# Research and development toward the realization of road utilization that is wise, safe, and sustainable

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### 1. Introduction

Roads form a network that constitutes the framework of national land and city blocks, etc. They are part of a vital social infrastructure that supports economic activities and people's lives by facilitating various functions including the movement of people and goods as well as retention and livelihood, disaster prevention, etc. Recent social transformation such as depopulation and aging, as well as the increased severity of disasters accentuated by climate change, highlights the need for further efforts toward the realization of a safe, secure, and flourishing society. That can be achieved by appropriately incorporating elements of the rapidly changing technological innovations, so that the roads function to the fullest extent.

Regarding mid- and long-term road policy, several discussions were held with the Council for Social Infrastructure Development, Road Subcommittee serving as the central platform. Proposals were made in June 2020 as the "Road Policy Vision 'Landscape of Roads Will Change in 2040'," and in August 2022 as "Now is the time to change the landscape of roads - Road Map to the 2040 Road Policy Vision -." Also, in order to define what the High Standard Highway network ought to be, an interim summary was made in October 2023, and it has been determined that the goal will be the realization of the "world's smartest, safest, and most sustainable infrastructure network system in 2050 (=WISENET2050)".

This paper presents an overview and a trend of the efforts of the Road Traffic Department that is based on the attitude of a sustainable society that should be aimed at and the direction of the road policy that have been shown in these proposals.

#### 2. Road traffic management utilizing ICT

After a period of high-growth, homogeneous road improvement projects have been enacted in an effort to meet the demands of increasing traffic and to connect regions. While the total length of the improved roads has increased, traffic jams still occur in various areas, and smooth mobility needs to be secured in order to increase productivity, vitalize the regions, and reduce environmental loads. In addition to the enlargement of traffic capacity by developing new roads and improving existing roads, the establishment of techniques to manage the demand and supply of road traffic by utilizing ICT and digital technologies is needed.

For this purpose, the first step is to observe the current condition of road traffic. The Road Traffic Department is currently developing traffic volume observation techniques by means of AI analysis of camera images for road management and techniques that estimate the traffic volume according to each of the starting and arrival points and the moving routes for each time zone based on the ETC2.0 probe information. Our department also conducts research on techniques for analyzing and predicting traffic jams, etc. on a real-time basis by using these various types of data. In the future, we will be engaged in research toward the realization of wise road utilization, through a study of measures for promoting changes in the actions of users, etc. using the provision of traffic jam information that has been predicted as well as other data.

### **3.** Efforts toward the realization, dissemination and enhancement of automated driving

Through the realization of automated driving, we will realize automation and energy saving of the movement of humans and goods. It is also expected that traffic accidents will be reduced by preventing human errors as well as alleviating the problem of a shortage of drivers. The national government aims to make the automated driving of private cars on highways a reality (Level 4) by 2025.

Regarding automated driving, the development of autonomous vehicle control technologies is under way in which acceleration and deceleration, lane keep, etc. are performed by using the information collected by onboard sensors. On the other hand, support for automated driving is required by providing information from roads in situations such as those where it is difficult for the vehicle alone to avoid forward hazards on a highway and to detect information required for merging into a main roadway. The Road Traffic Department has been implementing technological development through joint research etc. with automotive and electric equipment manufacturers, etc., in which the provision of information, etc. on vehicles running on a main roadway is performed by mutual communications between a road and a vehicle when there is an obstacle ahead or during merging. Until the present, we have prepared technical specifications for passenger car systems related to the provision of merging assist information. Currently, we are preparing specifications for trucks, and it

verification experiments are scheduled to be performed on actual roads in FY 2024. (Fig. 1)



# Fig. 1: Image of a verification experiment on the provision of merging assist information

#### 4. Efforts toward "zero traffic accidents"

With the goal of realizing a safe and secure society, the national government is determined to aim at zero traffic accidents in the future. In Japan, among the deaths due to traffic accidents, the ratios of pedestrians and bicycles are relatively high, and it is important to promote traffic safety measures on sidewalks and residential roads in neighborhoods.

The Road Traffic Department is conducting research, in order to take measures effectively by obtaining an understanding of local residents, etc., on the efficient extraction of areas where measures need to be taken by means of analysis of various types of data including accident data, ETC2.0 probe information, running images, etc. as well as on the techniques for planning the measures appropriately. Specifically, research is conducted on the technique to explain the problems and the necessity of measures in an easy-to-understand manner by overlapping various types of data on a map (Fig. 2). In addition studies were done of effective shapes and arrangements as well as installation methods, of physical devices (humps, etc.) that contribute to the prevention of entry of vehicles and speed control. These are being installed by road administrators in conjunction with speed control on residential roads by the police.



Fig.2: Example of a map to explain the problems in an easy-to-understand manner

## 5. Efforts toward low carbonization of road traffic

After the Paris Agreement that was adopted in 2015, it has become a world trend to set a goal of limiting the average temperature increase in the world to 1.5°C above pre-industrial levels, and in 2020 Japan also declared a policy to reduce greenhouse gas emissions to net-zero by 2050. After that, the Japanese government as a whole devised various plans, and the Ministry of Land, Infrastructure, Transport and Tourism devised the "MLIT's Green Challenge" in 2021.

In the road sector that accounts for about 16% of the total emissions in Japan, an interim summary of the carbon neutral promotion strategy was announced in September 2023, and it has been determined to promote efforts on the basis of 4 pillars: (1) Optimization of road traffic, (2) Converting to low-carbon flows of people and goods, (3) Greening of road traffic, and (4) Toward a low carbon life cycle for roads. Examples of the specific measures posted are as follows. (1) Measures to increase speed by means of traffic jam prevention measures and demand management, (2)Conversion to mobility with a reduced environmental load and automated driving of trucks, (3) Development and dissemination of the next-generation automobiles and improvement of electricity supply environments, and (4) Low carbonization of the plans, construction, and management of roads.

In order to effectively implement these policies, it is necessary to grasp the CO2 emissions reductions accurately. The Road Traffic Department is examining the CO2 emissions coefficient responding to the dissemination of EVs, etc. that substitute for conventional gasoline vehicles. In the future, we would like to aim for the development of techniques that enable the monitoring of CO2 emissions and the evaluation of reduction effects achieved by each of the policies.

#### 6. Conclusion

This paper has presented part of the efforts of the Road Traffic Department based on the direction of road policies in the future. The environments surrounding society and road traffic are changing at a pace exceeding our imagination, and as the Road Traffic Department, we would like to tackle the research that contributes to the solving of social problems and the creation of new values speedily and flexibly, in future. At the same time, we aim to ascertain what society will look like and what direction these new policies should take.

For detailed information, refer to the following:

1) Website of the Road Traffic Department https://www.nilim.go.jp/japanese/organization/koutsu/ jkoutsu.htm