

Public transport in Seoul

Meeting the burgeoning travel demands of a megacity

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With over 22 million residents, the Greater Seoul metropolitan area depends crucially on public transport for its growing travel needs. Rail and bus services carry 65% of all trips in Seoul, one of the world's highest market shares of public transport.

Introduction

South Korea has been one of the fastest growing countries in the Pacific Rim area. Seoul, the capital city has been one of the

world's fastest growing megacities, quadrupling in population between 1960 and 2002. The Greater Seoul metropolitan area now covers 12,446 km² and has 22.5 million inhabitants. It includes the City of Seoul itself as well as the City of Incheon and Gyeonggi Province.

With a population of 9.9 million in 2003, the core City of Seoul is one of the world's largest cities, and with 16,500 inhabitants per km², also one of the world's most densely populated cities; 1.3 times denser than Tokyo and twice as dense as New York. Scarcity of land, overcrowding, high housing prices, and serious traffic congestion have forced the decentralisation of most new housing to the surrounding suburbs, which now contain more than 12 million residents and continue to grow rapidly.

Population growth and the vast expansion of the geographic area of Greater Metropolitan Seoul have contributed to rapid growth in travel demand. Both the number of daily trips per person and their average length have been steadily increasing, especially for residents in the outer portions of the metropolitan area. More and more workers live in the distant suburbs, including five large new towns (planned 'satellite cities'), but must commute to jobs that are still concentrated in the central city of Seoul. An increasing percentage of firms are also decentralising to the suburbs, but suburb-to-suburb commutes to suburban jobs can also be quite long because the overall transport system is radially focused on the centre and not designed to connect up the suburbs.

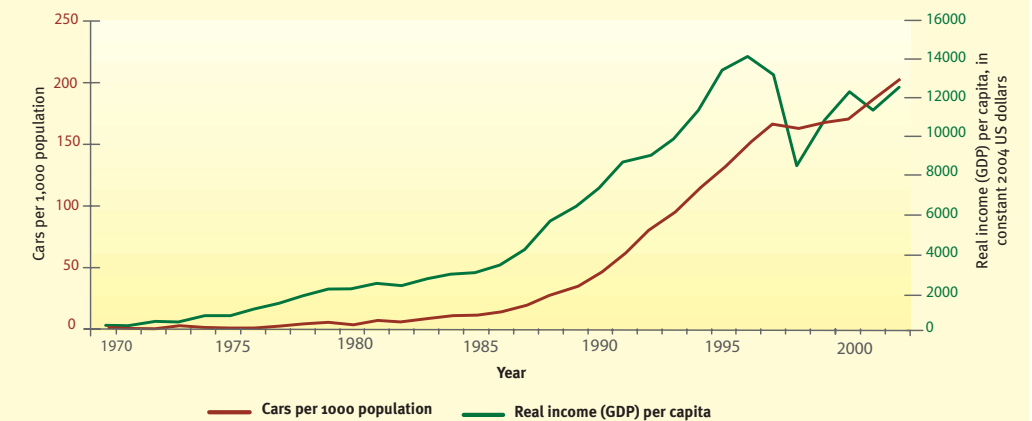
Increased per-capita income and car ownership have also spurred growth in travel. Since 1970, real per capita income in South Korea has risen dramatically (see Figure 1). Expressed in constant, inflation-adjusted 2004 US dollars, per-capita income rose from only USD 311 in 1970 to USD 2,044 in 1980, USD 7,378 in 1990, and USD 12,531 in 2002. That represents a 40-fold increase in real per capita income in only 32 years, a truly astounding accomplishment for any country.

Private car ownership has increased at almost the same pace as per-capita income. While only a tiny percentage of Koreans owned cars in 1970 (2 cars per 1,000 persons!), the rate of car ownership rose to 215 per 1,000 persons by 2003. Car ownership in the City of Seoul (214) is almost identical to the national average, but it is higher for Gyeonggi Province (237), which consists of more car-oriented, lower-density suburbs. Increased use of private cars has caused serious traffic congestion, especially on the radial arterial highways connecting the suburbs to the central city. Average roadway speeds are only 20km per hour overall, and only 17km per hour in the city's two central business districts. Congestion costs are estimated to exceed USD 8 billion a year, about 4% of GDP. Increased car use has also caused dangerously high levels of air pollution, noise, and traffic accidents as well as excessive use of scarce land for roadways and parking facilities.

Overall travel trends

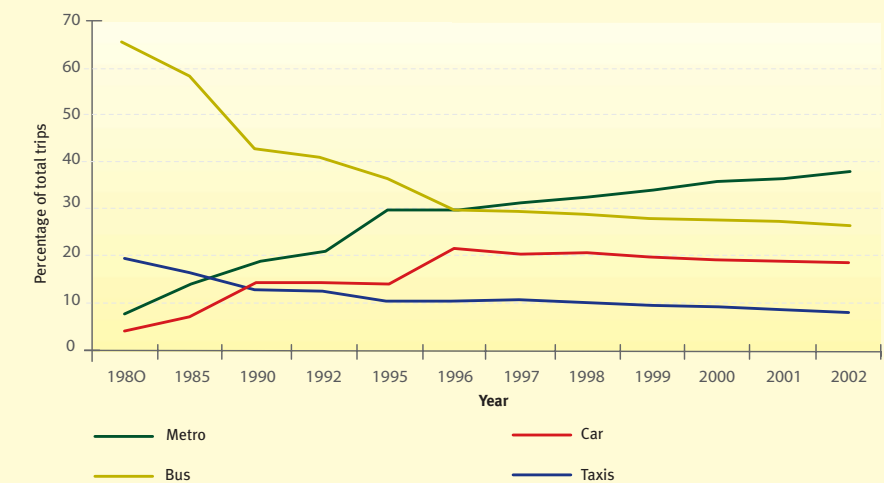
Perhaps the most striking trend in travel is the large increase in total trips made. Data for the suburbs are not available, but for the central City of Seoul, the total number of daily trips rose 5-fold between 1970 and 2002, from 5.7 million to 29.6 million. Continued economic growth in the coming years virtually ensures continued growth in travel demand in the future. That growth in travel is likely to be greatest in the suburbs, where both population and income are projected to rise significantly.

FIGURE 1: INCREASES IN CAR OWNERSHIP PARALLELING GROWTH IN REAL PER-CAPITA INCOME IN SOUTH KOREA, 1970-2002 (IN CONSTANT, INFLATION-ADJUSTED 2004 US DOLLARS)



Sources: Korea Transport Database and Korea National Statistical Office

FIGURE 2: TRENDS IN MODAL SHARES OF TOTAL TRIPS IN SEOUL, 1980-2002 (PERCENT OF TRIPS BY EACH TYPE OF TRANSPORT)



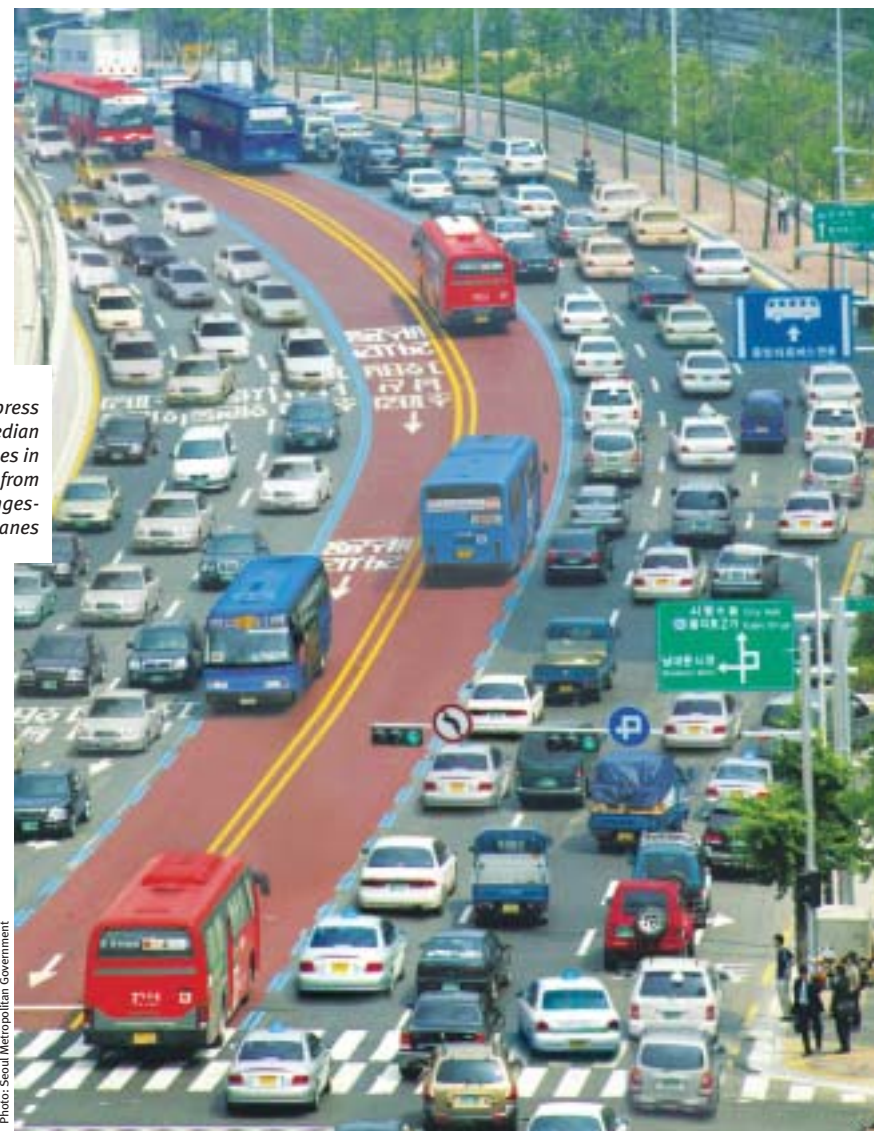
Sources: Seoul Metropolitan Government and Seoul Development Institute

The large increase in car ownership and use in the 1980s and early 1990s diminished public transport's share of total travel in Seoul. Thus, the combined modal share of bus and metro fell from 75% in 1980 to a low of 60% in 1996 (see Figure 2). By comparison, trips by private car rose from only 4% in 1980 to 21% over the same period. 1996 was a turning point. Thanks to a combination of metro system expansion and car-restrictive policies implemented in the mid-1990s, public transport's share of trips rose from 60% in 1996 to 65% in 2002, while the car's share fell from 21% to 18%. Those successful policies will be examined later in this article.

Another important trend for public transport is the simultaneous drop in bus usage and rise in metro use (see Figure 3). Indeed, the annual number of bus passengers has fallen almost continuously over the past two decades, from 2,582 million in 1980 to only 1,526 million in 2002. In contrast, urban rail passengers rose steadily with each successive expansion of the metro system, from 198 million in 1980 to 2,231 million in 2002.

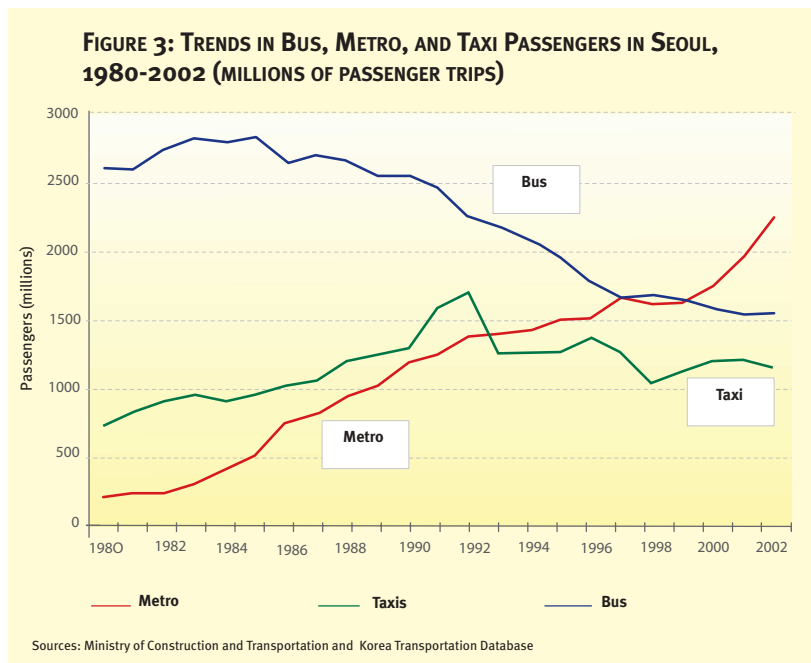
Urban and suburban rail systems

The Seoul Metropolitan Government has focused on improvements to Seoul's metro system as the key strategy to deal with



Red and blue express buses using median bus lanes in Seoul, protected from heavy traffic congestion on regular lanes

Photo: Seoul Metropolitan Government



the city's many transport-related problems. Until 1974, Seoul was almost entirely dependent on bus services. Sharply rising roadway congestion, reduced bus speeds, increased passenger volumes, and longer trip distances increased the necessity for an urban rail system.

The first metro line, 8km long, opened for service in 1974. Since then, the metro system has expanded again and again. By 2004, the metropolitan area's total rail network reached 487km, with further expansion in progress (see rail network map). The Seoul Metropolitan Government and City of Incheon are directly responsible for construction of the metros in their respective jurisdictions. The Korea Rail

Network Authority manages the construction of all new Korean Rail lines, but the rail infrastructure is the property of the national Korean government, which is also ultimately responsible for financing both investment and operating costs. The Korean Railroad Corporation operates the suburban portion of Korean Rail lines, while the two Seoul metro corporations operate the portions of Korean Rail lines within the Seoul city boundaries.

While the expansion of Seoul's metro system has been an impressive accomplishment, it has come at high cost. The cumulative construction debt has now reached almost USD 6 billion and represents 82% of the city's total debt. Moreover, passenger fares only cover about 75% of operating costs, with the remaining 25% subsidised through city government programmes. The annual operating deficit in 2004 was USD 634 million. Financing both construction costs and operating deficits has put an enormous financial burden on the city. Fortunately, the national government contributes 50% of metro construction and vehicle costs, but the city must bear the operating subsidy burden alone.

Bus systems before 2004 reforms

The first public bus services in Seoul began in 1953 and remained the principal mode of public transport until the mid-1990s. Bus usage rose rapidly with the growth of Seoul from the 1960s to the 1980s, but began a long-term decline around 1990 (see Figure 3). Bus services had to compete with ever-expanding metro services as well as rising car ownership. Just as buses



Korean Rail service within Seoul operating like metro

were faced with stiffer competition from metros and cars, bus services declined in quality due to roadway congestion that slowed down buses and made them less dependable. They also suffered from highly inefficient, uncoordinated, and dangerous operating practices of the many private bus companies who ran the services.

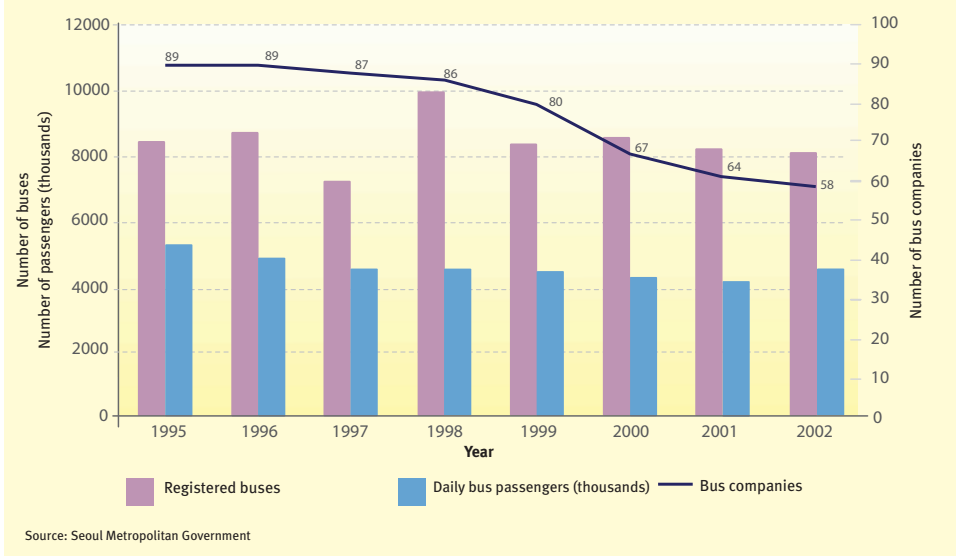
For decades, bus services in Seoul were operated by a large number of private firms, with virtually no government control of routes, schedules, or other aspects of service. Only the fares were determined by the Seoul Metropolitan Government, which also provided increasing operating subsidies to cover growing operating deficits that were causing many firms to go bankrupt or curtail the quality of their services. Each bus company operated different routes, with no com-

petition on any particular route. Because there was no coordination among the different bus companies, many routes were highly circuitous, overlapping, and not adequately integrated with metro services and the routes of other bus companies.

Most of the private bus firms sought only to maximise profits (or minimise losses) while disregarding rider safety and comfort. An official government report sharply criticised the private bus companies for encouraging truly outrageous bus driving behaviour. In order to squeeze as many passengers as possible into a bus, bus drivers used violent braking to jolt standing passengers further back into the bus. Bus drivers would recklessly race other buses to pick up passengers at stops, but they deliberately avoid picking up elderly or

	Seoul Metropolitan Subway Corp.	Seoul Metropolitan Rapid Transit Corp.	Incheon Rapid Transit Corp.	Korean Railroad Corp.
No. lines	4 lines	4 lines	1 lines	4 lines
Type of body	Public corp under control of Seoul metropolitan Gov.	Public corp under control of Seoul metropolitan Gov.	Public corp under control of City of Incheon	
Operation	Operates metro lines 1, 2, 3, 4	Operates metro lines 5, 6, 7, 8	Runs one metro line	Functions like a metro in the city, suburban rail in outer portions
No. km	135 km of metro routes	152 km of routes	22 km of routes	178 km system (57 km in Seoul City boundary)
No. stations	115 stations	148 stations	22 stations	104 stations
No. trains	199 trains	201 trains	25 trains	150 trains
Intervals peak	2.5-3 min.	2.5-6 min.	4-6 min.	1.7-8 min.
Intervals off-peak	4-6 min.	5-6 min.	7.5 min.	3.6-12 min.
Average daily ridership	av. daily ridership lines 1, 2, 3, 4: 2 mill. passengers	av. daily ridership lines 5, 6, 7, 8: 2 mill. passengers	Daily ridership: 325,000	Daily ridership: 2.2 million passengers

FIGURE 4: NUMBERS OF BUS COMPANIES, REGISTERED BUSES AND PASSENGERS



disabled passengers in order to save time. In addition, bus vehicles were old, poorly maintained, and did not meet international standards. Service was dangerous, slow, uncomfortable, and unreliable.

As shown in Figure 4, the number of bus companies has fallen considerably in recent years, from 89 in 1995 to 58 in 2002. To some extent, the decline was due to some firms going bankrupt. But the Seoul Metropolitan Government had also encouraged the consolidation of bus firms to eliminate duplication, reduce overhead costs, and improve coordination of services. That did not, however, solve the increasingly serious financial problems of the bus

companies. The decline in bus passengers meant fewer passengers and less fare revenue per bus, and escalating operating deficits. For example, the average number of total daily passengers per bus fell from 1,093 in 1989 to only 494 in 2002.

By 2002, the local government subsidy needed to cover the operating deficit was USD 65 million, on top of USD 66 million in capital subsidies for investment in new buses and garages. Although bus services cover a higher percentage of operating costs from passenger fares than metro services (85% vs. 75% in 2003), the soaring subsidy needs of bus services have become a grave concern. The main problem, however,

has been the sharp decline in bus service quality, which has driven away many bus passengers and encouraged more car use, congestion and pollution.

Although it did not deal with the core problem of unregulated, uncoordinated private bus firms until 2004, the City of Seoul has made several attempts to speed up bus services and thus boost usage. To protect buses better from worsening roadway congestion, the first curbside bus lanes were installed in 1984 and expanded to 89km by 1993, 174km by 1994, and 219km by 2003. That network of reserved bus lanes helped speed up bus travel somewhat, but it did not succeed in raising bus use. Clearly, more drastic changes were necessary.

Bus systems after 2004 reforms

1 July 2004 marks a milestone in metropolitan Seoul's transport policies, especially those affecting bus services. The Seoul Metropolitan Government greatly increased its control over bus routes, schedules, fares, and overall system design, introducing a 'semi-public operation system' that retains private bus firms but leaves route, schedule, and fare decisions to the Seoul Metropolitan Government. Moreover, it now reimburses bus firms on the basis of vehicle x km of service instead of passenger trips, which should act as an incentive for improving service quality and cut down on speeding, reckless driving, and discriminating against elderly and mobility impaired passengers.

The bus route network was entirely re-designed to better structure and integrate over 400 different bus routes. All bus services are now grouped into four types, with buses colour-coded to help passengers distinguish between them. Blue buses are long-distance express buses that connect outlying suburbs with each other and with the city center. Red buses are long-distance express buses that connect the satellite cities (planned new towns) with the city center. Green buses provide local services throughout the metropolitan area to feed metro stations

and express bus stops. Yellow buses provide local services within the city centre.

To coordinate bus services on a truly comprehensive, system-wide basis, the Seoul Metropolitan Government set up a new Bus Management System (BMS) using advanced intelligent transport system (ITS) technology. Global positioning system (GPS) terminals located in every bus now permit a central bus control centre to monitor bus locations and speeds, adjust the number of buses assigned to any given route, communicate with bus drivers, and provide real-time information to passengers waiting at bus stops or via the internet. On top of better passenger information, the new system will also help optimise service distribution by adjusting bus assignments and scheduling to meet the various travel demands on different parts of the extensive bus network.

Dedicated bus lanes were expanded and upgraded. The length of curbside bus lanes was increased from 219km to 294km, with more expansions planned. Most significant, however, is the development of a true bus rapid transit network (BRT) with dedicated bus median lanes, high-quality median bus stops, priority traffic signals at intersections, real-time information for passengers and system operators, and new, state-of-the-art buses. By early 2005, there were already 75km of BRT services over 6 different corridors. During 2005 and 2006, there will be an additional 88km of BRT over 7 more corridors. Expansion is likely to continue after that. These BRT services will benefit from an increasing number of new buses. By 2006, there will be over 300 low floor buses, mostly running on CNG (compressed natural gas). Of those, about 20 will be articulated buses. Eventually, all the blue and red express buses will be CNG and low-floor, and all red buses will also be articulated. With loading platforms at BRT stops, getting on and off the express buses will be easier, faster, and safer. The Seoul Metropolitan Government now views BRT as a much cheaper and quicker way to provide express

public transport services than metro expansion, which can take many years and requires much more capital investment.

In addition to these major service improvements, a unified, coordinated fare structure has been introduced that integrates both bus and rail services. Fares are now based only on distance traveled, with free transfers permitted between bus lines as well as between metro and bus. Although the overall fare level was increased, the distance zones that had previously only applied to metro fares were enlarged to permit longer trips without the distance supplement. Equally important, there is now a multi-purpose, stored-value smart card (called 'T-Money') that can be used for all bus and rail services, greatly enhancing ease of payment for the traveler. For the first time there are now monthly commutation tickets that offer discounts to regular travelers.

Although there was great disruption in the days just after the introduction of all these simultaneous reforms, the overall result is a resounding success. In the BRT median lanes, there was a steep increase in bus speeds. On the three initial BRT corridors, bus speeds rose from 32% to 85% in the morning rush hour and from 71% to 99% in the afternoon rush hour. The express buses using the median lanes carry six times more passengers than other lanes in the same corridor.

The benefits of the 1 July 2004 reforms have been system-wide. There was an 11.2% year-on-



Photo: Seoul Metropolitan Government



Photo: Seoul Metropolitan Government

Seoul public transport smart card, called T-Money, used a bus (above) and metro (below)

year increase in total bus passengers in Seoul and a 7.1% overall increase in total public transport trips. The number of bus-related accidents fell by 23%, and the number of seriously injured persons by 43%.



This central, computerised control centre in Seoul facilitates coordination of bus operations via remote GPS terminals and monitors traffic levels on roadways via closed-circuit surveillance cameras

Blue express buses using median bus lanes approaching bus shelter with digital monitor showing real-time information on bus arrivals



Photo: Seoul Metropolitan Government



These are the newest metro cars now operating in Seoul

Other innovative transport policies in Seoul

In addition to its metro system expansion, and bus service reform, Seoul has also introduced innovative and successful policy measures to curb the harmful impacts of excessive car use and to encourage public transport use, walking and cycling. The two key tunnels connecting northern and southern Seoul have been subject to congestion pricing since 1996. From 7am to 9pm on weekdays, most private cars with less than three occupants must pay a toll of 2000 won (about USD 2). After the congestion toll was implemented in 1996, traffic volume fell by 12% and travel speed rose by 84%. Perhaps most impor-

tant, there was a sharp rise in the number of users carried per hour, since carpooling increased dramatically. There are plans to extend congestion pricing to several other arterials in the coming years.

The Government has also hiked taxes on petrol and diesel fuels to discourage driving and generate needed revenues to cover its many investments in transport infrastructure. At the same time, it has put up parking fees for public parking facilities almost every year. And cut the required amount of parking included in newly built commercial and office buildings in the city centre. These two measures make parking less available as well as more expensive, thus doubly discouraging driving.

Finally, the City of Seoul has been implementing a range of measures to encourage more walking and cycling by making them safer and more practical ways to get around. Thus, motor vehicles are now prohibited on some streets, turning them into pedestrian streets. By improving pedestrian crossings, sidewalks, and other facilities for pedestrians, the city aims to increase the livability of the city while reducing car dependence. Similarly, the network of bike lanes has been growing, with almost 200km in 2004 and bicycle-only streets are also planned.

Conclusions and policy recommendations

Seoul has made impressive advances in transport policies over the past several decades in

an attempt to deal with the enormous growth in travel demand as the city and the surrounding metropolitan area have grown to be one of the world's megacities. Whilst the Seoul metro and suburban rail network provide high-quality public transport services to over 8 million daily riders, the bus system, has been much more problematic. The pathbreaking reforms of July 2004 completely restructured bus services and increased public control over routes, schedules, and other aspects of service. In addition, they integrated bus routes, schedules, and fares with the metro system, thus providing a far superior overall public transport system, reflected in the 7% overall increase in public transport trips.

The July 2004 reforms are just a beginning, however. Both routes and fare systems should be coordinated and uniform throughout the Greater Seoul metropolitan area. The T-Money smart card should be valid on all public transport services throughout the region. Fortunately, the Seoul Metropolitan Government and Gyeonggi Province are currently working on increased regional and intermodal integration.

The extension and continuous upgrading of bus rapid transit is likely to be the most cost-effective approach to providing the additional public transport services needed. Existing BRT systems throughout the world have demonstrated that they can provide excellent express service at a fraction of the cost of new metro construction. The BRT experience in Seoul so far has also been quite successful.

Finance is surely the most problematic aspect of Seoul's public transport system. Vast funding is needed for the extra investments in BRT, planned metro system expansion and new light rail lines. Modernisation of the entire bus and rail fleet will also need additional funding. While passengers can be expected to bear some of those costs through higher fares, as much of the burden as possible should be shifted to private car users. Car drivers are responsible for most of the environmental, social, and

land-use problems in urban transport. Thus, it is only fair that they should help pay for the solutions to those problems, ie. better public transport and pedestrian and bicyclist facilities. Increased petrol and diesel taxes, car registration fees, parking fees, driver licensing fees, and congestion tolls should be dedicated to a multi-modal transport fund that would provide the necessary revenue for investments in public transport, cycling, and pedestrian facilities.

Questions, comments or suggestions to pucher@rci.rutgers.edu copy to editor@uitp.com

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Train on metro line 1 approaching a station with protective door screens on the platforms to prevent passengers from falling onto tracks



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