Seoul's Challenges & Achievements
in Sustainable and Intelligent Urban Transport

Seoul Metropolitan Government
Introduction

Changes in policy framework, setting a new target

Efforts of Seoul for sustainable urban transport
- Provision of decent public transportation service
- Eco-friendly, human-oriented transportation system

ITS Global Leader, The Seoul TOPIS
Seoul’s Challenges & Achievements in Sustainable Urban Transport

Introduction
Seoul’s Challenges & Achievements in Sustainable Urban Transport

Seoul Condition & Transport Infra

Republic of Korea

27% Rate of Seoul’s Population in Korea

10.3mil. (Capital region 25mil)
3.1mil. (Capital region 4.7mil)
327.1km (9 lines)
9,334 (629 route)
72,109
Seoul’s Challenges & Achievements in Sustainable Urban Transport

**Transport Condition**

- Increasing of Income
- Rapidly Increasing of Pop.
- Housing Site Development
- Dramatic Increasing of Traffic Congestion

**Dramatic Increasing of Traffic Congestion**

**Infographic**

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Vehicle</th>
<th>Length of Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>3.1 mil.</td>
<td>8,214 km</td>
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</tbody>
</table>

- No. of Vehicle Increasing of 15 times
- Length of Road Increasing of 1.2 times
History and Change of Seoul Transport

- **Little Transport Service**
  - Not Enough Transportation Infra
  - Low Transit Service

- **Era of “My Car”**
  - Building Urban Expressway

Timeline:
- **1950**: Korea War
- **1970**: Building Urban Infrastructure
  - Building Transportation Network (Subway, Road, Bridge)
- **1980**: 1988 Seoul Olympic
History and Change of Seoul Transport

Increased Traffic Congestion
- Initiating Travel Demand Management
- Starting ITS & TSM

Public Transportation Reform
- Expand BRT (Bus Rapid Transit)
- Integrated Fare & Transfer system (Subway + Bus)

Human-oriented transportation
- Rebuilding Road Space for Pedestrian
- Car Sharing and Bicycle sharing Services
The vision of Seoul Transportation

Supply-oriented Transport

The Great Public Transportation Service & Strengthening TDM

New Vision

HUMAN-oriented

Eco-friendly, Human-Oriented Transportation

ITS & Share

- Upgrade of Transportation System based on ITS
- Sharing of Car & Parking lot

Depended on Fossil Fuels

Vehicle-oriented City
Subway Service

Seoul's Challenges & Achievements in Sustainable Urban Transport

Introduction

Subway Service

1974 OPEN

Line 1~9
336.1km, 307 stations
3,715 rolling stocks
National railroad in Seoul 121.7km

5.4mil. /day

Safe and Pleasant
Platform Screen Door & Free WiFi at all stations

Seoul's Challenges & Achievements in Sustainable Urban Transport
Introduction

Seoul’s Challenges & Achievements in Sustainable Urban Transport

Subway Service

1974 OPEN

Line 1~9
336.1km, 307 stations
3,715 rolling stocks
※ National railroad in Seoul 121.7km

Free WiFi
Screen Door
Convenient Facilities
Concrete Rail
high-pressure watering carts

5.4mil. /day

Safe and Pleasant
Platform Screen Door & Free WiFi at all stations
Seoul's Challenges & Achievements in Sustainable Urban Transport

**Under Construction**
- LRT Construction (96.7km, 9 lines)
- Extend Metro Line Network

- **Under Construction**
  - Line 4
  - Line 5
  - Line 8

- **Planning**
  - Extend Metro Line Network
  - LRT Construction (96.7km, 9 lines)

Network of LRT Line
for low-transit service area

- **Under Construction**
  - Line 9, 12.9km

- **Planning**
  - Line 4, Line 5, Line 8

- **-2025**

- **19.5km**
- **96.7km**

Extend Subway Network.
Bus Service

Introducion
Seoul's Challenges & Achievements in Sustainable Urban Transport

- All City Buses, Eco-friendly (CNG or Electronic Buses)
- 2,589 Low-flower Buses (35% of All city buses)
- High-class Bus Stop (convenient Shelter, BIT)

City Bus
- 390 routes, 7,855 buses
- 6,064 bus stops
- 19,910 bus drivers

Night Bus
- 00-05
- 8 routes, 47 buses

Safe Return
- Choice of Place to get off near home after 11 PM
- Return home with Safe Scout

5.8mil. /day
Changes in policy framework, setting a new target
Changes in policy framework, setting a new target

Seoul’s Challenges & Achievements in Sustainable Urban Transport

**Limitations**

Supply ↓ Demand ↑
- Urban & Sub-urban development
- Increasing of Traffic Demand
- Traffic Congestion Cost Increase

Road Construction
- Developed Area
- High Construction Cost ($50~80million / km)

Subway Construction
- Long Construction Time (10~20years)
- High Construction Cost ($100~110million / km)

**Problems**

Bus Route
- Complicated, Centralized in Particular Lines

Company
- Small Size, Low Willingness to Invest

Operation
- Slow, Not on time

Drivers & Passenger
- Poor Welfare, Unfriendly
- Uncomfortable

**What should we do**

Public Transportation Reform

Not a Choice But a Must
**Changes in policy framework, setting a new target**

### Seoul’s Challenges & Achievements in Sustainable Urban Transport

**Bus routing/operating**
1. Public ownership, Private operation
2. Establishment of trunk and feeder lines
3. Scientific operation management (BMS)

**Infrastructure**
1. Expansion of BRT
2. Improvements in transportation centers
3. Introduction of high-quality buses

**Assistant system**
1. Integrated Fare system (Subway + Bus)
2. Introduction of high-quality buses

**Social consensus**
1. Citizens’ Committee

**New Era**
1 July 2004

**Monitoring & Adjustment**

**Customer Satisfaction**
Changes in policy framework, setting a new target

Seoul’s Challenges & Achievements in Sustainable Urban Transport

**PTR – Public Transportation Reform**: Semi-public transportation system

### Government
1) Operational plan
2) Infrastructure Construction

### Bus Company
1) Operation and maintenance
2) Labor management

#### Key Entities
- **Seoul Metropolitan Government**
  - Financial support
  - Route planning
  - Request for financial support
  - Operation monitoring
- **Transportation card settlement company**
  - Operation Information
  - Settlement of operational profit
- **Bus company**
  - Operation Information
  - Distribution of operation profits
- **Bus operation consulting body**
  - Participating

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**Operational Plan**

1) Operational plan
2) Infrastructure Construction

**Transportation Card Settlement Company**

1) Operation and maintenance
2) Labor management

**Bus Company**

1) Request for financial support
2) Operation monitoring
Changes in policy framework, setting a new target

Seoul’s Challenges & Achievements in Sustainable Urban Transport

(Sub)Urban areas ↔ Center cities
Meet the demand of passenger car

Connecting suburban areas and center cities
Meet the demand of passenger car

Link trunk line buses or subways for easy transfer
Satisfy the local needs and secure accessibility

Circular bus service for business in urban areas

 PTR – Reorganized bus routes and numbering system

Inter-regional Lines

Trunk Lines

Feeder Lines

Circular Lines
Free transfer bus-bus, bus-subway in Capital Region, free transfer within 30 minutes (maximum of 5 times)

One Card, All Pass

- Train (KTX)
- Express way
- Express Bus
- Taxi
- City Bus
- Subway

NFC + Mobile

Anywhere

Integrated distance based fare system

- 5km, 1200won
- 4km, 0won
- Total 1,200 Won (Basic Rate Within 10km)

- 10km, 1,250won
- 4km, 100won
- Total 1,350 Won (Basic Rate 1,250won of Subway + Additional Rate 100won for 10km to 15km)

Card Usage Rate ('15)

100% 99% 59.2%
PTR – Bus Rapid Transit (BRT)

For faster, reliable & Punctual bus
For faster, reliable & Punctual bus

12 Corridor, 119.3 km

2004

2015 (Operated)

Plan

35.5 km

119.3 km

223.3 km

PTR – Bus Rapid Transit (BRT)
PTR – Bus Rapid Transit (BRT)

For faster, reliable & Punctual bus

12 Corridor, 119.3 km

- 35.5 km: 2004
- 119.3 km: 2015 (Operated)
- 223.3 km: Plan

BRT Station: 000

Bus Speed:
- 2004: 15 km/h
- 2014: 19 km/h

Variance in Operation Time: ±1-2 min

Seoul's Challenges & Achievements in Sustainable Urban Transport

Changes in policy framework, setting a new target
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Seoul’s Challenges & Achievements in Sustainable Urban Transport

In CBD & suburban CBD

Seoul Station
Cheongnyangni Station
Yeouido
Guro-digital Station

Seoul Transfer Center

Before

Number of passengers for transfer
80,000 person/day

Modal, able to transfer
Train(KTX) ➔ Bus ➔ Taxi ➔ Subway

Time for Transfer
12min ➔ 3min

After – Seoul Transfer Center
Changes in policy framework, setting a new target

Seoul’s Challenges & Achievements in Sustainable Urban Transport

Social benefits expected: $1.4 billion

- Increase of Passengers
  - 2003, 7-12: 9,322
  - 2005, 7-12: 9,833
  - 2010, 7-12: 10,588
  - 2011, 7-12: 10,874

- Citizens’ satisfaction
  - Not satisfied: 88.5 in 2004, 3.2 in 2011

- Decline in bus accidents
  - 2004, 1-6: 1,139
  - 2005, 1-6: 706
  - 2010, 1-6: 581
  - 2011, 1-6: 502

- Increase in fare revenues (Bus)
  - 2004-2010

Major Achievement

- PTR
Pedestrian Priority

Pedestrian-oriented transportation environment

- Car-free Day
- Transit Mall
- Car-free Street
- Barrier-free walking Space
Seoul’s Challenges & Achievements in Sustainable Urban Transport

Efforts of Seoul for sustainable urban transport
- Provision of decent public transportation service
- Eco-friendly, human-oriented transportation system
Efforts of Seoul for sustainable urban transport

Seoul’s Challenges & Achievements in Sustainable Urban Transport

History of Seoul TOPIS 1

TOPIS 1.0 Seoul TOPIS
2004 : Open TOPIS, Install Smart Cart System
2005 : Unmanned Surveillance System

“The First” introduction of ITS
1998 : Implementation in Nam-San area(10.6km)
2000 : Advanced traffic management system in urban expressway

1998

1998 : Implementation in Nam-San area(10.6km)

2000 : Advanced traffic management system in urban expressway
TOPIS 2.0
- 2008: Install Bus Information Terminals (BIT)
- 2009: Mobile Service
- 2010: Open traffic & bus information data
- 2011: Introduction of standard design (VMS, VDS)

TOPIS 3.0
- 2013: Open integrated control center
- 2014: Release of TOPIS Platform (ITS Solution)
Present of Seoul TOPIS 1

1,268 km
Length of roads for travel speed data collection

35,000 vehicles
Probe car collecting GPS data

1,181 detectors
Volume Speed Incident

CCTV
832
24 hour Traffic surveillance & monitoring

VMS
326
Real time traffic signal controller

VDS

3600 controllers
Lane Control System (LCS)

13 systems
Ramp Metering System (RMS)
Efforts of Seoul for sustainable urban transport

Seoul's Challenges & Achievements in Sustainable Urban Transport

Present of Seoul TOPIS 2

- 44% of all bus stops
- 2,612 bus stops
- 7,800 devices
  - 98% accuracy of BIS
  - 96% citizen's satisfaction for BIS

Bus Information Terminal

- 100
- 421
- 1711

- 5:15:7
- 6:50:10
- 6:7:15

- 4/1

- 4/1

24 mil./day

The Number of open data (traffic & bus information)

85 mil./day

The number of transportation Card Data

192 km

Only Traffic communications network

1,600 Persons/year

Foreign visitor to TOPIS

24 mil./day

The Number of open data (traffic & bus information)

2612

7,800 devices

98%

96%

The Number of open data (traffic & bus information)

24 mil./day

The number of transportation Card Data

192 km

Only Traffic communications network

1,600 Persons/year

Foreign visitor to TOPIS
Efforts of Seoul for sustainable urban transport

Seoul's Challenges & Achievements in Sustainable Urban Transport

Present of Seoul TOPIS 3

16.4 mil. dollars/year

Maintenance Cost

4 teams
32 persons

Organization of TOPIS

150 persons

Maintenance personnel

308 systems
Unmanned Regulation System (illegal parking, exclusive bus & bicycle lane violation)

180 Thousand/year
The number of charging penalty

157 km
Length of roads for traffic condition forecasting

Information media
Web, Mobile Broadcasting (Radio, IPTV) VMS & BIT SNS, LED Sign
Seoul’s Challenges & Achievements in Sustainable Urban Transport

ITS Global Leader, The Seoul TOPIS
Main System of Seoul TOPIS: Integrated Control Center System

24hours Integrated Monitoring and Surveillance
(Road traffic, Transit, Disaster & Emergency management)

Data Integration & analysis

Monitoring

Control & Operating

Control & Operating

VDS/CCTV/AVI
Bus OBE/Taxi GPS

Incident & Disaster Information

Traffic Signal

Transportation Card Data

Meteorological Admin

Control Tower

Determination and Immediate response

Operator

Control all devices & Information provision

VMS/Traffic Signal/Web/Mobile/SNS/LCS/Broadcasting

Police agency
Seoul TOPIS

Collecting Data
1) Real time bus location (GPS Data) & bus speed
2) Arriving & Departure Time on bus stop
3) Operating data (non-stop, reckless driving, etc)
4) No. of boarding and getting off passengers on bus stops
5) Incident information

Information Process
1) All bus Interval / Last bus Information
2) All bus arriving time forecasting
3) Analysis of securing bus operating situation
4) Analysis of bus passenger data
5) Analysis of total travel time & distance
Main System of Seoul TOPIS: BMS & BIS 2

**"Bus + Subway" public transport information integration**

1) All Bus & Subway arrival time
2) Last bus & Subway information
3) All Bus & Subway route, transfer service
4) Bus detour & congestion information
5) Incident information

**Information Provision Media**

- BIT
- Web, Mobile
- Web Portal(OpeAPI)
- Telecommunication company

**Evaluation of bus Company**

1) Result of bus operation (not-stop, reckless driving)
2) Basic data for operation cost calculation (total travel distance, frequency of bus running)

**Notice for securing bus driving**

1) Real-time interval
2) Real-time detour route
3) Incident information

**Notice for securing bus driving**

1) Bus location and speed
2) Data related with bus operation
Main System of Seoul TOPIS: Unmanned Regulation System 1

Fixed enforcement System (308)
1) Enforcing Illegal Parking within 200m
2) Exclusive bus & bicycle lane violation
Main System of Seoul TOPIS: Unmanned Regulation System 1

Seoul’s Challenges & Achievements in Sustainable Urban Transport

Fixed enforcement System (308)
1) Enforcing Illegal Parking within 200m
2) Exclusive bus & bicycle lane violation

Automatic enforcement System (7 routes, 28 buses)
1) Automatic detection and enforcement violation at all routes using camera system mounted on bus
2) All bus route enforcement (Origin to final destination)
Main System of Seoul TOPIS: Automatic Charging Penalty System

Seoul’s Challenges & Achievements in Sustainable Urban Transport

1) Searching vehicle owner
   - Automatic vehicle owner search

2) Charging penalty
   - Charging penalty and sending the mail to post office
   - Post office

3) Sending Mail
   - Automatic mail sending

Take 2-3 days to deliver the fine bill to vehicle owner (Non automatic system: 10~15 days)
Collecting Traffic Data:
1) Travel speed using detector (Urban express way) or taxi GPS data (City road)
2) Weather condition from Meteorological Admin
3) Traffic volume / Traffic situation from CCTC
4) Indent / data of real time traffic signal operation

Information Process & Management:
1) All Traffic information process
2) Analysis of traffic congestion area & road
3) Planning of real time traffic signal operating
4) Control device & information provision (VMS, LCS, Traffic signal)
5) Real time speed change monitoring of rods
6) Traffic information service for citizen (Web, Mobile, VMS, etc)
Main System of Seoul TOPIS: Big Data Analysis System

Card data
- 85 mil./day (bus+subway+taxi)

Real time Operation data
- 26 mil./day
  - “bus, subway, taxi”
  - Location, GIS data
  - Traffic speed & volume

Socioeconomic index
- The changing trend of Population, vehicle, lane use, etc

Data analysis
- Calculation of policy index
- Visualizing

Big data progress

Planning of new bus route
- Planning of running interval, etc
Main System of Seoul TOPIS: Traffic forecasting System

Using of cumulated data more than 5 years

Traffic forecasting with the model developed by Korea Transport Institute

1) Short time traffic forecasting within 1hr. (15minite interval)
2) Long time traffic prediction within 30days (1 hour interval)
3) Traffic Forecasting in normal condition
4) Traffic Forecasting in occurred incident or road work

Traffic forecasting Service on web (Urban expressway)

<table>
<thead>
<tr>
<th>Year</th>
<th>Lane Length</th>
</tr>
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<tbody>
<tr>
<td>2015</td>
<td>157km</td>
</tr>
<tr>
<td>2016</td>
<td>574km(417km)</td>
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The accuracy rate of traffic forecasting (urban expressway) 90%
ITS Global Leader,
The Seoul TOPIS

Seoul’s Challenges & Achievements in Sustainable Urban Transport

Total ITS Solution with Seoul ITS Technology & Operation experience

Center Platform
Center Operating System Integrated Surveillance & Response System

Bus Platform
Bus Information System
Bus Management System

UR Platform
Unmanned Regulation System
Automatic Penalty Charging System

FTMS Platform
Urban expressway traffic Management System

ATMS Platform
Advance Traffic Management System
Traffic Signal Operating System

Big Data Platform
Traffic Forecasting System Analysis System for building Transport policy
Seoul TOPIS Platform: Seoul's Challenges & Achievements in Sustainable Urban Transport

1. OS (operating system) free
Windows, Linux, Unix OS

2. DB free
Oracle, MS-SQL, My SQL, Tibero

3. Media service free
Global web standard protocol, HTML5

4. Free embedded ITS Solution

5. Hardware free
Global standard connecting interface & protocol to equipment
Seoul TOPIS Platform: Framework

Providing information (Service Layer)
- Providing information device (VMS, BIT, OBE etc.)
- Homepage
- Mobile
- Open API

Data processing (Business Layer)
- Processing
- Control
- Operation
- Analysis

Data collecting (Communication Layer)
- Byte Stream
- Linkage (ASN.1)
- Open API
- Message

Based on a common platform
- Common GIS
- Common DB
- Fused DB

Based on a common platform
- Batch service
- Batch job

Platforms:
- Center Platform
- Bus Platform
- Big data Platform
- FTMS Platform
- ATMS Platform

Introduction
Seoul’s Challenges & Achievements in Sustainable Urban Transport
Seoul TOPIS Platform: Feature & Function 1

**Response of Incident situation**

- Fast incident detection & response
- Analysis of incident influence

**System monitoring**

- Operation monitoring of all hardware & device
- Monitoring of program process

**Monitoring of Traffic situation**

- Congestion area & road
- Change of speed & volume

**Quick judgment & Response by dashboard**
Seoul TOPIS Platform: Feature & Function 2

**Integrated control of all device**

VMS, VDS, CCTV, LCS, RMS, BIT, Bus OBE & Traffic Signal

**Strict authority management**

Flexible setting of control right by user level

**Adaption of all media device**

Web, Mobile, openAPI, IPTV, Digital panel, etc
Seoul TOPIS Platform: Advantage & Strength 1

1. Open Source
   Free modification & improvement

2. Easy Installation
   Fast & easy setup at any city in the world

3. Saving Cost
   Minimum maintenance personnel & cost

4. High Technology
   ITS Operating such as Seoul TOPIS
Seoul TOPIS Platform: Advantage & Strength 2

Cost-effective & flexible expanding hardware system

**BUS Platform**
- BMS
- BIS
- OBE
- Collecting information
- Providing Information (VMS)
- Providing information (web/Mobile)
- GIS

**Center platform**
- Wall Controller(IP)
- Switch
- Backbone
- Firewall
- Router

**URS platform**
- Enforcement server
- Management

**H/W sector**
- Every server/communication device
  (IBM, HP, DELL)

**Center platform infra configuration**
- Main server: 1 unit
- Operation server: 7 units
- firewall, L4, backbone 1 unit each
- L2, L3 2 units each

**Integration between unit platforms**
- Bus platform
- Unmanned regulation platform
- Integrated operation is available with unit platform

Advantage & Strength:
- Opened OS
  (Linux, Windows, Unix)

Seoul’s Challenges & Achievements in Sustainable Urban Transport
Introduction

Seoul’s Challenges & Achievements in Sustainable Urban Transport

Seoul’s ITS Technology & ITS Project Consulting

- Consultation on ITS implementation, operation with Seoul TOPIS official Friendship Partner, (LG CNS, SK)

Technical support

1) Installation & Operation of Seoul TOPIS Platform
2) Policy development for various areas including ITS, BRT, Parking, TSM, Public Transport Operations, etc.

Seoul TOPIS Platform: Supporting & Consulting
We are ready to help you
Contact anytime If you need