
</tr>
</tbody>
</table>

- Emission from diesel vehicle is overwhelming, SMA’s percentage of Gasoline is also high

<table>
<thead>
<tr>
<th>구분</th>
<th>Fine dust emission (ton)</th>
<th>Percentage to National Total(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PM10</td>
<td>PM2.5</td>
</tr>
<tr>
<td>Gasoline</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Diesel</td>
<td>3,238</td>
<td>2,979</td>
</tr>
</tbody>
</table>

(Source: National Institute of Environmental Research (2014))
Diesel Vehicle Registration

- Rapid increase for 2008~2015, slowdown after 2016
- Percentage of diesel vehicle among new registration decreased slightly after peaking at 52%
- Aging Vehicle Issues

- Increasing aging vehicles in all vehicle type (pax car, bus/mini-van, truck
- Ratio of over 10 years old: passenger car 30%, bus/minivan 38%
- Trucks are aged about 40~45% since 2010
- Except highest gas price in 2008, diesel consumption was continuously increasing independent to diesel price.
- Regardless of social issues like diesel-gate, diesel consumption is stable or increasing.
SMG’s plan to expand electric vehicles

- Target number of electric vehicles

  (2017) 5,500 → (2022) 55,500 → (2025) 105,500

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2022</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger car</td>
<td>5,465</td>
<td>48,465</td>
<td>85,465</td>
</tr>
<tr>
<td>Bus &amp; Commercial</td>
<td>35</td>
<td>7,035</td>
<td>20,035</td>
</tr>
</tbody>
</table>

Subsidy for electric vehicles

- SMG’s Subsidy: (2017) 5.5 million Won ($5,000) → (2018) 5 million Won ($45,450)
SMG’s Plan for Changeover from CNG into Electric

Stepwise changeover of old CNG buses over 11 years (durable year) into electric buses
- Changeover of 3000 buses by 2025
  ▶ Electric bus operation in other cities: Busan 50, Jeju Province 79, Gimpo city 40

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<thead>
<tr>
<th></th>
<th>CO2</th>
<th>CO</th>
<th>NOX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Bus</td>
<td>0 g/km</td>
<td>0 g/km</td>
<td>0 g/km</td>
</tr>
<tr>
<td>CNG Bus</td>
<td>991 g/km</td>
<td>0.25 g/km</td>
<td>7.5 g/km</td>
</tr>
</tbody>
</table>

* Source: Korea Automotive Technology Institute
06 Conclusion and Implication

- **Transit-oriented policy and Utilization of ICT**
  - Bus based public transport system during economic development
  - Metro oriented bus route reshuffling and integration
  - Providing cheap and comfortable public transportation with fare integration
  - Introduction of PPP for public transport construction and operation

- **Subsidizing for bus operation and Funding by fuel tax & transport special account** to form a vicious cycle to increase public transport usage

- Public transport reform and replacement of diesel bus to CNG bus made synergy in reducing air pollutants from the road
  - Cheaper diesel price increased diesel cars and producing fine dusts

- Need to invest toward sustainable, integrated, coordinated, and digitalized mobility - TDM, TOD, maintenance, coordinated & automated transport, new transport industry
KOTI enriches the future by securing harmony among people, the environment and transport