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LONG-TERM STRATEGY FOR TRANSPORT SYSTEM IN ASIAN MEGACITIES

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1. INTRODUCTION

The condition of urban transportation in Asian megacities is getting worse particularly under the trends of rapid urbanization and motorization. Policy makers have realized the gravity of the problem and have taken various measures to improve the situation. As most developing countries are facing severe resource constraints, there is huge gap between infrastructure demand and supply in Asian megacities. And given the specific characteristics of Asian megacities, the policy solutions successfully tested somewhere else may not produce similar results for them. This calls for exploring innovative policy measures considering special features of Asian megacities and at the same time leaning from experiences of cities in developed countries. The urban transport system, in fact, constitutes a complex dynamics directly interacting with city structure. In such a situation policy strategy should be designed taking the long-term scenario into account. However, in the face of severe resource constraint and pressing needs of finding some immediate solutions, the policy process may run a risk of giving more priority to short-term improvement without considering long-term scenario.

In this paper, I will discuss why it is important to consider both short-term and long-term scenarios while setting policy strategies for urban transport in Asian megacities. Some policy options targeting long-term goals, such as investment for urban rail system, are resource-intensive and may not be feasible at the early stage. As stop-gap measures, less-resource intensive short-term measures can be considered not to let the situation degrade further until the option for long term solution become feasible. In the next section, the special features of Asian megacities and their implications are discussed, which will be followed by a discussion on do-thing scenario, desirable scenario and possible transition paths. Section 4 presents key sectoral issues related to urban transport and relevant for Asian megacities to be followed by conclusion.

2. SITUATIONS IN ASIAN MEGACITIES AND THEIR IMPLICATIONS

Urbanization in Asia is characterized by emergence of megacities, which are different from European or US cities in many respects. That is why policy solutions to urban transport problems in Asian megacities call for specific strategies considering Asian specialties and policy lessons from experiences of success and failure cases in developed countries. Since Asian megacities are still at the developing stage, such strategies should consider policy options for different stages, targeting both short-term and long-term goals. Details of special features of Asian megacities have been explained in following paragraphs.

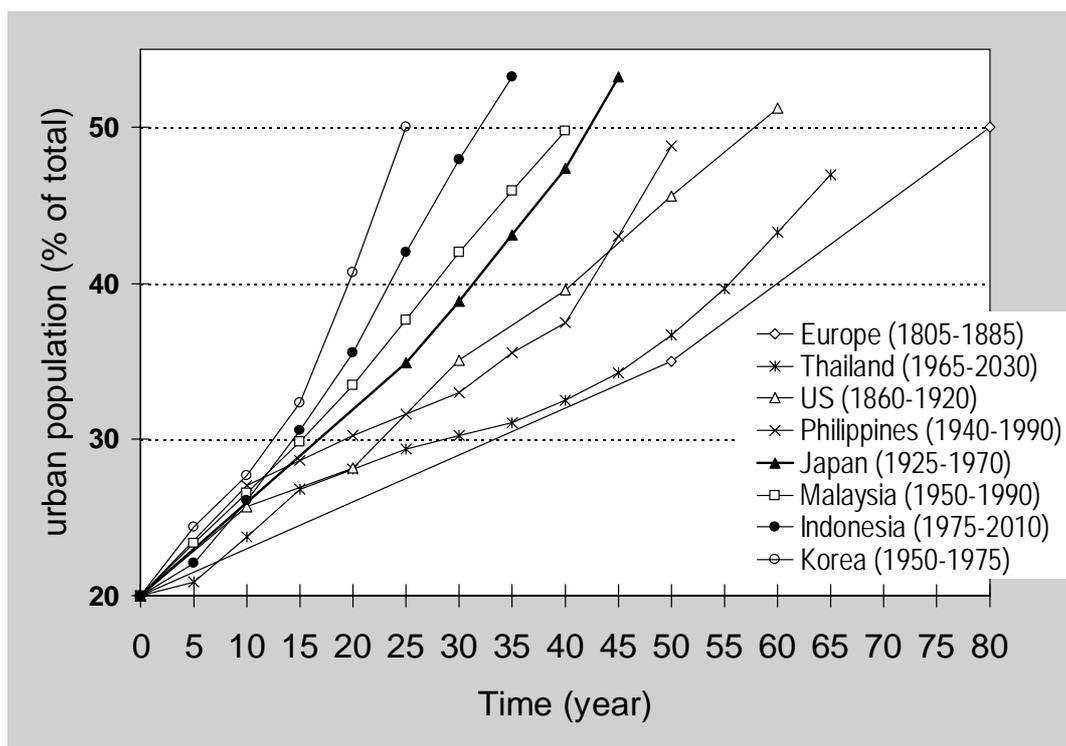


Figure 1. Speed of Urbanization in Selected Countries

2.1 Rapid Urbanization in Asia

The rapidly developing Asian countries are experiencing unprecedented rate of urbanization. Figure 1 shows the years taken by selected countries to increase their urbanization rate (ratio of urban population and total population) from a base-rate of 20 %. It took about 80 years for Europe and 60 years for US to increase urbanization rate from 20% to 50% of total population, while in case of Asian countries the corresponding periods were much shorter. For example, Japan, Malaysia, Indonesia and Korea took 42, 40, 32 and 25 years respectively for the same level of increase in the urbanization rate. Such a rapid urbanization can be considered as a natural outcome of high economic growth in Asian developing countries. On the other hand, the rapid urbanization is creating huge investment demand in a short-span of time for infrastructure and other services which is simply beyond the capacity of these countries. The

urbanization process is also putting much strain on the institutional capacity since institutional development takes some time to evolve, and the existing institutional capacity in these countries is not good enough to deal with the consequences of such rapid urbanization.

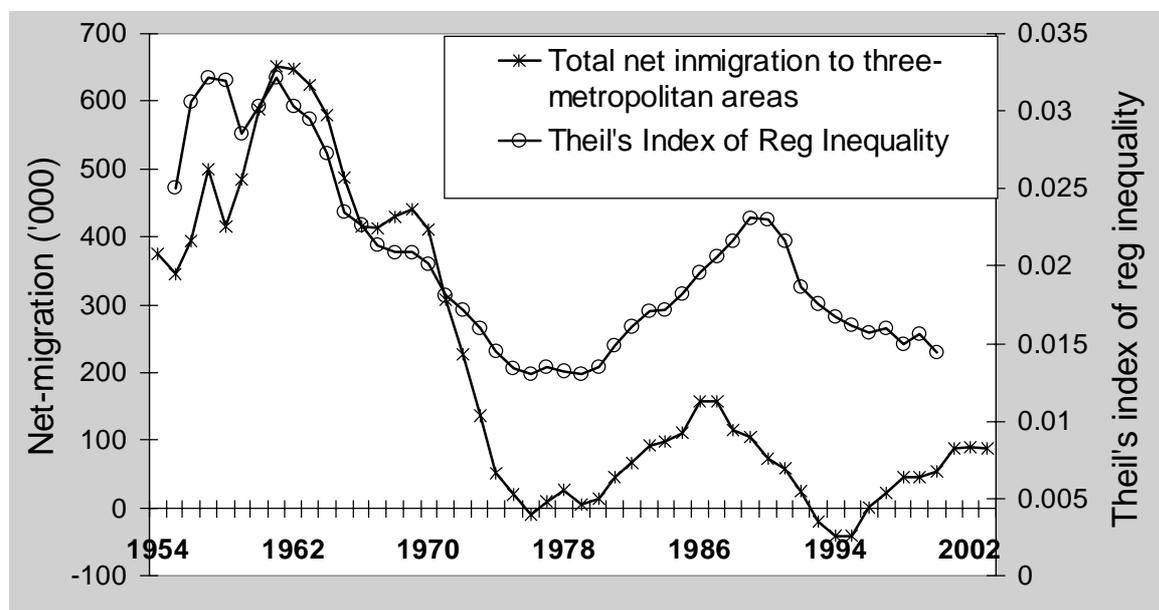


Figure 2. Regional Disparity and Net In-migration to 3-Metro Areas in Japan

For example, Japan also experienced very rapid urbanization in the postwar era. A huge population was migrated to big metropolitan areas (Figure 2). The migration was caused due to job creation in urban areas, and there were coordinated efforts by the Japanese government and business community to arrange housing for migrant population. Responding to the increasing demand for housing by new migrants in large metropolitan areas, large scale housing development projects were completed by the Japan Public Housing Corporation. In this way, Japan could successfully cope with the rapid urbanization after the World War II and avoided the problem of urban squatters. In contrast, in most Asian developing countries, people migrate to large cities without jobs, and government lacks a sound institutional mechanism to manage the migration and meet the housing need of new migrants. As a result, many big cities in Asia are now plagued with uncontrolled squatter settlements.

2.2 Over Concentration in Capital Cities

Another special feature of Asian urbanization is over concentration of population and economic activities in the capital cities. Different panels of chart in figure 3 show city size (in terms of metropolitan population) distribution in selected countries. The Rank Size Rule of city size distribution predicts that the population of n th rank city is equal to the population of the first rank city divided by n (Reed 2002). The city-size distribution pattern in US closely follows the Rank-Size Rule while that in Germany is even more evenly distributed. However, in France and most Asian countries, the city-size distribution is heavily skewed towards the

first rank city illustrating a situation of over-concentration in the first rank cities. For most countries the first rank city is the capital city. And one of the possible reasons for over-concentration in the capital city is centralized governance system such as in France, Japan or Thailand. In addition, in case of developing countries, the capital cities also serve as the gateway for international linkages. Because of this, the capital regions remained as the prime receivers of early Official Development Assistance (ODA) for infrastructure improvement. The concentration of ODA in capital region, in turn, attracted more of Foreign Direct Investment (FDI) and thereby contributed fast growth of capital region. Such early concentration of resources in capital region created more jobs and attracted migrants from lagging regions and eventually created a virtuous cycle of agglomeration economy. Over the time, the cycle got reinforced further and resulted in more concentration in the capital city.

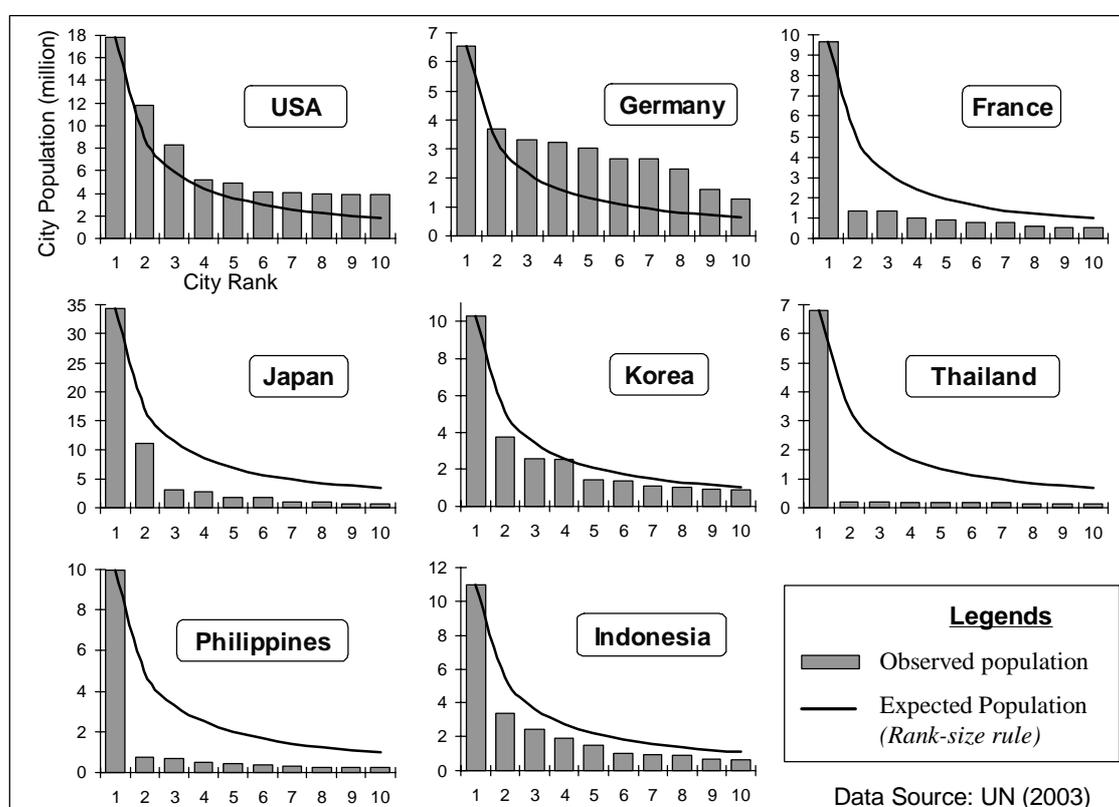


Figure 3. City-size Distribution in Selected Countries

Concentration of population and economic activities in the capital region at an early stage, in fact, is desirable from the view point of making best use of limited resources when countries are facing lack of resources as argued in development literature, such as Nurske (1952). There is also so called inverted U hypothesis, which argues that the problem of urban primacy (over concentration in one single city) can be solved by market mechanism since too much concentrated city lost the competitiveness due to higher cost of crowdedness (Alosno 1969). Yet, in practice, it is very rare that the problem of urban primacy has been solved through market process without requiring any policy intervention.

In Japan, when the momentum of economic growth was at its peak, the issues of over-concentration in three big metropolitan areas (Tokyo, Osaka and Nagoya) gained much prominence in national development plan. The growth of these metropolitan areas, had in fact, contributed as the engine of economic development at the early stage. But Japanese policy makers realized that the continuing concentration in these metropolitan areas was resulting in serious depopulation in peripheral areas, undermining the long-term economic potential of such lagging areas. The main reason for continuing concentration in major metropolitan areas was the income disparity as illustrated in figure 2. The metropolitan economy was based on secondary and tertiary sectors (high-value added) while the lagging regions had to rely on low-value added primary sector. This resulted in income gap between metropolitan and rural population and over the time widened the disparity and make people to migrate to metropolitan areas for job and higher income.

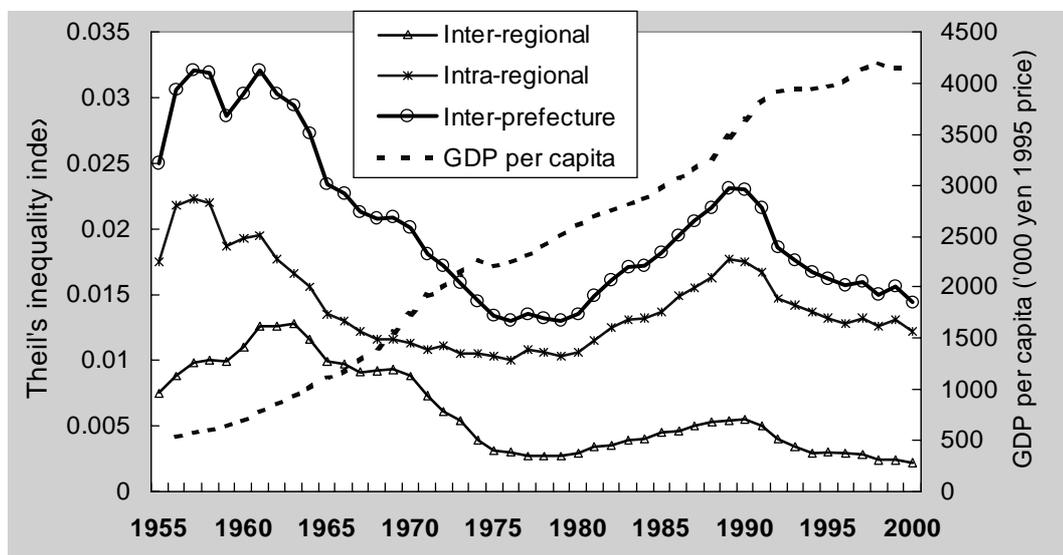


Figure 4. Trend of Intra-Regional and Inter-regional Disparity in Japan

To address this issue, Japanese government adopted policy strategies to relocate manufacturing plants from metropolitan areas to peripheral areas in order to provide jobs to farming population and increase their income. Specific measures under such strategies included incentives schemes for manufacturing companies, such as development of industrial areas with good infrastructure facilities in rural areas. This policy contributed industrial development in rural areas and provided second job to farmers and, as a result, income of rural population increased reducing regional disparity significantly until mid 1970s (figure 2). Since then, the disparity increased reflecting structural changes in Japanese economy which hampered the economy of lagging area as Japanese manufactures started relocating their plants to low-wage countries of South East Asian region. The disparity as measured by the Theil's index, (Theil 1967), taking prefecture as the unit of analysis, decreased since late

1980s, but the migration trend is not following the disparity trend.

Figure 4, which breaks down the disparity measures into the inter-regional (inter-block) and intra-regional (within-the block), explains partly why the migration trend is not following the disparity trend. The disparity is mainly due to intra-regional disparity and apparent improvement in disparity situation is due to increase of income in prefectures near metropolitan areas, which has nothing to do with reducing the migration flow from peripheral areas. In addition, the key factor driving migration process is no longer the income alone. Japanese people give more importance to higher quality social services, amenities, and metropolitan life style- factors not easily controllable through government interventions. This may give new interpretations for the competitiveness of the cities. At the early stages, industrial investment generated growth potential of the city attracting new migrants- an era of urbanization driven by industrialization. However, in the present era of globalization and knowledge-based economy, livability of city, which is the key factor to attract high skilled people, generates potential for the growth of new industries. In this context, we can see the importance of an efficient urban transport system that is key factor for better livability of a city and thereby influence the long-term competitiveness.

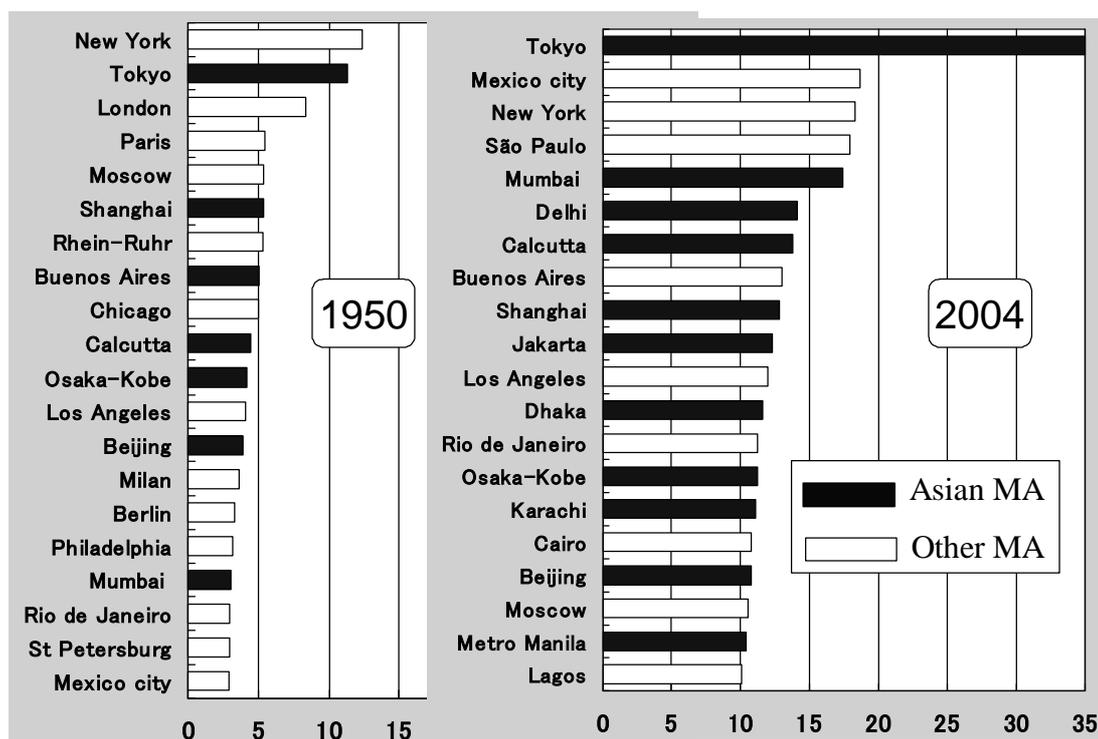


Figure 5. Population in World's 20 Largest Metropolitan Areas

2.3 Large Scale Urbanization

The above discussed two features of Asian urbanization (rapid urbanization in combination with concentration in a single city) are producing huge urban conurbation, commonly called megacities. Figure 5 shows that in 1950, the list of world's 20 largest metropolitan areas

contained only 7 Asian cities all (except Tokyo) with population less than 5 million. By 2004, there were 11 Asian cities all with more than 10 million population. Such unprecedented large scale urbanization in Asia is creating a complex situation in terms of providing necessary infrastructure, particularly transport infrastructure. Since the megacities of Asian developing countries are still growing, the policy makers may not find directly replicable model from elsewhere. What is needed is to consider the future scale of the city and take long term strategic view point to plan the transport infrastructure suitable for the city of such scale.

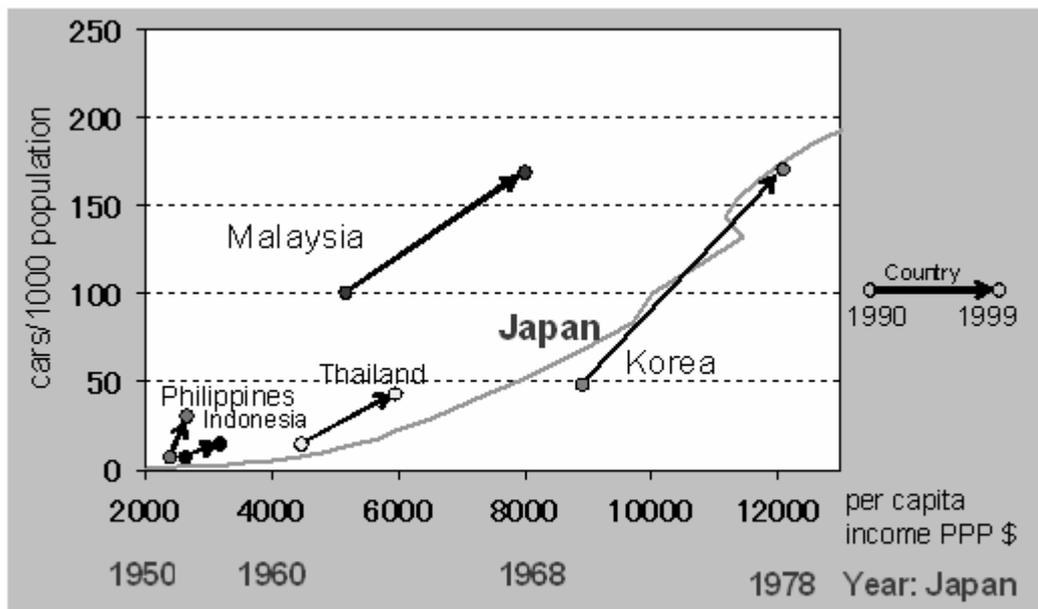


Figure 6. Motorization Rate in Selected Countries (Comparison with Japan)

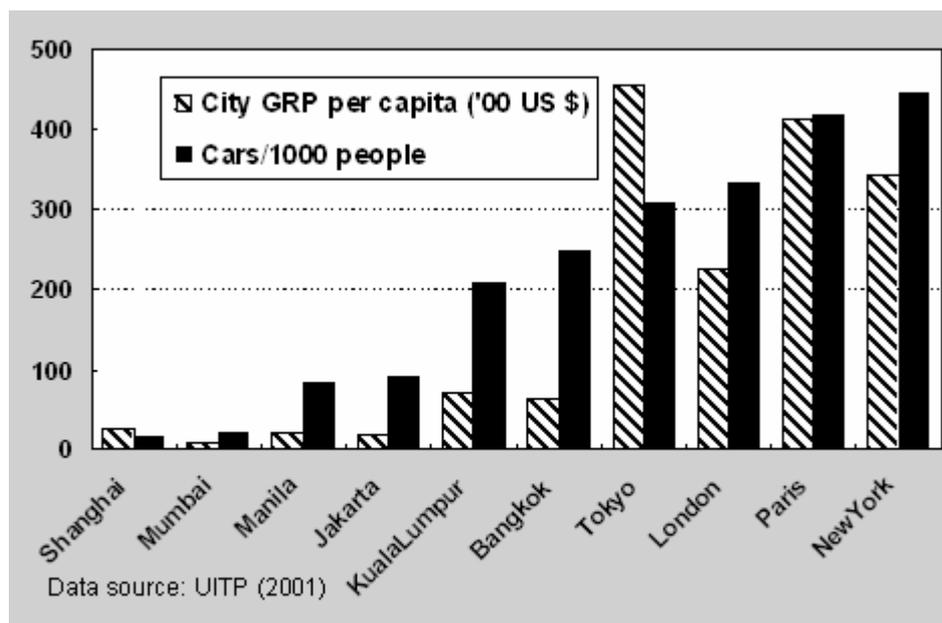


Figure 7. City Level Per Capita Income and Car Ownership Rate

2.4 Rapid Motorization

Asian region is also witnessing a rapid trend of motorization. Figure 6 shows the of car ownership rate in selected Asian countries in 1990 and 1999 and compares these with the trend of car ownership rate in Japan. The car ownership rate in developing Asian countries is significantly higher than that in Japan for corresponding level of per capita income. When looked at the city level ownership rate, the figure is even higher for developing Asia (figure 7). For example, in 1995, Bangkok's car ownership rate was about 80 % of Tokyo's rate while the per capita income of Bangkok was just about 15 % of Tokyo's per capita income (UITP 2001). In developed countries, there were extensive urban rail networks before the motorization gained momentum. This made it possible to maintain high quality public transport and dampen the speed of motorization. However, in most Asian megacities urban rail network is yet to be fully developed and the main public transport mode is the conventional bus, the service level of which is not comparable to the comfort and convenience of private mode. This situation has further accelerated motorization since car use appears to be a necessity rather than a choice.

2.5 Inadequate Infrastructure

As discussed before, the rapid pace of urbanization has generated such a huge demand for urban transport infrastructure that it is not possible to make necessary adjustment in infrastructure investment due to lack of financial resources. The narrow tax base generates government revenue far below the required level to meet competing demands from

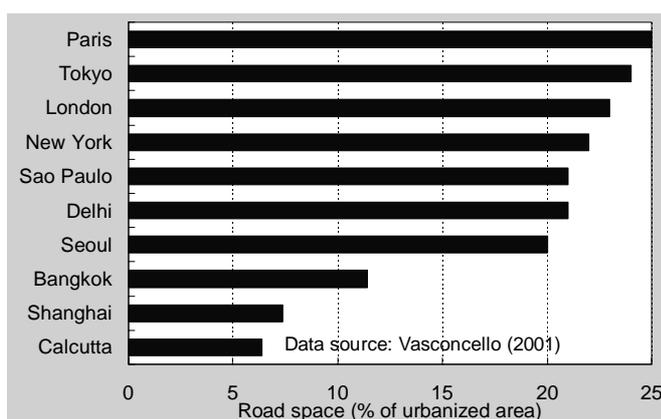


Figure 8. Available Road Space

various sectors on government revenue. To make the situation worse, since mid 1990s, major international donors shifted their priority from infrastructure sector to social sectors. One of the reasons for such shift in ODA policy was due to the expectation of growing potential for Privately Financed Initiative (PFI) in infrastructure sector. However, the early optimism for PFI evaporated soon, especially in transport sector, when PFI projects confronted many problems. Because of all these factors, the urban transport infrastructure in most developing countries is far inadequate to serve the emerging demand. For example, as shown in figure 8, the ratios of road space to total urban area in Calcutta, Shanghai and Bangkok are 6.4, 7.4, and 11.4 percentages respectively while those for Paris and Tokyo are 25 and 24 percentages respectively. Figure 9 compares the car ownership rate and urban expressway in selected cities. Expressway lengths in Asian megacities are much less for the given level of car ownership rate. Likewise, figure 10 shows city population and opening year of first subway

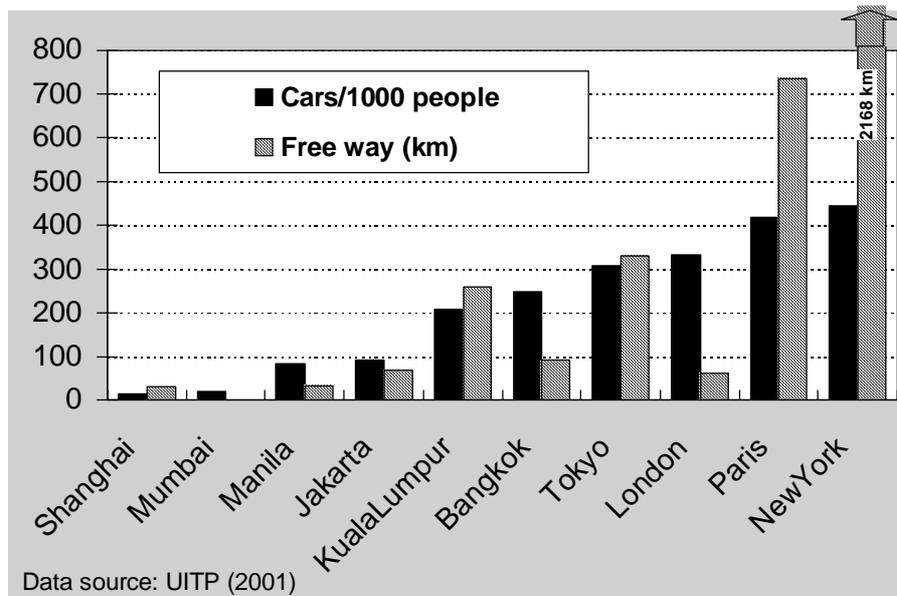


Figure 9. City Level Motorization Rate and Length of Urban Freeway

line. Usually, the size of city population is the key factor in determining if the city needs a subway system. Asian cities are too late to introduce subway system even though the population size is much bigger when compare with population of developed countries' cities at the time of subway introduction.

2.6 Monocentric City Structure

Most Asian megacities have monocentric city structure; that is city center containing all important urban functions such as business districts, government offices and shopping centers. Since city structure has direct links with urban transport system and eventually the livability

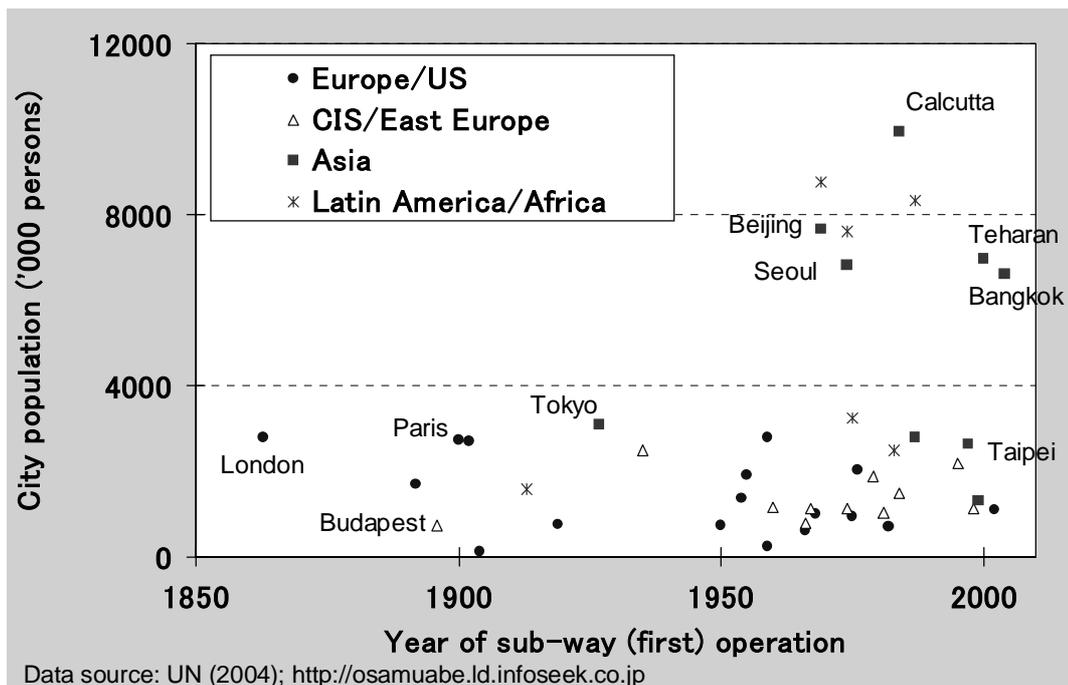


Figure 10. City Population and Opening Year of First Sub-way Line

aspects, due consideration need to be given to achieve desirable urban form in the long-run. Urban form, in fact, evolves over a long period of time and transport infrastructure is an important element that influences the evolution city structure. Hence, urban transport should be discussed not just for the short-term objective of meeting existing transportation demand but also for its long-term impacts on the future shape of city structure.

Fortunately, urban designers seem to have come to a broad consensus regarding the desirable form of city. Earlier they were sharply divided, some arguing for the centralized (monocentric) urban form and others for decentralized (low density sprawl). The broad consensus now is the middle way (Figure 11); that is decentralized-concentration (Frey 1999). The urban form of decentralized concentration (poly-centric) is also in consistent from the view point of railway based urban transport system. The major railway terminals provide candidates sites for the urban centers.

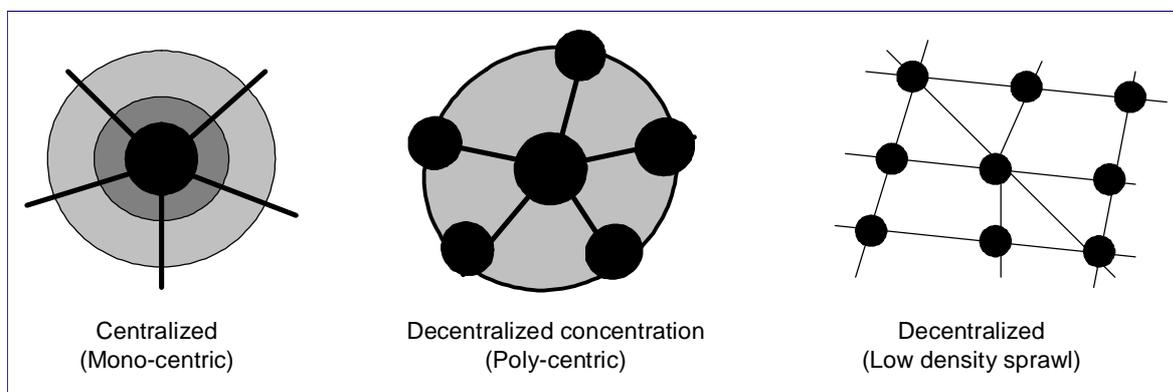


Figure 11. Different Urban Forms

The experience of Tokyo might offer important lessons to megacities in developing countries of Asia. Due to monocentric structure of Tokyo, all private and public sector jobs are located at the city center, and residential areas are in the suburban area. The average one-way commuting time is over one hour. The dominant mode for commuting is the urban railway. But due to large number of commuters to the city center especially during peak hours, there is severe congestion inside train cars and also on the railway tracks (due to higher frequency of train). Important terminals in the city centers are also over-crowded. In addition, higher frequency of trains is disrupting the road traffic since many suburban rail lines cross the roads at grade. To address these problems, Japan adopted a strategy to decentralize the concentration by creating sub-urban centers and encouraging business and government offices to relocate there. This strategy is expected to change the monocentric structure of Tokyo into polycentric. Japanese government is taking various measures under this strategy; however there is not much success.

The lesson from Tokyo is that the monocentric city structure is not easy to break. However, if railway oriented urban development is promoted from the early stage, and at the same time, the areas around the suburban railway terminal are developed as major sub-centers, a poly-centric city structure may evolve over the time.

2.7 Environment and Safety Problems

The direct impact of this trend is increasing road congestion in Asian cities. UITP (2001) reported that the average speeds of road traffic in Bangkok, Manila, Jakarta, Shanghai and Mumbai are 15, 18, 18.6 and 20 km/hr respectively. For obvious reason, the peak hour traffic speed is even less. Other associated problems include the road traffic accident and vehicular pollution. The left panel of figure 12 shows that the fatality rates from traffic accident are far higher in developing Asian cities as compared with developed cities. Likewise, the right panel shows that the concentrations of SPM in selected Asian cities (a common pollutant from vehicular emission) are far above the recommended level.

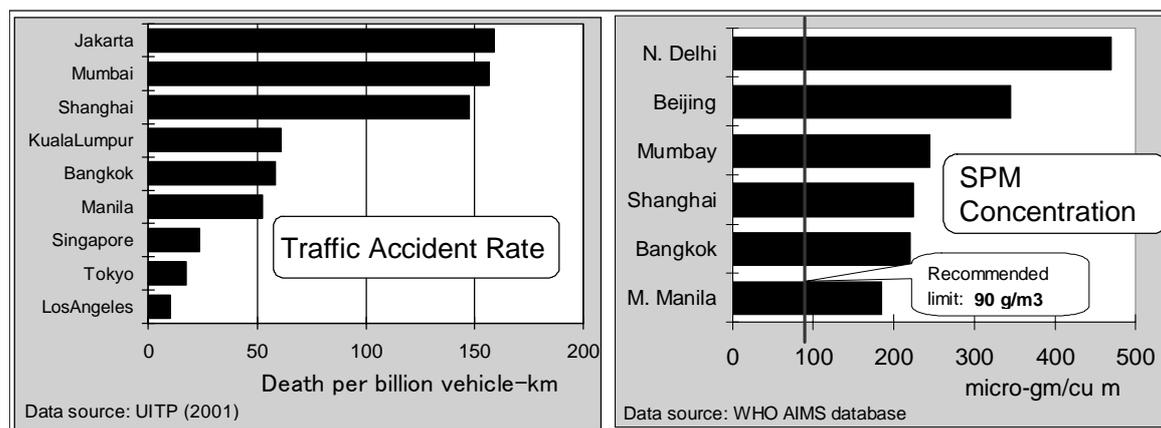


Figure 12. Road Traffic Accident Rate and SPM Concentration

3. DO-NOTHING SCENARIO AND DESIRABLE SCENARIO

3.1 Do-nothing Scenario

Given the above discussed situations, what path Asian megacities will follow under the Do-nothing scenario (or Business As Usual scenario)? Here “do-nothing” implies lack of major policy efforts to reverse the problematic trends taking long-term strategic view points. Of course, there will always be some measures in action usually for short-term relief. In a discussion to be followed, such sort-term measures are considered as “do- nothing”.

Under this scenario, the over-concentration in capital city continues as the growing income disparity forces people from rural areas to migrate to metropolitan areas, but without jobs and housing provision. This increases squatter settlements in urbanized area. In the face of weak instructional capacity to manage rapid urbanization, there will be mismatch between

infrastructure and land-use patterns, such as high Floor Area Ratio (FAR) in down town area without adequate road infrastructure. On the other hand, high income population may prefer suburban residential area, which accelerates low density sprawls in suburban area. Such a pattern of low density suburbanization further increases usage of private modes, such as motorcycles and cars, and causes significant reduction in the modal share and service level of public transport. The long terms dynamic interaction between urban transport system and urban form finally takes the city along irreversible path of automobile dependent and haphazard low density urbanization. The incompatible land-use makes it very difficult to provide adequate infrastructure, and as a result, overall quality of life in the city would be on a declining trend. Once the low-density sprawl takes its shape as dominant urban form, development of urban rail will not be feasible due to unfavorable land use pattern (demand density much lower than required for a rail service).

This scenario brings so many problems. The over-concentration in capital cities increases regional disparity undermining socio-political stability. High rate of motorization and worsening service level of public transport in the face of inadequate road infrastructure create severe congestion. Vehicular pollution and traffic accidents are further worsened. Overall, livability, economic potential and global competitiveness of the city will be significantly worsened.

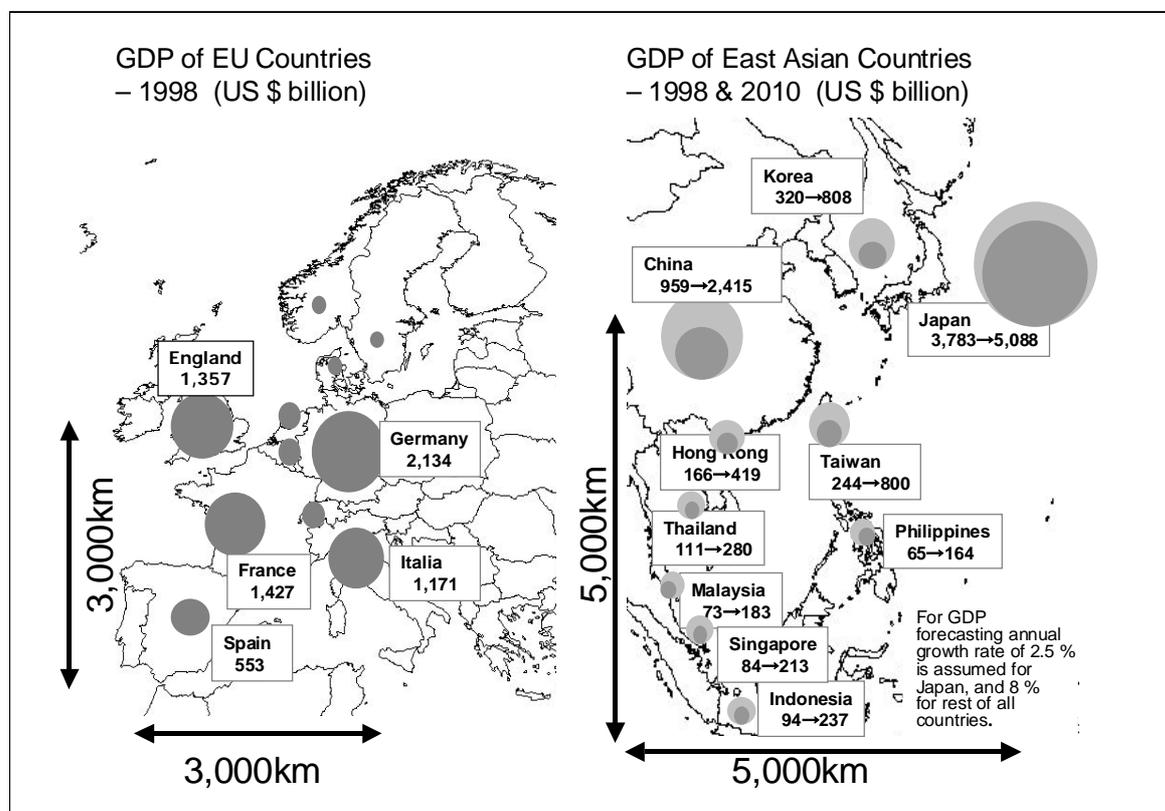


Figure 13. Comparison between EU and East Asia Regions

3.2 Desirable Scenario

(1) National and International Level

The over concentration in the capital city will be decentralized achieving a balanced distribution of population and economic activities among different regions or cities. The primate capital cities no longer suppress the competitive potential of other cities. Each city may have its own unique competitive futures and attractiveness for outsiders. In the face of globalization, it is also in the interest of national economy to help individual cities realize their competitive potential and directly participate in the global market. Each region is supported to have infrastructure facilities for smooth economic exchanges with rest of the world. This will stop the outflow of population and even the lagging regions are with minimum threshold size population to operate and maintain essential service facilities in efficient way. Potential of regional block area of East Asian countries to serve as individual international economic units in the East Asian economic region is fully realized. Figure 13 compares the regional economy of EU with that of East Asia illustrating close correspondence at least geographically. Given the rapid economic growth rate in developing countries of East Asia, and increasing trend of minimizing the resistance caused by national border for international exchanges, individual cities or regions emerge as competitive economic unit on their own in the global economy. The approach of balanced and strategic regional development thus makes individual regions or cities more competitive at both national and international level.

(2) Metropolitan Level

The existing mono-centric city structure is changed into the polycentric structure (instead of the current trend expanding sprawl). The polycentric urban form is well integrated with the urban rail network, the suburban railway terminals being the sites for new urban centers. New development occurs in the suburban centers without causing low density sprawls. Urban rail network serves as the back bone of urban transport system taking a significant modal share. Since the size of urban network would be quite extensive in Asian megacities, a hierarchical system for urban rail network would be established to maximize the network efficiency. It would include intercity high-speed train, sub-urban express train, sub-urban local train, subway, LRT and AGT as in the case of Tokyo (Figure 14). Adequate road infrastructure is provided to avoid road traffic congestion. In road network too, hierarchical system is established which includes four urban expressway, arterial roads, collectors and distributors, and local streets.

(3) Urban District Level

In the center of the city, business district is located near the railway terminal. The shopping district, which is also located near the railway terminal, is auto-restricted zone. In addition, the down town area includes a residential district of sufficient scale with strong land-use

regulation to control pollution, noise and landscape and thereby maintain good living environment.

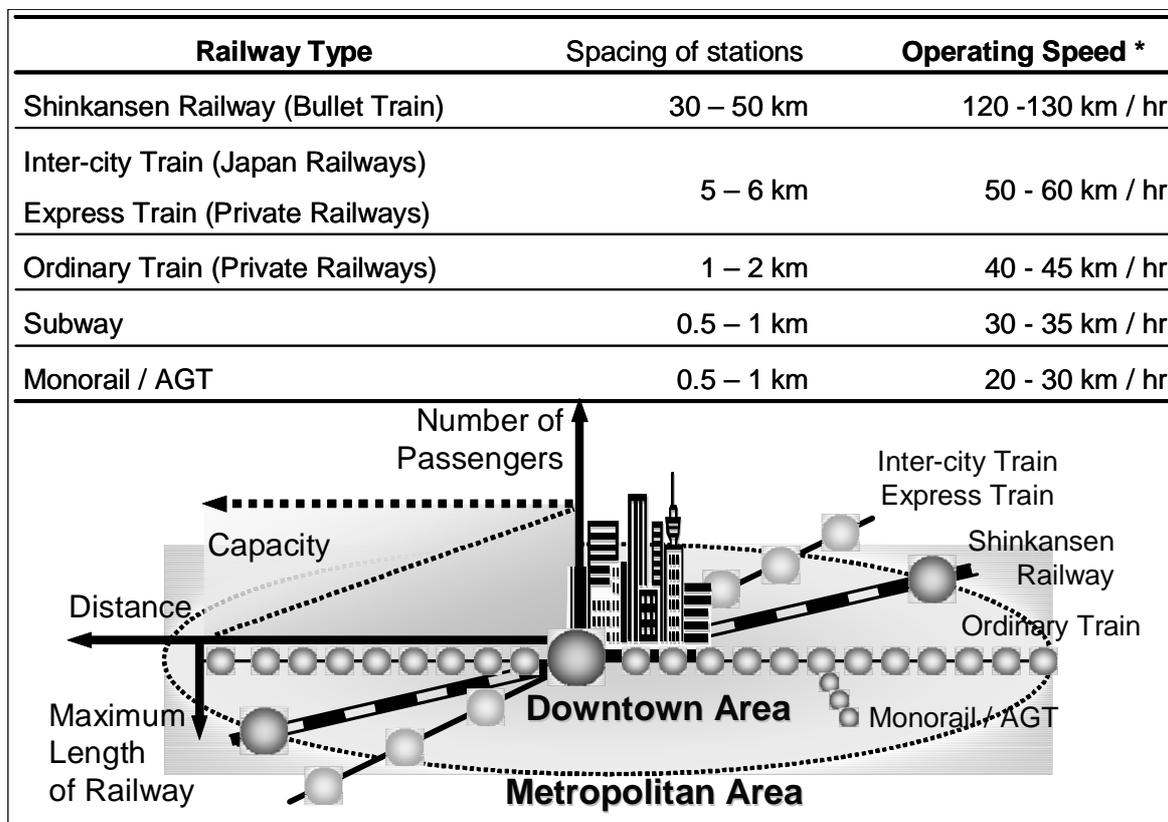


Figure 14. Hierarchical Network of Urban Railway in Tokyo

In suburban area, urban centers are developed near railway terminals. The business district and shopping centers are located closer to the terminal to make it easily accessible from the railway station. Residential districts, on the other hands, are developed in the outer ring areas with good natural and living environments. Provision for feeder transport services such as bus or para-transit is made to provide regular access to the residential areas from the railway terminal.

(4) Transportation System

The urban transport system is of truly multi-modal with rail-based public transport domination. It will adopt the concept of the Universal Design to make it seamless and accessible for disabled and elderly population. Also, every possible measure of Transport Demand Management (TDM) is adopted to maximize the system efficiency.

3.3 Paths towards Desirable Scenario

The challenge for Asian megacities is how to move towards desirable scenario. The modal share of public transport can be considered as a representative indicator related to both

scenarios discussed above. Figure 15 illustrates the both scenarios in terms of trend of public transport mode share as the level of city income rises. Curve AB represents desirable scenario, in which currently existing high modal share of public transport in Asian megacities is basically maintained. On the other hands, curve AC represents do-nothing scenario, in which the dynamics of urban transport and city structure works in the favor of private mode and, as a result, the decline in public transport mode share continues unabated. We can think of various kinds of policy measures at different stages to approach the desirable path (curve AB) as closely as possible and avoid the path along curve AC. However, once the modal share of public transport is too low, it is very difficult to reverse the trend through policy measures. This is because of the unfavorable land-use structure. So the key challenge is to adopt appropriate measures at appropriate stages considering the situation of given megacities. What is important in this context is to give balanced emphasis to both short-term and long-term optimal solutions. Short-term solution may be easier to implement and may give immediate relief but it may not bring about the desirable scenario in the long-run. On the other hand long-term solution may not produce immediate improvement and might appear as inefficient. That is why we need to look at the problem dynamics as illustrated by figure 15 and explore appropriate policy package.

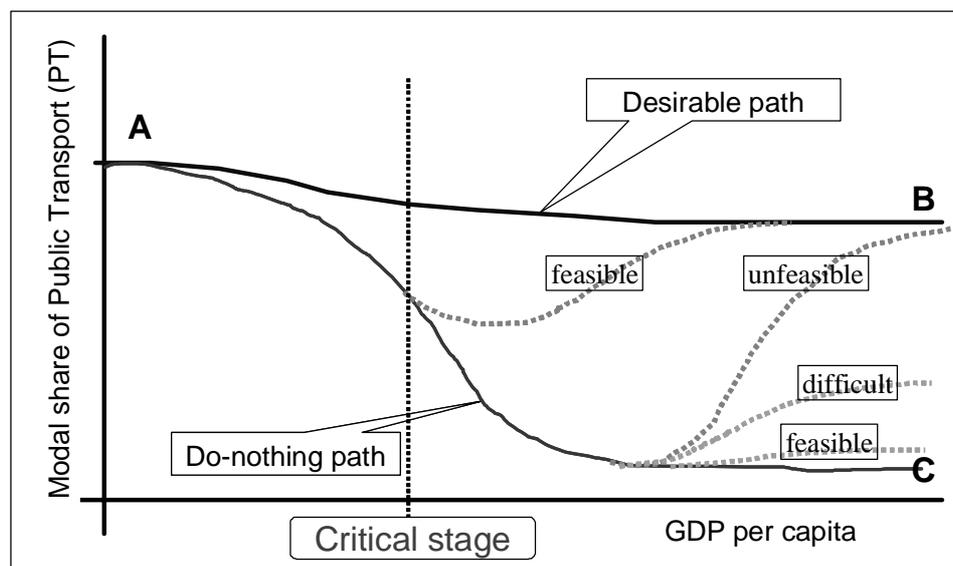


Figure 15. Do-nothing and Desirable Paths

Source: Acharya (2005)

4. SECTOR-SPECIFIC STRATEGIES

In this section, sector-specific strategies (related urban transport) that are important to lead the Asian megacities towards the desirable scenario are discussed in detail.

4.1 Railway

(1) Timing for Introducing Urban Railway system

Given the size of Asian megacities and huge transport demand, it is clear that urban railway network is essential for them. But the question is how to arrange the necessary investment resources in Asian developing countries. In Europe and US, burdens for all capital costs and part of operation costs are taken by the government. In case of Japan, only 50 % of capital cost of urban rail is subsidized by the governments (central and local) and there are no subsidies for the operation. The reason why urban rail systems need much less government subsidies in Japan than in US or Europe is high volume of railway demand in Japanese cities (Figure 16). The railway oriented urban structure of major metropolitan areas encouraged high population density along the railway lines making it possible to maintain a higher load factor for urban railways. As a result, the revenue is good enough to cover the operation cost plus part of capital cost.

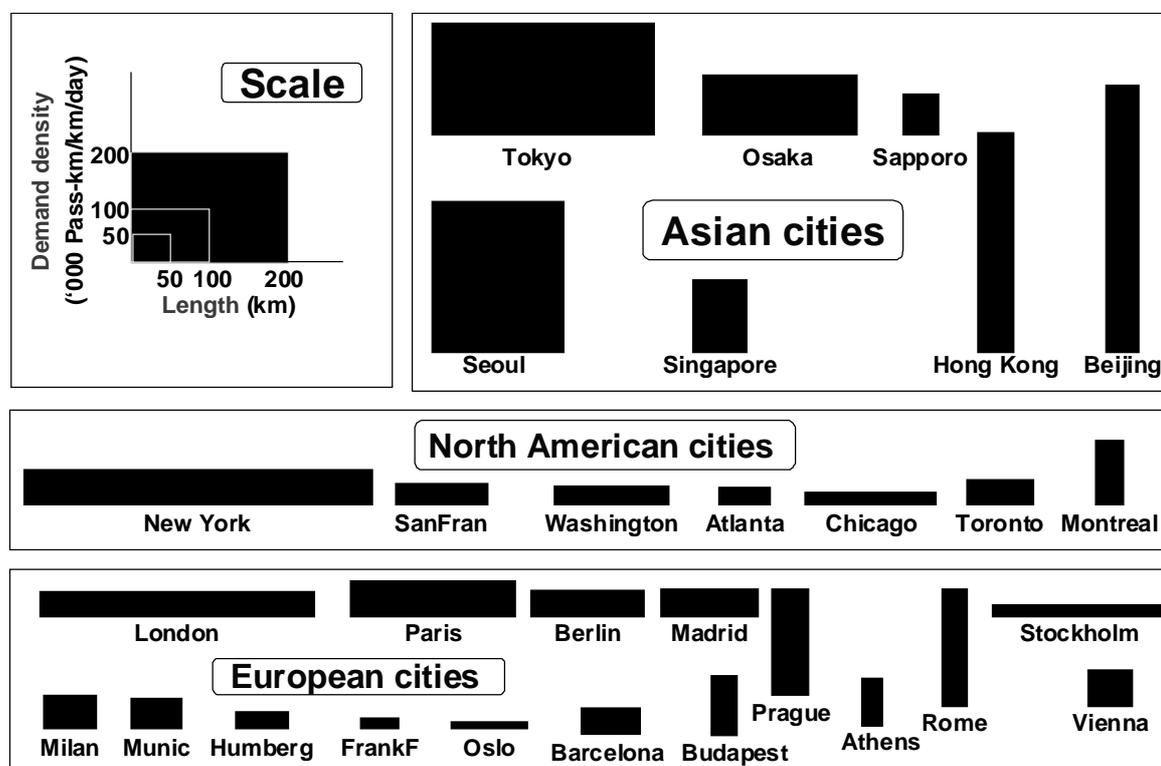


Figure 16. Network Length and Demand Density of Subways

Since both urban density and transport demand in Asian megacities is quite high, there is no question on the technical feasibility of urban rail projects. The cost of civil works for railway construction is also relatively lower than in developed countries. However, costs of railway vehicles and signals and other high-tech equipments are same as in developed countries. So, the overall cost of railway construction and operation is not so much different in developing and developed countries. But given the low income level in developing countries, the fare level has to be kept much lower in developing countries. Therefore, urban rail projects face

much difficulty to be profitable in developing countries. Hence, too early investment for urban railway in developing countries would involve financial difficulties, while too late investment has to confront the spread of low density urban settlements making the urban railway unfeasible forever. The challenge here is to identify optimal timing of railway investment making a tradeoff between short-term financial cost and long-term benefits of railway investment.

(2) Capacity Gap

In spite of financial difficulties, it is important to introduce urban rail system a little earlier by adopting less-capital intensive technology such as Light Rail Transit (LRT). Some Asian megacities, such as Manila and Bangkok have adopted such a strategy. The first LRT line would be along the high density travel corridor. Since the LRT operation induces further landuse changes and generate more demands, it will not take long before the demand saturates the system capacity creating a situation of serious capacity gap.

(3) Hierarchical Railway Network

As discussed before, for megacities, hierarchical railway network is necessary to cover the wide urbanized area and serve the peak demand more efficiently. However, in practice, the network development does not occur at once; rather it evolves over the time through development of individual lines. The challenge is therefore to develop individual lines, particularly those implemented at earlier stages, keeping in view that eventually they have to be part of a large hierarchical railway network. LRT lines which were built along the high-density demand corridor at the first stage may pose a difficulty to integrate it to the hierarchical railway network.

(4) Rail oriented Landuse

At the first stage, LRT route passes through existing Central Business District (CBD), where development of new business and shopping centers is difficult because of already built-up areas. So, in order to provide spaces for new business and shopping facilities, a new city center emerges a little far from the LRT station. The low level of initial travel demand at the site of new center does not justify the LRT route through this center. So, the first LRT line does not serve such new center and in the beginning the service level of public transport for the new center may not be so good.



Figure 17. Bicycle Parking on Pedestrian Way

For suburban terminals, the area in the vicinity of the terminals is more suitable for business and shopping facilities. But in the absence of effective land-use control, residential development might occur rapidly in such area.

(5) Inter-modal Facilities

At the first stage of railway development, the need of inter-modal facilities for Park-and-Ride, Kiss-and-Ride, bicycle parking, and station plaza and terminal facilities for their feeder services is not felt so much. Therefore the space near the station is usually developed as built-up area. But when such inter-modal facilities are required in the future, it is very difficult to acquire necessary land space. As a result road traffic around the station is disrupted due to parked or waiting vehicles or obstruction on pedestrian path is caused due to haphazardly parked bicycles (Figure 17). Likewise, the concept of Universal Design does not look so important at the early stage and, as a result, each facility such as station, transfer terminal, buildings etc are built only considering their independent functions. But eventually when it becomes important to adopt concept of Universal Design in urban transport system to improve overall service level (such as seamless and better accessibility for elderly users), independently built facilities pose great difficulty.

4.2 Urban Road

(1) Prioritizing Investments for Urban Road Network

At the first stage, the most important investment is to increase the capacity of the congested routes. At the second stage, priority should be given to expand the network along radial routes to cover expanding sub-urban areas. At the third stage, investment for ring roads is important for the purpose of (a) connecting sub-urban centers and (b) reducing traffic through city center. At the time of radial or ring road investment, the alignment areas would be heavily built-up, posing great difficulty for Right-of-Way (ROW) acquisition. To avoid such a situation, ROW should be reserved at an early stage or impose strict land use control on urbanization.

(2) Road Network Capacity and Demand Management

Under the rapid increase of traffic demand, the network capacity is always lacking. At each stage, expansion of network capacity is needed. At the same time, control on usage of private automobile is necessary, particularly in the downtown areas. In case of European cities, automobile restricted zones have been introduced with the provision of small size ring roads, LRT and Transit Malls. For Asian megacities too, such network structure should be considered and appropriate planning provisions needs to be made at early stage.

(3) Expansion of Toll Roads

At the first stage, arterial roads network and flyover in congested area are the most important

items for road investment. At the second stage, individual toll road projects are started using PFI scheme due to the lack of government financial resources. At the third stage, a comprehensive toll road network is needed. The toll road network includes all individual toll roads (from second stage) and some of the arterial routes (from first stage) upgraded to toll roads. So, while planning for the arterial routes at the first stage, ROW for toll road should be considered. Likewise, while implementing individual toll road projects at the second stage, we have to consider for the coordination between each toll roads to establish a well functioning toll road network, not only in the sense of physical structure but also in terms of toll system including cross-subsidy scheme. Equally important is a coordinating mechanism for different toll road operators to achieve optimal operation of the network.

4.3 Road-based Public Transport

(1) Fare Level

At the first stage, para-transit and buses are major transport modes. The second stage comes with increased motor-cycle traffic reducing public transport mode share. At this stage, the fare level of public transport is requested to keep lower to make it affordable since majority of public transport users are low income people. Besides, lower fare level of public transport is also expected to increase public transport ridership, and thereby contribute towards solving road transport problems such as congestion, pollution and traffic accidents. At the third stage, when urban rail system is introduced, the railway fare is usually set to recover operation cost (and also part of capital cost). So, rail fare is higher than the bus fare. In principle, the newly introduced railway system has to attract bus users which may not be easy if bus fare is continued to be kept at lower level (usually with public subsidy). As a result, railway project is not profitable.

Making transition from low-bus fare (second stage) to high-bus fare (third stage) may not be so easy, since public transport fare need to be affordable to low income people. However, some alternatives might be possible, such as segmenting the bus market by service level and set fare policy accordingly. Fare deregulation for air-conditioned (AC) buses may serve the purpose. For example, in Metro-Manila regulated low fare level is maintained for ordinary buses while fares for AC buses are deregulated. Since, the LRT fare is quite competitive as compared with that of AC buses, LRT lines maintain good ridership. Also equally important is to set expressway toll high enough to encourage people to use urban rail.

(2) Traffic Control

At the first stage, para-transit is the main public transport mode. As the average trip length increases due to urban expansion, bus traffic increases gradually. At the same time, mixed traffic, that comprises bicycle, motor-cycle, para-transit, buses and automobile, reduces traffic speed and increases level of traffic accident. As a result, road capacity is decreased and bus

ridership also declines. At this stage, fully operational hierarchical road network is yet to be established. So, especial traffic control is essential, such as phasing out of para-transit from arterial roads, designating exclusive lane spaces to different modes (e.g. bus or bicycle lanes), controlling stopping of buses and para-transit and managing intersections. Also important is the provision of inter-modal transfer facility at the LRT station, else traffic bottleneck might be created on the road around the LRT station due to crossing passengers and waiting buses and para-transit vehicles.

(3) Modal Coordination

Before the motorization, the road-based public transport experiences increasing demand and many operators enter the public transport market. However, too many operators in the market brings various problems, such as difficulty of delivering useful information to the passengers, inconvenient network coordination and lower load factor for each vehicle. In such case, public authority can play important role in coordinating the services (case of Seoul or Bangkok), encouraging the merging of different operators (case of Metro-Manila), introducing integrated fare system (case of Tokyo, Seoul) and providing terminal facilities.

In the case of Japan, at the timing of start of urban rail operation, the public authority reformed the bus network changing their service routes from long-haul to feeder services, using subsidies and building transfer terminals. In general, the role of para-transit and bus diminishes in the market at the timing of the start of railway service. However, under the TDM policies, para-transit, mini-buses and Bus Rapid Transit (BRT) are being introduced to cover the demand segment affected by automobile restriction.

4.4 Land-Use

Urban transport policies at each stage are related directly with the land-use policy. Because, (1) Transportation system influences the urban structure and land use (2) Evolving patterns of land-use determines the feasibility of transport projects (3) Reform of transport infrastructure requires changes in land-use, and (4) It is important to have appropriate land-use along transport routes to ensure good living environment.

Good coordination between transport projects and land development also make it possible for internalizing the external benefits of transport investment through the mechanism of Value Capture. This may generate much needed financial resources for capital investment. Typical good examples of Value Capture in private railway projects undertaken by Tokyu Corporation in Tokyo are given below:

- Tokyu Corporation started new urban railway project in combination with land development projects along the railway line.

- Railway facilities and the land-use along the railway line created good living environment and Tokyu Corporation earned huge profit through the increased land price and income from non-railway business, such as department stores, leisure business, entertainment facilities etc.
- Tokyu Corporation followed strategy to produce optimum land-structure in the long-run. For example, while developing the land near major suburban rail terminal, it first developed residential area in outer zones (connection with terminal through feeder bus service), and kept the areas near terminal reserved to develop it as business and commercial district later.
- Tokyo Corporation expanded the feeder bus network according to the increase in residential population or areas. The space for bus terminal and station plaza was kept reserved in front of the station.

5. CONCLUSION

Rapid growth in Asian megacities makes it quite difficult to provide necessary infrastructures. The gap between the demand and the supply of infrastructure creates various kinds of problems. Experts and policy makers are making best efforts under so many constraints. The most important issue is to find second best path to make a transition from do-nothing path to desirable path. At the same time, we have to realize that short-term optimal solution may not be in consistent with the long-term optimal solution. Under such situation, some of the seemingly effective solutions may not be appropriate for Asian megacities to achieve desirable scenario in the long-run.

In this paper, some examples of key policy issues which need to be considered at different stages were discussed. However, other ideas and more detailed analysis are necessary to work out policy solutions for different stages including long-term. As emphasized in this paper, the long-term solution for the urban transport problems in Asian megacities can be worked out only by giving due consideration to their specific features and other practical constraints. Though the experience of developed cities could be useful, successful policies in developed cities may not be directly replicable in Asian megacities. This calls for an active role of transport researchers and experts from Asian region to explore practical policy solutions. I can see a good scope of generating new policy insights by sharing experiences among Asian experts possibly through collaborative research efforts. I also hope that the professional network of EASTS makes it possible to undertake collaborative research initiatives in such a theme of practical importance.

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