

TRANSPORT PLANNING IN JAPAN FROM A EUROPEAN PERSPECTIVE*

Michael Wegener
Institute of Spatial Planning
University of Dortmund
F.R.G.

For a transport planner in a European country, a look on transport planning in Japan is a fascinating experience. After the Second World War, Japan has succeeded in constructing a highly efficient transport system almost from scratch in an incredibly short time. The famous 'bullet' train *Shinkansen*, the Japanese expressway system, the tunnels and bridges linking the Japanese islands and the land reclamation projects for new sea- and airports are truly impressive engineering achievements, and in no other country one can find so many experiments with new technologically advanced transport systems and new forms of transport investment and management.

Yet a look on Japan can also teach a lesson about the risks of unconstrained engineering and economic rationality if they are not controlled by a land use and transport policy guided by social and environmental concern. The rapid growth of transport infrastructure in Japan has contributed to the imbalances in regional growth and problems of overagglomeration in metropolitan areas such as exploding land prices, congestion, noise intrusion and pollution. However, there are also impressive examples of successful environmental regulation and control in transport.

This paper gives an overview on the development of transport planning in Japan from the beginning to the present, compares it with current trends and policies in Europe and asks whether some parts of the Japanese experience may serve as models for transport planning in Europe.

Introduction

With the Single European Market coming closer, further advances in European integration being likely and barriers between East and West Europe gradually being removed, transport policy issues are gaining new importance on the political agenda in Europe. New fixed links such as the Channel Tunnel or new high-speed rail lines promise to fundamentally change the accessibility surface of the continent, while at the same time the underprovision of transport infrastructure in peripheral regions and large parts of east Europe presents new problems and challenges.

In this situation, a look on Japan is a fascinating experience. After the Second World War, Japan has succeeded in constructing a highly efficient transport system almost from scratch in an incredibly short time. The famous 'bullet' train *Shinkansen*, now almost thirty years old, still sets unmatched standards for speed, comfort, punctuality and safety. The Japanese expressway system, though still not comparable to those of some European countries, has developed with impressive speed and connects even remote regions with the urban centres. No other archipelago country has linked its islands with so many tunnels and bridges, some of them breath-taking engineering achievements. The land reclamation projects for new sea- and airports are stunning demonstrations of how man can change the face of our planet. And in no other country one can find so many pilot implementations of new technologically advanced transport systems for the 21st century. Japan has also more than other countries experimented with new forms of transport investment and management allowing for extensive private sector involvement.

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Yet a look at Japan may also teach a lesson about the risks of unconstrained engineering and economic rationality if they are not controlled by a land use and transport policy guided by social and environmental concern. The spectacular growth of transport infrastructure in Japan has contributed its share to the imbalances in regional growth and problems of overagglomeration in metropolitan areas such as exploding land prices, congestion, noise intrusion and pollution. However, there are also impressive examples of successful environmental regulation and control in transport.

This paper consists of three parts. The first part gives an overview of the development of transport planning in Japan from its beginning to the present. In the second part the Japanese situation is compared with current transport trends and policies in Europe. In a concluding part it is asked whether some parts of the Japanese experience may serve as models for transport planning in Europe.

The paper is based on research of the author during a one-year stay at the University of Tokyo, Japan, and on the results of a survey on transport research in 19 European countries, including Israel, conducted by the Network on Communications and Transport Activities Research (NECTAR) of the European Science Foundation.

Transport Planning in Japan: Historical View

As an industrial nation, Japan is a latecomer. After 250 years of isolation under the Tokugawa Shogunate, Japan started its industrialisation period with the foundation of the modern Japanese state with the Meiji restoration in 1868, when the European countries had already developed a sizeable industrial base. As a consequence it took Japan almost until 1950 before less than half of its economically active population worked in agriculture, fifty years later than countries like Germany or Britain (Wegener and Shibasaki, 1989).

Prewar Japan

Until the early Meiji days, long-distance transport in Japan was largely sea transport or walking or carrying goods on unpaved trails winding through the hilly countryside. Even the *Tokaido*, the famous Eastern sea route was not more than a narrow cobble-stoned road. The first railway, between Tokyo and Yokohama, did not appear before 1872, and it took until 1890 and 1891 before the western and northern parts of Japan were linked to the capital by rail. The rivers in mountainous areas were largely unsuited for shipping.

Inside the cities again walking, carrying and being carried (by palanquin) were the major transport modes. Most cities, such as Edo (today Tokyo), were designed as castle towns with deliberately narrow and winding roads. Some had moats and canals on which boat traffic like in Venice was possible. The Meiji period brought the rickshaw and the horse-drawn carriage and later the trolley and the electric tramway. However, the narrow roads of the pre-Meiji cities were poorly fit for vehicles. Intra-urban rail travel started with the opening of the ring or Yamanote line in Tokyo in 1910.

In the period between the wars private rail lines shaped the spatial organisation of large cities in Japan like in no other country. These companies developed agricultural land along their originally electric tramways fanning out from the central area as residential suburbs for the growing number of white-collar office workers and so contributed to the seemingly endless urban sprawl characteristic for Japanese cities today.

The Growth Period

After the war, the provision of food and energy, housing and the prevention of natural disasters were given highest priority. However, transport became an issue after 1950 when the sudden growth sparked by the Korean War had revealed the inadequacy of ports, railways and roads for the needs of the rapid economic development. Since this time transport policy has continued to play a major role in national development planning of Japan. In a first period between 1950 and the mid-1970s, the construction of modern transport infrastructure was considered to be a key factor for the promotion of growth in a rapidly developing industrial economy (Ohta, 1989).

In 1950 Japan had an extensive but inefficient railway network. All tracks had narrow gauge and in mountainous terrain were slow and winding. Therefore it was decided to start a totally new standard gauge network of trunk railways. In 1964 the first 'bullet train', the Tokaido *Shinkansen* superexpress, went into operation between Tokyo and Osaka. The *Shinkansen* runs on a dedicated track with speeds up to 260 kmh and still today sets unmatched standards in comfort, punctuality and safety. In 1975 the Tokaido line was extended to Hakata on the southern island of Kyushu. The trains travel the 1,070 km between Tokyo and Hakata in six hours (Figure 1).

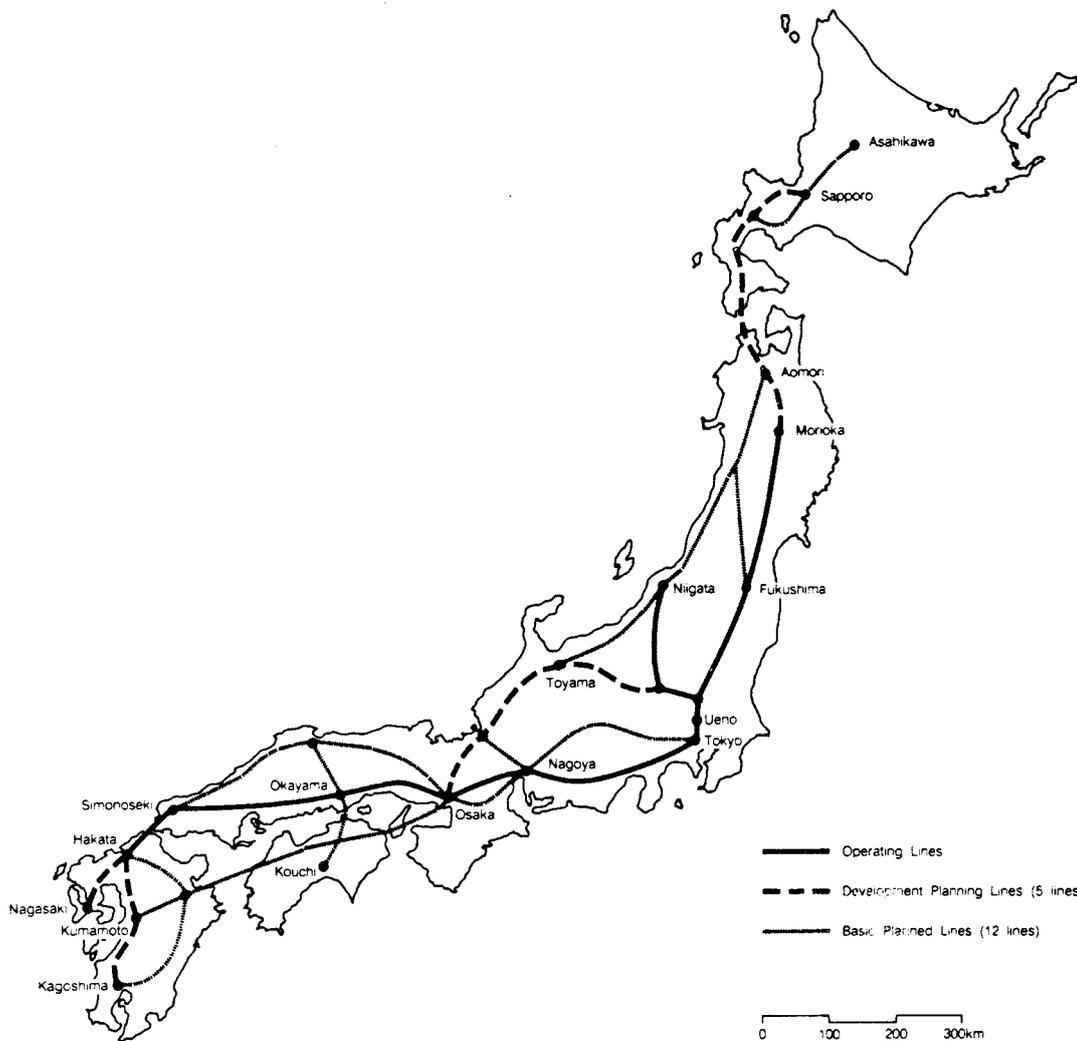


Figure 1. The *Shinkansen* network in Japan.

WEGENER: TRANSPORT PLANNING IN JAPAN

In the same period it was decided to develop a new system of national expressways to supplement the insufficient traditional roads of the country. In the first *Comprehensive National Development Plan* of 1962 the improvement of major transport routes had the function to link growth poles such as the 'new industrial cities' dispersed over the country with the existing agglomerations in the Pacific belt between Tokyo and Osaka. In 1966 the Cabinet approved the construction of 32 routes of 'arterial motorways for national development' comprising 7,600 km. The first expressways constructed were the Meishin Expressway between Nagoya and Kobe (1965) and the Tomei Expressway between Tokyo and Nagoya (1969). Until 1975, 1,500 km of expressways were completed (Figure 2).

In addition an extensive programme was initiated to enlarge harbour facilities in connection with the 'new industrial cities'. This led to a concentration of heavy industry relying on water transport mostly on landfill sites reclaimed from the sea along the Pacific coast. Another programme aimed at the expansion and modernisation of airports to serve the growing domestic and international air travel. For Tokyo, a new international airport was planned at Narita, 70 km east of central Tokyo. However, due to violent political protests it took until 1978 until it was completed.

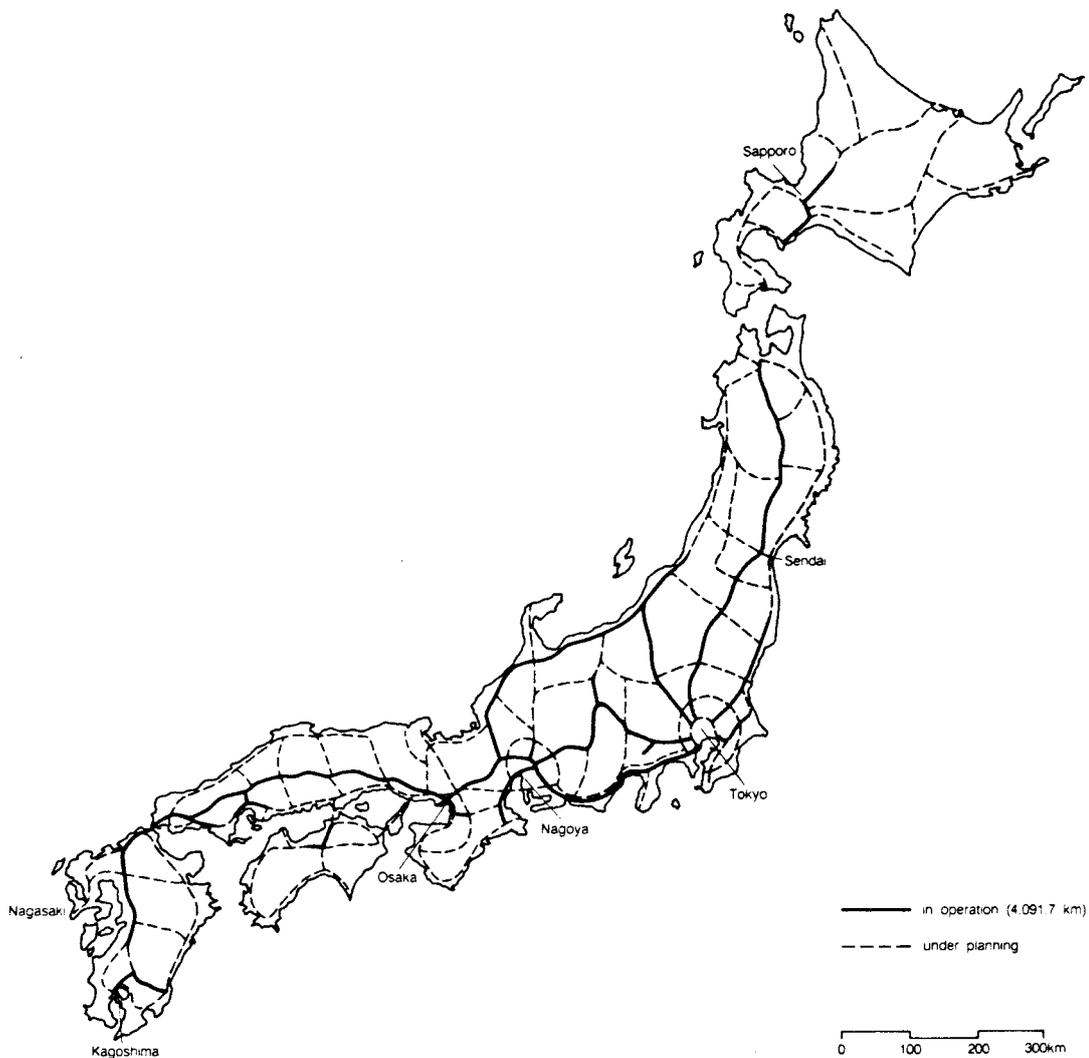


Figure 2. Expressway network in Japan.

During the stupendous economic growth Japan experienced in the 1950s and 1960s, population and industry became increasingly concentrated in the major metropolitan areas, in particular in the Pacific belt region. Income disparities between the central and peripheral regions increased, and while problems of congestion and overagglomeration appeared in the metropolitan areas, non-metropolitan regions suffered from economic decline and depopulation. The Second Comprehensive National Development Plan of 1969 addressed these problems by promoting the development of remote areas. Like its predecessor, it promoted the extension of high-speed transport networks, this time not as a key factor for more growth but as a means for spreading development potential throughout the nation. Successive plans were enacted to extend the expressway and Shinkansen networks and to link the islands of the Japanese archipelago by giant bridges and the Seikan undersea tunnel. Also port activities were to be developed, this time on the Japan Sea side, and a new international airport was to be planned for the Osaka (Kansai) region. However, as the economic growth of Japan continued, the centralisation of population and economic activity in the Tokyo-Nagoya-Osaka megalopolis went on.

The Period of Stable Growth

The energy crisis of 1973 brought a sudden end to the period of high growth of the Japanese economy. At the same time mounting problems of water and air pollution from industrial sources required a radical change of economic policy. It was in this period that Japan embarked on its present policy of promoting growth in high-technology industries with high export orientation. The 1970s also marked Japan's commitment to introduce strict measures of environmental control for industry and transport, as witnessed by the adoption of the emission control standards for cars of California, the most severe in the world. The problem of regional disparities received even more attention, and again transport infrastructure was assigned a key function in making remote regions more attractive. The Third Comprehensive National Development Plan (1977) proposed to extend the Shinkansen network by five more lines beyond the two new lines already under construction (see Figure 1) and the expressway system from 4,600 to 10,000 km (see Figure 2).

At the end of the 1970s the concentration of population and employment in the metropolitan areas seemed to have stopped and the income gap between the regions narrowed, but after 1982 the Japanese economy picked up new growth and the large cities, in particular Tokyo, took over new functions in international financial and high-level business services with the effect that the spatial polarisation of the territorial structure of Japan recommenced with new force. The Fourth Comprehensive National Development Plan of 1987, which is in effect still today, hopes to transform the "Tokyo-centered unipolar concentration pattern" into a "dispersed multi-polar pattern" for the high-mobility society of the 21st century. For this purpose, the present tree-like transport system oriented towards Tokyo is to be converted into a more neutral lattice-like network providing more equal accessibility to all parts of the country. To achieve this, the plan calls for 12 more Shinkansen lines (see Figure 1) and for a total of 14,000 km of expressways (see Figure 2).

Transport Planning in Tokyo

During World War II half the houses in Tokyo were destroyed by air raids and its population had decreased from 7 million to 3 million. After the War ambitious plans to fundamentally reorganise Tokyo had to be scaled down for lack of funds for land readjustment (Hanayama, 1986). At the same time remigration and growing rural immigration brought the population back to its prewar population.

During the years of rapid economic growth in the 1960s, the Tokyo metropolitan area grew by 600,000 persons annually, from 18 million to 24 million, half by natural increase, half by migration. The huge housing demand could only be met by moving farther and farther out into the suburbs. Infrastructure improvement concentrated on public housing in order to relieve the growing overcrowding of rush-hour trains. From early after the war Tokyo has continuously extended its subway system to its present 10 lines with 212 km of track. One ingenious specialty of the Tokyo subway is how it is linked with the commuter railways outside the Yamanote loop either at or one station before their terminals. In some cases the commuter and subway lines stop at the same platform for easy transfer. In other cases the commuter train even continues into the subway network carrying its passengers without transfer into central Tokyo. Today public transport (including bus) accounts for 70 percent of the 50 million daily passenger trips in the Tokyo metropolitan area. Current plans provide for the construction of three more subway and several more commuter rail lines.

Road construction lagged behind. Still in 1960 most residential streets in Tokyo were unpaved. Only few major thoroughfares had been widened after the war. Mass motorisation hit Japan not before the 1960s. In preparation for the 1964 Olympics, Tokyo superimposed an extensive expressway system over its irregular street network. As no land had been set aside in a long-range land use plan, the expressways had to be constructed using the space over existing roads or, in central Tokyo, former castle moats. Today Tokyo's expressways, despite their high toll fees, are heavily congested. As for lack of space widening of the inner sections is hardly possible, current improvements concentrate on the completion of the regional network. Eventually the expressway network will be a system consisting of radial expressways leading into central Tokyo connected by several rings.

Today the Tokyo metropolitan area has a population of 30 million, of which 11 million live in Tokyo itself. Its commuters come from an area extending over four prefectures within 50 km from central Tokyo.

Present Situation and Outlook

Today Japan, 45 years after its total defeat, has become one of the major economic powers of the world. In this period it has almost from scratch developed a highly efficient comprehensive transport system. Today Japan's transport infrastructure compares in density with many of the central European countries with a much longer history of transport (see Table 1).

The Shinkansen, now almost thirty years old, still sets unmatched standards for speed, comfort, punctuality and safety. With the nearly completed link connecting its two Tokyo terminals and new even faster, quieter and more luxurious trains it impressively demonstrates the potential of 'traditional' railway technology combined with advanced telecommunications.

The Japanese expressway system, though still not comparable to those of some European countries, connects remote regions with the urban centres and has quite radically changed the accessibility surface of the country. In the metropolitan areas, advanced road informatics technologies are used to utilise the existing capacity and as much as possible prevent congestion.

No other archipelago country has linked its islands with so many tunnels and bridges, some of them breath-taking engineering achievements. The 53-km Seikan tunnel between Honshu and Hokkaido presently is the longest undersea tunnel in the world. The gigantic new Seto-Ohashi bridge linking Shikoku to Honshu, is one of the largest suspension bridges of the world.

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Table 1. Transport infrastructure in selected countries, 1986 (m/km²).

Country	Railways	Motorways	Other Roads
Belgium	120	50	4,312
France	64	11	1,470
Germany, F.R.	110	34	1,942
Greece	18	0	306
Italy	34	20	975
Israel	42	10	607
Japan	68	11	2,984
Netherlands	68	48	2,321
Portugal	39	2	570
Spain	25	4	331
United Kingdom	69	12	1,522

Source: Eurostat, Statistisches Bundesamt.

The land reclamation projects for new sea and airports are stunning demonstrations of how man can change the face of our planet. The new port developments in Tokyo Bay and Yokohama, in Kobe and for the new Kansai and Fukuoka international airports are not only engineering projects of impressive magnitude and audacity, they are also expressions of the unbroken confidence of the Japanese people in the future of their country in the 21st century.

In Japan transport is today one of the major fields of technological experimentation. In no other country can one find so many plans, projects and pilot implementations of technologically advanced transport systems. There are presently two different MAGLEV (magnetic levitation) systems under development; one of them, the *Linear Express*, is designated to run on a new more direct inland route between Tokyo and Nagoya, a portion of which will be constructed as a reference line for final testing. In several cities there are already today monorail systems of various designs in operation, e.g. the Alweg monorail (now almost 30 years old) leading to Tokyo's Haneda airport, the Kobe *Portliner* or the Kitakyushu *Urban Monorail*, many more LRT systems, including a *Linear Metro* (with linear motor) are under study. Bus passenger information systems providing online information about approaching buses to passengers at bus stops are standard equipment in most Japanese cities.

Another field of experimentation is the institutional setting of transport. Japan has a long tradition of private railways which were economically successful while the national railway company JNR accumulated an enormous debt. In 1987 the government decided to divide JNR into six private companies each in charge of one region of the country (plus a freight company). All these companies have since reported profits. Also in 1987 the national airline JAL was privatised. The expressways in Japan were from the beginning financed as private toll roads by semi-public companies under government control. Public transport in metropolitan areas is financed with the help of public subsidies on investment, but increasingly it is also attempted to extract some of the necessary funds from land owners benefiting from the transport improvement using value-capture policies (Hayashi, 1989). Because of high densities and consequently high load factors most public transport companies operate profitably, therefore public subsidies on operations are practically unknown.

An Alternate View

However, it is also possible to look at transport planning in Japan from a more critical point of view. From this perspective Japan may teach a lesson about the risks of unconstrained engineering and economic rationality if they are not controlled by a land use and transport policy guided by social and environmental concern.

There can be no doubt that the spectacular growth of transport infrastructure in Japan has contributed its share to the imbalances in regional growth and problems of overagglomeration in metropolitan areas. Despite the numerous acclamations of the national goal to reduce disparities between the regions, the actual policies always reinforced the already overpowering role of the capital region. It is a remarkable feature of transport planning in Japan that notwithstanding the significant changes in the overall goals of national planning, the policy recommendations always suggested the extension of high-level transport infrastructure in the form of high-speed rail and expressway lines leading to and from Tokyo.

Similarly, transport planners in metropolitan areas, when confronted with the growing consequences of overagglomeration such as exploding land prices, congestion, noise intrusion and pollution, have invariably resorted to recommending even more expressways, wider roads and still more efficient public transport systems (Toyota Corp., 1990). In the Tokyo metropolitan area this has led, in conjunction with the mechanisms of a practically unregulated, highly speculative land market, to the present enormous expansion of the densely populated area and extreme duration of commuting times to the still centralised work places. The dilemma of the transport planner is that each improvement of the transport infrastructure, while it seems to offer a short-term solution to the capacity bottlenecks, in the long run actually worsens the situation as it stimulates further land price increases and so forces lower- and middle-class households to settle even further out.

Another effect of exaggerated land prices in metropolitan areas is that land for transport infrastructure becomes prohibitively expensive. The characteristic response of Japanese transport planners to this situation are plans to build 'deep-underground' subway or expressway lines in the central areas, i.e. in tunnels more than 50 metres below ground where, according to traditional Japanese legal practice, land property rights do no longer apply. One example of 'deep-underground' expressway is the projected new National Route 20 across Tokyo's central districts. A similarly technical solution to a problem which is essentially a political one are the vast land reclamation projects underway in Tokyo Bay because they are profitable only if they are calculated on the basis of the same exaggerated land prices they originally were intended to bring down.

One of the darkest sides, finally, of the extraordinary growth of the transport system in Japan are its environmental impacts. Although air quality in Japanese urban areas has improved considerably since its peak in the late 1960, in particular with respect to sulfur dioxide and carbon monoxide, little improvement has been made for nitrogen oxide (Nishioka, 1989). This situation is mainly due to the unanticipated increase of diesel engines in trucks as today more than 90 percent of all goods transport in Japan is performed by truck. Transport noise is another unresolved environmental problem. According to OECD (1986) estimates more than 80 percent of all people in Japan were exposed to transport noise of more than 55 dBA in 1980, and given the rapid increase of car ownership in Japan if anything this situation must have got worse. Also where the Shinkansen travels through densely populated areas of, say, Nagoya or Osaka, serious problems of noise intrusion occur.

On the other hand, the progress in environmental quality made by Japan since the early 1970s must be called amazing. In almost every respect, be it on a per capita or per GDP basis, transport-related emissions are only a fraction of what they are in comparable European countries such as West Germany, the United Kingdom or France (Nishioka, 1989). It is a familiar sight to see in Tokyo's streets air pollution displays installed in the early 1980s (when pollution levels were still much higher) showing all zeroes, i.e. measurements below the indicator range.

Japan and Europe Compared

In this section the situation of transport planning in Japan will be compared with current transport trends and policies in Europe. The presentation in this section is based on a survey on transport planning and research in 19 European countries, including Israel, conducted by the Network on Communications and Transport Activities Research (NECTAR) of the European Science Foundation. A more comprehensive account of the results of the survey is given in Nijkamp, Reichman and Wegener (1990).

Despite many differences between the countries in Europe, there are several common trends in the *socioeconomic context* of transport. Some of them are similar to the developments in Japan such as, in the area of demography and lifestyles, the decline of birth rates and household size, the increasing life expectancy and the general increase of household incomes and, in the economic field, the transition from traditional to sophisticated products, the growing importance of small and medium-sized firms with highly qualified workers and the revolution in international trade due to telecommunications. Also in the *technological context* the same trends exist both in Japan and in Europe: the impacts of microelectronics on traffic management and vehicle production, the impacts of advanced materials on vehicles, tracks and communications systems, and the impacts of computerised logistics on production and distribution patterns. Other trends and developments in Europe are significantly different from those in Japan such as the tendency to shorter work hours or the much stronger trend to decentralised, low-density housing.

As a consequence, there are in Europe as in Japan largely the same basic trends in *Transport Behaviour*: In passenger transport there is a common trend to faster and hence longer trips fuelled by the growth in car ownership, despite still large differences between the European countries. In Japan car ownership is still relatively low compared with European countries of similar affluence, so the growth potential before saturation is still substantial. With growing car ownership, also the proportion of car trips grows at the expense of trips by public transport, bicycle and walk. At the same time the composition of trips is changing: less work trips, but more shopping, business and leisure trips - this trend is still less pronounced in Japan. In goods transport there is in all countries a dramatic growth in transport volume as a consequence of more consumption and increasing spatial division of labour and internationalisation. This is accompanied by a shift from rail to road with overcapacities on railways and serious congestion on expressways. In this respect Japan has progressed further than most European countries, with the possible exception of Italy and the United Kingdom.

Transport *policies* in Europe have responded to these developments in a variety of ways, and here more distinctive differences between Europe and Japan appear: The energy crises of the 1970s had lasting impacts on the way people think about transport. The 1960s in most European countries, just as

in Japan, were the years of rapid improvement of the infrastructure in line with the growth of the economy. This growth period was interrupted by the energy crisis. From now on the emphasis in transport planning shifted from the construction of new infrastructure to a better utilisation of existing infrastructure through traffic management and control - in contrast to Japan where expansion of the transport infrastructure remained the dominant goal.

At the same time the economic recession affected public budgets with the effect that less money was available for transport investment. As a consequence, but also as an effect of changing economic doctrines, in many countries parts of the transport sector were deregulated or privatised, although rarely as extensively as in Japan. In conjunction with the partial retreat of the state from strong interventionist action, transport planning has become more incremental and short-range - a trend not found in the centralist institutional setup of Japan.

The most important difference between Europe and Japan, however, may be the weight given to environmental impacts of transport. At least in the more industrialised countries of Europe environmental concerns today play a primary role in transport planning. Car traffic restraint measures such as speed limits in residential areas, pedestrianisation of inner-city streets or parking restrictions in central areas are now common practice. It is also common practice that large transport projects are fought through the courts by environmentalist groups and sometimes delayed by years. In Japan, however, the environmentalist movement is still very weak, and although 'coexistence between people and cars' is being frequently referred to as a goal, this goal still plays only a minor role in the actual policy-making and planning.

Can We Learn from Japan?

The next decade is about to bring fundamental changes of the spatial organisation of society in Europe. The socioeconomic and technological trends discussed above will generate new locational patterns, change the relationships between city and countryside and will bring about new forms of spatial interaction. Future political changes - the Single European Market and the opening of the borders to Eastern Europe will shift the weights between the regions and set into motion new transport and communication flows.

These changes will mean new challenges for transport planning in Europe. The transition to the postindustrial society will not be without friction, but will be connected with social tension, economic conflicts and ecological risks. Transport planning and research in Europe are well prepared to tackle these challenges. The awareness for the social and ecological consequences of unlimited growth and mobility is increasing. However, ecological concerns may also lead to a situation where necessary innovations are delayed or made impossible. Japanese transport planners, who have always looked to Europe as their model to follow, now sometimes laugh at our timidity.

It might be a worthwhile goal to find a synthesis between the ecology-orientation of the European transport planner and the innovativeness of his Japanese colleague. The time is ending when only the Japanese transport planners came to Europe to learn from our experience. In the future we must learn from each other.

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