Orientation of technology development for realization of smooth, safe, and comfortable road traffic

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1. Introduction

Our country is facing difficult circumstances such as a population decrease, the escalation of a dwindling birthrate, an aging population, worsening disaster damage, the aging of infrastructure, and tough international competition. In the future, to support national life and economic activity, and construct road systems that are usable even during a disaster, we will focus on the preparation and efficient maximum utilization of the existing stock.

In this document, I will provide an outline of the orientation of the R&D in the road traffic field, along with approaches to the problems that we are facing, based on the activities of the NILIM from the long- and mid-term viewpoints.

2. Problems and changes in local circumstances

The problems surrounding road traffic and the basic orientation of policies were organized into a report by the Road Subcommittee, the Panel on Infrastructure Development [1)2)]. The following lists major problems from the research perspective:

(1) Although a highway network is being developed, the number of traffic lanes is small, and there are other quality problems. Moreover, traffic jams have not been eliminated.

(2) The international competition is getting fierce, and it is necessary to improve mobile productivity such as by improving the logistics efficiency.

(3) Although the number of traffic fatalities went down to approximately one fourth of the number at the peak, the number of fatal accidents involving walkers and bicycle riders is the worst for advanced countries.

(4) Better landscapes and the re-construction of the road space are important goals from the perspective of regional activation. Burying electric cables may contribute to these improvements, along with disaster prevention performance. However, this has been significantly delayed.

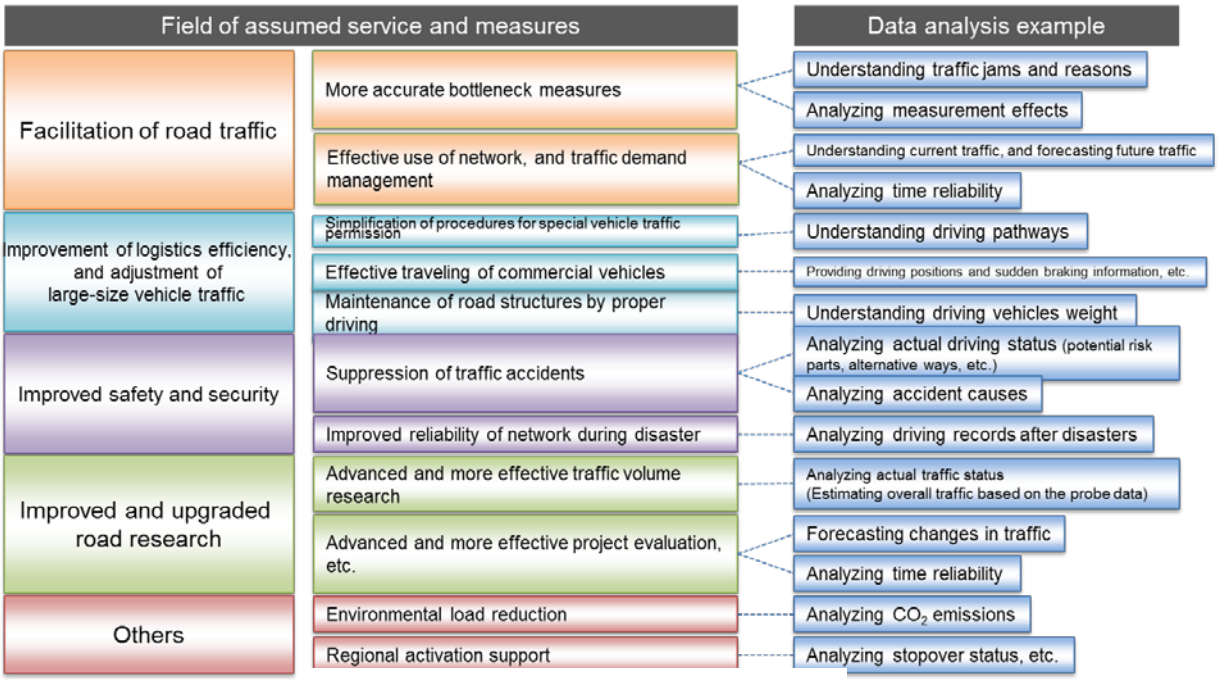

Figure 1: Problems with ETC2.0 data

(5) Because of innovations in information and communication technology (ICT), we will be able to collect road traffic big data (ETC2.0 probe, etc.) (Note that this item is not a problem.)

3. R&D of problems we are facing

1) Smart operation of roads, based on big data[3)]

Because ETC2.0 probes, etc. can collect precise traffic condition data all the time, they may contribute to the effective and efficient implantation of various policies. Figure 1 shows the concepts of the activities. The major ones are explained as follows:

(1) Smart use of road network

If we can identify the point of a traffic jam, and determine the contributing factors, pinpoint measures will be available. If we can supply appropriate traffic information to drivers, full-scale traffic demand management may be possible, including the avoidance of traffic jams and flexible tolls based on the traffic level. Furthermore, it is expected that supplying appropriate information will allow safe driving, and support a smooth evacuation and the transportation of critical materials during a disaster.

(2) Advanced and effective check of road traffic

The use of big data may improve the efficiency of the road traffic census currently conducted once every 5 years by drastically upgrading it. In addition, we have to work on the utilization of the big data to upgrade the measurement and evaluation methods for project effects, including stock effects and traffic jam elimination.

(3) Support of improved logistics efficiency and adjustment of large-size vehicle traffic

It is necessary to improve the logistics efficiency and productivity of transportation, by simplifying the traffic permission procedures for special vehicles, and supporting distribution operators' vehicle traffic. In addition, from the perspective of road life elongation, it is necessary to find methods to check and adjust the pathways and weights of vehicles.

(4) Visible environmental measures

If we can precisely calculate the CO_2 emissions of vehicles, the accurate prevention of global warming may be possible.

2) Traffic safety measures for community roads

The basic concepts of the traffic safety measures for community roads are controlling the through traffic and suppressing the vehicle speed.

(1) Switching of traffic from community roads to arterial roads

With the use of the big data, it is necessary to determine the actual state of the through traffic, extract areas where measures are necessary, and develop a method to switch traffic from the community roads to the arterial roads.

(2) Standardization of physical devices for speed suppression

Physical devices such as humps and narrowed areas are effective for vehicle speed suppression. Some places need guard fences with an appropriate shape and strength for community roads to physically protect walkers from collisions. It is necessary to prepare the environment for the standardization of technical standards for these hardware measures, along with their diffusion.

3) Promotion of electric cable burial

In addition to developing low-cost methods for burying electric cables, it is important to develop an evaluation method based on the policy purpose (better landscape, preparation of emergency transportation roads, etc.) with the use of ICT, and promote the consideration of a method to reconstruct the road space after the removal of electric poles.

4. Approaches to problems from long- and mid-term viewpoints

The people, vehicles, society, and technologies surrounding roads are changing drastically, because of the approaching ultra-aging society, improved vehicle performance, diffusion of speed control technologies, progress in driving techniques, development of super-compact mobility, energy revolution by fuel cell

vehicles, etc. I believe that approaches based on the following themes will also be necessary from the long- and mid-term viewpoints:

- Re-consideration of road structure, based on vehicle progress, etc.
- Ideal cooperative ITS service, in collaboration with vehicle technologies
- Impact of life-style changes (e.g., car-sharing) on road traffic
- Traffic safety measures based on human science, etc.
- Efficient collection of information about traveling vehicles, including the use of private technologies
- Relation between energy revolution and road infrastructure

Many of these do not currently appear in relation to problems, and we cannot reliably forecast the future social condition. However, it is estimated that the relationship between road traffic and infrastructure is significant. Thus, it is important to work on them from comprehensive and long- and mid-term viewpoints.

☞For more detail, access the following information:

1) Road Subcommittee, the Panel on Infrastructure Development: Interim guidelines for proposition, Jun. 2012 (in Japanese)
http://www.mlit.go.jp/common/000219233.pdf
2) National arterial road section, Road Subcommittee of Council for Social Infrastructure: "Activities for smart use of roads" focusing on highways, Jul. 2015 (in Japanese)
http://www.mlit.go.jp/common/001098868.pdf
3) Masahide Ito: Technological outlook of "smart use" of roads with ETC2.0, Civil engineering journal, vol.58 No.1, pp.30-33, Jan. 2016 (in Japanese)