
1. A Guide to Transportation Policy

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Policy Area: Transportation

Development of Transportation in Seoul

As a major city and the capital of South Korea, Seoul has undergone various stages of change with its transportation system over the passage of time. In the 1400s, streets were structured in and around the area within the four ancient city gates (the current city center) where most of the travel was by pedestrians. When tram and bus services were introduced in the late 19th century, urban functions spread beyond the boundaries of the city, modifying or expanding the existing street systems and continuing to change the city's transportation system until the Korean War (beginning in 1950) when most of the infrastructure and facilities were destroyed. However, the War presented an opportunity to revamp the urban transportation system while rebuilding infrastructure, but this was lost as an explosive growth in population and the consequent unmanaged urban development created structural deformity. This has led to chronic transportation problems in Seoul, some of which continues today.

Since the ceasefire, Seoul has endeavored to keep pace with the rapidly growing economy and trends changing the paradigm of transportation policy. War in the 1950s wreaked havoc on the nation, and the capital was captured and recaptured several times, with more roads, bridges, and other urban facilities razed to the ground each time. During the rest of the decade, one of the pressing matters, understandably, was to restore the city from the ashes and reopen the bridges and road networks. In the next decade, the nation set up a framework for self-sustainable and independent growth pursuant to the government's economic development plan. The speed of urbanization in Seoul and other cities accelerated, and the population inflow to Seoul grew. From the perspective of transportation policy, public transport was urgently needed. The city's transportation policies of the time were mostly such agendas as providing 100 buses to carry students to school every day, introducing express buses, increasing the number of bus services, and suspending operation of the downtown tram.

The 1970s was marked by noticeably significant growth of the scale of the Korean economy. With more and more of the industrial workforce flowing into the industrialized capital, overpopulation was inevitable, as were the accompanying problems. Transportation policy in the 1970s focused on addressing congestion in public transport and the city and building more roads and bridges. Subway Line 1 was opened in 1974, heralding the age of underground transportation, and new policies were introduced to disperse traffic volume. In 1971, the traffic control center was launched at the police agency in Seoul as part of the effort to take a scientific approach to resolving transportation issues. At the same time, intersections and signal systems were modernized.

Based on the remarkable economic growth up to that point, Seoul was quickly urbanized in the 1980s, to a level similar to cities in more advanced countries. It was also a period when more people began buying and driving their own cars. By 1989, the Transportation Systems Management (TSM) program was implemented. Urban expressways and bridges continued to be built. After a decade of Subway Line 1, Lines 2, 3, and 4 followed between 1984 and 1985. To strengthen the public transit system, the bus system was fully reorga-

nized.

The 1990s was a time of major contrasting changes: economic growth that pushed the national per-capita income up to \$10,000 and the financial crisis that resulted in aid from the IMF. Nonetheless, urbanization progressed rapidly. The population in Seoul and its vicinity accounted for nearly half of the total population of South Korea. Housing, water, and power were serious problems, but transportation also surfaced as one of the most serious issues. The focus of Seoul's transportation policy at this time was on improved public transit to ease congestion and on pursuing a transportation demand management policy. Major measures included the initiation of the congestion impact fee, opening of Subway Lines 5 – 8, comprehensive mid- to long-term parking plans, transportation demand management system for companies, and the 1-10 Road Space Rationing Program, etc.

In the 2000s, discussions were held on congestion due to the steady increase of vehicles, air pollution from exhaust, and high accident rates that did not match the nation's goal of joining the ranks of advanced countries. The key global agenda of the time was sustainable development, and Seoul modified its transportation policy in line with this trend. To bring sustainability to the transportation system, Seoul brought in various measures such as revising the public transit system, introducing a center bus lane, strengthening the transportation demand management policy, introducing a car sharing service, and providing assistance with electric car purchases.

History of Transportation System Construction by Period

1. Pre-modern (1394 – 1945)

Major Changes in Public Transport in Seoul

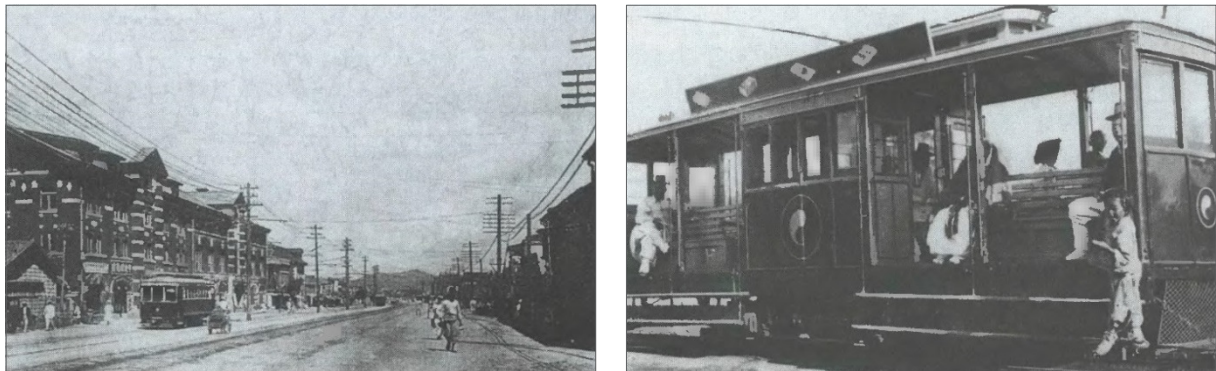
From 1394, when Seoul became the new capital, to the time when Korea finally opened its ports to the outside world, the transportation system was pedestrian-oriented. Within the boundaries of the four ancient city gates, the street networks were in a grid pattern according to the specific geographical features of the city: a network of streets flanking the three wide roads was the main route of travel. In 1426, a system was introduced to sustain the city's role as the capital and as an exercise of the dynasty's authority, dividing the road network into small, medium, and large roads. When Korea opened its doors to the outside world in the late 19th century, a new, modern mode of transport was brought in, altering the city's transportation system altogether: electric trams. These vehicles ran on tracks on downtown roads. Then, in the early 1900s, rail was introduced to provide arterial transportation between regions.

The tram was an innovative novelty. Starting with the 8 km leg connecting Seodaemun and Cheongnyangni in 1899, the tram quickly changed the pattern of travel, which had been mostly on foot. The popularity of this fast, convenient mode of transport grew, and the tracks were extended. Until the tram was completely removed in 1968, it was the main mode of public transport in Seoul. The first tram was 8.7 m long and 2.5 m wide, with a capacity of 40 passengers. It had no specific stops; when a passenger requested it, the operator stopped the tram. Routes were added along the major arterial roads downtown, and by 1945, the number of passengers jumped to 500,000 per day: nearly half of the city's population used the trams.

Construction of the Road Networks in Seoul

Town planning in the 1910s and 1920s helped build or expand the road networks, which was how modern improvements to the roads began. The city walls and gates that separated the downtown space from the outside were torn down, and Seoul's administrative and spatial area was expanded. Systematic improvement of the roads began with construction of 28 roadways in 1912. By 1919, this number had expanded to a network of 42 roads, with 25 more by 1929. In 1936, plans were announced to build/expand 220 routes (1 wide road, 55 large roads, 164 medium roads) downtown pursuant to the Seoul Town Planning, laying the foundation for today's road networks in downtown Seoul. There were only 2 cars in the country in 1912, but by the late 1920s, this number had grown enough to begin a full-scale automobile transportation industry. By then, the automobile was the main mode of transport in Seoul. Most of the vehicles introduced during this time period were city buses and taxis, competing with the tram to attract passengers.

Figure 1 - Seoul Downtown Transportation before 1945



Source: City History Compilation Committee of Seoul (2000).

2. Tram-Oriented System in the Chaos of the Korean War (1945 – 1960)

Destruction of the Transportation Infrastructure

From 1950, the Korean War ravaged the nation. In the chaos, it was difficult for any kind of economy to be built or any urban infrastructure for that matter. GNP per capita was \$40 in 1950, \$65 in 1955, and \$86 in 1960; people were in absolute poverty. After the War, aid from the international community helped rebuild road networks, and in 1957, the state route from Seoul to Busan was paved as part of a rehabilitation program and the 5-year Plan on Road Construction for Economic Prosperity was developed, which could not be put into action due to the lack of funds. In the meantime, Seoul's transportation system remained in its pre-modern form, and problems from the ever-growing population plagued the city. People were particularly distressed about transportation, but the government focused solely on building or rehabilitating roads. Society remained in chaos, with the government lacking funds to provide any other programs.

City Buses & Taxis as the Major Modes of Transport

People in Seoul relied mostly on the trams that traveled the major arterial roads, with, as mentioned, an estimated 500,000 people – nearly half the city population – using the tram daily. By late 1953, the city was home to more than a million people, and the demand for transportation grew louder. The existing tram system could not keep up with this growth, and the city buses and routes were added. In 1953, 230 buses traveled some 1.688 million km. They, along with the trams, shouldered the city's transportation system. Another important mode of transport after the War was taxis. In 1950, Seoul adopted a downtown taxi license system, and the shared taxis appeared. In 1957, 900 taxis were added to 24 routes, making them the third major mode of transport after trams and buses. Production of vehicles used as taxis began in 1956, after which the number of taxis exploded. By 1957, the industry had grown significantly, with 123 carriers operating 1,576 vehicles. This was a time characterized by the growth of the public transit system of trams, buses, and taxis, introduction of high-capacity means of transport, and vehicles operating along designated routes.

3. Public Transit Expansion & Discontinuation of the Tram Service (1960 – 1970)

Establishment of Road Plans for National Economic Development

The nation had one goal in the 1960s: economic development. At the beginning of the decade, the priority of transportation policy was on building nationwide railroads for industry. With motorways, focus shifted from building new ones to paving and widening the national route, and improving the flow and shape of the roads. In 1961, the Road Act was passed, providing a basis for the designation of state routes. In the early 1960s, the Act on Comprehensive Plans for Construction in the National Territory and the Urban Planning Act were key to national policy, alongside securing social overhead capital through establishment of a Ministry of Construction, or the like. Here, transportation assumed absolute importance.

Seoul had to next address the rapidly growing population and a transportation system that could not keep up. In 1960, a comprehensive transportation policy was developed, focusing on expansion of the public transit system (e.g., adding more buses and taxis) and extending the bus routes. In 1965, 301 buses on 10 routes were approved for the first express bus program in Korea. In 1967, the city took over operation of unprofitable bus services. At this time, Seoul adopted a bus-oriented urban transportation policy. As a result, buses accounted for 54.4% of the total means of transport.

Figure 2 -Traffic in Seoul in the 1960s



Source: Seoul Metro website.

Increased Number of Cars & Discontinuation of Tram Services

In the 1960s, the share of buses against the total means of transport continued to rise sharply. This caused the tram, the main mode of public transport in the city until the 1950s, to fade into history, finally being removed in 1968. It was argued that trams were slow and interfered with traffic flow, and people were more exposed to danger when boarding or alighting. It was also during the 1960s when the number of vehicles in Seoul gradually increased. In 1960, the number soared from 11,533 to 16,624 in 1965 and then to 60,422 by 1970. Most were buses or taxis, but the wealthy also began purchasing their own cars. By the late 1960s,

the government had set as a policy goal the building of roads between regions and embarked on the program in earnest. Following construction of the Gyeongin Expressway (Seoul – Incheon) in 1968, the Gyeongbu Expressway (Seoul – Busan) was opened in 1970. These two later served as the major drivers behind the rapid economic growth of the 1970s.

Table 1 - Share of Public Transport in Seoul (1965)

Buses	Taxis (Including Shared Taxis)	Trams
54.4%	26.20%	19.4%

Source: City History Compilation Committee of Seoul (2000), History of Transportation in Seoul

Table 2 - Major Transportation-Related Changes in Seoul in the 1960s

	Major Events
1960	Comprehensive transportation policy developed
1965	Express bus licenses approved for 301 buses running on 10 routes
1968	Tram services discontinued
1968	Gyeongin Expressway (Seoul – Incheon) opened
1970	Gyeongbu Expressway (Seoul – Busan) opened

4. Increased Number of Cars & Road Networks, Introduction of Subway during Period of Economic Growth (1970 – 1980)

Systematic Transportation Policy for Urbanization

This was a time when Korea had significantly industrialized and began SOC investment. The transportation system became ever more important to boosting economic growth, and had been continuously augmented since the 1960s. Expressways brought economic benefits such as a reduction of both time and costs associated with travelling, and out of these changes, phrases such as “one-day sphere” were coined. Road-related policies in the 1970s emphasized the importance of road networks that connected the major points of economic activity, such as major cities, industrial complexes, and ports.

In the meantime, the City of Seoul began more systematic development of transportation policy. There had been some previous effort to connect policies, but the Basic Design for Seoul Urban Plan (1977) provided a firm ground for a more comprehensive, long-term framework.

The First Subway System in Seoul (Metro Line 1)

By the 1970s, roads were relatively superior to the railway, in both quality and quantity. While the role of rail had diminished slightly, the City of Seoul used it to bring a new aspect to its transportation system. The tram,

a major pillar of public transport in downtown Seoul for nearly 40 years since the early 1900s, had been taken out of service in the late 1960s, and in the next decade, Seoul finally had its own subway system.

Policies to Improve City Bus Services

Due to poor management, bus services run by the City of Seoul ended up in debt, and were sold to the private sector and operated from 1972 to 1974. Management of the bus services had been rife with negligence, inefficiency, and the following of corrupt hiring practices. Under private sector management, these services became the leading mode of transport in the 1970s. Even when the first subway line opened in 1974, it only accounted for 6 – 7% of the use of transport until Line 2, 3, and 4 were built in the mid-1980s, while buses were responsible for a whopping 73% by 1974, indicating it was the preferred choice of the people.

As a way to improve operational efficiency of the transportation system, Seoul established a city traffic control center (1971) and developed plans to modernize intersections and signal systems (1973). In the late 1970s, the reversible lane system (1979) was introduced to arterial roads to improve traffic flow. From 1977, the Seoul Metropolitan Area Readjustment Plan was implemented in earnest, and the City of Seoul adjusted the city bus routes and installed electronic signal systems at 97 intersections within a 5km radius of the city center to keep pace.

Figure 3 - Subway Line 1: the First subway line in Korea (1974)



Source: Seoul Metro, "The 30 Years of Seoul Metro".

Table 3 - Major Changes Related to Transportation in the 1970s

Period	Major Policies
1971	City traffic control center launched
1973	Plan developed to modernize intersections and signal systems
1974	Subway Line 1 opened (construction started in April 1971)
1977	Basic Design for Seoul Urban Plan developed
1979	Use of reversible lane system decided

5. Motorization & Road Network Readjustment during Industrialization & Expansion (1980 – 1990)

Traffic Congestion Aggravated by Overpopulation

Development of the urban transportation system in Seoul in the 1980s was due more to external factors (industrialization, urbanization, development boom, inflation) than to policy. Urbanization particularly influenced the formation of a large built-up area, with Seoul's transportation policy only ancillary in nature, bent on connecting roads between large residential complexes and the city center.

The overpopulation that started in the 1980s only exacerbated the transportation problems. Some have described this as a vicious cycle: urban infrastructure is built, people populate the city, and the city again needs to expand its infrastructure. Seoul and other cities in the capital area became ever larger, and Seoul's transportation policy had to take a broader approach. In the late 1980s, the government built new cities near Seoul pursuant to its plan to supply 2 million housing units; Seoul had no choice but to focus on providing sufficient road networks connecting the new cities to the capital. In the meantime, explosive population growth and poorly-managed urban development intensified the transportation problems.

Sudden Increase of Cars & Response through Transportation Policy

The number of vehicles in Seoul skyrocketed from 200,000 in 1980 to 450,000 in 1985 and 1.2 million in 1990. Congestion worsened by the day, becoming a chronic problem across the city. The vehicle-to-road ratio in the late 1980s was around 19%, a significant jump from 11% in the 1970s and yet insufficient for the number of cars hitting the road.

Around this time, Seoul's public transit system was anchored by buses and the subway, with Line 2 starting service in 1984 and Line 3 and 4 in 1985. The subway carried 16.5% of the traffic that year, well on its way to becoming a key mode of transportation in the city. From the mid- to late 1980s, the city's transportation system transformed, thanks to international events such as the Asian Games (1986) and the Olympics (1988). In 1986, the Olympic Expressway was opened to connect eastern Seoul to its western half, and the major arterial roads, especially those in the eastern outskirts, also saw some improvement.

In short, the 1980s was a time of improvements to the transportation system, and ushered in the era of the subway and strengthened the transportation infrastructure as a whole in preparation for international events. Seoul began instituting transportation-related systems early with its Transportation Impact Assessment (1987) that estimates, and provides countermeasures for, transportation demand in line with construction of large facilities. By 1989, the TSM program was set in motion to utilize the existing facilities to manage demand, improve signals systems, and control parking, covering the major transportation axis in Seoul. Despite the multi-faceted nature of these efforts, criticism of transportation policy in the 1980s pointed out the failure to link each mode of transport and to optimize mobility, as policies on roads, the subway system, and other types of public transit were carried out independent of each other.

Table 4 - Major Changes Related to Transportation in the 1980s

	Major Policies
1984 – 1985	Subway Line 2 (May 1984) and Line 3 & 4 (October 1985) opened
1986	Olympic Expressway built
1987	Transportation Impact Assessment conducted
1989	TMS program implemented

6. Transportation System Restructuring in the City of Automobiles (1990 – 2000)

Construction of the Expressway Network

The number of vehicles registered in Seoul passed 1 million in 1990 and 2 million in 1995. Despite continued efforts to expand them, the road networks simply could not keep up with such drastic increase in demand. In the 1990s, congestion on major arterial roads continued to worsen. Seoul therefore augmented the infrastructure with major projects such as construction of urban expressways, arterial roads, and the expressway network connecting new cities in the capital area.

Basic Plans for Transportation System Improvement at Gu District Office Level to Mitigate Congestion due to Poorly Managed Urban Development

The local autonomous government system that had been adopted in the early 1990s laid the foundation on which each gu district office could develop its own Transportation Improvement Program (TIP) and resolve transportation-related issues individually. Moreover, the district transportation improvement program by block unit had an enormous influence on improving the transportation environment in residential areas. In the meantime, transportation infrastructure was still insufficient, but the bulk ratio was set excessively high for large urban construction programs (e.g., redevelopment, reconstruction), compounding the congestion. In other words, the failure to consider the relationship between transportation capacity and influences on congestion resulted in development of large residential complexes which further worsened an already-bad transportation environment. In particular, development programs were pushed through whether or not financing for roads and transportation facilities had been confirmed. Naturally, transportation infrastructure continued to fail to meet demand.

Phase 2 Subway Lines

Subway lines continued to be built, and the share of traffic using the subway grew with the introduction of Phase 2 – Line 8 (1996), Line 5 (1996), and Line 7 (2000). According to the Seoul transportation census in 1998, buses and subway lines carried roughly the same number of people, but the subway had jumped from 6.8% in 1980 to 30.8% in 1998, while buses carried 29.4% that same year. Bus operators began feeling the pinch as their share decreased, which in turn affected the bus route services. In response, the City of Seoul

came up with a Comprehensive Plan for Bus Services (1997), but this was not followed through, and efforts to reorganize the bus system faded away.

Implementation of a Transportation Demand Management Policy

In the 1990s, a transportation demand management policy was adopted to ease congestion by discouraging vehicles from entering the city center. A “congestion impact fee” was introduced in 1990, seeking to impose the cost of traffic on owners of facilities responsible for congestion of an area. In 1995, a transportation demand management policy for companies was introduced to reduce congestion impact fees for those facilities that participate in programs to reduce traffic volume. In the same year, the 1-10 Road Space Rationing program began. From 1996, a “congestion charge” was levied on drivers using Namsan Tunnel 1 and 3.

Introduction of the Intelligent Transportation System (ITS)

Along with the transportation demand management policy, a new transportation system was introduced. This one steered away from supply-oriented policies and embraced advanced technologies (i.e., computers, electronic devices, communications, and automation) for use in transportation infrastructure and vehicles – the Intelligent Transportation System (ITS). In the 1990s, at the behest of the central and Seoul city governments, research was done on the ITS and pilot programs were developed. This system provides various services which allow more efficient operation of transportation facilities and infrastructure, along with useful information for users, ultimately to ensure safety and convenience. Subsystems in the ITS include a traffic control system that manages traffic flow on expressways and backbone network and a transportation information system that delivers relevant advance or real-time information to users of the roads. The FTMS (Freeway Traffic Management System) was introduced to the city’s urban expressways in the early stages of the ITS program, and was comprised of: i) a ramp metering system that controls traffic at entry ramps to facilitate flow on the major urban expressways; ii) an incident detection system that quickly detects and processes information on accidents or events such as road construction; and iii) a transportation information system that provides data on urban expressway traffic and adjacent roads to drivers and system administrators at regular time intervals. A new signal transportation system, an automatic signal control system, and a bus arrival time system were also introduced.

Table 5 - Major Changes Related to Transportation in the 1990s

	Major Policies
1990	Congestion impact fee system introduced
1995	Transportation Demand Management system introduced for companies
1996	New subway lines opened: Line 7 (Oct. 1996), Line 8 (Nov. 1996), and Line 5 (Dec. 1996)
1996	Congestion charges introduced for drivers using Namsan Tunnel 1 and 3
1997	FTMS introduced on urban expressways

7. Paradigm Shift Towards a Sustainable Transportation System (2000 – Present)

Emergence of a New Paradigm – A Sustainable Transportation System

The enormous increase in the 1990s of the number of vehicles in Seoul could not be accommodated by the existing inefficient transportation infrastructure, and poor management of the public transit services made traffic congestion worse. More cars meant more exhaust, more air pollution, and more traffic accidents. Inconsistency in transportation administration systems also added to the bleak state of urban transportation in Seoul.

In the meantime, the rest of the world grew more conscious of the importance of preserving the environment, as proved in the Rio Summit of 1990. Since then, the concept of environmentally sound and sustainable development (ESSD) became a hot topic, with more interest in the environment as a whole and including the physical and even socioeconomic environments. Efforts were channeled to enhancing sustainability across various sectors, including the environment, energy, and the economy, with the concept embraced for transportation as well. The government of Seoul proposed various directions for its transportation policy in pursuit of sustainability, which include: a strengthened transportation demand management policy; restructuring of the public transit system; eco-friendliness in transportation policy; and improvements to the pedestrian environment.

Strengthening Transportation Demand Management Policy

Efforts were made to improve the transportation demand management policy put in place in the 1990s: the city improved the congestion impact fee program and the transportation demand management program for companies, while developing other programs (the weekly no-driving day, car sharing (Nanum-Car), better connectivity between modes of public transit) to better manage transportation demand. The Weekly No-Driving Day allows drivers to pick a day between Monday and Friday when they will not drive. Participation was high, reaching above 40% of all vehicles in Seoul. Participants were given incentives such as car tax cuts and discounts for parking in public lots. The car-sharing service was designed to discourage people from purchasing cars and facilitate car use by the low-income population that would not usually have such access. This program has grown in popularity recently. Measures were also taken to encourage the use of bicycles to get to areas serviced by public transit. Other policies included expansion of public transit routes.

Restructuring the Public Transit System

One of the most distinct transportation policies of this time was restructuring of the public transit system begun in July 2004, which aimed to enhance the quality of public transit services and make them efficient and logically. The most noticeable changes included: subway fares that varied according to distance traveled; fare integration; new transport cards; center bus lanes; and transfer points. Fare integration lightened the burden of transfer fare, changed the system of charging unreasonable fares for different downtown zones into one

based on the distance traveled same as in the zones outside the city, thereby encouraging more people to use public transit.

Eco-friendly Mode of Transport

As of 2008, the share of citywide energy consumption by the transportation sector in Seoul was second largest at 31.9%, following the residential/commercial sector. Road travel was responsible for 95.2% of greenhouse gas emissions by the transportation sector. Ever-increasing oil prices placed a backbreaking strain on residents, and eco-friendly cars became more attractive due to their lower consumption of fuel. In the late 2000s, the City of Seoul was aggressive in introducing these eco-friendly vehicles as a way to reduce carbon emissions by the transportation sector and to respond to the rising oil prices. As part of the policy, all city buses were switched to compressed natural gas (CNG), electric buses were used on Nam Mountain, and electric cars were offered through the car-sharing service.

Transportation Policy Oriented Towards Pedestrians & Public Transit

One of the differentiating features of Seoul's transportation policy in 2000 was the policy shift towards pedestrians and public transit. It was against this backdrop that overpasses were removed and a transit mall created. Overpasses, while facilitating traffic and city access, have long been criticized by residents as blighting the cityscape, isolating some areas from the rest of the city, and being detrimental to regional development. The city responded to these complaints by demolishing a significant number of these overpasses. After the Cheonggyecheon Overpass that connected the city's east and west was demolished in 2003, public demands grew even stronger for demolition of other overpasses throughout the city. In addition, introduction of a transit mall was discussed in June 2012, to accompany a new vision for the city which had as its slogan "Walk-Friendly Seoul". A transit mall is an area designated for pedestrians and public transit (trams, light rail, buses), strictly prohibiting access by any other vehicles. Starting with one in Shinchon in January 2014, Seoul is currently developing plans to create more across the city.

Table 6 - Major Changes Related to Transportation (2000 to the Present)

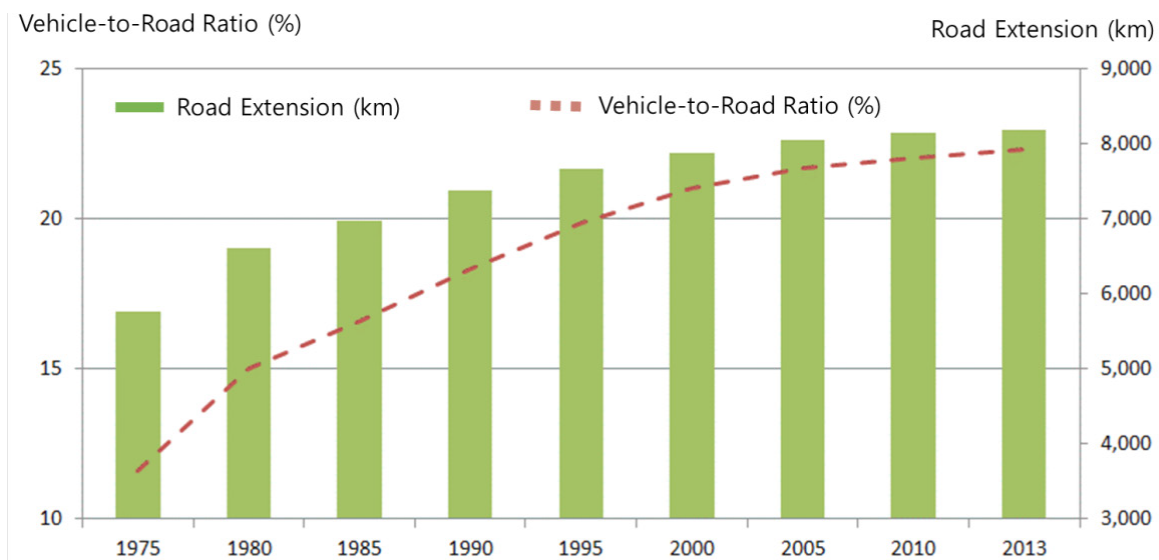
Period	Major Policies
2003	Weekly No-Driving Day program launched
2003	Cheonggyecheon Overpass removed
2004	City bus system restructured (bus system reform)
2007	Seoul Transport Operation & Information Service (TOPIS) implemented
2010	Eco-friendly electric buses begin operating on Nam Mountain (3 routes, 15 buses).
2013	Car-sharing services introduced
2014	First transit mall opened (Shinchon-ro)

Achievements of Seoul's Transportation Policy

Continued Road Expansion

The City of Seoul has continued to expand its roads to address the increasing population and number of vehicles while the city grew. As seen in Figure 4 below, roads expanded in Seoul by an average of 1.1% per annum over the past 40 years (1975–2013); as of 2013, the total extension was 8,198 km, with a vehicle-to-road ratio of 22.3%, higher than other major Asian cities such as Tokyo (15.8%) or Singapore (12.0%).

Figure 4 - Road Extension and vehicle-to-road ratio by Year

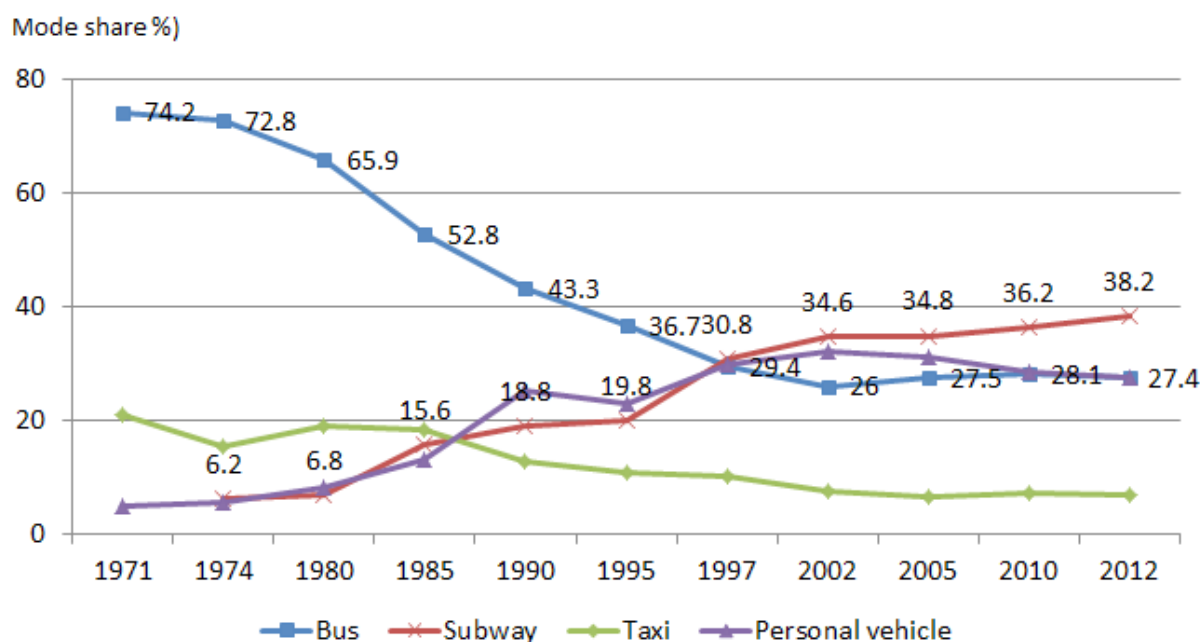


Emphasis on Public Transit

In the 1960s, the flow of people into the capital area accelerated and transportation demand grew even faster. The City of Seoul responded by developing transportation policies that focused on public transit, especially buses. However, this bus-oriented approach was not as efficient as expected in resolving the fundamental issues of congestion, spatial expansion of the capital area, and the rapid increase in transport users. The city worked consistently on expanding the city subway lines since opening Line 1 in 1974. By 1997, the subway began to surpass other modes of transport in terms of transportation share: as of 2010, the subway was carrying 2.4 billion people annually (refer to Figure 5). While the subway system carries a large number of people at high speed, significant amounts of time and financial resources are required for construction and expansion, making it harder for the system to respond immediately to rising demand. On July 1, 2004, Seoul decided to restructure its bus services to enhance connectivity to the subway and to maximize synergy. Bus routes leading to the subway system grew in use, and an integrated network of public transit was formed. More and more people began using transit cards, and management of revenues grew in transparency. Such

restructuring of the bus system led to improved air quality, shorter travel times, and increased safety, as seen in Table 7. Seoul's continued efforts to enhance its public transit system were recognized internationally for its use of innovative technology and effective policy, with the city receiving many international awards (Refer to Table 7).

Figure 5 -Transportation Share by Transport Mode & Year



Source: Seoul Statistics

Table 7 - Public Transit System Restructuring: Outcomes

	Performance Index		Achievement	
Speed	Travel Speed (km/h)		16.7 → 22.0	
Safety	Number of Accidents		659 → 493	
Affordability	Fare per Trip (KRW)		620 → 592	
Financial Management Transparency	Transit Card Use (%)		77.4 → 88.9	
Effect of Boosting Public Transit Use	Public Transport Share (%)		61.2 → 62.3	
Improved Air Quality	Fine Dust (PM10)	Carbon Monoxide (CO)	69 → 61	0.7 → 0.6
Reduced Cost	Reduced travel cost		KRW 225.1 billion less	

Source: Seoul Metropolitan Government (2006)

Table 8 - Public Transport Awards Won by Seoul

Year	Award	Awarded by
2006	The 2006 Sustainable Transportation Award	Institute for Transportation & Development Policy (ITDP)
2006	The 2006 UITP Award for Innovative Solutions	The International Association of Public Transport (UITP)
2007	EASTS Outstanding Transportation Project Award	Eastern Asia Society for Transportation Studies
2011	Golden Chariot Awards	Parliament of the Russian Federation, The Ministry of Transport, The Government of the Russian Federation
2011	UITP PTx2 Regional Award	The International Association of Public Transport (UITP)
2011	UITP PTx2 Showcase Award	The International Association of Public Transport (UITP)
2013	Local Government Award	The Intelligent Transportation Systems Society

Improved Air Quality

The steadily rising number of privately-owned vehicles led to greater greenhouse gas emissions and air pollution and deteriorated the urban climate, leading the city government to adopt different policies to improve air quality: limiting the use of personal cars, boosting public transit, and improving the pedestrian environment, etc., all as part of the drive towards energy efficiency and use of eco-friendly transport as the main mode of transportation. Continued efforts to make transportation policy kinder to the environment led to personal vehicle use falling in terms of transportation share and consequently increased use of public transit, shortening travel times and improving air quality. Fine dust – one of the most serious causes of respiratory conditions and a hotly-debated subject – was $60 \mu\text{g}/\text{m}^3$, higher than the normal level of $50 \mu\text{g}/\text{m}^3$ in 2004; this has dropped each year since, falling to $44 \mu\text{g}/\text{m}^3$ by 2013.

A “Smart” City

Seoul's transportation policies have made the city “smarter.” Introduction of center bus lanes and transportation data devices at bus stops has enhanced speed, timeliness, and efficiency, and reduced overall costs, also sparking widespread use of smart cards. The new transport card system adopted by this megacity of 10 million+ people is praised by the international community as an example of successful reform of a transportation system. In addition, the car-sharing service accessible via smart phone provides a novel example of a smart transportation system.

Limitations & Implications

In the past, Seoul's transportation policy focused on road infrastructure, signal systems, pedestrian and vehicle overpasses, and other vehicle-oriented approaches to accommodate increasing demand for transportation. However, this led to a soaring volume of cars for personal use; transportation alone consumed 30% of all energy use in Seoul. Personal cars particularly accounted for 60% of all energy use in the transportation sector, not to mention a large percentage of air pollutant emissions. Older policies were introduced in an environment that did not allow citizens to have a say in their development, simply focusing on building large facilities and infrastructure, mostly uninterested in details of actual public demand for a better transportation system. In order to resolve these issues and achieve sustainability, Seoul will need to consider the following: First, transportation policies need to shift their focus from individual transportation to people-oriented policies. Future policy needs to focus on providing infrastructure for the benefit of the public (pedestrians, bicycles, and public transit), while ensuring that effective transportation demand management (i.e., restricting the volume of personal cars) is warranted to place priority on creating an environment dedicated to pedestrians, bicycles, and public transit. The current system is mostly aimed at encouraging car ownership and development. This needs to change so that sharing transportation and preserving the environment are encouraged instead.

Second, a more systematic and environmentally-friendly transportation policy is key to improving the city's air quality. Collaboration between the city, the central government, the private business sector, and the people is critical to shaping the transportation system in this way. Under the auspices of the central government, Seoul needs to develop and systemize its own environmentally-friendly transportation policies and encourage private companies to help. Insistence on a city government-led approach is not the only answer to the problems: residents need to be able to take part in the effort to transform Seoul's transportation system so that it preserves and even improves the environment.

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