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# Research and Development into how the Construction of Road Networks Contributes to Solving Social Problems

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## 1. Trends concerning the orientation of road policies

Road networks are the most fundamental social infrastructure that connect regions and facilities and support the movement of humans and goods as well as economic activities and lives. Roads are expected to fulfill various functions, not only for movement, but for lodging, bustle, environment, disaster preparedness, and others. They help realize a safe, secure, and affluent society, and also help respond to recent social problems such as population decline, aging, the growing intensity of disasters, climate change, and distribution crises.

The formulation of specific policies was developed through discussions in the Social Capital Development Council where proposals were made such as the "Road Policy Vision 'Landscape of Roads Will Change in 2040'" (June 2020) and "What the High Standard Highway Network Ought to Be, an Interim Summary" (October 2024).

One goal of the national government is the implementation of autonomous driving. It was put forth in the "Comprehensive Nationwide Development Plan for Digital Lifeline" (June 2024) that was an initiative for nationwide deployment of digital technologies. It was also specified in the "Government's Mid- to Long-term Plan Toward FY2030" (February 2024), which was devised to reform physical distribution issues, to enable the enactment of comprehensive measures including increasing vehicle size and autonomous vehicles.

On the basis of these, the "WISNET2020/Policy Collection" (October 2023), which summarized the specific road policies to be implemented hereafter, the "Road Sector Decarbonization Policy Book Ver. 1.0" (December 2024) toward decarbonization, and other policies have been prepared.

Recently, the "Bill for the Act for Partially Amending the Road Act" was submitted to the ordinary Diet session in February 2025. The content of this Act was as follows. In order to further a more comprehensive response to disasters based on the 2024 Noto Peninsula earthquake, in addition to ensuring safe and smooth traffic, other functions related to disaster preparedness for roads must be secured. Also, the reduction of environmental load through the promotion of decarbonization and other measures are declared to be a foundational part of road improvement. This Act specifies the plans devised to accomplish these goals.

Henceforth, some of the approaches of the Road Traffic Department based on the aforementioned road policies will be presented.

## 2. Road network evaluation utilizing digital technologies

While the improvement of road networks greatly advances, there are challenges such as traffic jams that occur unevenly in both location and time, redundancy in times of a disaster, and time disparity from region to region. In order to improve productivity and regional vitalization it is necessary to evaluate networks from various vantage points such as the smoothness of movement, and how to proceed with measures that take into consideration both hardware and software aspects efficiently by utilizing data and new technologies.

For this reason, the Road Traffic Department has decided to tackle the development of techniques for efficiently grasping and estimating the road traffic status by utilizing ICT and other technologies. Some of those include the development of indexes for evaluating service levels in a multi-faceted manner, the study of road geometric structure standards corresponding to the target levels in regard to such service levels, the establishment of techniques for the management of traffic supply and demand utilizing digital technologies.

FY2025 is the year of implementation of a Road Traffic Census. The extent of application of efficient techniques for grasping the traffic status will be expanded including traffic volume measurement tools using AI image analysis. We will also engage in the development of the indexes for the purpose of evaluating service levels such as smoothness of movement according to the road classification.

## 3. Efforts to make autonomous driving a reality

Due to a growing concern about an insufficient number of drivers to meet the demands of distribution and regional traffic, the realization of autonomous driving is awaited with great anticipation. The national government aims at implementation of Level 4 autonomous trucks from FY2026 onward to operate in distribution services. They also plan to increase the number of locations providing Level 4 autonomous driving movement services to more than 100 locations by FY2027 to meet the demands of transportation.

The development of autonomous driving vehicle control technologies is under way in which acceleration and deceleration as well as steering are performed by using information from onboard sensors. Whereas, it is difficult for the vehicle alone to detect information necessary for merging on an expressway, it is tantamount that the merging be supported by information provided from the road level.

The Road Traffic Department, through joint research with automotive and electrical equipment manufacturers and others, has been engaging in the development of technologies that alert drivers to obstacles ahead and provide information about vehicles running on through lanes during highway merging, by means of communications between the road and the vehicle. Based on the results of such development, in January 2025, merging support information provision systems were (in 3 locations) installed on the Shin-Tomei Expressway (Figure-1). It is planned that priority lanes for autonomous vehicles will be installed in March 2025, and demonstration experiments to provide merging support information for autonomous trucks will be started from May 2025 onward.



**Figure-1 Experimental equipment for the provision of information on merging support**  
(left: vehicle detection sensor, right: information provision facility)

Also, it is planned that, with regards to transportation services such as autonomous buses, studies will be conducted about how to improve techniques whereby road space being used by autonomous vehicles are easy to run and are safe and comfortable for other users as well. The results of these experiments will be studied and summarized in FY2026 as a draft for guidelines.



**Figure-2 An example of autonomous driving movement services and space for bicycle traffic**

#### 4. Efforts toward "Zero Accidents"

In order to realize a safe and secure society, the national government aims at zero accidents in the future.

Therefore, the Road Traffic Department is engaged in research on effective traffic safety measures in order to create a road space where all users can utilize the space safely and securely.

Specifically, the development of tools is under way to help visualize problems by utilizing big data, AI image analysis and research in order to formulate an agreement which will enable proceeding with measures smoothly.

In addition, in order to enlarge and improve the space

where automobiles, bicycles, and pedestrians are appropriately separated, research on structure and related concerns for effectively redistributing the limited space is under way, taking into account consideration of such research results on the "Guideline for the Creation of Safe and Comfortable Bicycle Use Environments."

#### 5. Efforts toward the decarbonization of road traffic

Taking into consideration the global trends aimed at suppressing temperature rise, Japan has a policy of aiming at zero greenhouse gas emissions as a whole by 2050.

The road sector accounts for about 16% of CO<sub>2</sub> emissions in Japan. A decision in the "Road Sector Decarbonization Policy Book Ver. 1.0" was made to make efforts with the following as the basic pillars of the policy: (1) Creation of road space that supports the greening of road traffic; (2) Transformation into low-carbon human flow and distribution; (3) Optimization of road traffic; and (4) Low-carbonization of the entire road life cycle.

Specifically, the policy specifies that efforts will be made in the functional classification into high-standard roads and traffic management based on data, installation of EV charging facilities within roads and the improvement of guiding signs for such facilities, and others. In addition, it is required that various efforts be made efficiently and effectively, by building techniques that enable the following outcomes: estimation of CO<sub>2</sub> emissions due to automotive traffic as well as estimation and evaluation of the effects of CO<sub>2</sub> emissions reduction by means of road measures.

The Road Traffic Department is examining a CO<sub>2</sub> emissions coefficient corresponding to the dissemination of EVs, that substitute conventional gasoline vehicles. In the future, a technique for estimating CO<sub>2</sub> emissions will be created, thereby aiming at the development of techniques to evaluate the effectiveness of reduction in accordance with each of the policies.

#### 6. Conclusion

Since the period of high economic growth, for many years in response to an increase in demand for automotive traffic and changes in social environments, the improvement of road networks has been pursued while changing the structure and operation. Even today new road policies are developed every year, on the basis of social problems. It is our intention to flexibly engage in the development of new technologies and research that contribute to the acquisition of knowledge, so as to be helpful in solving such social problems going forward.

For more detailed information, visit:

1) Website of the Road Traffic Department

<https://www.nilim.go.jp/japanese/organization/koutsu/jkoutsu.htm>