Activities of Road Traffic Department for Productivity Revolution

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1. Introduction

The road is the foundation of all types of productive activities. Road development has played a major role in the economic development of Japan.

The Ministry of Land, Infrastructure, Transport and Tourism is now conducting twenty productivity revolution projects to realize the economic growth of Japan through the improvement of productivity at a faster rate than the declining worker population. Especially, in terms of road traffic, some projects aim to realize economic growth by effectively using the current stock of roads while utilizing ICT and big data. Many of the research themes of NILIM are related to these projects.

This paper discusses the activities of NILIM by focusing on the use of big data in the field of road traffic and automatic driving, including aspects related to the productivity revolution projects.

2. The use of big data

Road traffic investigations are the foundation of establishing road policies and have been conducted through observations by humans and surveys. Yet, ETC 2.0 enabled road administrators to directly gather the driving history of individual vehicles and the information of their movement as probe data. ETC 2.0 is the system that NILIM developed jointly with the private sector. It gathers the driving history of vehicles and their movements, which are accumulated in vehicles carrying ETC 2.0 through roadside devices installed by road administrators (Figure 1).

The number of vehicles carrying ETC 2.0 has been increasing to about 2.35 million vehicles as of the end of December 2017. The probe data gathered from these vehicles are now being available for use as big data.

NILIM is conducting research on methods to gather and utilize ETC 2.0 probe data and ways to advance the investigation and analytical methods using the characteristics of probe data as shown in Figure 2. The outcomes are being used in productivity revolution projects such as pin-point traffic congestion control and traffic safety measures using big data.

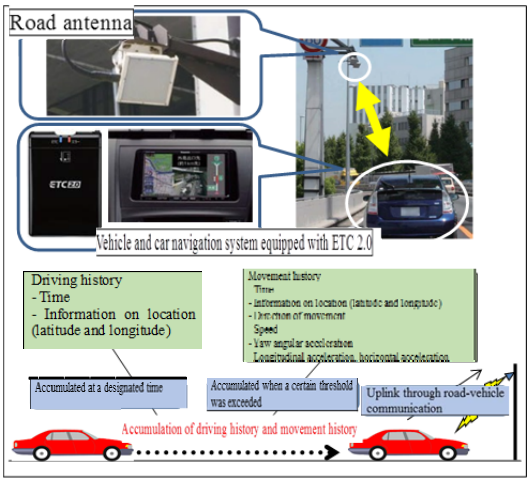

Figure 1 Collection of the ETC2.0 probe information

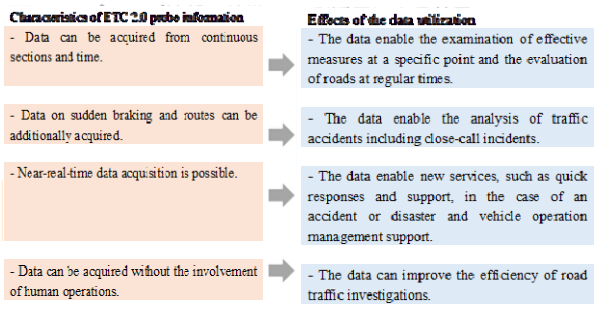

Figure 2 Characteristics and effects of ETC2.0 probe information

(1) Traffic congestion mitigation measures using big data

ETC 2.0 probe data, such as the speed and location of vehicles, can continuously be gathered in terms of time and space regardless of road types that vehicles are driving on. It enabled the examination of implementation of pin-point traffic congestion control, which can specify the timing and location of the onset of traffic congestion in detail to implement more effective traffic congestion mitigation measures as a productivity revolution project.

NILIM is also organizing methods to calculate indexes to evaluate the reliability of travel time without being limited to the average value based on the distribution of travel time.

Other research by NILIM includes research of the

traffic condition monitoring method that uses ETC 2.0 to establish traffic demand management (TDM) to optimize traffic flows, such as through strategic fee systems based on the conditions of congestion through real-time identification of road traffic conditions.

(2) Traffic safety measures realized using big data

The data of longitudinal and horizontal accelerations from ETC 2.0 allow the identification of the time and location when and where sudden braking or rapid turns occur. NILIM has been conducting research to extract locations with an increased risk of traffic accidents through these data.

In the identification of locations with an increased risk of traffic accidents on arterial roads conducted in 2017, NILIM analyzed locations with frequent high-risk movements based on ETC 2.0 data and designated about 460 locations around Japan as potentially high-risk areas. Also, the productivity revolution project titled Traffic Safety Measures Using Big Data is specifying high risk areas on community roads, such as where sudden braking often occurs, by analyzing ETC 2.0 data and other information. Traffic safety measures, such as speed restrictions and measures to restrict through traffic, are being implemented in the high risk areas.

(3) Road distribution innovation

Improved productivity, such as shortened cargo waiting times, can be expected in private businesses, such as distribution companies, when a central office identifies the real-time location of trucks and manages their operations. NILIM has been conducting social experiments with private businesses since 2016 to start a service in FY2018 that would provide ETC 2.0 data on specific trucks and vehicles to businesses, such as distribution companies, to support vehicle operation and management.

3. Activities of automatic driving

Automatic driving is a project that can improve safety and transportation efficiency and create new transportation services. It is also positioned as one of the productivity revolution projects as the ICT revolution of automobiles.

Technologies that work autonomously in individual vehicles to support safe driving, such as automatic braking, are advancing as automatic driving technologies. Yet, the autonomous type alone is not enough to identify sufficient information, such as the traffic conditions of a mainline at a merge point. Information provided from the road is also considered necessary.

NILIM has been conducting research on effective services with highway companies, automobile manufacturers, and electrical device manufacturers since 2012 to support automatic driving through the coordinated exchange of information between roads and vehicles (road-vehicle coordination) and to advance road management. As a specific service provided through road-vehicle coordination, a new joint research among the government, the private sector, and academia just started in FY2017 to explore services to provide information at highway merge points and services to provide information on accidents ahead on a road (look-ahead information).

Meanwhile, in mountainous areas where the population is rapidly aging, automatic driving service experiments are being conducted using low-speed vehicles and roadside stations as bases to secure the flows and distribution of people to revitalize rural areas. Experiments have been conducted at 13 locations around Japan mainly by Regional Development Bureaus since 2017. NILIM is providing technical assistance, such as the implementation of the experiments and verification and evaluations.

Photo: Automatic driving experiment at Roadside Station Nishikata

4. Summary

NILIM is going to continue research on methods to gather and utilize big data, such as ETC 2.0 data, and ways to assist and use new technologies for automatic driving based on road-vehicle coordination to realize economic growth through the improvement of productivity.

NILIM is also going to engage in research to realize safe, smooth, and comfortable road traffic based on proposals raised in the subcommittee of the Council for Social Infrastructure in August 2017.