ETC 2.0 Two-Way Communication between Vehicles and the Road

A section of the highway network
Photo: Courtesy of ITS Technology Enhancement Association

Since 2016, there has been an acceleration of the technological development of the Electronic Toll Collection (ETC) system used in vehicles on highways across Japan. Today, this advanced traffic technology is used as a solution supporting safe and comfortable driving and providing vital information services in the event of a disaster.

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JAPAN is an island country connected by over 1.2 million km of roads including a 12,000-km Arterial High-standard Highway Network (hereinafter highways). ETC (Electronic Toll Collection) is one system helping to make driving more comfortable on these highways.

Japan's research and development of ETC accelerated in the 1990s at a time when society faced serious traffic congestion problems. The system was introduced on the highways in 2001 and is in common use today, with more than 90% of vehicles on the highways using ETC.

Regarding the results that have been achieved over the past twenty years following the introduction of the ETC system, Nakamoto Tatsuro from the Intelligent Transport Systems (ITS) policy and program office at the Road Bureau of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), says, "Before the ETC system was introduced, congestion on highways was most commonly seen at toll gates and affected 30% of traffic. Today, this problem has largely been resolved. Furthermore, the system has significantly contributed to an improvement of the environment around toll gates, as CO_2 emissions from cars are lowered as the average speed of vehicles passing through the toll gate has increased."

Beginning in 2016, ETC 2.0, a more advanced ETC system, has become fully operational. The most significant change achieved by the new system is its facilitation of large-volume interactive communication.

The previous-generation system used communication technology only to collect tolls on highways, but ETC 2.0 offers new services using a vehicle's driving history data, such as GPS information, distance traveled, and acceleration and rapid braking data. This data is sent from ETC 2.0 onboard units to roadside antennas (ITS spots) that are installed every 10-15 kilometers on inter-city highways and every 4 kilometers on urban highways.

For example, vehicles equipped with ETC 2.0 onboard units can receive traffic information such as congestion in real time and display an optimal route on compatible in-vehicle navigation system monitors. To assist safe driving, the system issues warnings when approaching areas with a history of traffic accidents and when there are obstacles on the road ahead.

ETC 2.0: Two-way communication
Courtesy of the Road Bureau of the Ministry of Land, Infrastructure, Transport and Tourism

Joint initiatives by the public and private sectors are under way to provide logistics services operators with accumulated data seeking to facilitate the management of their operations to improve efficiency and ensure their drivers drive safely. It has become possible to develop road management measures to prevent accidents and congestion using the accumulated data.

In the case of the rain disaster in Kumamoto Prefecture and surrounding areas in 2020, accumulated traffic data enabled detailed traffic information advising whether local roads were passable to be successfully provided to business operators and local municipalities responsible for disaster management.

ETC 2.0 is the world's first system capable of collecting data and providing information about vehicles and roads at the same time. This technological achievement is largely due to remarkable innovative developments in sensing, telecommunications and other information technologies in Japan.

Initiatives to share data collected by ETC 2.0 and by private-sector service operators for statistical analysis and data processing have begun, with the participation of universities. It is expected that the research and analysis will lead to the introduction of more sophisticated services for road users such as avoidance of traffic congestion.

Given this, MLIT has selected twenty-three new ETC 2.0 service ideas from those collected from the public and is today performing a demonstration experiment. Among the ideas were using artificial intelligence capable of forecasting traffic congestion and accidents to optimize traffic flow, and using
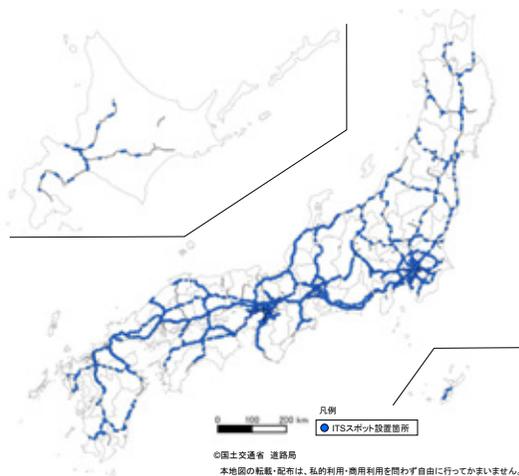
Locations of ITS spots (2018.7.1)

Courtesy of the Road Bureau of the Ministry of Land, Infrastructure, Transport and Tourism

optical sensor technology capable of tracking the flow of traffic to assist autonomous driving.

Approximately 6,110,000 units are being used as of the end of February 2021 and 25% of vehicles on the highways are using ETC 2.0 as of December 2020. How to increase the use of ETC 2.0 is an issue being addressed.

According to Nakamoto, "The Ministry is planning to take measures to achieve the early spread of ETC 2.0 and burden reduction for users such as by development of more attractive features and the introduction of fare discounts."

It is expected that the widespread use of ETC 2.0 will enhance mobility services in Japan, eventually helping to resolve a range of problems faced by society.

Detouring assist

Real-time region-wide traffic information and pictures of congested roads are provided.

Assistance in the event of disaster

Upon occurrence of a disaster, useful information will be provided.

Safe driving assist

Locations of obstacles, the location of the last car in the back up, and danger warnings are provided.

Information provided by car navigation systems

Courtesy of the Road Bureau of the Ministry of Land, Infrastructure, Transport and Tourism