

Transportation Problems in Tokyo

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Tokyo is a gigantic metropolis. However, unlike many other big cities in the world, Tokyo is relatively free of serious urban problems. Although Tokyoites complain about the high cost of living, most belong to the middle class. Tokyo has no inner-city problems and has some of the lowest crime rates. Nevertheless, Tokyo does have more serious transportation problems than metropolises in comparable industrial countries. The nature of these transportation problems, their causes, and the remedies being taken to correct them are presented briefly below.

1. Tokyo versus Tokyo Metropolitan Area

The metropolis of Tokyo has a population of 11 million. It is not as populous as Mexico City or Sao Paulo when viewed as an administrative unit, but we must remember that Tokyo is surrounded by many cities including Yokohama (population 3.3 million), Kawasaki (1.2 million), Chiba (0.8 million), etc. Many of the inhabitants of these and other cities commute to offices and schools in Tokyo each day, and these cities are closely connected to Tokyo in terms of freight transport and other commercial activities. Consequently, when we tackle the subject of transportation in Tokyo, we must consider Tokyo and the surrounding cities as collectively forming a single large area called the Tokyo Metropolitan Area (TMA). The urban area shown as the dotted line in a picture taken from a satellite (Figure 1) is the entire TMA, with approximately 30 million people living within a 50-km radius. This is the largest urban agglomeration of people in the history of humanity. Considering that people living in the TMA earn approximately \$30,000 per head each year, the TMA

is the largest agglomeration of economic activity ever. Naturally, the TMA could never function properly without the support of various means of transportation that are also creating serious problems, with a direct impact on society. Ironically enough, it is those means of transportation that are also creating serious prob-

lems, with a direct impact on society. The TMA never was a single, large urban area before World War II (WWII). Yokohama served as Tokyo's external port, Kawasaki was home to many heavy industries, and the key cities of the regional administration such as Chiba and Urawa, were all quite independent before WWII. In

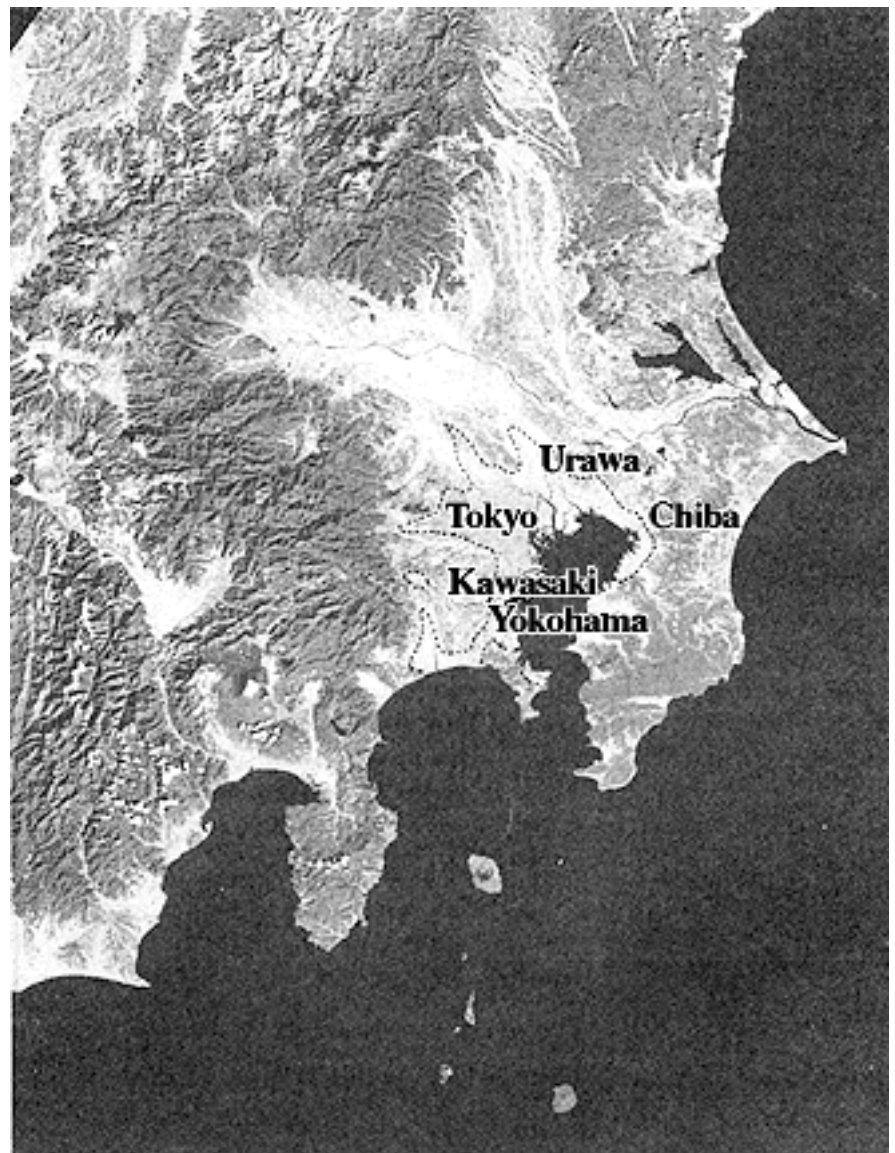


Figure 1 Satellite Photograph of Tokyo and Surrounding Areas

the course of Japan's post-war economic growth, many production and sales bases were located in Tokyo, which was a large consuming region and the country's political centre. This trend was promoted even further when easy access to various types of information became more valuable and as Japan became more involved than ever in international activities. The moderate climate, relative abundance of water, and the wide stretch of flat land in Tokyo and adjacent areas drew more people and industries from other parts of the country. Thus, Tokyo continued to extend its urban area. An extensive green belt, such as that in London, was planned around Tokyo in order to contain the never-ending expansion. But the plan proved powerless against the pressure of urbanisation and the demands of groups favouring further expansion. Dispersion of population and industries to other areas was always the most important objective in every national development plan which was revised almost every decade. As a result, manufacturing industry was reasonably dispersed to other parts of the country, but commercial, information and service industries remained and kept growing in the TMA. Education, culture, and a few other activities also grew more than in any other areas. As a result, urban land use has been sprawling in TMA and both population and industrial development has become more and more intensive. Today, the largest proportion of employment in the TMA is found within the 23 wards of Tokyo, especially in the three central wards, where all sorts of business activities and administrative and cultural facilities are agglomerated. In contrast, housing has been developing in Tokyo's suburbs and adjoining areas where land is cheaper. A number of "new towns" have been built, but they are primarily "dormitory towns" without their own employment opportunities. Most of the dormitory-town dwellers commute to offices in downtown Tokyo. Today, as many as 2.4 million people commute to their offices in the three central wards of Tokyo. In the most extreme case, Chiyoda Ward, one of the three cen-

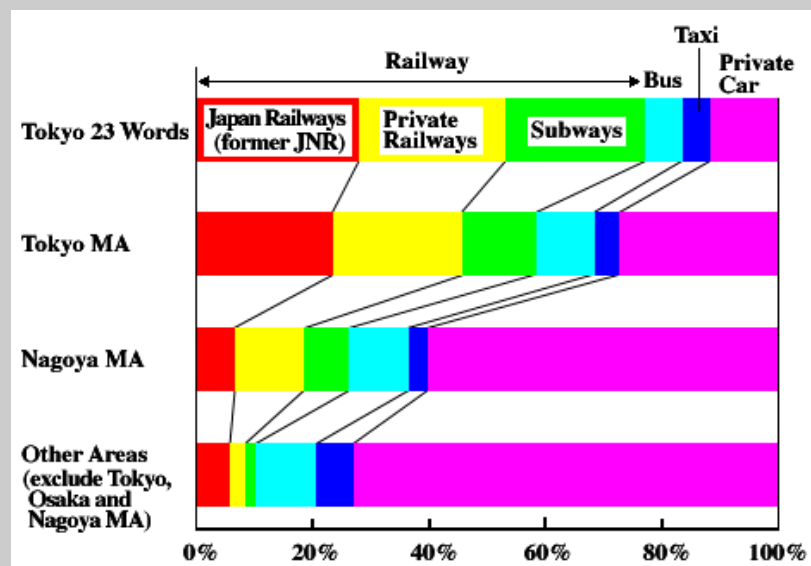
tral wards, has a night population of only 40,000 but an incredibly large day population of 1 million. As mentioned earlier, business, commerce and services are the major industries in Tokyo. The ratio of manufacturing industry in the TMA has decreased significantly, but is still high. The TMA is home to many manufacturers engaged in sophisticated processing and advanced technology. These manufacturers also create large demand for freight transport in and out of Tokyo, including international shipping. Tokyo's bayside area also houses electric power plants, gas plants, steel production facilities, petroleum refineries and other heavy industries that serve the giant demand of the megacity. They import materials mainly from overseas, but most of their products are consumed in the TMA. There are large deep-water ports such as Yokohama, Tokyo, Chiba, and Kawasaki where foreign materials are imported and from where products manufactured in the TMA are exported to other countries. Large warehouses are built alongside the ports in great numbers. This giant agglomeration of population and economic activities naturally leads to high land prices, which kept increasing after WWII. As a result, people believed that there was a serious

shortage of usable land in the area. Although the bursting of the "bubble" economy put an end to the land speculation craze, land prices are still very high, and people are reluctant to sell whatever vacant land they own.

2. Characteristics of Transportation

Historically, the Japanese relied on primitive means of transportation until the late middle of the nineteenth century. People travelled either by walking or riding on horses. Freight was transported manually by people, by carts pulled by oxen or by small boats on waterways. For longer distances, they relied on small ships. Horse carriages and canals were a very rare sight. Modernisation in Japan began towards the end of the nineteenth century. Railways, which were popular in Europe and America, were introduced, but only very low priority was placed on improving roads either in Tokyo or elsewhere. The urban areas of Tokyo and Yokohama were devastated completely by the Great Kanto Earthquake in 1923. Urban renewal plans including construction of boulevards were proposed during the recovery from the damage, but only a small part of these plans were imple-

Figure 2 Modal Shares in Various Metropolitan Areas (MA)



mented. The streets of Tokyo were destroyed yet again by air raids during WWII, and numerous large-scale city planning was formulated for the post-war recovery of Tokyo, but, again, many remained on the blueprint shelf. Few road construction or land readjustment works were executed. Large-scale relocation of houses in suburban areas of Tokyo began after the 1923 earthquake, and national and private railways were constructed to provide new access to the suburban areas. The second phase of the exodus to the Tokyo suburbs occurred after the war damage, and urbanisation sprawled along existing railways. The development of urban railways in Tokyo saw major progress during the first four decades of this century (1900s to 1930s). Suburban railways, loop railway lines and then subways were built; trams were popular and stretched over 400 km in total. Shortly after the war, in the 1950s construction of new subways began. Since then, more than 200km of line were built, and construction still continues. Noticeably, many of the suburban railways are now connected directly to the inner-city subway systems, providing direct access for passengers from suburban stations to central Tokyo. For example, trains on a suburban railway starting from the eastern edge of the TMA can now travel through Tokyo and continue on to the western edge of the TMA. Passengers no longer need to change trains at a terminal station. The trains can be operated most efficiently with a headway of no longer than 2 minutes. Frequency of service is one of the most remarkable aspects of railways in Tokyo and other large cities in Japan. In addition, train services are extremely punctual. Frequent and punctual operation naturally leads to higher reliability for passengers. Trains, on the other hand, created traffic congestion and passengers were annoyed by their slow speed. Demand for trams plummeted sharply and most were abolished by the late 1960s. Their demand was met by subways and buses. Today, about 41% of the railways in the TMA (approximately 2,100 km in total) are operated by JR which, prior to

its privatisation, was a national railway corporation. About 12% of railways are operated either by the metropolitan government of Tokyo or by the public corporation (Teito Rapid Transit Authority), financed by the Japanese government, etc. The remaining 47% are operated by private railway companies, which were mostly established between 1920 and 1940. They are entirely independent enterprises and manage without subsidies from the public purse. Japan is quite unique in that, unlike in Western countries, its urban railways are still operated today by private companies as businesses. Private railway business can succeed primarily because of the large demand in the TMA and also because the private railway companies are engaged in real estate and large retail (department stores) businesses. They spend some of the profits from their non-railway businesses on maintaining their railways. New projects were initiated towards the end of the 1950s, to increase the width of existing roads and to build new roads in Tokyo. Grade-separated and access-controlled urban expressways were also built on a large scale. But the momentum towards motorisation was very high and the demand for road transportation was always larger than the increasing road capacity. The result was constant road congestion. Passenger transportation in Tokyo is unique, in terms of the modal shares, compared to most other large cities in Japan or large cities in other countries. The biggest difference is the extremely high share of public transportation, especially railways (Figure 2). This is because most citizens do not use cars for commuting for a number of reasons. Railway networks are highly developed and trains depart frequently. In addition, parking space is scarce and expensive in central Tokyo and road transportation is costly due to expensive tolls for expressways. Also, expected travel times are not easily predicted due to high congestion levels. Another important aspect of road transportation is the high number of trucks for freight transport. In fact, trucks represent more than 50% of vehicles in some sections. This is attrib-

utable to several factors. First, Tokyo is a highly industrial area with an inherently-large volume of freight transportation. Second, people expect quick delivery of goods in even the smallest quantities whether to stores, factories, or private homes. Such a custom is strengthened by the recent development of information services and by "just-in-time" delivery logistics. Third, freight trucks are generally small. Fourth, there are insufficient ring roads bypassing busy areas, and as a result, the streets in central Tokyo are constantly crowded by through freight traffic. Tokyo is connected to other regions by railways, either shinkansen or conventional narrow-gauge railways. Shinkansen trains depart from Tokyo frequently on long-distance services to the west, northeast, and north. Tokyo is also connected from the Tokyo International Airport (Haneda) by air to many major cities and Haneda is easily accessible from central Tokyo by monorail. In other words, central Tokyo is closely connected to all major cities in the country by air and shinkansen. Expressways, stretching in six directions from Tokyo, carry vast amounts of region-to-region freight transport. In contrast, freight transport by railways has a very low share. Most of the main transportation systems in the TMA, roads or railways, run radially from central Tokyo. Networks running concentrically have yet to be built. Generally speaking, priority is often given to construction of radial systems because they promise greater influence on urban development while increasing land cost. Radial systems also ensure increased demand for transportation to and from the city centre. In contrast construction of loop lines is usually less developed due to a lower increase in demand and higher costs of construction. Tokyo is no exception to such priorities. The shortage of concentric routes causes undesirable through traffic in busy central Tokyo and corresponding air and noise pollution. Recently, international transportation increased significantly as foreign travel became more popular and as international trading expanded continuously. The New Tokyo

International Airport, at Narita, 60 km from central Tokyo, is practically the only international airport in the TMA and in eastern Japan that gives access to all key cities in the world. The New Kansai International Airport was built near Osaka in western Japan, but not a few number of travelers from western Japan still use Narita because more flights leave from there. However, due to strong objections from local people, Narita is operating with only one runway, although 25 years have passed since the construction began. Because of its highly limited runway capacity, Narita still cannot meet demand from foreign airlines wanting to start new flights in and out. Containerisation of international cargo has been growing. Most cargo to and from Yokohama and Tokyo ports is now being shipped in containers. Import cargo has been growing significantly in recent years, and is transported to its destination in containers on trucks within the TMA. Today, brisk investment is being implemented in the TMA to consolidate its transportation facilities. But all space in central Tokyo is utilised at high density and all existing facilities are "intertwined", resulting in extremely complex structures. For this reason and, coupled with the already high land costs, it requires enormous amounts of money to build new facilities. For example, it costs more than \$500 million to build 1 km of urban expressway or subway in the TMA. As mentioned earlier, use of passenger cars is uncommon in Tokyo compared to other large cities in Japan. Tokyoites rely on taxis more than on their own cars. As the result, over 50,000 taxis operate in the Tokyo Metropolis. Public transportation Tokyo, including taxis, is safe, with a relatively low risk of traffic accidents. Crime in public transport is almost non-existent, and vandalism is very rare. On the other hand, transportation facilities and walking space in Tokyo are limited in terms of capacity, and this circumstance sometimes makes the citizens uncomfortable during train travel and walking.

3. Transportation problems

Some details of transportation problems in Tokyo and the Tokyo Metropolitan Area (TMA) are discussed below, according to transportation mode. As mentioned earlier, the railway has the largest share of passenger transportation in the TMA. Railways are far more important in the TMA than in any other large city in Japan. The biggest problem of urban railways in the TMA is the congestion during rush hours. In fact, railway congestion is one of the most serious social problems in the area.

As many as 18 suburban railways connect stations somewhere in Tokyo's 23 wards. Some lines with the largest capacities carry 100,000 pas-

sengers on 30 trains per hour in one direction alone. It is actually painful to ride trains during rush hours because each car is crowded with more than twice as many passengers as the cars are designed for. Congestion is the result of continuous expansion of the residential areas towards the suburbs and the heavy concentration of offices in central Tokyo. Demand is growing much faster than new railways are built. The increasing location of commuter households at the periphery of the TMA has been encouraged by employers subsidising commuting costs. Capacity-increase projects are under way to build new railways and add new tracks parallel to existing ones, but these projects always face shortages of financial re-



■ JR East long-distance commuter-train depot near Shinagawa

(H.Morokawa)

sources. The projects have also been hampered by difficulties in purchasing land required for new railways and related facilities. Opposition in relation to noise nuisance, landscaping problems, etc. by people living alongside the proposed project sites has also significantly hampered smooth progress. The unbalanced urban structure of the TMA has created a heavy concentration of transportation flow into central Tokyo in the morning and out of Tokyo in the evening. This type of tidal demand naturally lowers the efficiency of investment in the projects. For many years, complaints have been made about the low speed of the suburban railways and the unpleasantly-crowded rides. Considerable improvements have been made in the past few years in terms of trains and station facilities such as high-performance cars, air conditioning, etc. However, the scheduled speed is still low due to too many stations and trains running at the same time. Trains and stations are still crowded and this makes rail commuting uncomfortable. These are the major problems remaining to be solved. Special efforts have been made to improve railway facilities for the convenience of elderly and disabled passengers, but there are still many tight spots preventing easy access, and further improvements are needed. An intensive survey of transport facilities was carried out last year by the Ministry of Transportation, aimed at checking and evaluating the various measures taken for the benefit of the aged and disabled. Such a survey is expected to contribute to introduction of the necessary improvements of the facilities for normalisation of activities of the aged and disabled. Train fares in the TMA are not high. In fact, they are quite low compared to the generally high prices of other items in the area. One shortcoming of public transport services in the TMA is that joint fare systems common in European cities have yet to be introduced. This system is not found in the TMA for a number of reasons. There are many railway operators varying greatly in business efficiency. Railways in the TMA are already so widely utilized, that there is

a lack of incentive to encourage people to transfer from automobiles to railways. As a result, passengers suffer from the complex fare systems. Each time they change trains run by different operators, they must pay extra and show their tickets at wickets more often. Congestion is also the biggest problem in road transportation. It results from the shortage of facilities to meet the growing demand. The TMA has 230 km of urban expressways (toll roads) and roads and streets in central Tokyo are under a wide-area traffic control to ensure smooth flow. But arterial roads are almost always crowded, resulting in major economic losses and environmental burdens. Construction is currently under way to build more ring roads and streets. But such projects are often behind schedule due to difficulties in purchasing right of way and opposition from local residents. More parking space is needed and underground parking is being built in many places within the TMA. However, the lack of large parking spaces is not as serious a problem in central Tokyo as it is elsewhere. People rely more on public transport than on cars and do not use their own cars so often. In addition, as parking space is required in all large buildings parking space is not very scarce in most of the business districts. A real problem is the short delivery stops made by trucks loading and unloading on narrow streets in commercial areas. These trucks often hamper the smooth flow of traffic on streets. Needless to say, another problem of road transportation is its effect on the environment. More than 10 million automobiles registered in the TMA create NO_x, other air pollutants and excessive noise. Countermeasures have been taken since the mid-1970s, both at the pollution sources and along roads, and lead pollution has been completely remedied. But the countermeasures are far from sufficient, and the NO_x and noise levels are still higher than the national standards in many areas. Another problem of roads in the TMA is the aesthetics of roads themselves and the buildings and landscape along them. New projects are being introduced to plant more trees and bury

electric and telephone lines. But, unlike in European cities, disorderly signboards are yet to be put under stricter control. The single most serious problem in air transportation in the TMA is the shortage of runways, resulting in short airport capacities. There is an urgent need to build more runways at Narita. But there is still no end to farmers' opposition and 25 years after the project started, runway 2 has yet to be completed. Future demand requires a third airport in the TMA, but it would also be extremely hard to find available space because of intensive land use and complex use of air space. The experience in Narita calls for very careful location of the site for a new airport. And this will require many more years of feasibility studies. One of the weaknesses of air transportation in the TMA, is the poor access to Narita which is 60km from central Tokyo. Faster and more frequent access by trains is urgently needed. Marine transportation, too, has the problem of congestion in seaways in Tokyo Bay, which has caused some accidents in the past. Many consignees of ocean freight complain about the short operating hours of the TMA port facilities. This causes service at these ports to fall behind the large container ports in Taiwan, Korea, and other neighbouring countries. The access from the ports to the expressways is not sufficiently developed. As a result, trucks carrying cargo for inland destinations in the TMA are forced to travel along the already busy roads in Tokyo and Yokohama. This presents major problems both economically and environmentally. A new port called Hitachinaka Port, is scheduled to open in the near future. When its highly-advanced facilities, including a deep-water container berth, begin operation, part of the current burden in the port in Tokyo Bay will be relieved. Safeguards against earthquakes are another concern of transportation in Tokyo, but are almost never called for in most Western cities, except along the west coast of the USA. A number of special measures have been taken, such as reinforcement of existing structures, but the recent Kobe Earthquake disaster

strongly suggests a need to review all these measures and to introduce still more substantial reinforcement.

4. Efforts toward solution

As seen above, Tokyo has many problems with regard to transportation and wide-ranging efforts are needed for their solution. For the purpose of this article, they are discussed below in four categories, including structural change of cities, supply of transportation facilities, demand control of transportation and technical improvements. Most of the transportation problems mentioned above are derived basically from the TMA's urban structure. Many attempts have been made to stop heavy concentration of population and economic activities in the TMA, and to disperse them to remote areas. But these attempts have never provided noticeable changes. More recently, the population in-flow to the TMA has stopped, and more people are moving out, due partly to the stagnating Japanese economy and the shift of industrial production bases to overseas. This trend is being promoted also by the recent increase of urban attractiveness of big cities away from Tokyo. Naturally, such a trend is desirable from the standpoint of reducing transportation problems in the TMA. It is important to apply continued control to new industrial locations within the TMA, thereby encouraging further distribution of population and industries to other parts of the country. The current efforts aimed at structural improvement of cities include the transfer of central Tokyo's functions to several key cities within the TMA. They also include promotion of new housing projects in central Tokyo. These plans are expected to reduce long-distance transportation, although the results will not be seen for many years. Projects are currently under way in many places involving redevelopment of existing urban areas and land readjustment. These and other projects aim to enhance living environments, as well as improve streets and other transportation facilities. Transportation facilities are

being reinforced in many places. The relevant projects include construction of large-scale transportation facilities such as urban railways and arterial roads. But they are far from sufficient, and more projects are needed. Conventionally, financial requirements for the necessary investment for building new urban railways and expressways has been paid for by the users of these facilities. However, when a large increase in transportation demand is unlikely, as it is today, such a principle is not sufficient for large investments. Major public subsidies, which are often found in cities in Western countries, are also needed in the TMA. Beneficiaries from these transportation developments, such as land owners in affected districts, should bear appropriate burdens in projects that are likely to create large profits for them. Facility improvement is also needed in such areas as station buildings, railway vehicles, parking spaces, and traffic signals at intersections. Moreover, continued effort is needed to improve facilities and equipment for the aged and disabled. There has been hardly any attempt to intentionally control transportation demand by means of fares, restricted location, and other legislative measures. Judging from the result, the high parking fees in central Tokyo do suppress car transport in the TMA. Staggered commuting is being encouraged to spread rush-hour demand, although it has not yielded very noticeable results. Peak-load pricing and other fare-based systems are deemed necessary to control demand for railways and urban expressways in a more explicit manner. It is safe to say that Tokyo has a high level of transportation technology, as evidenced by operation control and automated wickets in railways and wide area signal control in the road network. In the near future, implementa-

tion of new technologies such as automated toll collection on railways and toll roads, and travel information systems for automobiles by dual direction telecommunication are expected. These developments in electronic fare or toll collecting systems will undoubtedly reduce the technical difficulties in introducing economic ways of demand control mentioned above. New concepts for an underground transport network for freight are in the initial development stage, and experiments are scheduled in the near future. Research and development for such projects is being made mainly by transportation enterprises and equipment manufacturers. ■



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