HISTORY OF ROAD IMPROVEMENT AND ADMINISTRATION SYSTEM IN JAPAN

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ABSTRACT

The author describes how the development of transport facilities, in particular the road network, which supports people's daily lives and economic activities as one of infrastructures, was implemented in the course of modernization from the Meiji era (late 19th century) in Japan.

In the middle of the 20th century, full-scale road network development was started in 1954 when the first five-year plan for road development was formulated. Since then, an arterial road network of about 190,000 km has been constructed under several consecutive five-year plans that have provided funds for road development. The author also describes the road development systems as well as how road-related issues such as traffic congestion, accidents and environmental problems have been dealt with in the course of road network development. Further, the author refers to various technologies related to bridges, tunnels, earthquake countermeasures, etc. used for road construction in Japan, which is characterized by large mountainous areas and many disasters caused by earthquakes and typhoons.

Today, the road development systems under which road network development has been promoted, are about to drastically change, more than 50 years since their establishment. In addition to this systems issue, the author discusses other issues remaining to be addressed, ITS which is expected to be developed much further in the road transport sector, and future directions.

1. PROGRESS OF ROAD IMPROVEMENT IN THE 20TH CENTURY

Following the Meiji Restoration in 1868 when the modernization of Japan started, the Japanese government pushed forward with constructing transportation systems with emphasis on railways and marine transportation. As a result, the total length of trunk railways in operation reached 10,000 km in as early as 1920, and exceeded 20,000 km in 1944, when construction of most of the trunk railway networks as they are today in Japan was completed. The early establishment of national railway networks is considered one of the main reasons why railways account for a relatively large share (27% in 1999) of total passenger transport volume in Japan compared to the rest of the world. Meanwhile, less effort was made for the construction of roads than the construction of railways. Road construction started in full force only during the rehabilitation period of national land in the aftermath of World War II in 1945.

1.1. Meiji Era (1868 – 1912)

As regards road construction projects during the Meiji era, the conditions were such that no nationwide plan for road improvement programs could be formulated. For example, in

the first year of the Meiji era, the government failed to create a solid foundation of national finance, and furthermore, due to damages caused by large-scale flooding, public works were mainly directed to river-development construction. Even after the middle of the Meiji era when the financial foundation was solidified, the budget for road construction and improvement projects was reduced due to the impact of wars (civil war in 1877, the First Sino-Japanese War, the Russo-Japanese War, and so forth). As a result, Japan was in no state to formulate any national road improvement project as an urgent national task.

Throughout the Meiji era, there was greater expectation for the railways to serve as the main backbone of land transportation. Especially after the middle of the Meiji era, the main emphasis of transportation policy was placed on the construction of railways and nationalization of private railways. Meanwhile, marine transportation maintained its central status in terms of transport policy throughout the Meiji era because of the Japan's geographical conditions of being an island nation and surrounded by the sea in all directions. As a result, the conditions were not particularly favorable for promoting road improvements throughout the Meiji era. Since the road networks, which were the subject of road improvement plans, were not coordinated by the government on the basis of unified standards, it was impossible to formulate any national road improvement plan. As a result, the former Road Law was enacted without any coordination of roads on a nationwide scale.

1.2. Taisho Era (1912 – 1926)

With the enactment of the former Road Law and related laws in 1919, the 1st Road Improvement Program, which was the first long-term road improvement program in Japan, was formulated. This Road Improvement Program envisaged the improvement of national highways, military highways, prefectural roads and main streets in some major cities. However, following the Great Kanto Earthquake in 1923, the road construction budget was greatly reduced, and so a large gap arose between the planned budget and the actual budget of the Road Improvement Program.

Nevertheless, during this period, the so-called "transportation revolution" steadily advanced and the focus of road transport shifted from horse-drawn wagons to automobiles. In order to catch up with the development of automobile traffic, the government was faced with the need to promote not only the fixed Road Improvement Programs, but also to carry out repairs of especially prefectural roads from new perspectives as well. Consequently, in addition to the established programs, the government formulated the Industrial Road Improvement Program, whose goal was to improve important prefectural roads, and promote the development of regional industries during the next ten years after 1929 by removing barriers to automobile transport and increasing the efficiency of automobile traffic. However, a policy to tighten the national budget was laid down, and the working budget for the first fiscal year of the Program was regulated, and eventually the improvement program of designated prefectural roads was suspended.

1.3. Early Period of Showa Era (1929 – 1945)

In 1920, barely ten years after the 1st Road Improvement Program was formulated, the Japanese economy suffered a tremendous blow and the domestic economy faced extreme stagnation. As a result of economic recession, the national financial situation deteriorated, budgetary policy was scaled down, and as a result, the Industrial Road Improvement Program became unfeasible as early as in the first fiscal year of the program. This tough situation was not improved when, in 1931, the Mukden (Manchurian) Incident and the

Great Famine of Hokkaido and Tohoku regions occurred. Finally in the same year, the government voted for an unemployment relief project under the control of the Interior Ministry, and as part of this project to implement road improvement programs. In this sense, 1931 marked a turning point because the national highway project has been an established program under the direct control of the national government since this year.

In 1936, Japan notified its withdrawal from the London Naval Treaty and thus embarked on a regular wartime footing. In other words, reinforcement of the wartime footing was given more priority and urgency than the construction of roads, which is considered to be the foundation of industrial infrastructure, and for a long time thereafter, the road improvement program in Japan made little headway. Indeed, from this time until 1948, roads went through a period of tremendous ordeals.

1.4. Latter Period of Showa Era to Heisei Era (1945 – 2007)

Following defeat in World War II in 1945, in an effort to rebuild a nation and economy ravaged by war, the government promoted an industrialization policy by adopting the priority production method, in which resources were concentrated on key industries such as coal, electricity, steel and so on. However, transportation facilities in those days were extremely poor and hindered industrialization. In order to overcome this bottleneck, the government formulated the 1st Five-year Road Improvement Program in 1954, with which road construction projects started in full force. In May of 1956, while the 1st Five-year Road Improvement Program was being implemented, the government leaned toward the direction of constructing expressways with loans provided by the World Bank. For this purpose, the government invited a party of Nagoya-Kobe Expressway researchers led by Ralph J. Watkins to conduct a survey at the request of the Ministry of Construction. Watkins was a world-leading economic research specialist, and the report by the group of researchers was the trigger for the decision regarding loans provided by the World Bank. The report started with harsh criticism of the poor state of roads in Japan: “The roads of Japan are in incredibly bad. No other industrial nation has so completely neglected its highway system.” In conclusion, it recommended that the Japanese government should acquire new perspectives and start working on expanding road construction projects immediately.

Figure 1 - State of roads aftermath of WWII

Figure 2 – First Expressway in Japan

In addition, the government formulated the New Long-term Economic Program in 1958, and National Comprehensive Development Program in 1961, which covered the construction of social infrastructure facilities including transportation systems such as roads and railways, communication systems, energy supply systems, and so forth. These programs were followed by a series of successive programs that consisted of a dozen economic and national land construction programs that have continued up until today,

carrying out the development of Japan's economy and the development and construction of the national land.

Based on these economic programs and national land development programs, a series of road improvement programs has been implemented up until the 12th Five-year Road Improvement Program (1998 – 2002). As a result of these efforts, the trunk road networks in Japan, which were extremely poor initially, have been developed so much that in 2004, the trunk road networks consisted of 8,700 km of expressways, 54,000 km of national highways and 129,000 km of prefectural roads. These steady road improvements were promoted and funded by the special funding source system initiated in 1953, whereby gasoline tax was set aside as funds earmarked for road improvement, and the toll road system, whereby the loans obtained under the Special Measure Law for Road Improvement enacted in 1952 used to construct toll roads, and the revenues from toll roads were used to repay the loans.

As a result, the road networks improved radically and the number of registered vehicles increased dramatically from 920,000 vehicles in 1955 to 79 million vehicles in 2006. During the same period, the volume of passenger transportation by automobiles increased from 27.5 billion person-km to 993 billion person-km, and freight transportation by automobiles increased from 9.5 billion ton-km to 335 billion-km.

During the latter half of the 20th century, Japan recovered from the aftermath of World War II, made great strides in industrialization and economic growth, and became the world's second-largest economic power with a gross domestic product of approximately 503 trillion yen in 2005. Trunk roads improved during this period were instrumental in supporting physical distribution as well as transportation for people which increased tremendously owing to the rapid expansion of economic activities. Furthermore, these road networks extended people's daily milieus, and enabled them to easily access facilities for jobs, education, medical services, shopping, recreation and so forth and to receive various types of urban services.

However, throughout this process of economic development, urbanization phenomena such as concentration of population and industries in large cities were observed in the megalopolises of Tokyo and Osaka, and other major cities. This caused social problems such as traffic congestion on roads and railways, housing shortages and skyrocketing land prices. During this period, as regards road improvement, radial road networks that connected key cities were steadily constructed thanks to the policy of placing priority on improving the national trunk road networks. On the other hand, the improvement of road networks within urban areas such as ring roads lagged behind. Moreover, due to the lack of access control to these improved trunk roads, buildings started to spring up along these roads as people adopted them for city streets, and as a result, these trunk roads became like streets and gradually lost their function as trunk roads.

2. PROBLEMS THAT EMERGED IN THE PROCESS OF IMPROVING ROADS AND HIGHWAYS

2.1. Intensifying and Prolonging Traffic Congestion

During the 53 years from the initiation of the 1st Five-year Road Improvement Program in 1954, the level of Japan's road improvement efforts has risen considerably. However, the speed of growth of the number of registered vehicles has far exceeded that of improvement efforts, causing worsening traffic congestion. As of March 2006, the number

of registered vehicles totaled 78 million vehicles, which is equivalent to 1 vehicle per 1.6 persons, and this figure is expected to increase.
Concerning the traffic situation on Japanese roads and highways, the number of sections with the width of more than 5.5 meters that registered a traffic congestion rate of more than 1.0 continues to grow, irrespective of the type of road. Traffic congestion on major sections thus remains extremely serious. The deterioration of the road traffic situation is largely attributable to the steep growth in the demand for road transportation and the increase in the inefficient use of roads. The combined loss caused by traffic congestion across the nation annually totals 3.81 billion person-hours, which means about 30 hours per person. The serious traffic congestion is causing various troubles, such as environmental pollution and declining economic efficiency.

In FY1988, the Ministry of Construction formulated the Emergency Action Program for Mitigating Traffic Congestion to be implemented in 37 cities, and a plan to promote measures for mitigating traffic congestion to be carried out in the remaining areas across the nation. In FY1993, the Ministry devised a new program for mitigating traffic congestion such as expansion of the road traffic capacity and transportation demand management, among other measures. Since then, the Ministry tackled the traffic congestion problem in cooperation with the road administrators, prefectural public safety commissions and other organizations. As a result, the traffic congestion eased at about 600 major congestion sections across the nation during the five years from 1993 through 1997. However, the national survey on traffic congestion conducted in FY1997 revealed that traffic congestion remained extremely serious at about 3,200 sections nationwide, and the Ministry was required to step up its efforts to resolve the problem.

Confronted with this situation, the Ministry of Land, Infrastructure and Transport reviewed the existing plans and programs, and devised the 3rd Traffic Congestion Mitigation Program for each prefecture. By implementing this program that contains measures for expanding road traffic capacity such as improving bypasses, intersections and other places, measures for transportation demand management and multi-modal transportation, and measures to be carried out by the Public Safety Commissions, the Ministry promoted comprehensive measures to mitigate traffic congestion. In the 3rd program, the measures to be carried out during the period from FY1998 through 2002 were incorporated. The result was that traffic congestion at about 1,300 of the 3,200 major congestion sections was alleviated or eliminated within the period.

In FY2003, the Ministry designated the time lost due to traffic congestion as the Outcome Indicator in the Priority Plan for Social Overhead Capital Provision. By setting the target of reducing the lost time by approximately 10% by FY2007 from the 3.81 billion person-hours registered in FY2002, the Ministry is promoting measures for mitigating traffic congestion.

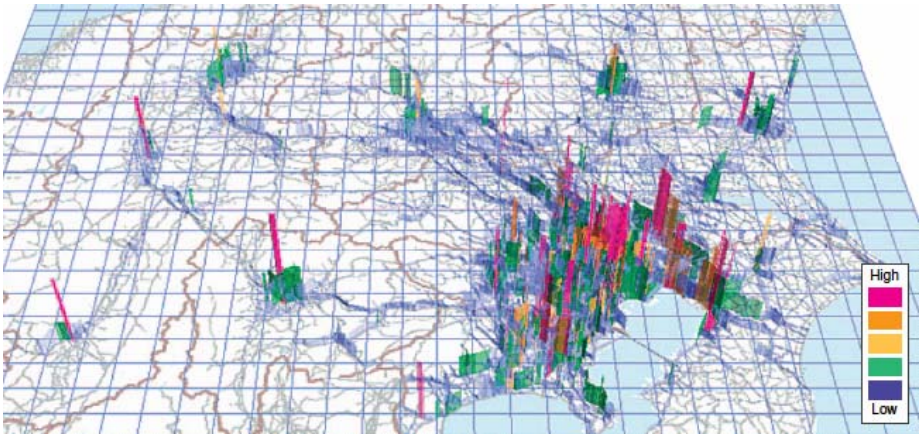

Figure 3 – 3D map of time losses due to traffic congestion (Tokyo metropolitan area)

2.2. Sharp Increase in Traffic Accidents

In the 1950s, the volume of vehicle traffic increased dramatically. Due to this extraordinary increase in the number of vehicles, the number of traffic accidents rose sharply, with the number of annual traffic-accident casualties soaring from 6,379 fatalities and 77,000 casualties in 1955, to 12,484 fatalities and 426,000 casualties in 1965.

To deal with this situation, the government set up a traffic accident prevention headquarters and carried out various measures. Despite this tremendous effort, the number of traffic accidents continued to grow sharply from 1965; it became necessary to take drastic measures against traffic accidents, and the Three-year Traffic Safety Facilities Improvement Program was formulated. In accordance with this program, scores of traffic safety facilities such as side walks, pedestrian crossings and guardrails were built or improved. As a result, the road environment was improved substantially.

Due to a series of five-year programs concerning traffic safety measures, traffic safety facilities were improved considerably and various traffic safety measures were implemented. These efforts produced a remarkable result: the annual total of traffic accident fatalities almost halved from the peak level of 16,765 in 1960 to 8,466 in 1979. However, the number of traffic accidents caused by changing social and economic situations and the traffic environment, such as the steep growth of accidents involving elderly people, has offset part of the decline. The traffic-accident fatalities per vehicle-kilometers traveled have stopped declining and have virtually leveled off. In 1988, the annual total of traffic-accident fatalities has exceeded 10,000, indicating the harsh situation involving traffic safety. In 2005, the annual total of traffic accident fatalities decreased to 6,871, however, the annual total of accidents and its casualties are increasing over 1 million.

To rectify this situation, it is required to promote the improvement of traffic safety facilities; conduct surveys to correctly grasp the actual situation of traffic accidents and to analyze the results; and systematically carry out traffic safety measures based on the results. It is also necessary to effectively prevent traffic accidents by making the most of the latest information and telecommunications technology and by collecting data on the people using the roads and the situation of the communities where the roads are located.

Traffice Safety Facilities Improvement Program was united to Priority Plan for Social Overhead Capital Provision. In this plan, by setting the target of reducing traffic accident ratio by approximately 10% by FY2007 from 11.8 accidents per billion vehicle-km in FY2002 to 10.8 accidents per billion vehicle-km, the ministry is promoting measures to realize safe and secure road traffic environment.

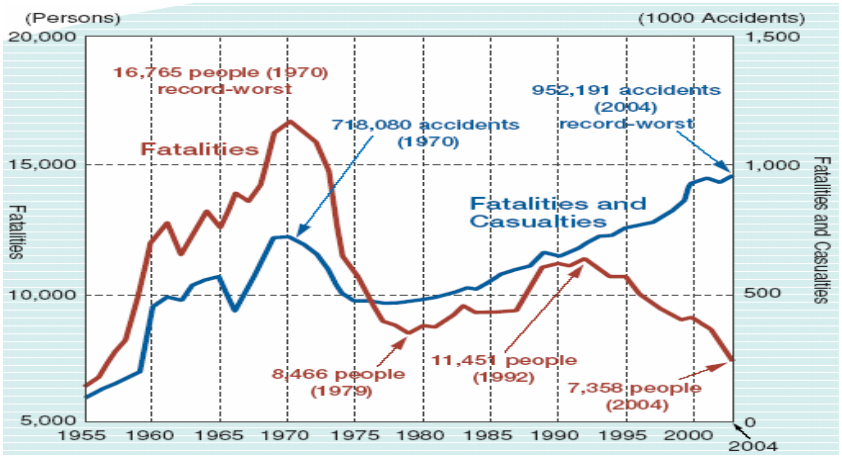

Figure 4 – Traffic accident fatalities and casualties

2.3. Expanding Influence of Road Traffic on the Environment

2.3.1. *Roadside environment*

Typical examples of the negative influences of road traffic on the roadside environment are noise, vibration, air pollution, reduction of sunlight, and disturbance of radio waves. As for noise pollution, 30% of national highways met the required level of the environmental quality standards in FY2003. Concerning air pollution, the nitrogen oxide (NOx) and suspended particulate matter (SPM) from vehicle emissions are causing serious problems. The level of nitrogen dioxide (NO_2) exceeded the permissible level of the environmental quality standards at 24% of monitoring stations. As for SPM, higher concentrations than the permissible level were registered at 38% of monitoring stations.

In the areas where these environmental problems are extremely serious, residents living in the roadside areas have filed lawsuits. In the trials on these cases, courts have delivered judgments that the heavy traffic on the arterial highways inflicted damage on the residents' lives and caused health problems.

To promote measures against environmental pollution, the government established in 1967 the Basic Law for Environmental Pollution Control, and in 1968, the Air Pollution Prevention Law and the Noise Control Law. The assessment of environmental impact was previously conducted in accordance with a Cabinet decision in 1984 but this system was changed. Currently, it is carried out in accordance with the Environmental Impact Assessment Law which was promulgated in 1997.

Based on the new systems established on the basis of these laws, the government is comprehensively promoting measures against air and noise pollution caused by motor vehicle traffic, for the residents living in the areas along the arterial highways. The measures include improvement of the structure of motor vehicles, construction of better road networks by building loop roads, bypasses and other facilities, improvement of road structures by, for example, constructing low-noise, pavement and sound insulation walls, and granting subsidies for soundproofing.

2.3.2. *Global environment*

It is recognized worldwide that the global warming caused by the emission of carbon dioxide (CO_2) and other gases that have a greenhouse effect is a very serious environmental problem. In the Earth Summit held in Rio de Janeiro in 1992, many countries signed the United Nations Framework Convention on Climate Change. In the third session of the Conference of the Parties to the United Nations Framework Convention (COP3) held in Kyoto in 1997, the Kyoto Protocol which stipulates numerical

targets for the reduction of greenhouse gas emissions was adopted. In Japan, Law Concernig the Promotion of the Measures to Cope with Global Warming was legislated in 1998, and various measures are currently being implemented in accordance with Outline for Promotion Effects to Prevent Global Warimig.

With regard to road traffic, efforts are being made to reduce CO_2 emissions from automobiles. These include using roads and highways more efficiently and establishing more efficient road traffic systems, such as: improvement of fuel efficiency of automobiles, promotion of automobile Smartways, construction of bypasses, ring roads, and overhead crossings, and elimination of traffic congestion through traffic demand management (TDM) measures.

2.3.3. *Natural environment*

Japan is comprised of many islands, big and small, stretching from the sub-tropical zone to the sub-arctic zone. The topographical features of the land and climate are highly varied, and the local flora and fauna are multifarious. The major factors that have close bearings on the natural environment are geographical and geological features, flora and fauna, and natural landscape, and these factors are closely related with each other. The flora, fauna and other items that were designated as the nation’s natural treasures or have high scientific value are given great importance and are protected by the government.

The local flora and fauna form an ecological system with the help of soil, water, temperature, sunlight, etc. It is the role of society to maintain a balance and co-exist with the ecological system and to preserve the diversity of the local flora and fauna. In our efforts to improve roads and highways, we are trying to respond to these needs properly and pay attention to harmony with the natural environment and regeneration of nature.

2.4. Spate of Natural Disasters

Japan is subjected to harsh natural conditions including geological conditions, topography, and meteorological phenomena that cause difficulties for those in charge of road improvement and road management. Counting only those requiring traffic restrictions, in some years, the number of natural disasters affecting roads exceeds 20,000. These disasters have a huge impact on national life and economic activities. These disasters have motivated road administrators as well as ordinary citizens to develop a new understanding of the importance of building roads that are safe and secure. In order to provide a network of roads and road spaces that is safe and can be relied upon to withstand disasters including those triggered by earthquakes, tsunamis, torrential rains, and heavy snowfalls, efforts are being made to promote disaster prevention measures and earthquake countermeasures as well as measures against heavy snowfalls and extreme colds.

2.4.1. *Earthquake countermeasures*

In the aftermath of the earthquake that struck Los Angeles in 1971, people’s awareness of the importance of earthquake countermeasures for roads, especially in large metropolitan areas, was heightened. As a result, with the cooperation of various government ministries and agencies, comprehensive earthquake countermeasures came to be implemented.

The Ministry of Construction conducted road inspections corresponding to a review of the technical standards governing roads based on new knowledge and an expansion of the scope of roads to be inspected for age deterioration. All relevant factors are being studied with a view to building a database for assessing the earthquake-resistance of facilities. In

addition, learning from the Hanshin-Awaji Earthquake in January 1995 and the Niigata Chuetsu Earthquake of October 2004, the Ministry is reinforcing the nation's bridges to make them more quake resistant.

Furthermore, in 2005, in anticipation of major earthquakes in the future, the Central Disaster Prevention Council adopted an outline of earthquake countermeasures for the Tokyo metropolitan area as well as an outline for the Tokai, Tonankai and Nankai areas. The Council set concrete goals (disaster reduction goals)—including the time it would take to reach them—concerning reduction in human suffering and economic loss that a major earthquake would cause and adopted an earthquake disaster prevention strategy featuring items that should be addressed selectively and strategically. The earthquake disaster prevention strategy sets a goal of reducing the number of deaths and economic loss by half over the next 10 years. As for disaster prevention measures for roads, the Council plans to promote, among other things, seismic reinforcement of bridge roads and provision of escape routes.

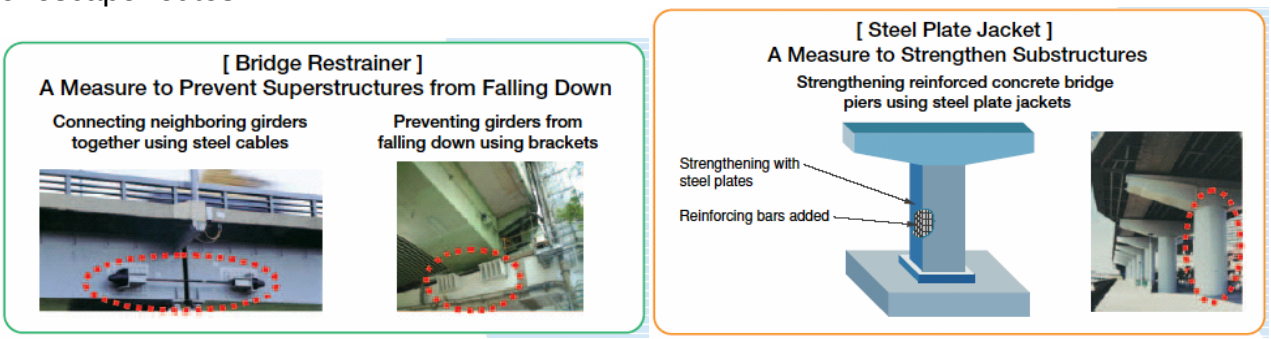

Figure 5 – Seismic reinforcement of bridge roads

2.4.2. *Countermeasures for torrential rain*

In 1968 to 1970, there were two lawsuits concerning mudslide accidents. The Supreme Court decisions served as an eye-opener to the road administrators. Namely, the two decisions concluded that even in cases where building safeguard facilities would be so costly that road administrators would find it difficult to budget for such an undertaking, this would not relieve them of their obligation to pay damages for losses incurred due to flawed road administration. If the road is left in a hazardous condition, it is not enough to put up a sign warning drivers of the danger. Rather, the court decisions require road administrators to construct necessary facilities and provide means of escape.

With these two cases as a turning point, steps came to be taken one after another to make roads and bridges safer, including conducting inspections of hazardous spots caused by falling rocks and improving safeguard facilities, as well as imposing traffic restrictions in times of abnormal climate, establishing guidelines for making inspection rounds, and creating an information exchange system. The decision to allow traffic restrictions to be imposed in times of abnormal weather conditions is a complete turnabout from the policy of "not stopping traffic under any circumstances" that road administrators had adhered to up to the time of the two Supreme Court decisions.

In FY1968, comprehensive inspections of hazardous spots throughout Japan were conducted. On the basis of the data obtained, various measures to improve hazardous places were implemented, including slope protection works,rockfall prevention measures, improving road alignments and other reconstruction projects were carried out especially to make roads more disaster-resistant. As for information on the need to restrict road traffic and so forth, road users were provided with information through the Japan Road Traffic Information Center and the Disaster Prevention Information Provision Center.

2.5. Lack of Spatial Functions

In the past, road spaces were where people moved and goods were moved as well as where children played and people interacted with each other. However, in response to the rapid pace of motorization, new roads were built and old ones improved centering on automobiles without first securing sufficient space for roads. Consequently, today there are not enough spaces like sidewalks and zones for planting trees for pedestrians and roadside residents. Also, roads are too narrow to provide adequate room for bicycles, resulting in the creation of roads that are shared by pedestrians and cyclists as a stopgap measure. It has been a long time since such roads were first created, but hardly any progress has been made to ameliorate this situation. Furthermore, electric wires and other facilities installed on telegraph poles on narrow sidewalks, together with haphazardly erected roadside billboards, greatly damage the scenery. Indeed, the road landscape, including sidewalks, bicycle lanes, zones for planting trees, and roadsides, has become so blighted that there are now loud calls for the construction of roads that offer adequate space for people.

At present, the Ministry of Land, Infrastructure and Transport hosts a workshop of experts with the aim of establishing “a pattern of interaction between humans and roads” and “a new relationship between local community and roads” appropriate for the 21st century. The workshop is based on recognition of the need to consider a flexible system related to the formation of new roads and new road spaces, that is to say, a “road renaissance.”

3. THE TRANSITION OF SYSTEMS AND ORGANIZATIONS CONCERNING ROAD IMPROVEMENT

3.1. Structural Standards for Roads

Article 29 of the Road Law stipulates that road structures must be designed to sustain a safe and efficient flow of traffic with due consideration of the topography, ground type and meteorological conditions of the region as well as traffic characteristics. Article 30 stipulates government ordinances setting out structural standards such as width, clearance limits, alignment, sight distance and gradient for different types of roads. These form the basis for the Road Structure Ordinance providing general technical standards for use in new road construction and road upgrading works.

The basic legislative framework for the road structure standards was provided in the 1919 Road Law, at a time when road traffic still consisted mainly of horse-drawn carriages and wagons. The advent of the automobile in the 20th century, however, and the subsequent increase in both vehicle performance and ownership, transformed the fundamental objectives of the legislation.

The Road Law was amended in 1952 to allow technical standards for road structures to be stipulated by government ordinance, and the Road Structure Ordinance was duly promulgated in 1958. The Road Structure Ordinance was overhauled in 1970 in response to the rapidly changing nature of traffic usage

Further amendments were undertaken in 1982 to reflect further changes in road traffic usage patterns since 1970. As always, the primary objective of the Ordinance was to maintain a sound and proper road network designed to facilitate the safe and efficient flow of both vehicles and pedestrians.

The Road Structure Ordinance was next amended in 1993, due to the continuing rise in dependence on the motor vehicle, causing exacerbation of problems such as traffic congestion, environmental pollution and road safety. The amendments also introduced socially motivated consideration for the welfare of elderly and disabled persons and signaled a shift towards a people-oriented focus in road development. Finally, modernization of distribution methods was designed to reflect the importance of road transport to the domestic distribution industry.

The 2001 amendments were designed to address a range of issues, including rapid growth in the number of accidents involving pedestrians and cyclists, and rising awareness of the need to provide safe and convenient pedestrian precincts in order to promote the integration of elderly and disabled persons in society. The amendments also sought to reduce the environmental burden associated with road usage, particularly with respect to CO_2 emissions, by facilitating interchange with pedestrians, cyclists and public transport, while promoting the beautification of roadway precincts.

The most recent amendments, carried out in 2003, introduced “local rules” for road structures. These allow greater flexibility to interpret the road structure standards tailored to local circumstances. The aim is to promote rapid service delivery, improve service quality and reduce wastage through more efficient road improvement. As well as relaxing the interpretation of existing technical standards, the 2003 amendments also provided a wider range of choices in road development as a means of reducing road development costs and promoting road development tailored to local circumstances.

3.2. Earmarked Funds for Road Works

“Earmarked funds” for road works are designed to promote systematic and rapid-response development of road networks. Funds are generated through direct levies on beneficiaries, namely, vehicle users. This approach was introduced in 1953, when fuel taxes were designated as earmarked funds. Since the 1st Five-Year Road Improvement Program in 1954, road development in Japan has been based on a succession of twelve five-year programs and Social Overhead Capital Provision Priority Programs. As investment in road development has increased, additional funds have been procured by lifting tariff rates and imposing new tariffs as necessary.

Earmarked funds for road works are predicated on the user-pays principle, including payment for restoration of damage incurred. Funding sources include specific tariffs such as the fuel tax, local road tax, petroleum gas excise and gas oil trading levy, as well as charges that are directly proportional to the distance traveled (i.e., the benefit received). The automobile weight tax is also a user-pays tax; it is proportional to vehicle weight, which determines the level of damage exerted on the road surface. For many years now, the earmarked funds approach has provided funding for systematic and rapid-response road improvement based on contributions from automobile users.

However, revenue from earmarked funds is expected to exceed expenditure on road improvement in FY2007, due to an overall improvement in the standard of roads and a general squeeze on public works expenditure including roads. For this reason, the government decided in December 2005 to produce a set of basic principles for reviewing the earmarked funding scheme. The two most important areas for review are the prioritization of road development projects to identify the areas of real need at the current point in time, and a total overhaul of the earmarked funds system that is supported by taxpayers.

3.3. Toll Roads System

The 1st Five-Year Road Improvement Program, starting in FY1954, heralded the beginning of coordinated road development. Due to the lack of general funding, however, the public works funds available at the time were not enough to satisfy burgeoning traffic demand. To this end, the 1952 Law Concerning Special Measures for Highway Construction approved the introduction of toll roads, whereby loans could be taken out to cover the funding shortfall, then repaid after completion of the new roads by means of tolls levied on road users. in 1961, the Japan Highway Public Corporation was established as a means of boosting project implementation efficiency and utilizing idle funds in private industry. The Corporation took over responsibility from the national government for the construction and administration of toll roads. The advent of toll roads as described above provided the financial basis for the development of the expressway network in Japan in conjunction with 7,600 km of trunk roads under the 4th Five-Year Road Improvement Program from FY1964 and 14,000 km of arterial high-standard highways under the 4th National Comprehensive Development Program initiated in 1987.

However, under this kind of construction system, road improvements were implemented through enormous loans and national bonds driven by one-sided orders. There were various criticisms, including that there was no means of preventing the construction of unprofitable roads which were inherently costly because construction and maintenance costs were not constrained. Sustained criticism of this system eventually led to the privatization of the four corporations under four separate pieces of legislation enacted in June 2004. The privatization process brought substantial reforms to the overall toll roads scheme. In October 2005, the corporations were formally abolished, to be replaced by the Japan Expressway Holding and Debt Repayment Agency (an independent administrative institution) and six expressway companies.

3.4. Road Administration Management

Not only Japan but also many countries have sustained widespread criticism of bloated and inefficient bureaucracy that is too far removed from the people. This problem was widely recognized in the 1980s. In Japan, a range of strategies has been employed in a bid to address the issue and work towards more efficient government administration.

Since FY1997, roads bureaucracies have embraced project-specific evaluation systems based on cost-benefit analysis, such as pre-evaluation of new projects, in a bid to promote more efficient and effective project implementation. Furthermore, roads bureaucracies are promoting community participation in all stages of road development projects, namely, conceptualization, planning, implementation and maintenance and management. Examples include introducing participation models into road planning processes at the conceptualization stage, in order to boost fairness and transparency and promote awareness and acceptance in the community.

The Five-Year Road Improvement Programs include indicators of the volume of projects being undertaken (such as the total length of the arterial high-standard highways network), as well as road development objectives based on outcome indicators that show outcomes from the perspective of road users. In this way, the overall objectives of roads are expressed quantitatively. Nevertheless, the process of selecting road projects is still seen as lacking transparency, and there is distrust about the efficiency of projects. Working to alleviate these concerns among the general public while also working towards outcome-based approaches are still important problems for road administrators.

To this end, the Roads Bureau at the Ministry of Land, Infrastructure and Transport set up a Road Administration Management Study Group to conduct an in-depth study of new user-oriented, outcome-driven roads administration, and the Study Group's findings were released as a report. In 2003, according to the recommendations of the FY2003 Report by the Study Group, a planning document was released publicly by road administrators as a new road administration management paradigm. The document sets out 17 separate indicators and considers the validity of various strategies and project processes for achieving the objectives. It also performs data analyses and presents an objective appraisal of the validity of prioritized strategies. Finally, the document provides background data in relation to indicators and other figures for each prefecture, to enable public verification of the processes.

4. OBJECTIVE OF THE PRESENT POLICY FOR ROAD IMPROVEMENT

The social infrastructure of Japan has been improved rapidly and systematically through plans based on the conventional Emergency Measures Law for Road Improvement by project sectors. However, significant measures are being called for with respect to the policy issues which remain unsolved, in order to strengthen global competitiveness, cope with the low birth rate and aging of society, respond to environmental problems, create a safe and secure society, and build a beautiful country. In addition, it is necessary to improve the social infrastructure more effectively and efficiently in line with the modern needs for lower-cost and higher-quality projects.

Taking such circumstances into account, it was decided to shift the emphasis of the plans for social infrastructure improvement to producing results beneficial to people and to unify the plans by project sector for providing social overhead capital which underpins people's lives and industry, in order to promote closer ties with the Priority Plan for Social Overhead Capital Provision (Cabinet decision in October 2003). The following summarizes the efforts of the road improvement projects under this plan.

4.1. Efforts towards Significant, Effective and Efficient Implementation

In order to promote a shift to more effective, efficient and transparent road administration, road administration management based on performance will be employed. Budgets based on performance targets such as traffic congestion alleviation and traffic safety will be defined at the stage of budgetary requests, and the results of post-project evaluations will be reflected in subsequent budgets. In addition, measures to build quickly and efficiently, and to use existing stock effectively will be promoted while making a clear distinction between measures and projects that lead to results that people and users desire.

4.2. Recovery of Economic Vitality through Urban Redevelopment and Inter-regional Association

In order to secure safe and smooth traffic, traffic congestion measures such as traffic demand management (TDM) and intersectional solidification will be implemented. Also, crossing roads will be reduced. and improved, and strengthening of traffic node functions through improvement of station squares and utilization of public transportation facilities will be promoted.

To alleviate traffic congestion, create favorable living spaces and form the framework of cities, ring roads will be significantly improved by raising the construction rate of ring roads in the three major metropolitan areas from 35% (in 2002) to 60% (in 2007). Road improvements in urban areas, land readjustment projects and urban redevelopment

projects that encourage private-sector urban development, improvement in disaster prevention capabilities in crowded city blocks with many wooden houses, and improvement of city roads to form good urban areas will also be promoted.

To support urban development promoted mainly by the regions, introduction of transit malls to secure safe and comfortable mobility for pedestrians in central urban areas and to invigorate create cities will be implemented. General projects to provide support through packages of multiple projects such as roads, rivers and city parks, and improvement of high-quality sidewalks that enable people to experience regional characteristics as well as improve the quality of roadside stations will be carried out. In addition, construction of access roads between airports and harbors, arterial high-standard highways, and road improvements to support the construction of logistics bases will be promoted.

In order to support safe and comfortable movement of road users as well as the development of IT-related industry, support to various services utilizing ETC communications technology, research & development and introduction of ITS to support safe driving and movement of pedestrians, and establishment and utilization of the information infrastructure will be promoted.

Figure 6 – Smart IC (ETC-only IC) placed on Parking Area

4.3. Improvement in the Quality of Life

In order to improve the cityscapes and disaster prevention capabilities, and to secure safe and comfortable pedestrian spaces, electric wires will continue to be put underground for the trunk roads in urban areas. In addition, removal of telegraph poles will also be fully promoted for non-trunk roads in priority improvement districts based on the barrier-free transportation law and in the districts where good city and living environments are needed, as well as in historic districts.

While priority is given to safe and comfortable usage by pedestrians and cyclists by excluding through traffic, support including software aspects will be actively provided in order to create user-friendly road zones in high-quality living environments. Expansion of barrier-free pedestrian space and improvement of the environment for bicycles will also be promoted.

Figure 7– Barrier-free sidewalk network

4.4. Issues Concerning Safety and Secure Lives

In order to provide a safer environment for all, it is important to introduce concentrated traffic reduction strategies at accident “hot-spots” on trunk roads, together with comprehensive, spatial pedestrian safety initiatives in the form of safe and secure pedestrian precincts.

The road network is a vital support for ongoing local activity as well as emergency services in the event of a natural disaster such as earthquake, tsunami, torrential rainfall or heavy snowfall. It is important to be prepared for disaster. In areas affected by extreme cold and snowfall, snow shields, snow removal programs, anti-freeze strategies and regular snow reports are all important for safety and security on the roads.

Many of the road structures built during the period of rapid economic growth in Japan will soon be approaching the end of their usable life. In order to prevent a massive surge in renewal works and reduce the overall costs involved, an asset management system will be set up, along with appropriate supporting technologies and administrative frameworks.

4.5. Environmental Conservation and Beautification Initiatives

The roadside environment will be improved through initiatives such as: development of trunk road networks (including ring roads); trials of flexible pricing structures and strategies to regulate road traffic demand such as TDM; and development of vehicles with low emission levels and high fuel economy.

In order to create attractive, high-quality roads, all elements of the road environment will be reappraised, including roads and roadside structures, with a view to creating a road space that blends with the environment. Support will be provided for consensus-based approaches such as evaluating scenic considerations and developing beautification plans in conjunction with local residents.

Figure 8 – Green Corridor Project

Figure 9 – Burying Electric Cable Project

4.6. Evaluation of Strategies and Projects

Evaluation of government policies and strategies was introduced under the 2002 Government Policy Evaluation Law. In the field of road transport, a Road Investment Evaluation Steering Committee was set up at the Roads Bureau back in 1993 to develop a process for evaluating individual road projects. The resulting Cost-Benefit Assessment system was introduced on a trial basis for new projects in 1996.

1998 saw the introduction of a re-evaluation process whereby projects that have not commenced within five years of the initial selection date are subject to a second assessment to determine whether to proceed with the project or abandon it. A post-evaluation process was introduced in 1999. Every completed project is now evaluated in terms of the benefits and environmental impact, and to determine if improvements or modifications are required. The post-evaluation findings are also incorporated into future projects. In terms of policy evaluation, the 11th Five-Year Road Improvement Program in 1993 introduced indicator-based performance evaluation. Measurement and analysis of performance achievement levels has been in use since 2000. Since 2003, both policy evaluation and individual project evaluations have been integrally linked features of a “full-set” public works project evaluation system. The full-set evaluation system is used at all stages—budget request, planning and project execution.

5. CONCLUSION

This report provides an introduction to road improvements in the 20th century based on social and economic conditions throughout that period, and describes initiatives taken by road administrators to deal with traffic congestion, traffic accidents, natural disasters and other problems that have appeared through the process of road improvement. It also explains sources of finances, the toll road system, and appropriate road administration that have been forced to evolve through this process, and stipulates specific targets for future road improvement.

Looking back at road improvement in the 20th century, we see that road improvement began in earnest in Japan after the end of the war in 1945. It was accomplished at great speed as part of an economic development strategy motivated by a strong awareness of the need to restore the devastated national land and to catch up with European countries and America. Progress in road improvement in Japan has greatly enriched the lives of its people: supporting Japan’s economic growth by achieving more efficient cargo transportation and expanding the range of interactions between different regions of the country. But, as this report has stated, this process of road improvement has been the cause of numerous challenges.

During the more than fifty years that have passed since road improvement in Japan began in earnest with the 1st Five-year Road Improvement Program of 1954 until the present day, the number of registered vehicles has far outpaced road improvement, resulting in the present intensified and chronic traffic congestion. The number of traffic accidents has reached approximately 950,000, and the number of people killed and injured is now about 1.19 million, both record levels in Japan. Measures must be taken promptly to overcome the negative impacts of roads on the environment: traffic pollution such as noise, vibration, and air pollution produced by automobile traffic, advancing global warming caused by emissions of CO_2, and destruction of vegetation and ecosystems that make up the natural environment. To preserve the lives and the property of the people of Japan from natural

disasters caused by Japan's harsh natural conditions, both hard measures (public works etc.) and soft measures (evacuation and disaster education systems, etc.) must be taken so that social and economic activities can be restored quickly after such disasters. Regarding the functions of roads, changed circumstances demand that present road improvements focused on use by automobiles give way to road improvements focused on people, specifically roads that provide routes and spaces for pedestrians and cyclists. And with the falling birth rate and rising population of elderly people in Japan transforming the structure of society, road administrators now face a variety of challenges that must be overcome so that everyone, including elderly people and adults with children, can lead lives safe and free from fear.

If we are to more efficiently and effectively carry out road improvement projects while reducing road investments to deal with harsh financial conditions in Japan, we must strive to practice more transparent road administration by setting improvement goals represented by, in addition to indices that quantify projects, indices that represent achievements that will bring benefits to road users and evaluating our progress.

It is important for us to respond to these challenges by learning from the history of road civilizations of the 20th century, while initiating a discussion about roads among both road users and roadside residents, understanding the road improvements that the people of Japan genuinely require and carrying out road improvements that further enrich their lives, thus leading to the continued expansion of social and economic activities.

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