INTERNATIONAL COMPARISON OF TRANSPORT CONDITIONS AND POLICIES IN TOKYO AND SEOUL: USING TIME-SERIAL DATA

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Abstract: The major purpose of the paper is to compare the characteristics of transport conditions and policies of two capital cities, Seoul and Tokyo. Comparison is based on the time-serial data of the past 20 years. The study attempts to identify different stages of the transport development of the two cities by examining various transport related indices such as car ownership, traffic accidents, modal share, etc. In particular, the relationship between economic growth and motorization is examined in detail. One of the major findings is that there is a consistent trend between economic growth and transport development.

1. INTRODUCTION

As the economy grows, transport problems and policy measures appear to be changing correspondingly. It is often discussed that the city of Seoul has been going through development stages similar to those the city of Tokyo has already experienced in the area of transport development during the last several decades.

Seoul, the capital city of Korea, is suffering from various transport problems caused by high population density and rapid motorization. Some typical transport problems are: serious road traffic congestion, high traffic accident rates, air pollution, poor public transport services, etc. In general, these transport problems may be caused by the imbalance between transport infrastructure investment and traffic growth. The shortage of transport infrastructure deteriorates the efficiency of present transport systems. Eventually it appears to be one of the major barriers to the development of the national economy and the improvement of people's quality of life.

On the other hand, Tokyo, the capital city of Japan, went through similar transport situations, that Seoul is now experiencing, during their rapid economic growth period, from 1960 to 1970. Now, in Tokyo, urban population change and vehicle ownership growth have been stabilized. Various transport systems and traffic policies have been implemented. In particular, the heavy investment of urban railway networks and urban express-highways in the early stage greatly helped to ease transport problems due to rapid motorization.

The major purpose of this paper is to compare the characteristics of the transport conditions and development of two capital cities, Tokyo and Seoul. Comparison was based on the time-serial data of the past 20 years. The items of the analysis included, demography

changes, vehicle ownership growth, modal share, traffic accident records, air pollution, etc. Furthermore, the study attempted to identify different stages of the transport development of the two cities corresponding to those of economic development. The relationship between economic growth and motorization was especially examined in detail.

2. HISTORICAL BACKGROUND AND DEMOGRAPHY

2.1 Historical Background

Seoul is located on the mid-western part of the Korean peninsula. The large Han River, divides the city into northern and southern parts. Seoul as the capital city in Korea, has been the center of politics, economy and culture since the fourteenth century. In 1960, the city of Seoul was greatly expanded and its area was doubled. At present, the population of Seoul comprises of about 24% of the national population and its area accounts for 0.6% of the whole national land area.

Tokyo is located in the center of the southeastern part of Japan. Tokyo has been the modern capital city of Japan since the Meiji Revolution in 1867. Since then, the population and area have been steadily changing, and Tokyo has grown to be one of the largest cities in the world. The current population of Tokyo Metropolitan is about 30 million and it accounts for about 25% of the national population.

2.2 Demography

The city of Seoul consists of 22 boroughs (called ku), while Tokyo consists of 23 boroughs (ku), 27 suburban cities and 1 town. The area of Seoul is 627 km^2, whereas the area of Tokyo Metropolitan is 2,183 km^2, almost three times bigger than Seoul.

Population: In 1990, the population of Seoul reached about 10.6 million. This is higher than the population of the 23 boroughs of Tokyo, 8.2 million, but lower than that of Tokyo Metropolitan, 11.9 million. (See Table 1. Comparison of demography conditions in Seoul and Tokyo.) Observation of the urban population changes over the period from 1955 to 1990, indicates that there is a gap of about 30 years in the population trend between Seoul and Tokyo. As shown in Figure 2; the population of Seoul shows a decreasing trend soon after the beginning of 1990 whereas in the case of Tokyo, this kind of decreasing trend started in early 1960.

Table 1. Comparison of demography conditions in Seoul and Tokyo(1990)

city	area (km^2)	population (1000 persons)	population density (1000 persons/km^2)
Seoul	627	10,612	16.9
Tokyo 23 Ku	592	8,164	13.8
Tokyo Metropolitan	2,183	11,855	5.4

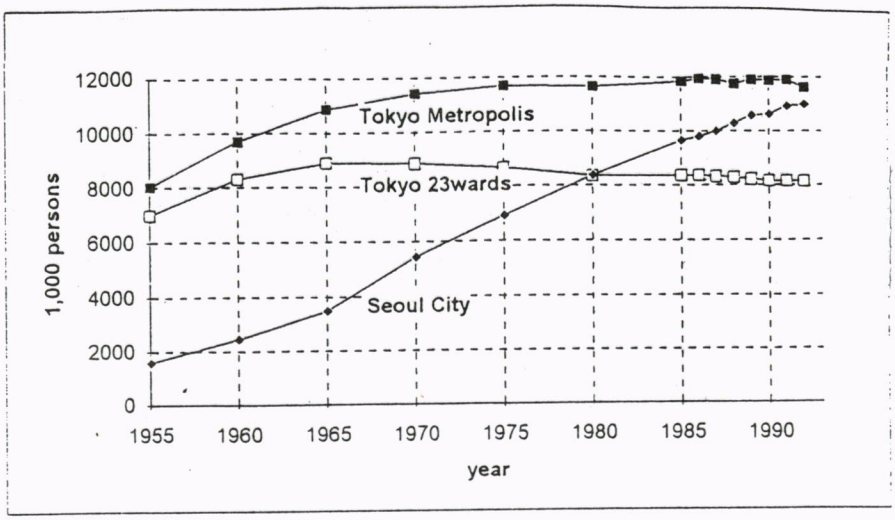

Figure 1. Trend of population in Seoul and Tokyo (1955-1990)

GNP per capita: Looking at the GNP level per capita, in 1992, Japan approached $28,220, about four times greater than that of Korea, $7,379. It indicates that there is about a 20 year gap in terms of the economic development level between Japan and Korea. Furthermore, examination of the price rate changes suggests that during the period of 1975 to 1990, Japan recorded an annual inflation rate of 7.5%, compared to the Korea's rate of 15%. (See Figure 3. Trend of GNP per capita and Figure 4. Trend of Market Prices Based on 1990.)

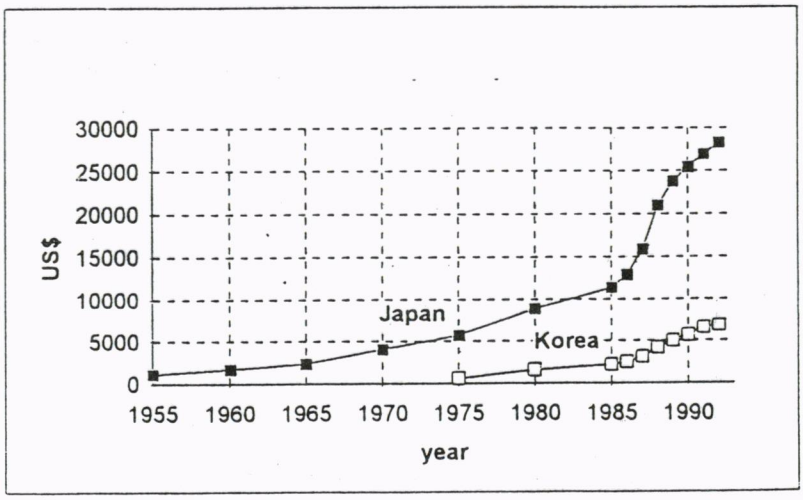

Figure 2. Trend of GNP per capita in Korea and Japan

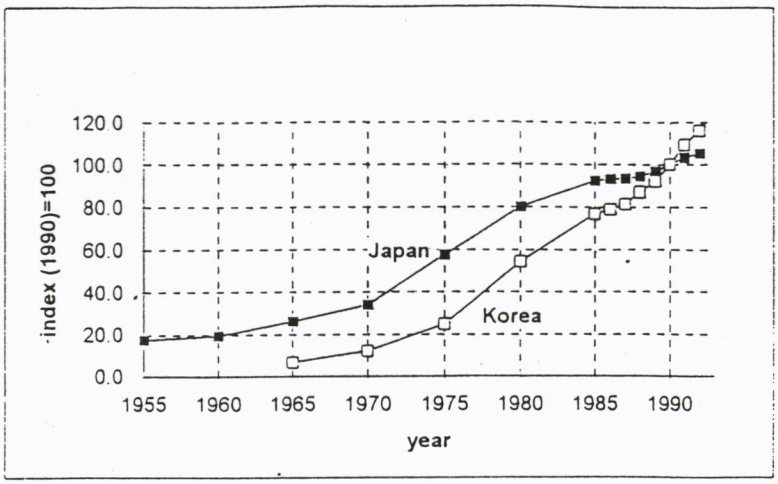

Figure 3. Market price change(base year, 1990)

3. COMPARISON OF TRANSPORT INDICES

3.1 Vehicle Ownership

It 1992, the vehicle ownership of Tokyo, was 4.62 million, about three times higher than that of Seoul, at 1.56 million. As shown in Figure 4, the trend of vehicle ownership during the period of 1955 to 1992 suggests that there is a gap of 30 years between Tokyo and Seoul in terms of vehicle ownership growth. Figure 5 shows the trend of car ownership rate over the GNP level per capita. It indicates that Seoul follows a similar path as Tokyo, although a lower car ownership rate is identified.

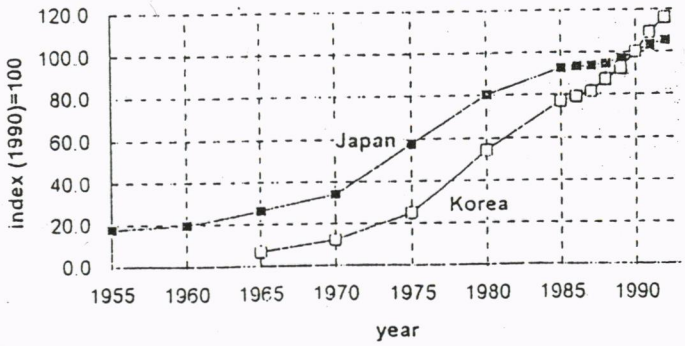

Figure 4. Trend of vehicle ownership per 1000 persons

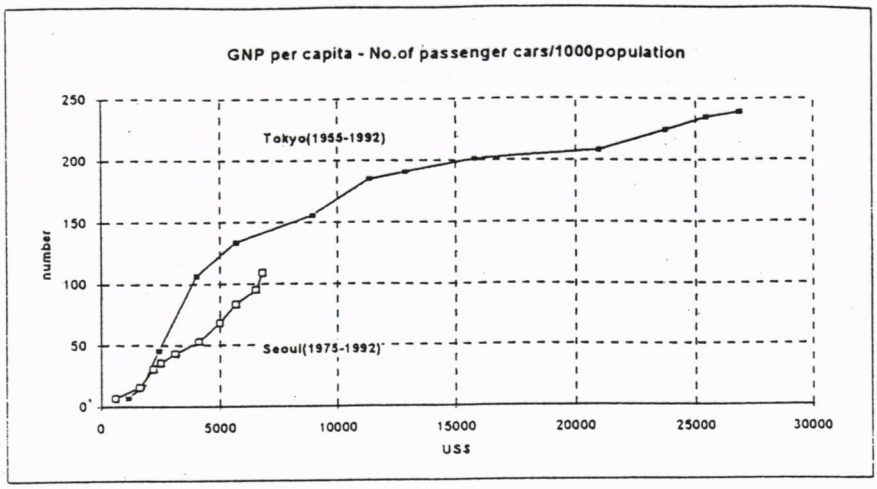

Figure 5. Trend of car ownership over level of GNP per capita

Figure 6 shows the trend of the car ownership rates in the Tokyo and Seoul metropolitan areas compared to their national ones. The relative car ownership rate of Tokyo became lower than that of the nation in 1975, and since 1980, it has become steady. On the other hand, in Seoul, the car ownership rate became lower than that of the nation in 1990. An interesting question is, how fast will the car ownership rate in Seoul reach a steady state level?

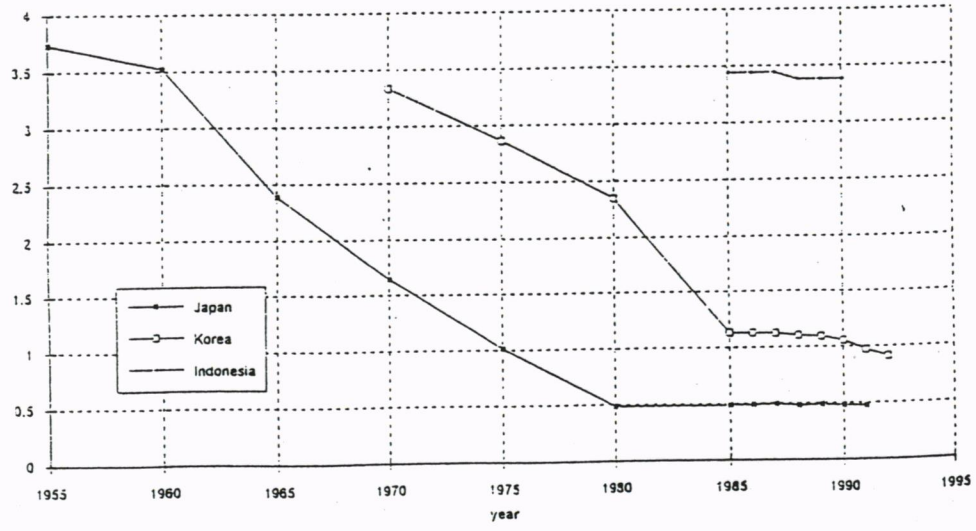

Figure 6. Change of car ownership rates in Seoul and Tokyo compared to their national rates.

Figures 7 and 8 show the trend of the number of registered buses and taxis. In Seoul, around the late 1970s and early 1980s, there was a large growth in the number of registered buses and taxis. This was due to active economic activities in the early 1980s. In Tokyo, the number of taxis had a high growth from 1960 to 1975. However, the number of buses registered has made no significant increase since 1960. This is due to the major role of urban railways in urban passenger transportation. Consequently, buses play minor role in transport demand share in Tokyo.

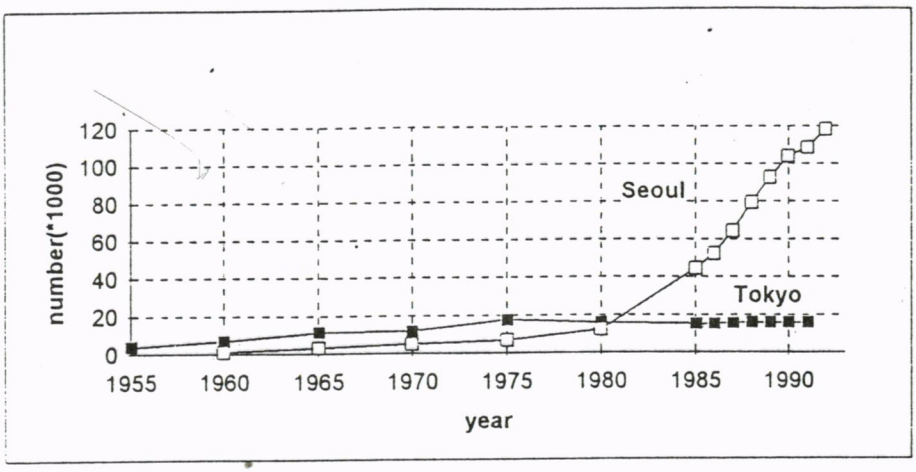

Figure 7. Trend of number of buses (1955-1992)

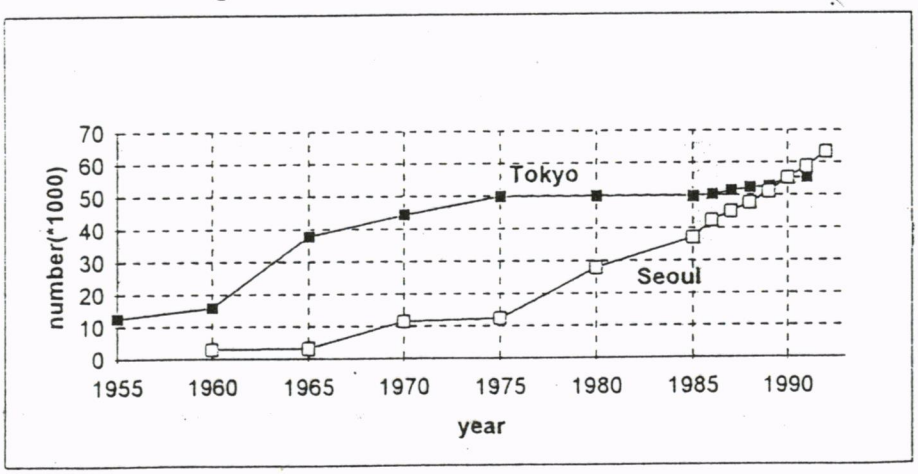

Figure 8. Trend of number of taxis (1955-1992)

3.2 Transport Infrastructure Provision

Road: As shown in Table 2, in 1992, the total extension of roads in Tokyo was 22,972 km, around three times longer than that of Seoul's 7,516 km. In the case of urban expressways, Tokyo has 216 km and Seoul has 89 km. The comparison of road density (road length per unit land area) indicates that the level of Seoul's roads (11.99 km per km^2) is higher than that of Tokyo (10.52 km per km^2).

Table 2. Length of urban roads in Tokyo and Seoul (1992)

city	road length (km)	road density (km/km^2)	road length per 1000 vehicles	urban expressways
Tokyo	22,972	10.52	5.03	216
Seoul	7,516	11.90	5.47	89

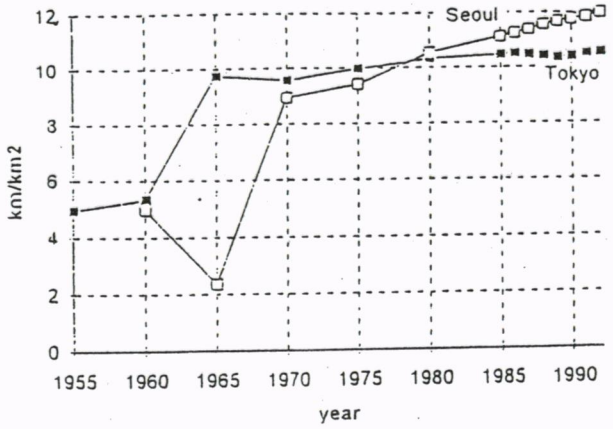

Figure 9. Change of road density (1955-1992)

However, in general, the density of roads depends on administrative boundary and land characteristics, etc. Furthermore, road length per 1000 vehicles in Seoul is 5.47 km/1000 vehicles. This is slightly higher than that of Tokyo, at 5.03 km/1000 vehicles. This is due to the higher vehicle ownership in Tokyo. Figure 9 shows the trend of road density in Seoul and Tokyo over the last 30 years. It can be said that the intensive road investment made in Seoul since 1980 helps to greatly improve the road density level.

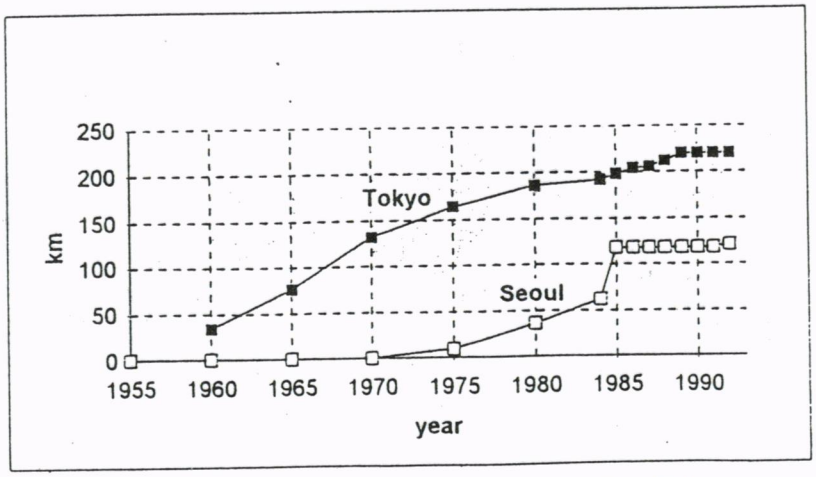

Figure 10. Change of subway length (1960-1992)

Urban Railway: As shown in Figure 10, by 1992, the extension of subways in Seoul had reached about 121 km. In Tokyo, the extension of subways by 132 km had already been under operation by 1970. By 1992, Tokyo had subway extensions of 220 km and urban railway networks of 736 km compared to 75 km in Seoul. Furthermore, the total length of urban railway networks within a radius of 50 km from the city center amounts to about 3,000 km. Thus, in terms of urban railway length, Seoul is far short of Tokyo.

3.3 Transport Fare

Transport fare is one of the most important policy measures in dealing with traffic congestion problems effectively. As shown in Figure 11, in Tokyo, after 1970, there was rapid increase of taxi fare compared to price change. However, bus and subway fare increases stayed close to price change. On the other hand, in Seoul, the increase of public transportation fares, including bus and subway fares, is much slower than price change. However, taxi fares rise very closely with price increase. This means that public transport services in Seoul should be given big subsidies from the government. There might be an urgent policy change in Seoul to help to make pubic transport fare levels more realistic.

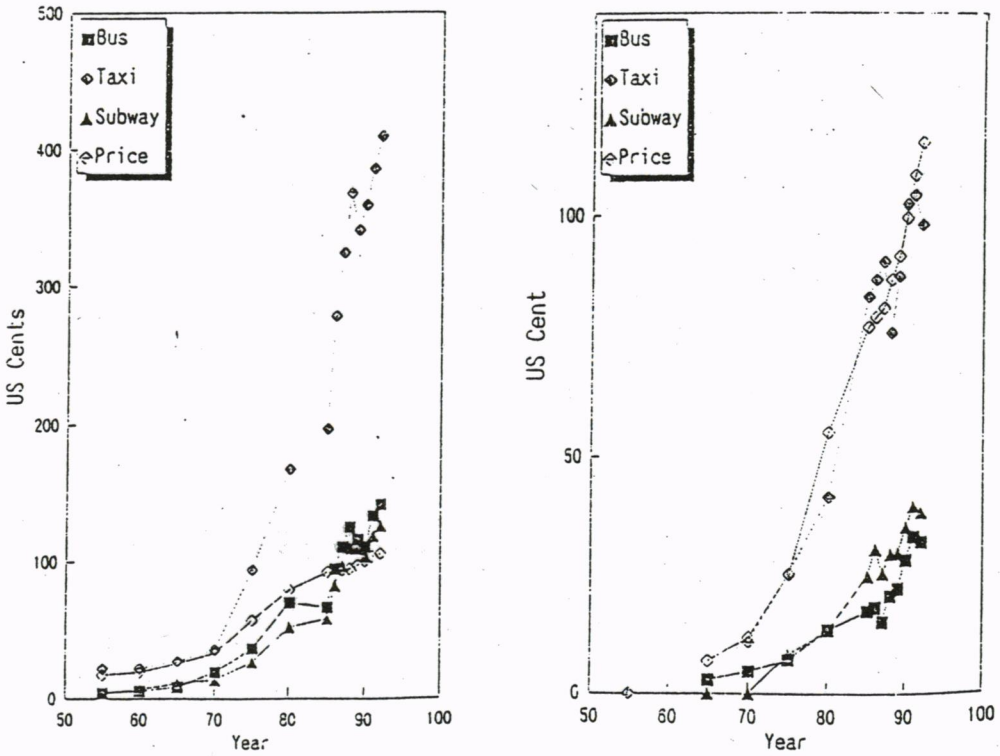

Figure 11. Change of transport fare level in Tokyo and Seoul (1955-1992)

3.2 Modal Share

As shown in Table 3, based on 1988 statistics, in Tokyo, the 62% demand share of rails is the greatest among the three modes: rail, private car and bus. On the other hand, in Seoul, the 51% share of buses is the greatest. After buses, the share of taxis is 18%. In recent years, because of severe road traffic congestion, the share of buses is decreasing and the share of rails and private passenger cars is increasing. In particular, the extensive construction of subway networks contributes greatly to improving the share of rails. In Seoul, another interesting characteristic in transport demand share is that taxies are used as a kind of paratransit due to low taxi fares and poor public transport services.

Table 3. Trend of modal share in Tokyo and Seoul (1988)

%

city	bus	rail	private car	taxi
Tokyo	5.21	61.73	33.06	-
Seoul	51.09	13.29	17.87	17.75

As described earlier, the greatest difference in modal share between Tokyo and Seoul is the role of urban rails. One of the important questions is how fast the share of rail in Seoul approaches that of Tokyo. Although the city government of Seoul has been making an intensive investment in rail construction, the difficulty of financing expensive rail construction projects during a short period appears to be the biggest task to tackle.

3.3 Traffic Accidents

In general, traffic accident rates change with various factors such as car ownership level, driving behavior, road safety facilities, etc.

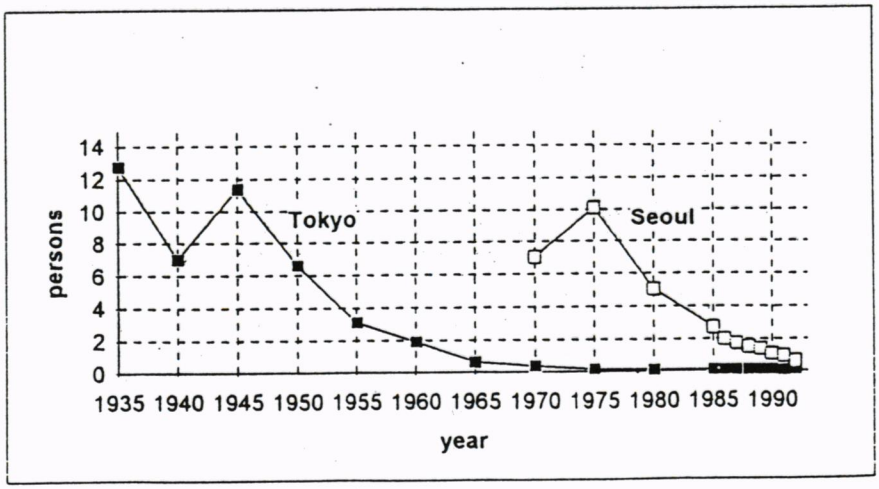

Figure 12. Trend of the number of death per 1,000 vehicles by traffic accident.

As shown in Figure 12, there is a similar trend in the number of traffic accidents in Seoul and Tokyo. Examination of past traffic accident record in Seoul and Tokyo indicates that traffic accident rates increase as car ownership rates rise. This is due to rapid motorization following fast economy growth. Moreover, it can be identified that when the GNP per capita becomes higher than $5,000, traffic accident rates gradually start to decline. This might be due to various efforts used to reduce traffic accident rates, such as increased investment to traffic safety facilities, improved driving behavior, traffic safety campaigns, etc.

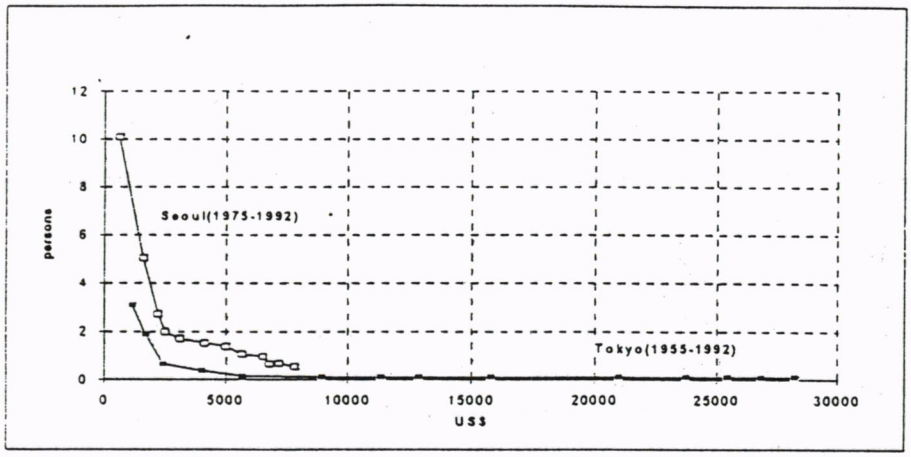

Figure 13. Change of the number of death per 1000 vehicles over change of GNP per capita

Examination of the number of deaths by traffic accidents per 1000 vehicles over the same level of GNP per capita indicates that both Seoul and Tokyo tend to decrease gradually, as the level of GNP per capita increases. However, even for the same level of GNP per capita, the traffic accident rate in Seoul tends to be two to three times higher than that of Tokyo.

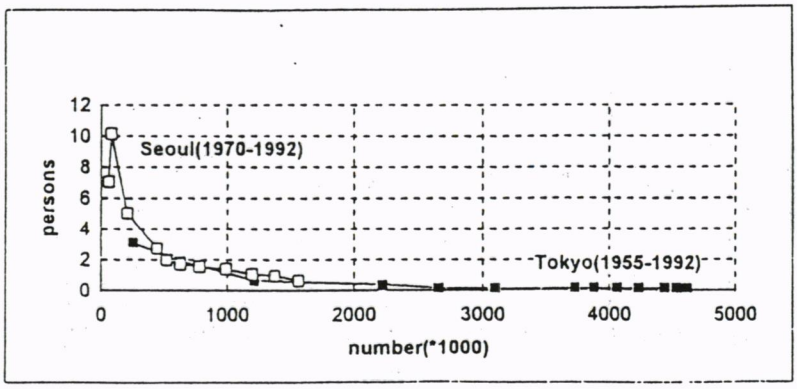

Figure 14. Trend of the number of deaths by traffic accidents per 1000 vehicles(1935-1992)

Figure 14 shows that a similar trend can be identified for traffic accident rates and car ownership rates. In other words, traffic accident rates start to drop as car ownership levels reach a certain point. Together with the index of GNP per capita, the level of car ownership represents the welfare state.

3.4 Traffic Emission

Three types of traffic emissions, SO_2, NO_2 and CO are analyzed as shown in Figure 15. In Tokyo, the amount of SO_2 decreased during the period from 1980 to 1988. However, since 1988 it started to increase again. In Seoul, since 1988, the amount of SO_2 has continued to decrease, although its level in Seoul is two or three times higher than Tokyo. However, the amount of NO_2 keeps a steady level in both cities. Finally, while the amount of CO in Tokyo has not changed, the amount of CO in Seoul has been dropping since 1989. Overall, in spite of the lower car ownership level, the amount of traffic emission in Seoul is higher than Tokyo. This might be due to the successful enforcement of vehicle emission regulation in Tokyo.

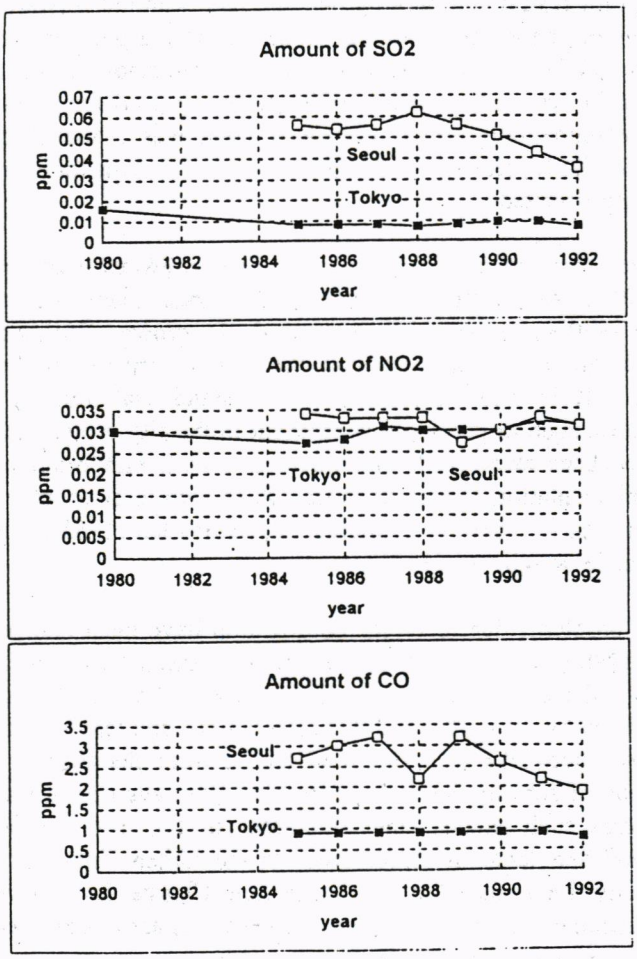

Figure 15. Trend of amount of vehicle emission, SO_2, NO_2 and CO

4. TRANSPORT POLICY AND PLANNING

As discussed earlier, car ownership is proportionally increasing to the level of personal income or GNP per capita. Increase of car ownership leads to various transport problems, including traffic congestion, traffic accidents, poor environmental conditions, parking problems, etc. In developed as well as developing countries, various policy measures to deal with traffic problems caused by increases in car traffic, are being implemented, corresponding to the stage of motorization.

In Tokyo, the level of car ownership reached 1 million in the early 1960's. In Seoul, the same level of car ownership was reached in the early 1990s. There is a gap of about 25 years in terms of traffic growth between the two cities. As traffic volume increases, various transport problems have occurred. Consequently various transport policies and plans have been applied.

For example, in Tokyo, in trying to resolve parking difficulty and a shortage in parking capacity, legislation for restraining parking demand had been put forward and large-scale underground parking lots have been planned. In Seoul, similar policies and measures were implemented around the late 1980's. Another similar comparison can be made for bicycle traffic measures. In Tokyo, in the earlier 1970's, a strong need for promoting the use of bicycles as an environmentally sound transport mode was realized and a legislation movement began. Similarly, recently in Seoul, measures and plans for encouraging bicycle traffic have been implemented.

In Tokyo, extensive construction of subways and urban railways were carried out during the 1960's and 1970's. As a result, compared to the modal share in the late 1960's, the share of rails in the 1970's and the 1980's have gradually grown. During the same period, in spite of the steady growth of car ownership, the share of private cars has not made any significant change. It is also necessary to understand that various traffic demand management measures, such as parking management in the city center and encouragement of bicycle traffic have been successfully implemented. Another important policy movement in Tokyo is the implementation of various taxes, which help to discourage the purchase of and the use of private cars. These taxes include a gasoline tax (1965), vehicle purchasing tax (1968), and vehicle weight tax (1971).

In Seoul, transport problems due to rapid motorization have been realized since the late 1980's and early 1990's. Traditionally, the public transport system in Seoul mainly depended on buses and taxis. However, rapid increase of the use of private cars slowed down road traffic speed by 20 km/hr, and this affected bus and taxi services badly. There were not enough rail networks to divert road traffic from the road to the rail. With intensive construction of subway networks, Seoul has been attempting various soft traffic management measures such as bus lanes, increases of fuel tax, car pooling, etc. In addition, institutional and legal measures such as the Urban Transport Planning Law, Traffic Impact Study Law and Traffic Generation Charge Law have been passed. However, until a substantial amount of urban rail networks are constructed, it is expected that the current poor transport conditions will continue.

Another similar trend can be found in transport data surveys. For example, in Tokyo, the urban person trip data survey which is one of the most fundamental data sources for the urban transport policy making and planning process was implemented in 1968. On the other hand, in Seoul, the first person trip data survey was made in 1983, about 15 years after Tokyo.

5. CONCLUSION

This paper attempts to review various transport indices which help to understand transport conditions of two capital cities, Seoul and Tokyo. Both cities have been suffering from transport problems due to rapid motorization. In particular, from the view point of the relationship between economic and transport development, various demography and transport indices are analyzed. It was found that there is a consistent gap of 20 to 30 years in transport development between Tokyo and Seoul. This finding has been shown by comparing various indices. This study has been carried out with a limitation of available historical data sources. With a collection of reliable data, a further detailed study will be carried out.

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