Research for road network operation method using intelligent transportation system

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1. Introduction

Under a network of expressways such as the three ring roads, the need for "smart road use" has been pointed out, in which the functions of a road network are fully demonstrated through operational improvements, to deal with social losses such as traffic congestion and accidents, under financially and spatially limited conditions. At the NILIM, we conduct research and development on utilization measures for intelligent transportation system (ITS) technology to realize the efficient operation of road networks. In this article, we report major issues that need to be examined, and the direction of the research.

2. Issues to examine for road networks

To realize a smooth road operation that deals with traffic conditions that change hourly, it is important to carry out a plan-do-check-act (PDCA) cycle, where we quickly grasp the occurrence of a problem, and take an effective measure. For that purpose, it is necessary to establish a means to grasp road traffic conditions at all times, along with a way to implement operational measures. In our Division, we are addressing these two issues. ETC2.0 has a mechanism to provide combinations of basic functions that are required for the operation of a road network, such as toll collection, probe data collection, and the provision of information. Using this technology, we aim to establish a method for road operation where various data and ITS technologies are used complementarily.

3. Method to grasp road traffic conditions

At present, on expressways, we grasp the road traffic conditions from observation results obtained by vehicle detectors. A vehicle detector is a device used to observe the volume of traffic and speed at the installation point of the device. Considering the cost of installation and operation management, the area where traffic conditions are grasped with high accuracy using only a detector is limited. In contrast, ETC2.0 uses a technique to uplink the travel record accumulated in a vehicle when the vehicle passes through a roadside unit, which allows us to obtain a continuous running trajectory of each individual vehicle. However, it can only measure vehicles equipped with an ETC2.0 in-vehicle device, which makes it difficult to grasp the volume of traffic. Using this mutually complementary information makes it possible to generate highly accurate traffic information, and we are developing a method to monitor the traffic conditions of a road network using these two types of data complementarily.

4. Approach to implement operational measures

There are two major operational measures: one has the goal of leveling the demand across the entire network, and the other has the goal of smoothing the traffic flow at a bottleneck. The former facilitates a change in a user's route by providing information about traffic congestion and enforcing a congestion charge, whereas the latter enforces dynamic control of the speed and lane use to suppress the occurrence of traffic congestion. Concrete

examples of these measures are shown in the figure. Most of these examples have never before been implemented in Japan, and there is an issue about how to implement them. Therefore, we plan to mainly address the issues of how to provide information that is safely recognized and understood by drivers (a method, timing and so on), which is commonly important in each measure, and a way to implement each measure and evaluate its effectiveness. In addition, in a road network, the collaboration of multiple road administrators is an important issue, and we plan to examine measures in cooperation with expressway companies.

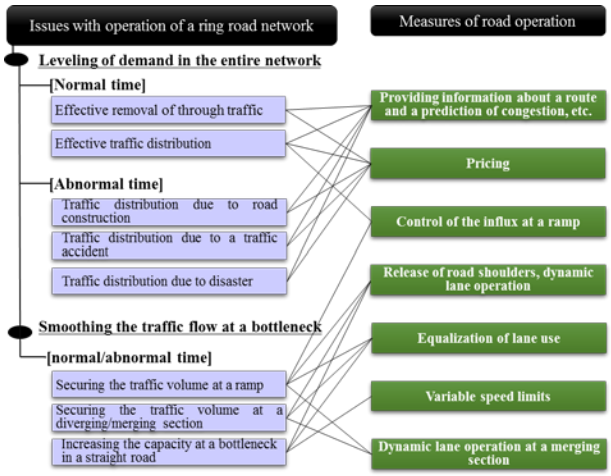

Figure Issues for road network operation and examples of measures