CRP 3840: GREEN CITIES
FALL 2009
PROFESSOR SCHMIDT
FINAL PROJECT

SEOUL BUS SYSTEM
REFORM PROJECT

BY
DANIEL KIM
SARA GRAHAM
Introduction

Faced with a growing population of over 22 million residents in the Greater Seoul metropolitan area, increased usage of personal vehicles, and elevated levels of air pollution, Seoul finally decided to introduce a wide range of reforms to its public transport system. In July 2004, the Seoul Metropolitan Government launched a new, revolutionized public bus system in order to revitalize the deteriorated public transportation service that had long been losing its popularity with the city’s citizens. The new system was comprised of coordinated bus and metro services, integrated fare structure, and shorter, more time-saving bus routes. In this paper, the city-wide reformation project is described in four main aspects: 1) The external factors that contributed to the need to reform the contemporary bus system, 2) The difficulties faced during the planning process, 3) The major outcome and successful attributes of the project, and 4) Possible implications for other mega-cities.

Background

1. Population/GDP Growth

Since the end of WWII, the capital city of Korea, Seoul, has been one of the fastest growing cities in the world. The metropolitan area’s population has effectively quadrupled to 22 million people between the years of 1960 and 2000 (Korea National Statistical Office 2005), making it home to not only one of the largest populations in the world, but also one of the fastest growing economies as well. According to Pucher at el., the per-capita income in South Korea has
increased from $311 in 1970 to $2044 in 1980, to $7378 in 1990, and finally to $12531 in 2002 (Korea National Statistical Office 2005). With such an exponential increase in both population and economy, there has been a significant increase in both freight and personal travel demand. To keep up with this growing demand for ridership, the public transportation system has been expanding its available services accordingly. Until 1974, most personal travel was dependent on the public bus system. However, as the population’s income level began to rise, private cars became more affordable and hence an attractive alternative. According to Pucher et al., while only 2 out of every 1,000 Koreans owned cars in 1970, the rate of car ownership increased to 215 out of every 1,000 persons by 2003 (Ministry of Construction and Transportation 2003). As car ownership increased, the roads became more congested and caused decreased mobility. Average roadway speeds in Seoul metropolitan area were measured to be only about 20 km per hour (Pucher et al., 2005). The bus system’s ability to operate was severely affected by this rise in vehicles on the roads, and the decline in quality of bus services that resulted were further impaired economically by fewer people seeking the public bus system for their transportation needs. In addition to the dramatic decrease in public popularity for buses, air pollution levels due to the increased car use, increased traffic noise, and accidents were all becoming serious health issues.

2. Cooperation with Seoul Metro

The need for an urban rail system became apparent with the sharply rising congestion levels, reduced bus speeds, higher passenger volumes, and longer trip distances that Seoul’s population was demanding at the time. Seoul metro built its first line in 1974 and has been expanding its size ever since—it now carries more than twice the daily passenger volumes that the New York subway and the London underground carried in the year 2000 (Pucher et al., 2005). The construction of the metro system cost over $6 billion, which equates to approximately 80% of the city’s total debt. Although efforts were made to help pay down this debt through passenger fares and government subsidies, the rising funding needs soon became overwhelming. As a result, central and local government officials began seeking more affordable ways to expand urban public transport services while at the same time, maintaining cost-efficiency, speediness, connectivity, comfort, and overall attractiveness.

3. Before 2004

Since its establishment in 1953, the Seoul bus service has been operated by a large number of private companies, which faced little governmental regulation (Kim & Dickey, 2009). Competition between the companies, who only sought to obtain the largest number of passengers
and revenue as possible, resulted in circuitous, overlapping, and inadequately integrated bus routes. Bus drivers had little regard for passenger safety and the buses themselves were poorly maintained. Companies began to run buses only in high-demand areas where they could actually make profit. As a result, regions with a lower demand for public transportation ended up not having any bus services at all, while the higher demand regions had an over-abundance of buses competing for passengers’ fares. People started using personal vehicles, as well as the metro system as alternative methods for traveling and soon the bus industry was facing a huge deficit that needed increasing amounts of governmental subsidies just to function.

The Plan

As part of his election campaign in 2002, Myung-Bak Lee, the newly elected mayor of Seoul, promised to help redesign the Seoul traffic system. As part of that promise, he formed meetings with planners, governors, and community leaders to discuss and brainstorm a possible revitalization plan for Seoul’s public transportation system (Seoul City, 2006). In August 2002, the Public Transportation Renovation Committee was formed. This committee identified the problems with the contemporary bus system and assigned each committee member a role in proposing resolutions to given issues according to their respective specialities. With these proposed resolutions in hand, the committee set up a plan to integrate all transportation-related attributes (such as payment method, location of bus stations, bus routes, and service qualities) into one, ultimate management system. Some of

Myung-Bak Lee

As the mayor of Seoul in 2004, and now the president of ROK, Myung-Bak Lee has enforced an efficient planning process for the reformation, effectively integrating leaders from different fields into one cohesive project.
The innovative ideas regarding the plan were to construct a multi-level system of bus routes, where each level depends on the distance that the buses travel, as well as a payment method that can be used for both bus and subway services, allowing for easier transfer from one to the other. Furthermore, construction of a bus monitoring/traffic enforcement system would enable better and faster circulation of traffic. However, the most difficult part of this plan was to convince private companies to cooperate with the city government. Private bus companies, as expected, strongly refused to let government take control over their operation system. However, after 2 years of weekly and daily meetings, and presenting both private and public sides’ concerns and opinions, Seoul created the Bus Reformation Planning Board which was comprised of 4 community leaders, 8 transportation specialists, 3 bus company representative, and 5 government representatives. By formulating a council comprised of the representatives of the companies, worker unions, and community groups, the plan was discussed and debated in a deeper and more accurate manner and thus, the plan itself was boosted and accelerated to a new level with more support from everyone involved. After years of planning, surveying, and communicating with every group that was connected with public transporation system, Seoul city was finally ready for its big launch of the innovative reorganization of the public bus system.

### The Result

#### 1. Public-private Partnership

The most significant change Seoul considered while restructuring the bus system in 2004 was the implementation of a joint public management system. At the beginning of the restructuring plan, bus routes were privately operated, which resulted in disjointed bus routes that over-serviced some areas of the city, and left some areas of the city without bus service altogether. Seoul tried to resolve this problem by setting up a public-private partnership for the bus system and established two main policies:

1. The government and private companies would maintain a joint management of revenues, and;
2. The government and private companies would work together to maintain a common bus route.

The joint management of the revenues policy integrates all of the revenues earned by buses and divides them according to each company’s operational record. Seoul provided additional funding payments so that the whole bus system did not operate in the red. The bus route policy targeted higher service quality by giving bus companies permission to run their buses on city-owned bus-only-roads. Bus companies rotated their buses on the roads and reported their operational status to the government. The highest ranking companies were given privilege to operate for certain number of years over other companies. These policies created less competition in terms of numbers of passengers, but more competition for better service. Having bus routes controlled by the public sector allowed the bus system to become more consumer-oriented, which encouraged bus companies to expand their services into previously unserviced areas of the city. The sharing of revenue improved bus drivers’ welfare as well as the flow efficiency of buses on the roads.

The partnership that formed between the Seoul government and private bus companies resulted in many benefits for everyone involved. These changes put an end to practices that many private bus companies implemented in an effort to maximize their profits, usually at the cost of discrimination of passengers, or safety to the general public who utilized the same roadways (Pucher et al., 2005). Although initial confusion with the reforms caused a decrease in bus ridership in the first month after the reforms were introduced, the ridership increased by 400,000 and 700,000 passengers a month in the 2nd and 3rd months respectively after the reforms were introduced when compared to ridership in the previous year (Pucher et al., 2005).

#### 2. TOPIS

To help coordinate all of the bus routes and manage ridership effectively, the government implemented the TOPIS (Transportation Operation and Information Service) system. Seoul TOPIS indentifies congestion caused by accidents and
construction work, monitoring traffic conditions of roughly 450 arterial roads and 3,000 intersections in real time utilizing over 700 CCTV cameras installed all across the city. Seoul’s TOPIS also combines the T-card, an auto-regulation system, transportation broadcasting, and the police agency into one administration center. Thus, through this center, the operation of 8,000 buses in the Seoul metropolitan area are processed in real time, providing interval data between each bus and on every route. This functionality is achieved by using GPS and wireless telecommunications.

The system also engenders safer operation across the network and on-going analysis of public transportation conditions. More specifically, TOPIS provides information on areas of congestion, bus lane conditions, and route delays to both passengers and drivers through various means of media. For bus drivers, it updates them on time intervals between the bus stops so that they can manage their speed, and notifies them of any emergencies, such as traffic accidents, so that drivers can take alternate routes. For passengers, it informs them of the location of buses and how long the wait time will be at bus stops, as well as the expected arrival time. It also screens the speed and service of each bus in order to advance the quality of service and customer satisfaction, giving incentives for the drivers to work harder for raised payment according to the service report.

3. Route Changes

The government also re-designed and re-planned the routes that each bus line traveled in the city. Before the reforms, there were over 400 individual bus routes throughout the city—many of which overlapped, or left out certain areas in the city altogether. The grouping of bus services into one of four types that were color-coded (red, green, blue or yellow) based on the number of stops and area of service within and outside the city that the bus serviced, allowed passengers to easily identify where each bus was going, and which bus they needed to get on next. Additionally, the government also redesigned the bus stop areas and started introducing newer bus standards. Curbside bus lanes were lengthened, and new low-floor buses that run on compressed natural gas were introduced. The eventual plan was to make sure that all boarding platforms are level with bus steps to make getting on and off the buses faster, easier, and safer (Pucher et al., 2005). Because of these changes, the numbers of bus accidents and injuries that occur monthly have fallen by 33% compared with accident rates before 2004 (Pucher et al., 2005). Although customer satisfaction initially went down because of confusion over the changes, four months after the changes had been implemented, almost 90% of the customers surveyed seemed satisfied with how things were going (Pucher 51).

4. Bus Lanes - Expansion of Mid-Lane

One of the greatest impacts of the bus reforms was expansion of the mid-road bus
lanes that are for the exclusive use of city buses. Prior to the bus system changes in 2004, Seoul had approximately 219.1 km of bus lanes in the city. Most of these lanes were located on the side of the road while a very small portion, 4.5 km, were located in the middle of the road. The placement of the bus lanes on had the tendency to cause traffic problems because buses would very often have to cut through traffic to reach their stops or pick and drop off passengers on the side of the road. This slowed down the overall speed of traffic and sometimes resulted in accidents. One of the innovative plans for this bus revolution was to increase the speed and efficiency of bus circulation by constructing mid-road bus lanes. The mid-road bus lanes would ensure that the buses would not have to weave through traffic to reach their bus stops, hence allowing them to keep their schedules on time and keep customers satisfied. Additionally, since the mid-road bus lanes were not open to personal vehicles, buses could travel on them without delays and hindrances to their schedules. This, in conjunction with TOPIS, which also be helps to coordinate traffic signals, have allowed average bus speeds to increase everywhere mid-road bus lanes were created or expanded upon—sometimes as much as 100%. Average car speeds also went up because there was less disruption and weaving from the buses impeding their flow. Finally, the inclusion of these lanes has allowed each exclusive bus lane to carry up to six times more passengers than other traffic lanes in the same area.

In 2004, Seoul added additional mid-road bus lanes in several counties including Dobong, Sung-san, and Gang-nam. The speed of buses, especially in Dobong County, increased dramatically and allowed the bus schedules there to be at most, 2 minutes off schedule. Passengers began to ride buses instead of taking their personal vehicles because they could depend on the schedules.

5. New card system

Along with the public-private partnership, Seoul implemented a ‘new card system’ for its publicly operated transportation systems. The ‘old card system’, which was launched in 1996, included different cards and infrastructure for the bus and the metro that could not be combined into one consistent method. As a result, Seoul planned for an integrated card system that could be used for all public transportation methods in Seoul. The new card system bases the transportation fares on the distance traveled without regard to “distance zones” that previously required the payment of additional fees, and provides
an automatic discount when a passenger transfers from one transportation system to another (e.g. bus to metro). Seoul hired a private company to manage this card system, and named it “T-money”.

When a passenger touches the card sensor on a bus with a T-card, the information about the number of transfers or distance traveled by the passenger is transmitted by satellite to a recording station. This information, which equates to approximately 22 million transactions daily, is downloaded by each company at 2am, organized and prepared, and then the statistics are reported to the city by 7am.

This T-card system is compatible among different regions in Korea and has a vast amount of memory capacity. As a result, the T-cards can be used in other applications such as pay-n-go in theatres, convenient stores, malls, internet shopping, and also has a mileage service that gives consumers a variety of bonuses.

6. Auto-regulation system

Seoul TOPIS includes an automated system that requires minimal human input for the regulation of illegal parking or traffic law violations inside bus lanes. The installment of surveillance cameras began in 2004, and today Seoul currently has 36 cameras for general regulation, and 84 cameras for illegal parking. If the cameras detect the presence of an illegally parked vehicle, a sensor is automatically activated. After 7 minutes, if the car is still parked illegally, TOPIS automatically searches the plate number and puts the car’s information onto the illegal parking record database. This information is sent to city hall, where the fee is recorded and then charged to the person who owns the car. In the regions where illegal parking is frequent, TOPIS contacts the local enforcement agents to quickly resolve the problem for faster traffic flow.

7. Economical Analysis

While all of these bus reforms have increased the efficiency of the system and brought in higher passenger ridership rates, this has not been enough to eliminate the annual government subsidies.
that had been needed to keep the bus system operating prior to the reforms. In fact, the annual governmental subsidies have effectively tripled since the reforms have been implemented. However, these costs are much lower than they would have been if Seoul had decided to reform the metro system instead. The US General Accounting Office estimates that for every 1km of metro rail that undergoes reconstruction, about 2.44km of BRT could be reconstructed for the same amount. (Pucher 56). As a result, Seoul was right to complete the renovations even though its upfront financial cost was high—it was the cheapest alternative to a growing problem that had to be addressed.

Application to Other Cities

Seoul is a very good example of some technologies and policies that can be applied to other cities to increase transportation efficiency. Out of all of the changes that were implemented in the Seoul transportation system, the one that would probably have the biggest effect when applied to other cities would be the middle-road bus lanes. Although the amount of analysis for this change would be significant, it would not require a lot of construction when compared to expanding the size of roads. Installing a system similar to TOPIS would also help—especially the automated regulation system that uses cameras instead of staff to monitor the illegal parking is definitely applicable in other big cities such as New York City. During the 2008 fiscal year, NYC handed out approximately 10 million parking tickets and collected $588 million in parking violations. Those numbers were made possible in part to the 238 Traffic Enforcement Agents were hired during that time. Meanwhile, budget limitations resulted in more cuts to the Police Department, bringing its total down to 35,000 uniformed officers—the lowest figure in the past 10 years. Installing a camera-based ticket system would allow the money that usually goes towards funding the Traffic Enforcement Agents be put back into the Police Department—where it is needed most. At the same time, more revenue would be brought in from the more efficient camera system, further increasing revenues (Donnelly

Decline in Monthly Bus Accidents and Injuries in Seoul, 2003 to 2005

![Graph showing decline in monthly bus accidents and injuries](chart.png)
Finally, another campaign brought along with this renovation in bus system was the “Weekly No Driving Day”, which decreased the traffic congestion in Seoul drastically. The voluntary program allows people to choose a day of the week during which they pledge that they will not drive their vehicles. In return, participants are given incentives such as reduced gas prices, free parking, or free car washes. Compliance is regulated by the use of e-tag stickers that are placed inside the participants’ cars to ensure that they do not drive them on the day that they registered on. This system would be fairly easy to apply within cities, although it does require partnering with transportation-related businesses to provide incentives to participants. Most existing e-tags could be programmed to include monitoring for this purpose as well. The implementation of this program in Seoul has decreased traffic volume by 3.7% and saved approximately $50 million in fuel costs, showing that voluntary programs can have a significant impact (C40 Cities).

Conclusion

Seoul has successfully reconstructed not only the public bus system but also the characteristics of the public transportation system through increased public control over bus routes and by creating a new payment system. The demand for public transportation has increased dramatically since the reformations, and citizens’ feedback on the improved service has been very positive. Although in the first month after the reforms, there was some initial disruption and confusion, over time, the new public transportation system has received very positive evaluations from its users, staff, and foreign urban planners and governments such as England, China, Vietnam, and Japan (Seoul Special City, 2006). Implementation of every attribute of improvement in Seoul’s public bus system may not be suitable for every mega-city considering transportation reforms. However, Seoul offers many good options that could be successfully applied to cities looking for a more sustainable public transportation system. By encouraging citizens to use public transportation, Seoul has become even more sustainable than it was before.
Reference


Authors:

**Sara Graham** is a senior in the Sibley School of Mechanical and Aerospace Engineering. After her graduation in December, she will be working in Fayetteville, NY as a renewable energy engineer for the Antares Group, Inc, where she hopes to have a positive impact on energy efficiency and management.

**Daniel Kim** is a senior majoring in Urban Planning in school of Architecture, Art, and Planning. He will be pursuing a career in community development in underdeveloped countries after his graduation in summer 2010. He plans to go to business school afterwards for his further academic achievements.